International Institute for Sustainable Development
Institut international du développement durable
http://www.iisd.org
TRADE, INVESTMENT AND CLIMATE CHANGE SERIES

Energy service companies in developing countries: Potential and practice

DRAFT FOR DISCUSSION

Jennifer Ellis

August 2009

This draft is a product of IISD's "Bali to Copenhagen" Trade and Climate Change Project.

Energy service companies in developing countries: Potential and practice

DRAFT FOR DISCUSSION

Jennifer Ellis

August 2009

IISD's Bali to Copenhagen project carries out research, analysis and networking on trade and climate change in six thematic areas: border carbon adjustment; liberalization of trade in low-carbon goods and services; investment; intellectual property rights and technology transfer; subsidies for greenhouse gas reductions; and fossil fuel subsidies. For more on IISD's work on trade and climate change see www.iisd.org/trade/crosscutting, or contact Aaron Cosbey at acosbey@iisd.ca.

We gratefully acknowledge the generous support of the governments of Denmark, Finland, Norway and Sweden.

Published by the International Institute for Sustainable Development

The International Institute for Sustainable Development contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change, measurement and assessment, and natural resources management. Through the Internet, we report on international negotiations and share knowledge gained through collaborative projects with global partners, resulting in more rigorous research, capacity building in developing countries and better dialogue between North and South.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC) and Environment Canada; and from the Province of Manitoba. The institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

International Institute for Sustainable Development
161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba
Canada R3B 0Y4
Tel: +1 (204) 958–7700
Fax: +1 (204) 958–7710
E-mail: info@iisd.ca
Web site: http://www.iisd.org/

Executive Summary

Investment in clean energy technologies in developing countries is a key component of achieving global commitments to reduce greenhouse gas emissions under the Kyoto Protocol. One mechanism to promote investment in energy efficiency technologies is through energy performance contracting (EPC) undertaken by Energy Service Companies (ESCOs). Under EPC, an ESCO designs and installs energy efficient technology for clients in the public, industrial, residential or commercial sector. The ESCOs' remuneration is based on the amount of energy saved. After the term of the contract is complete, the value of the energy savings is passed on to the client. ESCOs have successfully operated in many developed countries for years. However despite the simplicity of the concept, they have yet to gain a significant foothold in many developing countries. This paper examines the potential for ESCOs in developing countries, focusing on barriers to their growth and measures that can be undertaken to eliminate those barriers.

Section one will discuss what ESCOs are and describe how they operate. It will also review the potential and current status of ESCOs in developing countries. Section two will examine what programs are currently in place both internationally and domestically to foster the growth of ESCOs in developing countries. In section three, barriers to ESCO development are considered in detail. Section four highlights some of the measures that might be put in place to overcome the barriers to ESCO development. Finally, section five provides some overall conclusions.

The focus on this paper is on developing countries and formerly developing countries that are now economies in transition, such as China, India and Brazil. These countries will most frequently be referred to broadly as developing countries. However where differentiation is required, the more specific terms will be utilized. It does not provide as much detail with regard to former eastern bloc Central and Eastern European countries, such as Russia, the Ukraine, Poland and Bulgaria, since they are not technically developing countries or formerly developing countries and as a result their circumstances are somewhat different. However some examples are drawn from these countries where relevant. The paper will draw heavily from examples in Asia, as China and India are considered are two of the most important countries in the world in terms of current energy consumption, projected energy consumption, energy intensity and the level of potential that exists in these countries to improve energy efficiency. Hansen (2009a) observes:

"The developing countries (non-OECD) are expected to contribute 80 percent of the world's economic growth from 2004 to 2030. Expectations that this growth and a modest increase in economic prosperity will nearly double this sector's energy demand, adding 4.2 btoe. China and India are expected to lead this demand as they become the two greatest energy consuming nations in the world." (p.2).

Table of Contents

1.0 ESCO potential and actual roles

This section will outline what ESCOs are and how they operate. It will then discuss their potential and status in fostering investment in energy efficiency technologies in developing countries. ESCO activity in specific developing countries will then be considered.

1.1 What are ESCOs?

ESCOs in North America and Europe are based on an energy *performance-based contracting* model, referred to as EPC. ESCOs offer both technical and financial services to implement energy efficiency projects, and guarantee that the energy savings associated with the project will be sufficient to cover the costs of the project over a certain period of time. This is what differentiates them from other energy efficiency firms such as consulting firms or firms selling energy efficiency equipment (Lee et al., 2003). Performance-based contracting means that ESCOs remuneration is directly linked to the amount of energy saved by the project (Lee et al., 2003; World Energy Council, 2008). Thus, the ESCO assumes the technical and performance risks associated with the project (Lee et al., 2003). If the energy savings are not achieved, the ESCO does not get paid. ESCO terms are usually two to five years in developing countries, but can be as long as ten years in developed countries (Taylor, 2009). Payback periods can be as short as one year, but as long as five to ten years (Urge-Vorsatz, 2007). Average payback periods, particularly in energy intensive developing countries, often fall in the one to two year range (Taylor et al., 2008).

However in many developing countries, and economies in transition, the term ESCO has been utilized more loosely. In several developing countries, such as China and Mexico in particular, and even in some developed countries such as Australia, ESCOs undertake more traditional fixed-fee energy efficiency contracts without a guarantee or a performance based remuneration element, as either a portion of, or the mainstay of their business (Hansen, 2009a; Hobson, 2009; Storment, 2009; Sugay, 2009). They do not take performance risks, arrange financing or undertake monitoring and verification, sometimes due to lack of technical or financing capability, and sometimes due to client preferences (Cowan, 2009; Hobson, 2009). Even some well established EPC ESCOs in North America, such as Siemens, undertake a portion of their energy efficiency work in developing countries through straight fee-for-service contracts, rather than energy performance contracts (Sugay, 2009). Moreover, some large multi-national ESCOs will not consider performance contracts in some developing countries due to client risks. In discussing the ESCO industry in aggregate in developing countries, it is impossible to parse out these ESCOs that engage in non-EPC energy efficiency activities, or within an ESCO, the number of projects that are EPC versus non-EPC. Thus some of the ESCOs discussed will not be EPC ESCOs in the strictest sense of the term.

Moreover, non-EPC ESCOs may be critical for getting the ESCO industry started in some developing countries. To some extent it seems that there is a rebranding process underway by ESCOs in developing countries, whereby EPC is being labelled as one method of purchasing energy efficiency, but ESCOs will sell energy efficiency services and equipment in a variety of ways. As the industry matures in some developing countries, it may move to more of an EPC model, consistent with North American ESCOs. But EPC may be a model for ESCOs that is more successful in North America and Europe, and may not be as applicable in some developing countries. As a result, this paper will include non-EPC ESCOs, provided they engage in energy efficiency service provision.

In addition, in many least developed countries, the term ESCO is applied to companies that provide rural electrification services whereby the company purchases the energy equipment (often solar photovoltaic equipment), installs it and maintains it for the client. The ESCO retains ownership of the equipment and the client pays a fee for the electricity received. This is a different model than EPC ESCOs. This paper will focus on ESCOs engaged in energy efficiency activities, not on rural electrification ESCOs.

1.1.1 ESCO services

ESCOs usually offer the following services:

- The identification, development and design of energy efficiency projects;
- Financing, or acquiring the financing, of the energy efficiency project;
- Installation of energy efficiency technology/equipment; and
- The measurement, monitoring and verification (M&V) of the project's energy savings (Lee et al, 2003; World Energy Council, 2008).

In some cases, ESCOs will also maintain the energy efficiency equipment that has been installed.

ESCOs implement a variety of energy efficiency measures, including high efficiency lighting, heating and air conditioning, efficient motors, industrial process improvement, cogeneration, variable speed drives, waste heat recovery, and centralized energy management systems (Lee et al., 2003).

ESCOs can be vendor-based or consultancy-based (Sridharen, 2005). Consultancy, or technically-based ESCOs are often consulting firms with have a general expertise in engineering or energy efficiency. Vendor or technology-based ESCOs are often energy technology suppliers, sometimes with a connection to a particular energy efficiency equipment manufacturer.

1.1.2 ESCO financing models

There are four main ESCO financing models, based on who makes the upfront investment:

- *Client pays* – The ESCO conducts study and makes proposal guaranteeing certain energy savings over the contract term. The client pays for the equipment and remunerates the ESCO for project implementation, based on the energy savings achieved (Karrir, 2005).
- *Financial Institution lends money* – A financial institution signs a tri-party agreement with the client and ESCO, or one or the other, providing credit either to the ESCO or the client (World Energy Council, 2008). The ESCO conducts the study and guarantees certain energy reductions and then is remunerated for project implementation, based on the savings achieved (Karrir, 2005).
- *ESCO invests* – The ESCO provides the funding to implement all necessary energy upgrades based on the ESCOs study and proposal. The client provides a bank guarantee for the cost of the investment. The ESCO guarantees certain energy reductions and receives operating and maintenance costs, and receives a major share of the savings to recover its investment (Karrir, 2005).
- *SPV invests* – SPV refers to a special purpose vehicle – usually a corporate body or partnership created to fulfill narrow temporary objectives to isolate financial risk, sometimes to secure loans. The ESCO buys the equipment and sells it to the SPV, who extends an operating lease for the equipment. The client pays its energy savings to the ESCO, as well as operating and maintenance costs. The ESCO pays the SPV lease rentals, which should be less than the energy savings. At the end of the contract term, the client should own the equipment (Karrir, 2005).

There can be amalgams of these models depending on the situation.

1.1.3 ESCO remuneration models

ESCO remuneration in North America and Europe has traditionally been based on one of two models:

- *The guaranteed savings model* – The ESCO guarantees a certain level of energy savings to the customer (World Energy Council, 2008). In China and the US, this model is more often utilized when the client is making the upfront investment (Shen, 2007). The ESCO provides design, procurement and construction services and receives a service fee in exchange (Taylor, 2009). If the savings falls short of the ESCO forecast, the ESCO is obligated under the contract to compensate for this. The guaranteed savings model is considered to be the lower interest rate option (World Energy Council, 2008).
- *The shared savings model* – Under the shared savings model, the client and ESCO share the cost savings based on some predetermined percentage for a certain number of years (World Energy Council, 2008). Once the years are up, the project is over and the client retains any

further savings afterwards (Lee et al., 2003). Under the shared savings model, it is usually the ESCO financing the project, generally through third party financing. Thus, the ESCO generally assumes both the credit and the technological risk, and therefore often receives a higher share of the project savings. A key challenge associated with the shared-savings model is that it can produce a more acrimonious relationship between the client and the ESCO because the ESCO is motivated to verify to its customer that savings have been achieved, and in many cases, overachieved, in order to get paid, while the customer is motivated to argue that savings less than that contracted were actually realized (Sugay, 2009). In some countries, such as China, anticipated energy savings cash flows to be shared, and the sharing ratio, are specified in the contract so payments can follow an agreed upon schedule (Taylor, 2009).

In the 1970s and 80s in North America, the shared savings model dominated. However, in cases where savings were in dispute, smaller ESCOs sometimes were forced out of business, due to bankruptcy resulting in a lot of consolidation of ESCO companies in North America in the 1980s. As a result, the shared savings model has been in decline in North America since the 1980s, with most companies switching almost exclusively to guaranteed savings models (Roy, 2003; Sugay, 2009). However shared savings is till the dominant remuneration model in some developing countries such as China, accounting for 68 percent of projects (Taylor, 2009). Nevertheless, The guaranteed-savings model is on the rise in China because few ESCOs can get loans for projects over US $2 million (Taylor, 2009). Thus as a percentage of investment, guaranteed savings projects are significantly higher accounting for 71 percent of investment in China (Taylor, 2009).

As mentioned above, these remuneration models have not always been applied in precisely the same manner in developing countries. In some cases in developing countries, energy efficiency contracts with ESCOs do not always have a performance guarantee for a wide variety of reasons relating to the ESCO's willingness to take on risk and the general maturity of the ESCO industry and market (Sugay, 2009; Storment, 2009). Rather they are more straight *fee-for-service* contracts. The shared-savings model has also been adapted to Chinese circumstances whereby the anticipated energy savings cash flows and sharing ratio are outlined upfront in the contract to reduce the risks to the ESCO (Taylor, 2009).

In addition a new model is on the rise in China called the *outsourcing model*, whereby the ESCO manages and upgrades the client's energy use equipment on an ongoing basis for a specified fee (which is less than the energy savings gains), based on a 10 to 15 year contract (Zhao, 2007; Shen, 2007). This seems to be increasingly popular in commercial buildings, hotels and hospitals in China, whereas the other two models are employed more in industry and residential buildings (Zhao, 2007). The outsourcing model has also been utilized by ESCOs in Mexico, with some success, particularly in the hotel industry (Storment, 2009). There is also a new *tariff model* in India, in which energy is managed by an ESCO at predetermined tariff (Roy, 2006).

1.2 Potential and status of ESCOs

1.2.1 Potential of ESCOs

ESCOs have a huge potential role to play in reducing global energy consumption and therefore greenhouse gas emissions. They could also play a key role in addressing energy shortages and price increases (IREDA, 2006a). ESCOs could be a particularly important force for change in developing countries and countries in transition for a variety of reasons. Energy demand in some developing countries, such as China, India and Brazil, is forecast to increase by 60 percent over the next 25 years in the International Energy Agency (IEA) 2004 Reference Scenario (ESMAP, 2006). In addition, the intensity of energy use in many developing countries, particularly in industrial settings, is higher than those in developed countries, providing even greater opportunity for savings through energy efficiency (IREDA, 2006a; Taylor, 2009). In China, for example there is a wide array of very profitable potential projects that will provide quick returns. (Taylor, 2009). It is estimated that energy efficiency measures in buildings and industrial operations in energy intensive countries could reduce energy consumption in these countries by 25 percent (Environmental News Service, 2006). Some ESCO projects in India have already resulted in load reductions of 25 to 48 percent (IREDA, 2006b). In an IEA Alternative Policy Scenario, intended to highlight how a more sustainable global energy supply could be established by 2030, the IEA estimates that two-thirds of carbon dioxide emission reductions in developing countries must come from energy efficiency measures (Taylor et al., 2008). Finally, energy efficiency investments can also pay off dramatically from a cost savings perspective within a year or two. The financial savings that could be achieved from energy efficiency measures in certain countries are very high. Some projects in India result in annual savings that are close to half the total project cost, or in some cases exceed the total project cost (IREDA, 2006b).

ESCOs could play an important role in bringing about these energy efficiency advances. Many industrial operators and building managers do not have the technical capacity to undertake energy efficiency improvements independently. Because they are specialists, ESCOs can design more effective systems, and because their profits are directly linked to the energy savings, the ESCO is going to endeavour to ensure the savings are as large as possible, and must engage in monitoring and verification to prove the energy savings (Roy, 2006). Clients working on their own to implement energy efficiency measures often select lowest cost, minimalist approaches that can be quickly executed, with no monitoring and verification (Roy, 2006).

ESCOs also can provide access to innovative financing that clients might not be able to acquire on their own, as well as reducing burdens to public budgets (Metz, 2007). ESCOs can meet the needs of both the client and the financial institution (ESMAP, 2006). They also provide separation between the financial institution and the end-user clients.

In addition, many energy efficiency projects are small scale, and due to high transaction costs would not be undertaken by industrial, commercial or public sector clients on their own. ESCOs can perform a key role as bundlers of these projects, allowing them to proceed. They can also bundle the procurement of technology over several projects (Roy, 2006).

1.2.2 *Status of ESCOs*

ESCOs were established in the US in the 1970s (World Energy Council, 2008) and the US ESCO industry is considered to be one of the most successful in the world (Goldman, 2005). In the US, ESCOs evolved out of least cost planning activities of utilities, based on the realization that it can be cheaper to invest in energy efficiency than build new generation and distribution capacity. ESCOs spread to Western European countries and some Asian countries in the 1980s and 1990s and have enjoyed some moderate success in some countries, such as Germany (Langlois, nd; World Energy Council, 2008). In the 1990s, ESCOs started to be established in developing countries, due to global concerns regarding climate change (Langlois, nd; World Energy Council, 2008).

ESCOs are most numerous in the United States where it is estimated that there are 500 to 1000 ESCOs (World Energy Council, 2008), with a total annual project value of US $2 billion in 2002 (Metz, 2007). ESCO success varies widely in other parts of the world. The value of Canada's ESCO projects in 2001 was estimated to be at most US $100 million (Urge-Vorsatz et al., 2007), while the total value of ESCO projects in the European Union in 2000 was US $190 million. Some European countries, such as Germany and Austria have very successful ESCO industries, while others, such as Denmark and the Netherlands do not, in part because they have more mandatory demand side management (DSM) programs (World Energy Council, 2008).

The developing countries with the highest value of ESCO projects in 2001 were Brazil, China, Poland, South Korea and South Africa (Urge-Vorsatz et al., 2007; World Energy Council, 2008). Table 1 provides the total value of ESCO projects in some of these countries in 2001 in US dollars.

Table 1: Total value of ESCO projects in developing countries

Country	Total value of ESCO projects in 2001 (in US dollars)
China	US $ 49.7 million
Poland	US $ 30 million
South Korea	US $ 20 million
South Africa	US $ 10 million
India	US $1 million

Source: Urge-Vorsatz et al., 2007

Note that the total annual expenditure on ESCO related projects in 2001 in any one of these developing countries was less than 5 percent of that in the US. On a per capita basis in 2001, expenditures on ESCO projects in these developing countries was at most 13 percent of that in the US in the case of Poland, and in the case of China, was only 0.5 percent of the US (Urge-Vorsatz et al., 2007). However the ESCO industry has dramatically changed in the last eight years in China, with total investments rising to US $1billion, which is half of that in the US in 2007 (Taylor, 2009).

Nevertheless, despite China's recent success, the energy efficiency potential in most developing countries remains vastly untapped (ESMAP, 2006; Taylor et al., 2008; Hansen, 2009a). Vine (2005) estimated that the total value of ESCO activity outside the US in 2001 is between $560 million and $620 million, which is less than half the ESCO revenues in the US alone for the same year. Moreover, few if any developing countries have reached the point where their ESCO industries are operating without any international or domestic government support (Hansen, 2009a).

ESCOs are most active in different sectors in different countries. The public sector has always been considered an important trigger to ESCO success (World Energy Council, 2008). In developed countries, it is often in the public sector that ESCO projects are most concentrated (World Energy Council, 2008). For example in the US, it is estimated that 75 percent of ESCO business is in the public sector (Metz, 2007). The public sector has also been a critical source of business for ESCOs in many developing countries and countries in transition as well. However, in most developing countries and countries in transition, the industrial sector has the highest concentration of ESCO activity (World Energy Council, 2008). For example in Brazil, the industrial sector comprised 43 percent of ESCO business (Moreno, nd). In countries such as Bulgaria, Egypt, Kenya, the Philippines, Thailand and Ukraine, the industrial sector comprises 70 percent of ESCO activity (Urge-Vorsatz et al., 2007). However, in some developing countries, such as India, Mexico and Brazil, ESCOs are increasingly active in the commercial sector (Urge-Vorsatz et al., 2007; World Energy Council, 2008). The residential sector remains relatively unexplored in both developed and developing countries, with some exceptions such as Nepal and South Africa, due to the small overall savings associated with individual projects. However, it is estimated that overall residential consumption could be reduced by 40 percent through energy efficiency measures (Metz, 2007; Urge-Vorsatz et al., 2007).

1.3 ESCO status in specific developing countries

This section will examine ESCO status in some specific developing countries, focusing in particular on the total investment in ESCOs and the number of ESCOs in operation to try to develop some sense of the degree of market penetration of ESCOs. Measures that have been undertaken to promote ESCOs in particular countries will be discussed in detail in a later section. If a country is not mentioned, it can be assumed that there not significant ESCO activity in it. Data on ESCO market penetration are often limited and the numbers available are often challenging to compare among developing countries, as they are often from different years and are do not always refer to the same inputs (i.e. total ESCO investment versus total EPC investment, investment from international agencies versus domestic investment). Table 2 is intended to provide a quick comparative summary of how ESCOs are faring in individual countries. The numbers are the best available at this point in time, and are based on sources that are 2005 or later unless otherwise specified. For total investment, more than one total is sometimes provided where sources differ. Where there is a blank, it can be assumed that no numbers are available for that particular country. The individual countries and the references are discussed in more detail in the text.

Table 2: ESCO Status in Developing Countries

Country	Number of ESCOs	Number of Projects	Total Investment	Main Assistance Received	ESCO Association
China	Over 400 with 50-60 core	1426 since 1998	US $260 million in 2006 US $1 billion in 2007	World Bank GEF	Yes/EMCA
Brazil	25-40		US $40 million/year in 2008	World Bank 3CEE, Domestic government	Yes/ABESCO
South Korea	125	519 in 2000	US $76 million in 2000	Domestic government	-
Thailand	24	-	-	World Bank GEF, Domestic government	Yes
South Africa	35	-	US $ 10 million in 2001	Domestic utility	Yes/SAAEs
India	20	-	US $ 1 million in 2001	World Bank GEF and 3CEE, Domestic government and banks, USAID, CDM	Yes/ICPEEB
Mexico	20	-	-	US National Renewable Energy Laboratory, Domestic government	-
Kenya	1	-	-	World Bank GEF	No

1.3.1 China

As of 2008, China had the largest ESCO industry in the developing world in terms of total investment (Taylor et al., 2008). ESCOs have a short history in China and had to be jump started by the World Bank Global Environmental Facility (GEF) (ESMAP, 2006). In 1998, three pilot ESCOs were created through the GEF (Zhao, 2007). Phase two of this project commenced in 2003 to assist new and potential ESCOs to expand and grow with the formation of an ESCO association and an ESCO Partial Loan Guarantee Program through China's national Investment & Guarantee Co. (Zhao, 2007). Between 2004 and 2006, the Loan Guarantee Special fund provided funding for 85 projects, through a combination of investing (US $66 million), loans (US $40 million) and guarantees

(US $36 million) (Shen, 2007). By 2007, the number of ESCOs operating in China had risen to over 400, with at least 40 to 50 well-established core ESCOs (Taylor, 2009). Overall, based on GEF investment, by the end of 2006, 1426 projects had been completed (Zhao, 2007). Total investment in EPC in China annually has risen from US $128 million in 2003 to US $260 million in 2006 (Zhao, 2007), and US $1 billion in 2007 (Taylor, 2009). Indications are that investment in 2008 was even higher (Taylor, 2009). Carbon dioxide emissions savings have risen from 4 million tonnes in 2004 to 38 million tonnes in 2007 (Taylor, 2009). Building and industrial projects make up the bulk of China's ECSO industry. The industrial projects are larger with an average project investment of $1.7 million while building projects have an average project investment of $400,000 (Taylor, 2009).

1.3.2 Brazil

Brazil's ESCO industry is well established, with 40 ESCOs currently operating, but still needs support (Govindarajalu, 2006; REEEP 2007). Because of the manner in which funding in Brazil has operated (discussed in detail in section 2.2), dozens of firms have developed some energy efficiency engineering expertise, but only about 25 have sufficient expertise to enter into performance contracts (Taylor et al., 2008). Brazil has an active ESCO association and is reasonably self-sufficient and growing, although there is still significant potential for it to be larger (Day, 2009). According to Taylor et al., (2008) the investment in these companies is approximately US $40 million per year.

The ESCO industry in Brazil was assisted in the early 1990s by collaboration between the Canadian government (Industry Canada) and the National Confederation of Industry in Brazil, which was interested in making Brazil's industry more competitive (Day, 2009). The GERBI project, funded through the Canadian Climate Change Development Fund (CCDF) and administered by the Canadian International Development Agency (CIDA), was a major undertaking in the late 1990s to train new ESCOs, seek development bank funding and provide the industry (supply and demand side) with information and training on energy efficiency and ESCOs (Day, 2009). This resulted in 28 projects in industries financed by industry through commercial banks at high interest rates (Day, 2009). Much of the ESCO activity in Brazil is in industry, due to some high profile public sector project failures, and also due the challenges of single year budgets in the public sector (Day, 2009). However there are signs of more recent interest in the public sector (Day, 2009). The Brazilian Development Bank (BNDES) is also putting the finishing touches on a lending program for ESCOs (Day, 2009). The World Bank is working with the public sector to encourage ESCO projects in the reduction of infrastructure operating costs through Performance Contracting in waste and potable water treatment plants.

Brazil has received a fair bit of assistance from the Canadian government and international consultants in terms of developing an ESCO industry association, an industry accreditation program, Super ESCOs and a utility ESCO (Day, 2009). However, for a variety of bureaucratic and other reasons, only the ESCO association (ABESCO) has been successful (Day, 2009).

1.3.3 South Korea

South Korea is considered one of the major success models for ESCOs in developing countries due to significant support from the South Korean government. In South Korea, investment in ESCO business increased 12 times from 1997 from US $5.99 million to US$75.79 million in 2000 (Lee et al., 2000), with projects increasing from 25 to 519 and the number of ESCOs increasing to 125 (Lee et al., 2000). According to Urge-Vorsatz et al. (2007) the total value of ESCO projects in South Korea for 2001 was US $20 million.

1.3.4 South Africa

In South Africa the total value of ESCO projects in 2001 was US $10 million (Urge-Vorsatz, 2007). ESCOs in South Africa must be registered with Eskom, the only electricity utility in South Africa, and all of their projects have come from Eskom's demand-side management (DSM) programs, discussed in more detail below (Eskom DSM, 2008). There are two ESCO associations in South Africa, the South Africa Association of ESCOs (SAAEs), and the Black Energy Service Companies Association (Eskom DSM, 2008). In 2008, SAAEs listed 35 corporate ESCO members, each of which had completed at least one successful ESCO project (SAAEs, 2008).

1.3.5 India

In India, despite implementing a number of demonstration projects in the public, commercial and industrial sectors (Cherail, 2005), ESCOs have not achieved a critical mass in terms of numbers. In 2003 there were 10 to 15 ESCOs operating in India (Roy, 2003). By 2005 there was considered to be 20 (Sridharen, 2005). Indian ESCOs are generally small in size and weak in asset base (Sridharen, 2005). Nevertheless, projects have been implemented in India to retrofit municipal lighting, improve the energy efficiency of hotels, and demand side management for industrial operations. As of 2007 there were 38 projects in the public sector in India (Hansen, 2009). The typical size project in India is small (US $0.1 to 1.1 million) and payback is usually within two years (Sridharen, 2005). Most projects have been financed by the client and are undertaken in accordance with the guaranteed savings scheme, however there are many shared savings projects (Roy, 2003). Nevertheless, the effectiveness of ESCOs in India in terms of increasing energy efficiency in any notable way cannot be considered significant (Karrir, 2005). They are still at an infant stage and are unlikely to develop without sustained government support (CRISIL, 2004; Dhingra and Julena. 2005; Govindarajalu, 2006). India is hampered by challenges associated with limited energy supply, energy theft and the State Energy Board distribution structure, and therefore there are not as many opportunities for, or interest in, energy efficiency projects as in other countries.

1.3.6 Kenya

In Kenya, a broad GEF/Kenya Association of Manufacturers Industrial Energy Efficiency Project commenced in 2001 to remove barriers to energy efficiency in small to medium scale enterprises (Kirai, 2007). The project is a broad one and involves capacity building, policy and institutional support and implementing EE services through financing and ESCO development. As a result of the project, one ESCO was established in 2005 to deliver energy services (Kirai, 2007). Data are unavailable, however, on how many projects this ESCO has undertaken.

1.3.7 Egypt

In Egypt, a GEF project, the Energy Efficiency Improvements and Greenhouse Gas Reductions project (EEIGGR), with a grant of US$4.11 million was undertaken from 1998 to 2006 to remove technical, institutional and capacity barriers to energy efficiency in Egypt (UNDP, nd). Eight ESCOs were established through this project to provide advice in energy efficiency and financing. The project provided training in energy auditing, energy efficiency technologies, project evaluation and financing to the ESCOs (UNDP, nd). A sales process was also developed for private and public sectors. In 2004, support for the ESCOs was refined to focus on a supplier-based credit model, simpler contracts and technologies with low technical risks and short payback periods (UNDP, nd). EEIGGR has now developed a loan guarantee program for ESCOs to enable them to get bank financing (Yassin, 2007). However there is limited information with regard to how successful this program has been. A USAID project was also planned to establish a credit guarantee mechanism for energy-efficiency financing in Egypt (Vine, 2005).

1.3.8 Thailand

ESCO development in Thailand was fostered by a GEF project in 1999. Working through the Thai Department of Energy Development and Promotion, some goals of the project included reducing the incremental cost of financing, and assessing the applicability of ESCOs in the Thai commercial and industrial market (du Pont et al., 2000). The Thai Department of Alternative Energy Development and Efficiency (DEDE) lists 24 ESCOs in Thailand on its website, and Thailand has an active ESCO association (DEDE, 2008).

1.3.9 Mexico

Mexican ESCO development has been facilitated by a Mexican Commission for Energy Savings (CONAE) and US National Renewable Energy Laboratory (NREL) project that commenced in 1999 (NREL, 2005), and by the North American Development (NAD) Bank (Storment, 2009). The NREL/CONAE project focused on matchmaking of clients and ESCOs and training. The number of ESCOs in Mexico is unclear, with estimates ranging from ten to twenty (Taylor, nd; Storment, 2009). However, many of these are only loosely considered ESCOs as they provide some energy efficiency services but do not generally engage in EPC. ESCOs in Mexico have struggled with obtaining long term financing from domestic financial institutions (APEC Energy Working Group, 2006b). Significant information was distributed and capacity building was undertaken through the CONAE/NREL program. However, as of 2001, only two projects had resulted from the program, although the promotion of more was planned (Taylor, nd). Likewise, despite significant efforts from the NAD Bank, to promote municipal lighting projects, and industrial projects, no projects have resulted due to limited client interest in taking on the loan risks, due to major procurement and political barriers (Storment, 2009). FIDE, Mexico's Electric Energy Savings Trust Fund, does promote electrical energy efficiency projects in Mexico through small loans for street lighting projects and small industry. However FIDE undertakes the work itself. Nevertheless, there are a few ESCOs that have managed to carve out a reasonable market by undertaking small projects in the industrial and hotel sector (Storment, 2009). One ESCO in Mexico, OptimaEnergia, has been fairly successful in the tourism industry working in larger older hotels and therefore has been able to attract private equity funding (Storment, 2009). It offers a whole package of energy efficiency options and also does water conservation and desalinzation work (Storment, 2009). It operates on somewhat of a performance guarantee, although the monitoring and verification protocols tend to be weaker than in developed countries, and generally offers a ten-year service contract, in which maintenance and monitoring are ongoing (Storment, 2009), more consistent with the outsourcing model of remuneration, described earlier.

1.3.10 Philippines

ESCOs in the Philippines were fostered through a World Bank IFC/GEF program called the Efficient Lighting Initiative (Vine, 2005). The lighting initiative identified potential ESCO projects, particularly lighting retrofit projects and held symposia for lighting businesses to educate them regarding ESCO business concepts and project opportunities (Vine, 2005). A pilot project was undertaken with the Development Bank of the Philippines to serve as an industry benchmark (Vine, 2005).

1.3.11 Other Countries

ESCOs also exist in several other developing countries and countries in transition. In the Central and Eastern European countries with economies in transition, such as Ukraine, Russia, Estonia, the Czech Republic, Hungary, the Slovak Republic, Poland, Lithuania, Romania, Croatia, Belarus and Bulgaria, ESCOs are reasonably well established, although they have still benefited significantly from financial assistance through the World Bank GEF, IFC and USAID in terms of financing programs. While they share some characteristics with developing countries, ESCO experiences in these countries are not discussed in detail in this paper, although they are referenced occasionally where specific examples are required.

Other developing countries in which ESCOs exist include: Argentina, Chile, Columbia, Ghana, and Nepal (Vine 2005). However, data on the level of ESCO activity in these countries is limited. It should be noted however that other than the countries mentioned, there is very little ESCO activity in Africa.

2.0 Programs and mechanisms to increase ESCO activity

ESCOs have promoted in developing countries through a variety of programs and mechanisms. The support of international development agencies and financial institutions, as well as developing country governments, have been particularly critical to ESCO success. However other programs and mechanisms, including domestic financial institutions, ESCO associations, domestic utilities and joint ventures with multi-national ESCOs, have also played a key role in some countries.

This section will examine some of these programs and mechanisms. For each type of program, some examples of the agencies undertaking them, or the countries in which the programs have been undertaken will be provided. These examples are not meant to be exhaustive, but rather to provide a sense of the range of programs operating, where they are most important and the degree of success they have experienced. Overall there have been significant efforts by a multitude of agencies to promote ESCOs in developing countries, but they have met with only mixed success, and in some cases very limited success.

2.1 International development agencies and funds

International development agencies and funds have been critical in fostering the development of ESCOs in many developing countries. Support is generally provided in the form of grants, programs and concessional loans. There are multiple agencies providing aid with regard to energy efficiency. Some of the key international agencies involved in ESCO development include the World Bank, European Bank for Reconstruction and Development and the US Agency for International Development. The activities of some of these agencies have already been highlighted above, with respect to individual developing countries. This section will consider the programs of these agencies in more detail.

2.1.1 World Bank

The World Bank has been a key source of funding for ESCO related programs both independently, through its many programs, such as the Energy Sector Management Assistance Program (ESMAP) and working in conjunction with other agencies. Two of its largest efforts to promote ESCO development have been through the Global Environmental Facility (GEF) and the World Bank-UNEP Three-Country Energy Efficiency Project. The World Bank has also engaged in a wide variety of smaller ESCO investments.

Global Environmental Facility

The World Bank Global Environmental Facility (GEF) has played a critical role in promoting the start of ESCO industries in many developing countries over the last ten years (ESMAP, 2006). As already discussed, the GEF has played a key role in China, Thailand, Kenya and Egypt. It has also funded ESCO development in Hungary, Brazil and India.

The GEF played a particularly critical part in ESCO development in China. The World Bank GEF China Energy Conservation Project started in 1996 to promote energy performance contracting and the ESCO industry in China (Zhao, 2007). In phase one, three pilot ESCOs were established as well as a national energy conservation information dissemination centre (Zhao, 2007). In phase two, the GEF funded the China ESCO Partial Loan Guarantee Program in 2003 (Taylor et al., 2008; World Energy Council, 2008). The Loan Guarantee Program played an essential role in allowing new ESCOs to establish a credit history and borrowing relationships with banks, thereby allowing them to become established borrowers who no longer need the program (Taylor, 2009). As a result of the GEF program, China is considered to be the leader in ESCO industry development in the developing world. Much of the assistance offered to developing countries by many agencies has been in the form of workshops, training and studies. However this approach does little to eliminate some of the institutional barriers to the ESCO industry. It is believed that a key element of the success of the World Bank program was to establish the three pilot ESCOs and undertake projects (Taylor, 2009). This facilitated the identification and resolution of many of the barriers to ESCO operation, as the World Bank worked with the local ESCOs to implement the projects (Taylor, 2009).

The GEF has also provided funding to a diverse array of other initiatives intended to promote ESCOs in a variety of countries. GEF programs in Thailand and Egypt have already been described. One key GEF initiative was in conjunction with the International Finance Corporation (IFC), a World Bank Group bank, to fund a loan guarantee program in Hungary called the Hungary Energy Efficiency co-financing program (HEECP2) (Taylor et al., 2008; World Energy Council, 2008). This program commenced in 1997 and has been fairly successful in promoting energy efficiency lending in Hungarian commercial banks (Taylor et al., 2008). Technical assistance is offered to both the bank and the project developer. As a result, it has been expanded to other Eastern European countries (Taylor et al., 2008). It is designed to promote energy efficiency lending in general and is not specifically targeted at ESCOs, whereas the China loan guarantee program is. Other GEF ESCO projects include: the Bulgarian and Romanian Energy Efficiency Funds (Gerginov, 2007; Urge-Vorsatz, 2007), the Energy Management and Performance Related Energy Savings Scheme (EMPRESS) in Slovakia and the Czech Republic, and the GEF Technical Assistance Program (TAP) which provided aid to the Indian Renewable Energy Development Agency (IREDA) in India for institutional development, marketing energy efficiency, supporting ESCO market development, capacity building of stakeholders, and development of energy efficiency projects in certain sectors (Valavan and Bhatia, 2005).

The Three Country EE Project

In conjunction with UNEP, the World Bank funded the Three Country EE Project, a multi-year technical assistance program to develop financial intermediation mechanisms for energy efficiency in Brazil, China and India (ESMAP, 2006). The goal of the project was to develop new ideas for energy efficiency financing schemes, to ease the usual investment requirements required by financial institutions (ESMAP, 2006). These measures could be implemented by local financial institutions, with help from the World Bank and other international agencies (ESMAP, 2006). The project involved stakeholders from the financial and energy efficiency communities in all three countries to foster market development through the sharing of knowledge regarding projects, financing approaches and contracting systems (ESMAP, 2006; IREDA, 2006b).

In India, demonstration projects were undertaken, information was distributed to banks, and banks were assisted in developing EE financing schemes (Shridharen, 2005; IREDA, 2006b). As a result, three banks to launched programs targeted at energy efficiency projects including the State Bank of India, the Canara Bank and the Union Bank of India (Cherail, 2005; Sridharen, 2005). The program has significantly improved dialogue between ESCOs and banks, established financing structures for ESCOS, increased banks' interest in ESCO projects, created a forum in which ESCO project experiences can be reviewed and made banks aware of international funding opportunities such as the clean development mechanism (Sridharen, 2005). It has also raised interest among venture capitalist funds and equity investors (Sridharen, 2005).

Other World Bank ESCO Initiatives

The World Bank has also funded a wide variety of other smaller initiatives to promote ESCOs. Working with CIDA, the World Bank funded the Greenhouse Gases Emissions Reduction in Brazilian Industry (GERBI), a $3 million project which played a critical role in getting 28 ESCO projects undertaken through ESCO training, working with the development bank to access financing and training of industry members with regard to what to look for in an ESCO and how to undertake an ESCO project (Day, 2009). In addition, ESMAP has undertaken a program in Mexico to establish financial solutions for ESCOs through a Special Purpose Company. The World Bank has also established a guarantee fund for ESCOs under The Brazil, China, India Agreement (Moreno, nd). It has also extended lines of credit for energy efficiency lending and loans for EPC in India, Croatia and Poland (Valavan and Bhatia, 2005; Urge-Vorsatz et al., 2007).

In 2007, a US $200 million World Bank line-of-credit for energy efficiency lending projects was approved for China (Taylor et al., 2008). Under the program, local banks will be responsible for project implementation including project appraisal and creation of loan terms (Taylor et al., 2008). The World Bank funds will then be provided to each bank to serve as a line-of-credit for a portion of the financing (Taylor et al., 2008). The goal is to create a viable commercial energy efficiency lending program in China through local banks.

Overall, the World Bank initiatives have been criticized on the grounds that many of the ESCO projects that resulted were only undertaken because of the availability of World Bank funding, while not enough has been done to promote the interest of commercial banks in lending to ESCOs that is necessary for a more sustainable ESCO industry. The interest of commercial banks in lending to some ESCO projects remains limited in some countries in which the World Bank has been very active. The World Bank initiatives have also been criticized for forcing a North American style shared-savings EPC ESCO model in developing countries, where other models might have been more appropriate. Nevertheless, World Bank funding has been helpful in laying the groundwork and developing some local expertise and interest in ESCOs in many developing countries.

2.1.2 European Bank for Reconstruction and Development

The European Bank for Reconstruction and Development (EBRD) has endeavoured to play a role in promoting ESCOs in Central and Eastern Europe. Starting in 1994, the EBRD worked with some larger European ESCOs, (Honeywell, Siemens and Dalkia) to set up frameworks to finance and establish ESCOs in several Central and Eastern European countries (Hobson, 2009). Efforts were initially hampered by limited client interest in energy efficiency, challenging public procurement rules and unwillingness to take risks (Hobson, 2009). From 1994 to 2000, there was very limited success in getting projects underway (Hobson, 2009). After 2000, there was greater interest in energy efficiency by public authorities due to increases in energy prices (Hobson, 2009). By 2004, the bank had financed 15 ESCO projects (EBRD, 2005). These projects are generally bundled multi-projects in a single facility with an international partner such as Honeywell and Siemens (EBRD, 2005). The projects had mixed success and faced regulatory barriers. More recently the bank is promoting projects in public sector facilities such as schools. The bank provides debt, equity and guarantees but requires technical guarantees, buys receivables from ESCO projects (forfeiting) or risk shares with another forfeiting institution and finances start up ESCOs with a credible sponsor and a put option with the sponsor (EBRD, 2005). The EBRD has also created a credit line for energy performance contracting in the residential sector in some countries (Urge-Vorsatz et al., 2007). In the last two years there has been a significant upsurge of interest in ESCOs in Central and Eastern Europe. The EBRD has been funding consultants to develop EPC processes and examine public procurement and financing laws in several countries to provide a working model and contract structure for engineering and construction firms interested in engaging in energy efficiency EPC in the public sector (Hobson, 2009). Pilot projects in the public sector will also be undertaken (Hobson, 2009).

2.1.3 USAID

USAID, the United States Agency for International Development has been active in ESCO promotion in various developing countries. USAID has played a key role in India, starting in the early 90s, funding feasibility studies, ESCO promotion grants, study tours in the US, formation of a few ESCOs (Roy, 2003; Sridharan, 2005). It worked with India's public sector development bank

IDBI (Industrial Development Bank of India) on these projects (Roy, 2003). USAIDs ECO I program assisted with some ESCO projects and developing model performance contracting (Sridharan, 2005). The USAID ECO III program is a bilateral project between the US and India government to promote energy efficiency in the building sector (Kumar, 2008). ESCO projects will be a component of this program (Kumar, 2008). USAID has also assisted ESCO development in India less directly, through its Energise and WENEXA initiatives (Roy, 2003).

USAID has also offered smaller scale ESCO assistance to some developing countries. For example, in Armenia, the USAID Energy Efficiency, Demand-side management, and Renewable Energy Program funded a project undertaken by ESCOs to improve the efficiency of fire stations (Armenian ESCO Assn, 2006). It also provided funding so members of the Armenian ESCO Association could attend the ESCO Asia conference in Bangkok in 2006 to facilitate learning, partnership development and capacity building (Armenian ESCO Assn, 2006). USAID provided some funding between 1995 to 2000 to try to get North American ESCOs established in some developing countries, or to have North American ESCOs assist in ESCO promotion in developing countries (Lockhart, 2009). North American ESCO representatives were brought in to conduct workshops and trade missions for developing country government officials and local ESCOs. These workshops and trade missions were of limited success in terms of resulting in any concrete projects (Lockhart, 2009).

2.1.4 Clean Development Mechanism

The Clean Development Mechanism (CDM) is an agreement under the Kyoto Protocol, in which developed countries (Annex 1 countries) can gain credits by funding projects in developing countries to reduce greenhouse gases instead of more expensive emission reduction projects in their own countries. These credits are then applied by the developed countries against their own emission reduction requirements (International Finance Corporation et al., 2008). In theory, the CDM could be a key means of funding ESCO projects and it has been utilized by ESCOs in India to design and develop projects (Cherail, 2005; IREDA, 2006b). Financing obtained through the CDM can provide additional revenue for an energy efficiency project and therefore make it more appealing for commercial financing (International Finance Corporation et al., 2008). However there are some challenges. The frequent small size of EE and ESCO projects has been a limiting factor (Roy, 2006). The administrative costs of preparing a CDM application and transaction, in terms of labour and expenses to demonstrate the existence and size of the savings, are often higher than the revenue that would be gained from the savings (International Finance Corporation et al., 2008). Rules of additionality under the Kyoto Protocol whereby it has to be demonstrated that the emissions reductions are additional to what would have happened in the absence of credits (International Finance Corporation et al., 2008). Since energy efficiency is cost effective, it does not qualify unless it can be demonstrated that barriers other than the rate of return would have prevented the project in the absence of carbon credits. It has been proposed that ESCOs could serve as a project aggregator for CDM applications, to increase the size of the savings and therefore the viability of the application given the transaction costs. This is starting to happen with some positive effects in Brazil where the Brazilian ESCO association is serving as the project aggregator (Day, 2009).

2.1.5 *The Clinton Climate Initiative*

The Clinton Climate Initiative may play a major role in promoting ESCO developing in the future as an intermediary through its Energy Efficiency Building Retrofit Program (Sugay, 2009). The program was announced in 2006 and created a partnership between five international banks, four ESCOs (Siemens, Honeywell, Johnson Controls and Trane) and 16 major international cities, in both developed and developing countries, including Bangkok, Johannesburg, Karachi, Mexico City, Mumbai, and Sao Paulo (Philippine Daily Inquirer, 2007). The banks have agreed to provide up to $1 billion each to cities and private landowners to upgrade their older buildings through ESCOs (Philippine Daily Inquirer, 2007). Projects are already underway in several of these cities to retrofit more than 300 municipal buildings (Clinton Foundation, 2009). In addition private building owners have started commercial retrofit projects. Over 200 square million of energy efficiency upgrade work is underway (Clinton Foundation, 2009).

2.1.6 *North American Development Bank*

The North American Development (NAD) Bank operates on the border of the United States and Mexico. Its jurisdiction extends 100 km into the United States and 300 km into Mexico. The NAD Bank started work on promoting energy efficiency projects in the border region in 2002 (Storment, 2009). The bank cost-shared studies with the federal government to examine ESCO market feasibility (Storment, 2009). Significant efforts were undertaken by the bank to generate interest in energy efficiency projects, particularly public street lighting in municipalities, chosen due to the high cost of electricity and the rapid payback period of two to three years (Storment, 2009). Despite significant work and offers to finance loans to municipalities, no projects have yet to go forward due to a wide array of political barriers, and unwillingness of the municipalities to take on the risks of the loans. Nevertheless, there are several projects still in progress and the bank is hoping to finance some in 2009 (Storment, 2009).

2.1.7 *Other International Programs*

Many other international agencies have also played a role in ESCO development, on a smaller scale. For example, the UNEP Collaborating Centre on Energy and Environment played a role in South Korea. The Asia Development Bank (ADB) has also been a supporter of ESCOs through its Project Preparatory Technology Assistance (PPTA) program (Roy, 2006). Other programs include the Renewable Energy and Energy Efficiency Partnership (REEEP), which in 2007 funded a project in Mexico to encourage local banks to provide long term financing to ESCO projects (REEEP, nd). The Canadian International Development Agency (CIDA) has been active in Brazil and India with ESCO initiatives (Day, 2009). The US National Renewable Energy Laboratory (NREL) also provided funding and assistance to the Mexican government in 1999 to promote ESCO projects through matchmaking of potential clients with ESCOs, training of ESCOs, as well as the development of financial vehicles for ESCOs (NREL, 2005). NREL has also been active in ESCO promotion in South Korea, Egypt and India (Taylor, nd).

2.2 Domestic government programs

Government programs to support ESCOs are considered critical for their success in developing countries, particularly in the start up stages (Lee et al., 2003; ESMAP, 2006). Governments of some developing countries have established programs aimed at fostering ESCOs domestically. Examples include Brazil (Langlois, nd), Korea (Lee, et al., 2003), India (Dhingra and Julena, 2005), Thailand (APEC Energy Working Group, 2006b) and China (ESMAP, 2006). Programs can include policy support, such as energy efficiency Acts, demonstration programs to promote market creation, financial assistance and other forms of strategic support. Key elements of some of these programs are discussed below.

2.2.1 South Korea

The South Korean government has played a very active role in ESCO support both financially and through policy. ESCO growth in Korea is considered strongly linked to financial and institutional support from the Korean government and KEMCO (Korea Energy Management Corporation). (Lee et al., 2003). Some of the measures undertaken by the Korean government include (Lee et al., 2003):

- Redrafting its energy act to prepare a legal background for financially supporting ESCOs;
- Tax credits for ESCO projects;
- Long term and low interest loans to ESCO projects; and
- Provision of loans through KEMCO through financial institutions from a special account collected from surcharges on the import and/or sale of oil and some petroleum products.

Nevertheless, the key to success of ESCOs in Korea did not come from the financial support, which did not lead to significant ESCO growth, but rather the removal of institutional barriers in 1998. This involved changing government procurement, budget and accounting laws to allow public entities to write multi-year contracts (Lee et al., 2003; Roy, 2003). Prior to this, energy efficiency equipment was only considered when budgets were available and energy purchase budgets and energy expense budgets were separately managed. With ESCO projects, there is often a time lag of more than a year between installation and payback from the energy savings. Allowing for multi-year contracts was key to the growth of the Korean ESCO sector. In addition, a demonstration project was undertaken in a government complex (Lee et al., 2003). It was a small project involving only lighting, but for a total investment of $180,000 it produced an annual savings of $100,000 in addition to ancillary benefits of an improved work environment and reduced maintenance costs (Roy, 2003). The demonstration project was key to promoting greater interest in the public sector including local governments, military bases and public corporations as well as in the private sector (Lee et al., 2003).

2.2.2 *India*

India has offered support to the ESCO industry primarily through policy development. The Indian government enacted the Energy Conservation Act in 2001 (EC Act), established a Bureau of Energy Efficiency (BEE) and committed to reducing energy consumption in government buildings by 30 percent by 2010 (Roy, 2003; Environmental News Service, 2006). Mandatory energy auditing in designated consumers has been a key driver of the ESCO industry in India (CRISIL, 2004). Building codes, requirements for appliance standards and labelling and accreditation for energy managers and auditors have also been established (Sridharen, 2005). Presentations and workshops have been undertaken with respect to the EC Act (Dhingra and Julena, 2005). The India Industry Program for Energy Conservation (IIPEC) was also launched (Roy, 2003). These initiatives all gave ESCO business somewhat of a boost (Cherail, 2005). BEE has enlisted ESCOs for government building EE projects (Sridharen, 2005). However some argue that the EC Act is not being enforced strongly (Dhingra and Julena, 2005), and there is no legal framework to safeguard ESCO contracts (Sridharen, 2005).

2.2.3 *Brazil*

The Brazilian government has played a very active role in the financial support of ESCOs and energy efficiency projects in the form of two main initiatives: its utility wire-charge program and its national electricity conservation program. CONPET is an energy efficiency program managed by Petrobras for the Brazilian Government and is focused on the reduction of oil and natural gas consumption in Brazilian industry.

The Brazilian ESCO industry has received support from ANEEL, the Brazilian Electricity Regulation Agency. In 1998 ANEEL mandated a "wire-charge" of one percent of annual utility revenues for public benefit investments, usually by the utilities themselves (Taylor et al., 2008). A significant portion of this investment initially went to energy efficiency investment (Taylor et al., 2008). The proportion declined over the years until 2007, when Congress established that the energy efficiency allocation would be 50 percent (Taylor et al. 2008). Initially all investments by the utilities were in the form of grants, but utilities are now allowed to utilize the funds for performance based contracts in which they recuperate some of the funds, allowing them to reinvest the returned funds in new projects (Taylor et al., 2008). From 1998 to 2004, energy efficiency investments through the wire charge have ranged from approximately US $35 million annually to US $76 million annually (Taylor et al., 2008). This investment has been five times greater over the years than the investment by PROCEL, the government electrical energy efficiency program (Taylor, et al., 2008). These funds have been a critical source of income for ESCOs, who rank the regulated energy efficiency program as their largest source of income (Taylor, et al., 2008). ESCOs compete for and receive about 20 percent of the energy efficiency related projects through this program (Taylor et al., 2008). However, they are generally straight engineering contracts, not performance based contracts (Taylor et al., 2008). The program has been criticised for being too rigid, resulting in fragmented projects, not being backed by public energy efficiency policies, and failing to involve the commercial financial sector or prepare ESCOs for a sustainable future accessing commercial financing (Taylor et al., 2008).

Brazil's national electricity conservation program (PROCEL) was established in 1985 and funds or co-funds energy efficiency projects including research and development, education, labelling and standards and demonstration projects (Taylor et al., 2008). It has provided support for ESCOs which has been channelled through ABESCO, the Brazil association of energy service companies (Taylor et al., 2008). The Brazilian government has also created a loan guarantee fund for energy efficiency projects called PROESCO. The Brazilian National Development Bank (BNDES) shares up to 80 percent of the credit risk, while the remaining 20 percent is taken up by the intermediary bank. The guarantee fee is paid by the borrower (CRISIL, 2004).

2.2.4 Thailand

The Thai Energy Conservation Promotion Act (ENCON Act) was passed in 1992 (Energy Futures Australia, 2005). Among other measures, a key element of the act was to require designated facilities (large buildings and industries – approximately 4500 in total) to undertake energy efficiency activities (Energy Futures Australia, 2005). A voluntary program was created for small and medium sized enterprises. The Energy Conservation Promotion Fund (ENCON Fund) was established through the Act and is financed by a levy of US$ 0.001/litre on petroleum products (Energy Futures Australia, 2005; APEC Energy Working Group 2006b). The ENCON fund has an inflow of about US $50 million per year (Energy Futures Australia, 2005).

The ENCON fund is used to fund the Energy Efficiency Revolving Fund, which is a program started in 2003 to encourage Thai domestic banks to become involved in lending for energy efficiency projects (Energy Futures Australia, 2005). The fund provides the capital at no cost to the Thai banks, who then provide energy efficiency project proponents with loans at low cost (Energy Futures Australia, 2005). The ENCON fund is also utilized to provide 30 percent subsidies to clients for energy efficiency projects (Energy Futures Australia, 2005). The Revolving Fund has been key to increasing the interest and experience of domestic banks in EE lending and has leveraged a significant amount of commercial lending (APEC Energy Working Group, 2006b). In phase two, the Revolving Funds of US $51 million are expected to leverage approximately US $255 million in commercial bank lending (APEC Energy Working Group, 2006b). ESCOs are permitted to apply for the energy efficiency loans, but as of 2005 only one loan had been granted to an ESCO as they do not have land or collateral (Energy Futures Australia, 2005). Clients have instead acquired the loans for ESCOs to undertake the work in some cases (Energy Futures Australia, 2005).

2.2.5 *China*

In 2006, the Chinese government launched an aggressive Five Year Plan (2006 – 2010) to reduce both energy consumption and emissions. Part of the plan involves decreasing the country's energy intensity by 20 percent (Taylor, 2009). Many programs have commenced and very specific targets have been set for each of China's provinces with regard to how much energy has to be saved. This has created a very receptive market for ESCO services in the last two years and is a key part of the reason for the massive growth in the Chinese ESCO industry from US $260 million in 2006 to over US $1 billion in 2007 (Taylor, 2009).

2.3 Domestic development banks

Domestic development banks have played a role in ESCO development in Brazil (BNDES), India (IREDA), China (National Investment & Guarantee Co. Ltd.) and Mexico (BANOBRAS and Nacional Financiera) through financing, loan guarantees and other initiatives (Cherail, 2005; APEC Energy Working Group, 2006b; REEEP, 2007). The North American Development bank (NAD), owned by both the Mexican and United States governments, has also provided lending for energy efficiency projects at preferential rates along the US-Mexico border (APEC Energy Working Group, 2006b).

2.3.1 *Brazil*

The Brazilian development bank (BNDES) has offered energy efficiency services and financing to domestic industries (REEEP, 2007). These funds have been utilized by Brazil's main oil company and an international consulting firm to establish an ESCO to help industrial and commercial clients reduce their utility bills (REEEP, 2007). BNDES offers preferential financing rates to these projects (REEEP, 2007). BNDES and PROCEL (Brazil's National Electricity Conservation Program) in conjunction with the Ministry of Mining and Energy also have an Investment Fund, based on energy efficiency service companies business (Moreno, nd).

2.4 Domestic commercial financial institutions

Domestic commercial financial institutions have generally played a fairly limited role in most developing countries to date, although they are starting to play a role in countries such as India and Thailand.

2.4.1 *India*

In India, largely as a result of the Three Country Energy Efficiency project, five of India's largest banks have established small energy efficiency lending programs, which are expanding and attracting some attention (Environmental News Service, 2006). The first bank to establish such a program was the State Bank of India in 2002 (Sridharen, 2005). The Canara Bank and Union Bank of India followed suit in 2004 (Sridharen, 2005). The programs are targeted primarily at existing bank clients, although the Union Bank program will lend to small to medium sized enterprises (SMEs) with no liability to other banks (Sridharen, 2005). The banks will finance 75 percent to 90 percent of the project cost, but all three banks have a maximum lending limit of US $220,000 (10 million Rs) (Sridharen, 2005).

2.4.2 *Thailand*

Much of the involvement of the Thai banking sector has been fostered through the government Energy Efficiency Revolving Fund. The fund has been key for promoting commercial bank interest and expertise in energy efficiency lending. As a result of the program, three Thai banks have established specific energy efficiency departments or units, in one case with a team of in-house engineers for analyzing projects (APEC Working Group, 2006b). As discussed above, the funding provided by the Thai government has leveraged significant commercial funds, however lending directly to ESCOs remains problematic due to lack of collateral (Energy Futures Australia, 2005). The challenges associated with loaning money to ESCOs could be overcome with a loan guarantee program (Energy Futures Australia, 2005).

2.5 Domestic utilities/energy producers

Domestic utilities and energy producers can promote energy efficiency investment with their customers, often through demand-side management (DSM) programs (ESMAP, 2006; Calemayer, 2008). This has not customarily been a role taken on by utilities, as energy efficiency represents losses in sales revenue. Governments can provide special incentives to utilities to focus more on energy efficiency. Utilities in North America did own and operate ESCOs in the past, but have largely sold them off in recent years. Nevertheless, utility DSM programs and partnerships with ESCOs have been key to fostering the growth of ESCOs in countries such as South Africa (Calemayer, 2008), Japan and Thailand (Roy, 2006).

2.5.1 *South Africa*

Demand-side management projects at South Africa's Eskom (the electrical utility) have been the primary source of business for South Africa's ESCO industry. The utility establishes benchmarks for the projects, screens ESCOs and provides a list of ESCOs to prospective clients (Eskom DSM, 2008). Approved projects qualify for financial assistance from Eskom DSM through its "profitable partnership program". Selected partners receive funding for 50 percent of the capital expenditure and implementation costs for energy efficiency projects (Eskom DSM, 2008).

2.5.2 *Brazil*

Petrobras, Brazil's flagship oil company had planned to establish an ESCO through its retail subsidiary BR and Econoler International to help its customers reduce their energy consumption (REEEP, 2007). ESCO training was provided to Petrobras in 2002/2003 by international ESCO experts (Day, 2009). The ESCO was expected to leverage financing that will eventually be offered through a Brazilian Development Bank (BNDES)/World Bank financing package that is under development (REEEP, 2007), and focus on Telemar, a telecommunications company that owns or operates over 50 buildings as its first client (REEEP, 2007). This project did not end up occurring for a range of reasons (Day, 2009). However it does demonstrate utility interest in the ESCO concept.

2.6 ESCO associations

ESCO associations can play a key role in promoting energy efficiency investment in collaboration with governments, banks and utilities (Cherail, 2005). ESCO associations engage in public outreach, the creation of new partnerships and training and capacity building for their members. They can also promote working relationships among members allowing them to collaborate on projects, allowing them to take on larger projects and/or projects that require combinations of various skill-sets. In some countries, ESCOs have considered pooling their resources to establish a corpus guarantee fund, in the absence of government funded loan guarantee funds (Cherail, 2005; IREDA, 2006b). ESCO associations also work with ESCO associations in other countries to hold conferences and exchange knowledge and create networking opportunities (Hansen, 2009a). ESCOs in some developed countries, such as the Japanese ESCO association (JAESCO), have played a mentorship role with ESCO associations in developing countries, facilitating knowledge sharing and networking (Hansen, 2009a).

There are many developing countries and countries in transition with active ESCO associations including China, Brazil, South Africa, Egypt, India and Armenia.

2.6.1 *South Africa*

The South African ESCO association has 32 corporate members and 11 associate member companies (Calmeyer, 2008). It is working on outreach to the public and business decision makers, establishing standards and accreditation, working with the utility (their main source of project funding) to streamline project process, and partnership building (Calemeyer, 2008).

2.6.2 *Brazil*

The Brazilian ESCO association (ABESCO) was founded in 1997, through the assistance of international ESCO consultants, with 15 members and currently has 75 associate members (Moreno, nd; Day 2009). ABESCO has over 2000 industry partners i.e. lighting associations, engineering consulting associations, the installation industry union (Moreno, nd). The association has been working on an ESCO accreditation program with Eletrobras and PROCEL (Moreno, nd). The first stage of this program was completed in 2003 (Moreno, nd), but has since encountered some challenges and does not appear to have been completed.

2.6.3 China

The China Energy Management Association (EMCA) is China's national ESCO association. It was launched in 2004, and is the implementing agency of the ESCO component of the World Bank GEF China Energy Conservation Project Phase II (Zhao, 2007). Its goal is to promote the sustainable growth of the Chinese ESCO industry, through promotion of the energy performance contracting model, working with the government, training, communication and outreach, policy studies and industry standards (Zhao, 2007). It produces a newsletter, maintains a website and develops an internal exchange journal (Zhao, 2007). By the end of 2007, EMCA had 308 members (Taylor, 2009).

2.6.4 Armenia

The Armenian ESCO Association has eight members and engages in strategic planning, capacity building, partnership creation and other activities (Armenian ESCO Assn, 2006). Members of the association went on a study tour in 2006 in which they attended the ESCO Europe conference, participated in training sessions, experience exchange programs, and met with members of other ESCO associations to build cooperative relationships (Armenian ESCO Assn, 2006). The association has also promoted joint projects in which two ESCOs work together on larger projects (Armenian ESCO Assn, 2006).

2.6.5 Egypt

Egypt has an effective ESCO association, the Egyptian Energy Service Business Association (EESBA). Reflective of Egyptian businesses interests in developing their own model of energy efficiency contracting, instead of just including ESCOs, EESBA has deliberately incorporated equipment suppliers and other related parties (Hansen, 2009).

2.7 Multi-national ESCOs

Multi-national ESCOs have also been a component of ESCO development in some developing countries, in some cases through partnerships with local ESCOs, but more often operating on their own. North American ESCO companies have considered expanding their markets overseas but are very selective due to the range of financial, administrative and cultural impediments, as well as the large initial investments, lagging profit and long-term commitment required (Lee et al., 2003; Cowan, 2009; Lockhart, 2009). Most North American ESCOs, perceive the business opportunities in developing countries to be limited (Lockhart, 2009). Some early North American ESCOs efforts to expand into developing countries were hampered by lack of experienced personnel, which resulted in expertise being spread too thin and less than successful operations (Hansen, 2009a). In order to be successful in developing countries, given the array of challenges, North American ESCOs generally have to send their most experienced personnel, which they often do not wish to lose from their North American operations (Cowan, 2009). Moreover, in developing countries, ESCOs are often expected by the private and public sector to finance the project themselves, whereas in North

America, most ESCO projects are financed by the client, through a leasing arrangement or loan with a financial institution (Lockhart, 2009). Undertaking the project financing presents too much risk to many North American ESCOS when there are still significant market opportunities in North America. Even with financing arranged, some multi-national ESCOs will not at this time consider taking on performance contracts in some developing countries, due to the risks associated with the clients.

Nevertheless, the large market opportunities in some developing countries are being recognized by some of the larger North American and European ESCOs (Hansen, 2009a). In particular, Honeywell, Siemens, and Johnson Controls are larger global ESCOs that are active in developing country ESCO industries (Zhao, 2007; Hansen, 2009a; Lockhart, 2009). For example, Siemens is engaged in strategic geographic expansion into Asia-Pacific, including China, Korea, Singapore and Taiwan, as well as India (Sugay, 2009). Honeywell has an ESCO presence in countries such as Poland, India, Hungary and China. In India, Honeywell started as a joint venture company with an Indian company, but Honeywell recently became the major stakeholder in that company and as of 2005 had delivered 35 energy efficiency projects in India (Sharma, 2005). A key element of success for Siemens and Honeywell is that their ESCO operations are just part of their overall operations, and they already have offices in many developing countries (Lockhart, 2009; Sugay, 2009). For example, Honeywell is a multinational company and a global leader in energy control systems for buildings and industrial processes. Their ESCO business is just a component of their overall energy efficiency operations. Their size provides them with many financing options and as a result, these companies often provide the financing for their ESCO projects in developing countries themselves, through their own financial arms (Sugay, 2009). This resolves the financing challenges that are often a large barrier to ESCO projects in developing countries. The presence of offices with pre-existing employees in these countries eases the challenges associated with finding appropriate staff and/or moving North American or European staff to these countries. In the case of Siemens, the local offices are contacted by strategic expansion staff and provided with training and toolboxes of processes and procedures with regard to how expanding into the ESCO business could be profitable (Sugay, 2009). Additional people are then hired locally if that office decides to proceed. Nevertheless, even with established ESCO offices, some multi-national ESCOs face challenges achieving similar profits on some developing country projects compared to those in North America, due to smaller project size, and more limited types of project offerings due to more limited local expertise (Sugay, 2009).

Proximity has played a role in ESCOs expansion decisions. In general, European ESCO companies have been more willing to expand their operations in to Central and Eastern Europe and to some extent Asia than North American ESCOs (Cowan, 2009). If greater efforts are made to remove some of the barriers to ESCOs in developing countries, it is likely that there will be more North American and European ESCOs interested in conducting business there.

Some multi-national ESCOs have considered or undertaken joint ventures with local ESCOs in developing countries. However success rates have been mixed due to differing business cultures and practices in different countries (Sugay, 2009; Storment, 2009). Some multi-national ESCOs have elected not to work with local ESCOs in the short term, due to challenges associated with agreeing on risk mitigation measures and differing perspectives on monitoring and verification, and compliance (Sugay, 2009; Storment, 2009). North American and European ESCOs are accustomed to undertaking investment grade audits with strict monitoring and verification protocols in order to qualify for financing, and their financial institutions partners rely on this. ESCOs in some developing countries have not yet reached a stage of maturity whereby they operate by the same business protocols.

3.0 Barriers to ESCO success

This section will address the barriers that have limited the market penetration of ESCOs in many developing countries, despite the many considerable efforts to promote ESCO development. Although they are separated out for the purposes of discussion, they are interrelated. Often removing just one or two barriers is insufficient. Lee et al., (2003) point out that even in a very favourable financing environment in South Korea, that administrative barriers in terms of government procurement laws, had to be lifted in order for ESCOs to be successful.

Broad overarching factors, such as overall low global energy prices or price fluctuations, also make energy efficiency investment less appealing in all countries (ESMAP, 2006). Developing countries face additional challenges such as political and economic instability which can be a barrier to any type of investment and can make ESCOs a non-starter (Vine, 2005; ESMAP, 2006). Many developing countries and economies in transition, particularly formerly communist countries, still have legal structures and market mechanisms for buyers and sellers that are in their infancy. The degree of sophistication of the market matters, and countries in Central and Eastern Europe that had relatively more free market structures or in which reforms progressed more rapidly, such as Hungary, the Czech Republic and Slovakia, also have a more established ESCO industries.

3.1 Difficulties accessing financing

In developing countries, lack of financing, or inability to access financing, is one of the main barriers to ESCOs (World Energy Council, 2008; Taylor et al., 2008). The main options for ESCO financing include: the client, domestic commercial financial institutions, domestic development banks (i.e. IREDA in India), government energy efficiency funds, private equity, and international agencies (ESMAP, 2006). The existence of a sufficient financing sector is critical to the success of an ESCO industry. In addition to technical expertise, ESCOs must have expertise in accessing financing (Langlois nd; World Energy Council, 2008).

Some of the key financing barriers include:

3.1.1 Scarce capital and immature banking sector

In some developing countries the domestic financial institution sector is immature, dysfunctional or unstable making it very difficult for ESCOs to access local financing (ESMAP, 2006). In addition, there is scarce capital, and energy efficiency projects must compete with other valuable energy and industrial projects (Vine, 2005).

3.1.2 ESCOs are not aware of how to access financing

There are a large number of international financial support mechanisms that exist in the form of grants, loans and credit facilities. Development banks such as the North American Development Bank and the European Bank for Reconstruction and Development are eager to finance viable energy efficiency projects (Hobson, 2009; Storment, 2009). However ESCOs are often not aware of how to access them (Urge-Vorsatz et al., 2007; World Energy Council, 2008), or cannot get their potential clients to agree to the loan terms. Systems for accessing domestic sources of capital are also often unknown and unclear (ESMAP, 2006). ESCOs often have significant technical expertise but sometimes have limited financial expertise and minimal understanding of financial institution needs (Roy, 2003; Hansen, 2009a).

3.1.3 ESCOs and their clients are unknown or not considered creditworthy

The banking systems in many developing countries are conservative and lack knowledge of and experience with energy efficiency, performance based contracting and ESCOs (Vine, 2005; ESMAP, 2006; World Energy Council, 2008; CRISIL, 2004). ESCOs are considered unknown and risky. High perceptions of risk drive up interest rates (Taylor et al., 2008). New ESCOs in particular, with limited credit history, projects or references have difficulty getting financing (Vine, 2005). Potential clients also often have limited financial capital, making the whole project less creditworthy to financial institutions (Roy, 2003; Vine, 2005). Public sector clients, which have been key to jumpstarting and maintaining the ESCO industry in North America, are often considered even less creditworthy than private sector clients in developing countries (Cowan, 2009). The lack of available success stories reinforces this belief (Karrir, 2005). Unfortunately ESCOs sometimes discover that their client lacks credit-worthiness only after they have undertaken significant preparatory work for the contract (Urge-Vorsatz et al., 2007). Failed or less than successful past projects cause the banks to be even more reluctant to lend to ESCOs. This has happened in India where rates of returns on some ESCO projects have proven poor due to hidden and extra costs (IREDA, 2006a).

3.1.4 Conventional financing rules are inconsistent with EPC

Conventional financing rules often present a barrier for ESCOs. Commercial banks are very conservative in their lending practices for ESCO type projects and can be very unwilling to be creative in finding ways around their financing rules (Cowan, 2009; Storment, 2009). In some developing countries, banks even more conservative than in developed countries, and the domestic public development banks adopt similar practices (Storment, 2009).

Some key challenges include:

- Most financial institutions *prefer lending for working capital* (Sridharen, 2005; ESMAP, 2006; Taylor et al., 2008). Energy efficiency projects or cost-savings projects are non-conventional (ESMAP, 2006). Banks prefer positive cash inflow projects rather than negative cash outflow projects (due to savings) (CRISIL, 2004). Projects that provide savings are not considered on par with projects that increase production (Taylor et al., 2008).

- Financial institutions have a *preference for large projects or large enterprises* (Vine, 2005; ESMAP, 2006), partly because they have better financial credentials (REEEP, 2007), and partly because smaller projects have higher transaction costs (ESMAP, 2006). For example, in Mexico, financial institutions believe that projects must cost at least US $50 million to justify the high transaction costs that result from the complex financing required (APEC Energy Working Group, 2006b). However, many energy efficiency improvement projects cost between US $500,000 and $1 million (APEC Energy Working Group, 2006b).
- Financial institutions *prefer asset-based financing, over cash flow project-based financing* (Vine, 2005; Energy Futures Australia, 2005). Most lending is based on the borrowers credit history, and borrowing capacity based on collaterals. For example, lending for ESCO projects in Mexico or Brazil was considered only if the ESCO or client had the cash on deposit or a liquid asset (Day, 2009; Storment, 2009). Project financing considers the project equipment and cash flows as collateral (APEC Energy Working Group, 2006b).
- ESCOs have *difficulty acquiring start-up financing* (Karrir, 2005; Sridharen, 2005). ESCOs require financing for equipment purchase, upfront costs, project development and capacity building activities. These are often non-asset based investments without collateral (Roy, 2003; Karrir, 2005; Vine, 2005).
- There is often a *requirement for short payback periods* or returns on investment, which is not always the case with energy efficiency projects (Karrir, 2005). Payback for energy efficiency projects can be as short as one year, but also as long as five to ten years. ESCOs require long-term financing in order to grow their operations and carry out projects.
- Banks *prefer commercial risk, over technical risk* (CRISIL, 2004). Energy efficiency projects rely on technology to provide savings. However banks often have little knowledge of technology or experience with assessing the level of risk associated with energy efficiency technology and therefore tend to be very conservative in their evaluations.

These challenges often result in a commercial banking sector that is unwilling to finance ESCO projects. In China, even in a very active ESCO market, commercial banks will often not provide financing, even at high interest rates (Taylor, 2009). If they are given funding at all, ESCOs in developing countries must often co-finance projects themselves or are given short payback periods and/or very high interest rates and/or liquid assets in excess of the face value of the loan (World Energy Council, 2008; Day 2009; Storment, 2009). In Brazil, in the late 1990s, interest rates on ESCO loans were 20 percent and the term of the loan was three to four years (Day, 2009). This has improved somewhat, but interest rates on commercial ESCO loans remain around 12 percent (Day, 2009). Likewise in Mexico, ESCOs must often obtain financing from private equity at very high interest rates ranging from 20 percent to 30 percent, compared with domestic financial institution rates in the 9 percent range (APEC Energy Working Group, 2006b). The high cost of financing restricts the types of projects considered by ESCOs, forcing them to concentrate on projects with a very fast payback (APEC Energy Working Group, 2006b).

3.2 High administrative and transaction costs

ESCOs face numerous administrative barriers. Some of these are related to the nature of the ESCO industry itself and the types of projects undertaken. Others are related to the institutional and business environment in which ESCOs operate. As a result, ESCO projects generally have high transaction costs (Roy, 2003; CRISIL, 2004; Taylor et al., 2008). High transaction costs have resulted in a preference for very large projects in some developing countries on the part of ESCOs, clients and financiers, because small-scale projects are not affordable (Lee et al, 2003; Vine, 2005, World Energy Council, 2008). This has lead to a concentration of ESCO projects in the public and industrial sectors, because residential/commercial projects tend to be smaller. But smaller projects can be important, as they are often easier, allow ESCOs to establish themselves and still provide energy savings (Lee et al., 2003). Administrative costs can be related to technical challenges, contract negotiation, institutional barriers and government procurement rules.

3.2.1 Technical

There is often a high administrative overhead associated with identifying, procuring, installing and maintaining energy efficient equipment (Vine, 2005). Information must be tracked down, some projects require design innovation, and equipment must be located (Vine, 2005; ESMAP, 2006). ESCOs also have to deal with equipment shortages, lack of affordable equipment and the need for imported technology, which increases costs due to import taxes (Vine, 2005). Safety and reliability concerns hinder the introduction of new technology (Vine, 2005).

ESCOs can also face challenges in proving energy savings through M&V. For example in India, in general there is a poor measurement and accounting system for energy consumption (Roy, 2003). The M&V approach adopted in India in the government sector is the whole facility measurement approach which is problematic for a variety of reasons (Dhingra and Julena, 2005) including: the influence of non-EEM loads on the baseline and future energy bills (which can be substantial and not known), baseline load fluctuations over the seasons, and inadequate metering, including the practice of using common meters by multiple facilities (Dhingra and Julena, 2005; IREDA, 2006a). Total energy consumption can be in dispute which presents serious difficulties for ESCOs trying to undertake M&V (IREDA, 2006a).

3.2.2 Contract negotiation

Contract negotiation is often time consuming and arduous (Vine, 2005). Because EPC is a complex and relatively new process, the legal and contractual terms are often convoluted and there is rigidity on both sides, which brings negotiations to a standstill (Dhingra and Julena, 2005). ESCOs in many cases face significant barriers in structuring workable contracts with their clients, due to client concerns regarding risk, limited commitment to the project and other procurement and institutional barriers which will be discussed in greater detail below (Taylor et al., 2008; Storment, 2009). Contract negotiations can take as long as two years, and there is always the risk of "non-contract" at the end of that time (Urge-Vorsatz et al., 2007). In South Africa, the turnaround time for proposal reviews is just under a year (Calemayer, 2008), which means that the pricing of proposals are outdated by the time it comes to procurement negotiations (Calemayer, 2008).

3.2.3 Institutional

ESCOs face entry barriers, such as accrediting mechanisms to certify ESCOs, legal redressal systems, tax, auditing and legal barriers (Karrir, 2005). There is often no institutional or legal framework for ESCOs (Taylor, 2009). Governments are unsure whether to treat ESCOs as equipment sale businesses, financing businesses or service businesses, which can create significant challenges at startup (Taylor, 2009). Weak legal frameworks and systems mean that the interests of the clients and ESCO cannot be protected and result in insecure contracts that cannot be enforced equitably, or at all, resulting in some cases in the ESCO not being paid (Vine, 2005; ESMAP, 2006). ESCOs also often operate in unfavorable tax regimes (Vine, 2005) with imperfect tariff signals (CRISIL, 2004). Government policies with regard to energy efficiency often do not exist and if they do are in conflict with other government policies (Vine, 2005). Monitoring and verification requirements can be too onerous (Lee et al., 2003).

3.2.4 Government procurement rules

The public sector is a key trigger for ESCO success, but in many developing countries government procurement laws and processes conflict with ESCO approaches or requirements. Some key problems include:

- Government procurement policies do not exist, are not well defined or are not standardized, leaving ESCOs to have to start fresh every time (Vine, 2005; Urge-Vorsatz et al., 2007). This was particularly problematic in many former Eastern bloc countries where public procurement had not been undertaken under communist control (Hobson, 2009).
- If government procurement policies are defined, they are administratively burdensome (Urge-Vorsatz et al., 2007).
- Government procurement laws often do not allow multi-year financing (Lee et al., 2003), or payments to be made in the current budget year that will result in cost savings sometime in the future (Urge-Vorsatz et al., 2007). For example, in the case of Mexico, municipalities must go to the state congress to get approval for long-term contracts (that exceed 2 years) or off-balance sheet financing (Storment, 2009).
- Money cannot be shifted from one budget to another in some agencies (i.e. operational – where the savings are realized, to investment – from which the payments must come) (World Energy Council, 2008).

- Public procurement rules focus on the lowest asset cost, rather than lower life cycle costs, making it difficult for agencies to purchase energy efficiency equipment (Vine, 2005; World Energy Council, 2008).

3.3 Government energy policy disincentives

3.3.1 Limited Energy Efficiency Policies

Many developing countries have no energy efficiency or demand side management policies, no energy codes or standards, or requirements for energy audits (Vine, 2005). In the absence of government policy as a driver, ESCOs face challenges developing a critical mass in countries such as Mexico (Storment, 2009). Some governments commit few or no energy efficiency funds and do not sufficiently engage in ESCO demonstration projects, if they do at all (CRISIL, 2004; Vine, 2005).

3.3.2 Limited Enforcement of Energy Policy

If the country does have energy efficiency legislation, it is not always enforced (i.e. in India) providing little incentive for industries (Dhingra and Julena, 2005), it is often ad hoc and poorly understood (Karrir, 2005; Vine, 2005), or it differs from state to state within the country (Urge-Vorsatz et al., 2007). Moreover the degree of central government control over energy policy and the implementation of that policy varies from country to country and has created challenges in the implementation of energy efficiency measures in countries such as India and China (Hansen, 2009a; Sugay, 2009). For example in China, strong energy efficiency policies exist, including a priority list of the 1000 largest energy users, all of which are industrial operations. However these policies have in the past failed to be implemented at the state and municipal level, where the focus is on economic development rather than energy efficiency (Sugay, 2009).

3.3.3 Subsidized Energy Prices

In addition, many pricing disincentives for energy efficiency investment exist in developing countries. Energy price subsidies (Vine, 2005; World Energy Council, 2008), or price distortions, existed for many years and still exist in many developing and transition countries. Although subsidies are being phased out to some degree in some larger developing countries such as China, India and Brazil, many developing countries and countries in transition keep their energy prices relatively low to maintain price competitiveness for their products and as a poverty alleviation mechanism (Lee et al, 2003; Taylor et al., 2008). Government subsidies that keep energy prices artificially low are one of the most serious impediments to ESCO industry development (Sugay, 2009). When energy costs constitute such a small percentage of input costs, clients are not motivated to reduce these costs through efficiency gains, as priority is given to other more critical cost cutting measures. Often in developing countries, the companies that are interested in energy efficiency are the ones that are so inefficient that energy inputs constitute 50 to 60 percent of their cost of production, making a 10 percent savings a big deal, despite the subsidized energy costs (Sugay, 2009). In some countries where price subsidies have recently been lowered or removed, there is growing interest in ESCOs (Hobson, 2009).

3.3.4 Energy Efficiency Programs that do not promote ESCOs

In addition, in some countries, ESCOs also have to compete with energy efficiency programs that are not focused on EPC. For example, in some countries energy efficiency subsidies and loans provided by governments allow clients to undertake projects on their own. (World Energy Council 2008). Other countries have mandatory demand-side management programs for utilities (Urge-Vorsatz et al., 2007), which cuts into ESCO business as utilities will often undertake the measures themselves.

3.4 Limited knowledge of ESCOs and reliability concerns

ESCOs in many developing countries face a lack of client, bank, supplier and government knowledge regarding energy efficiency (technology characteristics, costs and energy savings potentials and installation potentials) (Langlois, nd; Vine 2005), of the various types of performance contracting, sources of financing, and what specifically ESCOs do (Roy, 2003; Karrir, 2005; Dhingra and Julena, 2005; World Energy Council, 2008).

ESCOs often face significant challenges in convincing potential clients and financiers of the certainty of delivering savings (Cherail, 2005; IREDA, 2006b), and the sustainability of savings (Roy, 2003). Cultural and institutional aversion to new practices and risk are a serious factor. Clients often assume that the services provided by ESCOs sound too good to be true, so there must be something wrong (Cowan, 2009; Hobson, 2009). The absence of success stories contributes to this (IREDA, 2006a). Until recently, ESCOs and the notion of performance based contracting were considered too new in conservative risk averse societies such as Japan and Korea (Lee et al., 2003). Former eastern block countries in central and eastern Europe had a very non-risk culture when the concept of ESCOs were introduced, which had a significant impact on the initial success of ESCOs (Hobson, 2009). There is the perception in some countries, such as India, that the ESCO will make huge profits at the expense of the company (IREDA, 2006a). There are also often concerns regarding the reliability of the equipment (Vine, 2005). The problem is compounded by the fact that local ESCOs, which are often well staffed by competent engineers, do not have experienced marketing and sales people on staff to sell their services to clients and assuage concerns (Lockhart, 2009). As a result, both the client and the financial institution often want additional independent technical assessment, which adds to costs (ESMAP, 2006).

In some countries, there is limited confidence in ESCO services, due to past ESCOs with poor track records and failed energy efficiency projects (Vine, 2005; Hansen, nd). In India, there have been cases where the actual energy savings are lower than the estimations, which has contributed to a mistrust of the ESCO industry and an increased demand for third party M&V which increases costs (IREDA, 2006a). The ESCO business model is challenging and in the past companies have jumped into it with little expertise (Hansen, nd). Past reputations and historical relationships of groups engaged in energy efficiency work plays a critical role in developing countries and has factored into the failure of some projects undertaken by international institutions (ESMAP, 2006).

3.5 Lack of human resources

Human and institutional capacities on the part of both the ESCO and the potential client are required to undertake energy efficiency projects. Both the ESCO and client must have some energy efficiency, contracting, financing, and project management skills.

Within the ESCO, individuals must have the capacity to identify possible projects, design them, and implement them. This includes the ability to select market segments to focus on, and understanding of approaches to getting funding. ESCOs are required to have significant knowledge of energy, financing, industrial processes and buildings (Urge-Vorsatz et al., 2007). Often ESCOs have considerable technical expertise, but insufficient financial expertise (Hansen, 2009a). ESCOs also can lack sales and marketing expertise, which is required in order to be able to sell their services to potential clients (Lockhart, 2009). These types of expertise can't just be created by funding agencies, they must to some extent already be present in the countries. In Brazil, China and India, local energy efficiency industry capacity is developing and/or strong (Taylor et al., 2008). In other countries it is weak (ESMAP, 2006).

Clients also must have the human and institutional resources. Although the technical capacity can come from the ESCO, the client must have an overall willingness and ability to commit to energy efficiency, both on a management level and on an operations and maintenance staff level. On a management level, many industries are reluctant or do not have the capacity to dedicate human resources, which is often their resource in most limited supply, to establish and manage ESCO contracts over 3 to 5 years (Dhingra and Julena, 2005; Urge-Vorsatz et al., 2007). It is often assigned as a secondary responsibility to someone with limited expertise in energy efficiency (Dhingra and Julena, 2005). Division of organizations into departments without clear connections between the technical energy management staff and the management level can create challenges (Urge-Vorsatz et al., 2007). Clients must also have capacity in contracting and understanding of their own procurement rules, which is problematic in some small operations, particularly smaller public sector agencies (Urge-Vorsatz et al., 2007). Moreover the operations and maintenance staff must believe in the project and be willing to undertake it. A critical component of achieving energy savings through energy efficiency technology is in the operation and maintenance practices. If operations and maintenance staff are not committed to the success of an energy efficiency project, the project will often fail because they will not operate or maintain the equipment appropriately (Hansen, 2009a).

3.6 Client preferences for in-house solutions and other priorities

Often potential ESCO clients prefer to apply in-house energy efficiency solutions or have other non-energy efficiency priorities. Many of the reasons for this are common across the public, industrial, and residential/commercial sectors. For example, as discussed above, artificially low energy costs and lack of regulatory requirements for energy efficiency provide little incentive for energy efficiency. It was emphasized repeatedly in the literature and in interviews that decision-makers in both the industrial and public sectors often side-line energy efficiency in favour of measures that are more politically or economically 'exciting,' such as increasing production, promoting new building or road paving, or encouraging economic development. In addition, ESCO participation is often considered too expensive and clients sometimes do not like to outsource due to job losses and loss of control (World Energy Council, 2008). In developing countries in particular, potential clients often simply do not have the funds to dedicate to energy efficiency improvements, even if they will provide long-term savings (IREDA, 2006a). Even if these clients are able to finance the cost of the improvements, having loans on the books affects clients' overall credit availability (Urge-Vorsatz et al., 2007), and in the end some potential clients are unwilling to undertake the projects based on the loan terms (Storment, 2009). Likewise, current energy costs in some developing countries are based on buildings run at sub-par comfort levels (i.e. low heat or light). Thus if the new project improves comfort levels, the cost savings are not as evident (World Energy Council, 2008).

Some of the reasons for client preferences for in-house solutions or non-energy efficiency priorities differ from sector to sector. These will be discussed in turn.

3.6.1 Public sector

In the public sector, decision-makers often have political goals in mind and their priorities are focused on issues that are more important with voters, particularly considering that the payback period for ESCO projects can be longer than most election cycles (Urge-Vorsatz et al., 2007). Political continuity is a challenge in some developing countries, whereby political decision-makers have short terms and in some cases cannot run again. Thus their focus is on short-term achievements rather than projects that will payoff when someone else is in office. Moreover there are many basic social needs in developing countries that need to be met, for rural electrification, road paving and clean water. Energy efficiency, even though it pays for itself in the long-run, often is not considered as high a priority by public sector decision makers. In addition, budgets of many public sector operations are based on last year's consumption. If energy consumption is reduced, so are the budgets, providing little incentive to become more efficient (Urge-Vorsatz et al., 2007; World Energy Council, 2008).

3.6.2 Industrial sector

Industrial sector clients in particular, often prefer in-house energy efficiency solutions or have other priorities (World Energy Council, 2008). There are a variety of reasons for this, including:

- Big industrial operations often have the ability to plan and implement EE projects independently (Sridharen, 2005).
- Industrial processes are considered trade secrets in many large companies and ESCOs would not be permitted to examine them (World Energy Council, 2008). Therefore ESCOs have focused on some standard applications/equipment, such as boilers, pumps etc. (World Energy Council, 2008).
- Industrial clients ware not interested in improvements that would require temporary shut-downs in order to install equipment (World Energy Council, 2008).
- Pay-back periods for energy efficiency equipment are too long for most industrial operations who only consider pay-back periods of 3 years, unless they are investments in production areas (REEEP, 2007; World Energy Council, 2008). In some developing countries, managers are only credited with improvements achieved during their tenure. Thus energy efficiency improvements are often credited to successors (Urge-Vorsatz et al., 2007).
- Industries in many developing countries are focused on increasing their market share rather than energy efficiency (ESMAP, 2006). Main production line technology is often very advanced and up to date, but the same priority is not given to utilities and energy auxiliaries (IREDA, 2006a). Or, entire industrial processes can require modernization and small energy efficiency projects are not seen as attractive (World Energy Council, 2008). Energy efficiency projects must compete with production projects and thus it must be demonstrated that they will provide very clear after tax benefits for industries to consider them (Day, 2009).
- Significantly improving the energy efficiency of plants in developing countries often requires a large investment, which is not appealing to industrial operators even when the payback is significant (IREDA, 2006a).

3.6.3 Residential and commercial sector

ESCOs are not considered particularly attractive in the residential and commercial sectors given the smaller total energy savings and higher transaction costs. Residential and commercial building owners often prefer to implement energy savings measures themselves (World Energy Council, 2008). Multiple family dwellings and commercial buildings often face significant challenges of multiple owners or landlord/tenant issues, whereby everyone has to agree to proceed, which can be very challenging (Urge-Vorsatz et al., 2007). The perceived hassle and disturbance in the home, as well as client preference for spending money on measures to improve comfort are also barriers (Urge-Vorsatz et al., 2007). Moreover for most individual home and small building owners, EPC is considered too complicated and expensive, given the simplicity and low cost of many of the measures to be undertaken (Urge-Vorsatz et al., 2007).

3.7 Challenges of EPC business model

Even in the best of circumstances, ESCOs face certain business challenges due to the nature of the EPC business model. Low profitability margins can make ESCOs financially difficult (Karrir, 2005). The EPC remuneration model utilized by ESCOs can also be challenging. ESCOs have a long gestation period in terms of the time it takes to find clients, to signing the contract, to earning profits (Sharma, 2005). ESCOs have to prepare and submit extensive energy audits and proposals, often with no remuneration, in the hopes of signing a client. If there are numerous ESCO proposals, the unsuccessful submitters will receive no compensation. In addition, some industrial operations will have ESCOs prepare and submit proposals, and then implement the proposal themselves, leaving the ESCO out time and money (Urge-Vorsatz et al, 2007). Even when the client does sign on, in the shared savings model in which the ESCO acquires financing, there can be a lack of commitment on the part of the client, as they have not become financially involved. In addition, if the payment is based on dollar cost savings, the ESCO is betting on the price of energy. If the price rises, the ESCOs remuneration can be adversely affected (Hansen and Brown, 2003).

There are also risks for ESCOs associated with providing guarantees, and having to prove that savings have been achieved (Sharma, 2005). The client and ESCO need to agree very clearly on how the energy savings are going to be accounted, and what monitoring and verification methods are going to be employed. If the energy savings are not clear, then clients often will not pay (Cowan, 2009). If the client has difficulty agreeing on the savings and how they will be accounted for, then commercial banks become even more uneasy and often refuse to finance the project, unless the client has assets that can be utilized to secure the loan (Cowan, 2009). These challenges are compounded by the fact that energy audits are often inaccurate. One study suggested that they are on average 25 percent off using traditional approaches, which are generally snap-shots that do not consider future varying conditions or the human element in operation the new technology (Hansen and Brown, 2003). ESCOs do not have control over how the technology is operated and maintained. ESCO projects sometimes fail because the on-site operation and maintenance staff do not have the skills or are not committed to ensuring the project is successful (Hansen and Brown, 2003). Investment grade audits should provide more accurate assessments of risks of future varying conditions and human factors (Hansen and Brown, 2003).

ESCOs have limited ability to buffer procurement delays (which often lead to them not getting paid), as they require a steadier cash-flow than straight suppliers. Delays in payment are even more challenging when the ESCO has to raise capital from the market to meet its investment requirements (Dhingra and Julena, 2005). Delays considerably alter financial projection and payback time.

Finally in developing countries, clients present risks. They are often less financially viable and there can be concerns regarding client integrity (Sharma, 2005). In the industrial sector, companies can be moved, and are a higher credit risk (World Energy Council, 2008). Often ESCOs themselves prefer public sector clients (Urge-Vorsatz et al., 2007). But both companies and public sector clients can undergo organizational change, negatively impacting the ESCO (Sharma, 2005).

4.0 What can be done?

Over the past few years, international events and challenges have promoted increased interest in ESCOs, and will likely continue to do so. These events and challenges include climate change, greater energy demand, energy shortages, higher energy prices, international competition and environmental concerns (Lee et al., 2003; Vine, 2005; REEEP, 2007). Energy efficiency will be a key mechanism for addressing some of these issues. Mechanisms within international agreements, such as the Kyoto Protocol, i.e. emissions trading, could play an important future role in promoting ESCOs. (Vine, 2005).

Over and above these international forces, there are many measures that can be undertaken in developing countries to promote ESCO industry success. This section will consider those measures. The literature and experts emphasize repeatedly that support and action by the developing country government is critical to promote the development of the ESCO industry (Taylor et al., 2008; Hansen, 2009a). Developing country governments have a key role to play in creating an environment favourable to ESCO development through financial support, energy efficiency policy and removal of barriers to entry, as well as the creation of an early market through demonstration programs. In the absence of this support, establishing a successful ESCO industry in any country will be challenging. Thus many of the measures outlined below are specifically directed at governments. However there are also many measures that can and must be undertaken by ESCOs, ESCO associations, domestic financial institutions and international organizations.

It should be emphasized that solutions really need to be country specific and customized based on the local institutional environment, contracting frameworks and customs (ESMAP, 2006; Taylor et al., 2008; World Energy Council, 2008). Nevertheless, solutions do not need to be entirely homegrown, lessons can be drawn from experiences in other countries (Hansen, 2009a). Overall, however, ESCOs are unlikely to provide the answer to energy efficiency in all countries in all sectors. Targeting ESCO promotion efforts might be critical to promoting the advancement of the ESCO industry.

It would likely be helpful to focus on appropriate countries. Countries with that are reasonably stable economically and politically are an obvious choice. In addition, energy intensive countries such as India, China or Central European countries have higher potentials for savings through energy efficiency than other developing countries (Urge-Vorsatz et al., 2007; World Energy Council, 2008). Although energy intensity on its own is insufficient to promote ESCOs, it sets the stage for clients in these countries to take a greater interest in ESCOs (Urge-Vorsatz et al., 2007). Likewise, ESCOs may have a greater opportunity to gain a foothold in countries where energy capacity is a challenge, such as India and South Africa, where utilities and industries have to deal with energy shortages on an ongoing basis (Hansen, 2009a). It should be stressed that ESCOs might not be the answer for all countries and in some developing countries, it may be more desirable to focus funding and efforts elsewhere (Taylor et al., 2008).

Moreover even in the appropriate countries, ESCOs may only provide a partial solution in certain sectors. The public and industrial sector have traditionally been where ESCOs have been most successful, due largely to the greater challenges associated with the residential and commercial sectors outlined above. The public and industrial sector will likely continue to be the basis for much ESCO business. Many of the measures outlined below are general and would facilitate greater ESCO success in all of the sectors. However to truly promote ESCO development in the residential and commercial sectors, additional measures targeted specifically to those sectors may be required. Likewise, focusing ESCO efforts within sectors may be helpful. For example, in some countries in the industrial sector, it has been suggested that ESCOs are not the answer for large industry. Rather ESCOs should focus on small to medium enterprises (SMEs), as they do not have the same level of in-house expertise as larger industries and are less likely to be able to undertake energy efficiency improvements themselves (Sridharen, 2005).

4.1 Financing support structures/funding mechanisms

Financing support structures and funding mechanisms are vital to the success of ESCO industries and the development of the first ESCO projects (Langlois, nd; Karrir, 2005; World Energy Council, 2008). They assist in reducing the initial high costs and risks associated with starting up, help build capacity and facilitate the use of new approaches (ESMAP, 2006). This is a key measure for developing country governments to undertake. However in some developing countries, the government may not be able to take on this task and international agencies will likely need to continue to play an important role in financially supporting ESCOs.

However this is only a short-term solution and should be considered as a means of jump-starting domestic commercial bank funding. Eventually the local banking sector must be sufficiently mature and comfortable with ESCOs, and ESCOs must be able to face commercial terms for their financing (Lee et al., 2003). It is important that international agencies not compete with domestic commercial banks for profitable ESCO projects, once domestic banks are able to and interested in participating in ESCO financing (Urge-Vorsatz et al., 2007). Once this occurs, international agencies and banks could play a secondary role in financing less profitable projects (Urge-Vorsatz et al., 2007). In addition, financing options other than international agencies and commercial banks should also be considered. For example, in Japan much of the funding for ESCO activity has come from large parent companies of the ESCO (Hansen, 2009a). Likewise, in Mexico SPVs have been utilized to finance ESCOs. Venture capital fund investment and listing ESCOs as publicly traded companies are other approaches that are being utilized by some ESCOs in China (Taylor, 2009).

Some types of financing support structures and funding mechanisms that could be key in encouraging ESCO development include:

4.1.1 Dedicated debt agencies for EE lending

Establish dedicated debt agencies (Karrir, 2005), or development banks for energy efficiency lending (ESMAP, 2006). These kinds of institutions could be particularly important where the local financial sector is in disarray or in the midst of restructuring (ESMAP, 2006). However separation from the commercial banking sector presents some challenges associated with eventually fostering take-up by commercial banks (ESMAP, 2006).

4.1.2 Concessional financing, development funds and grants

Governments or international agencies could provide concessional financing, in the form of low interest loans, interest-free loans or grants to ESCOs. An ESCO development fund, green fund, or an energy efficiency fund could be developed (Karrir, 2005; Vine, 2005; ESMAP, 2006). These funds could offer 80 to 100 percent financing. The ESCO could offer the balance of funds or if 100 percent is provided, interest rates could be higher (Vine, 2005). The goal of these funds would be to reduce the risks associated with starting up, including engaging in capacity building and undertaking initial energy audits (Taylor et al., 2008; World Energy Council, 2008). Funding can also be provided for feasibility studies, audits and preparation of financing applications to decrease the amount of equity capital required by ESCOs (Vine, 2005). This financing must be transitional to facilitate the development of commercial financing capacity (Taylor et al., 2008).

4.1.3 Loan guarantees

Loan guarantees, backed by public or international funds, could be a critical component of fostering the interest in domestic commercial financial institutions in lending money to build a viable ESCO industry (Sridharen, 2005; Taylor et al., 2008; World Energy Council, 2008). Full or partial-risk loan guarantee programs defray part or all of the risks of loan repayments on an individual project basis, or as a broad package of assistance to financial institutions (ESMAP, 2006). Loan guarantee programs assist new ESCOs in getting initial financing, establishing a credit history and developing a borrowing relationship with a bank. Once this was established, larger ESCOs in China no longer needed the loan guarantee program (Taylor, 2009). World Bank experience suggests that loan guarantees may work best as the final push, where the banking sector is fairly functional and is interested in energy efficiency lending, but where real or perceived repayment risks are the main barrier to that lending (Taylor et al., 2008). Loans should still be commercially viable and secured. Successful models for loan guarantee programs include the Brazilian government's BNDES program, and the World Bank GEF programs in Hungary and China (discussed in detail in section 2 above).

4.2 Domestic commercial financial institution support for ESCOs

For long-term success of ESCOs, domestic commercial financial institutions/banks must eventually play a role in financing ESCO projects (Karrir, 2005; Taylor et al., 2008). ESCOs must be able to face commercial terms for their financing (Taylor et al., 2008). This requires institutional change and therefore a sustained effort over time (ESMAP, 2006). ESCO successes in most developing countries have to date been driven by investments by international agencies, such as the World Bank, and ESCOs are not yet at the stage of commercial financing self-sufficiency (Cowan, 2009). Preparing ESCOs to face commercial financing terms and the commercial banks to finance ESCOs will require significant work. Careful in-country diagnostic work and customization to recognize unique factors specific to each developing country may be required (ESMAP, 2006). Frequently the failure of energy efficiency financing projects arises from translating solutions from elsewhere into new environments (ESMAP, 2006). It would also be helpful to customize financial institution loan products to take into account the unique needs of ESCO projects.

Some approaches to fostering changes in domestic financial institutions include:

- General *capacity building exercises* for bank staff and other stakeholders to understand EE financing through ESCOs (Karrir, 2005; Vine, 2005).
- For financial institutions interested in energy efficiency lending, provide more *detailed technical assistance* in developing new lending mechanisms and engaging in project assessment (Taylor et al., 2008).
- Establishing *partnerships* with financial institutions interested in energy efficiency lending at the outset of ESCO development programs so that they are involved and understand the projects (and may even be involved in project selection). This reduces their perception of risk, increases their capacity to evaluate energy efficiency projects and encourages them to create appropriate tools for ESCO lending (Taylor et al., 2008).
- Create a *third party financing network* including ESCOs, government agencies, ESCO associations, lighting and equipment manufacturers, banks, and utilities to help disseminate information on third party financing and accelerate investments by coordinating activities, and allowing for collaboration (Vine, 2005).
- Encourage banks to consider energy efficiency lending as a means to provide *an extra service* to good customers or as an approach to strengthening the bank's position in certain industrial lending markets (ESMAP, 2006; Taylor et al., 2008). Energy efficiency lending is a relatively small market. As a result, banks may be uninterested unless they can see some of the broader benefits (Taylor et al., 2008).
- Help financial institutions to see the benefits of *learning from international financial institution partners*. International financial institutions are often involved in energy efficiency projects.

Local financial institutions can benefit from learning risk assessment and appraisal techniques from these partners (Taylor et al, 2008).

- Provide *incentives to first movers* or "good citizens" in the financial institution sector. Many banks have corporate and social responsibility goals (Taylor et al., 2008). Encouraging them to see energy efficiency lending as a means of achieving these goals and receiving recognition for these goals may be of some value. For example, a website could be established dedicated to financial institutions that support ESCO projects (Vine, 2005).
- Establish *loan guarantee funds*, backed by public funds, as discussed in the previous section, which reduces some of the financial institutions' concerns regarding risk and could be key to the development of commercial energy efficiency lending programs (CRISIL, 2004; Taylor et al., 2008).
- Support the development of and promote an *International Energy Efficiency Financing Protocol (IEEFP).* This protocol is already under development and is intended to serve as a blueprint and guideline for domestic financial institutions to analyze projects and lend money to ESCOs (APEC Energy Working Group, 2006b; Urge-Vorsatz et al., 2007; Hansen, 2009a). It is intended to give local commercial bankers greater comfort in lending to ESCOs. Development of the IEEFP was undertaken by the Efficiency Value Organization (EVO), starting in 2004 (APEC Working Group, 2006a). EVO is a non-profit organization that was also responsible for the development of the International Performance Measurement and Verification Protocol (discussed below). EVO has undertaken development of the IEEFP in Thailand and Mexico (APEC Working Group, 2006a).

Some key changes that financial institutions could be encouraged to make include:

4.2.1 Move to cash flow-based or project-based financing

Move from asset-based financing to cash flow-based or project-based financing (Karrir, 2005). Financial institutions need to develop mechanisms to recognize and outline the cost-savings cash flows arising from ESCO projects, and employ these funds as a means of loan repayment and loan security (ESMAP, 2006). Ideally the loan repayment schedule should correspond with the project cash flow (ESMAP, 2006).

4.2.2 Create sound payment structures for loan repayments

Creating a sound payment structure to ensure that the cash flows arising out of the project are provided to the lenders is key to the success of ESCO contracts. ESCOs need a payment security mechanism to secure the cash flows from energy savings for debt repayment (Roy, 2006).
Clients, lenders and ESCOs may need to consider irrevocable payment structures, including escrow accounts, letters of credit or cash collaterals (Valavan and Bhatia, 2005). For example in the case of an escrow account, the borrower deposits the cash that results from the energy cost savings into the account (ESMAP, 2006).

4.2.3 *Change collateral requirements*

Allow for loans on credit (Lee et al., 2003) or allow for securitization through collaterals provided by clients and other agencies (Karrir, 2005).

4.2.4 *Greater flexibility*

ESCOs need greater flexibility in loan products in general. There may be a need to customize loan products for certain target segments (Roy, 2006). There is a need to allow for more flexibility in loan design so that programs can be adjusted during implementation (ESMAP, 2006). Allowing for the re-financing of projects may be a key need for ESCOs (Roy, 2006).

4.2.5 *Ability to finance small projects or bundle projects*

Smaller projects often do not qualify for financing due to the preferences of financial institutions and the high transaction costs of smaller projects. Yet they could constitute an important component of a viable ESCO industry. Bundling projects decreases transaction costs and increases ability to get financing as some banks do not consider projects below a certain value (European Bank, 2005; World Energy Council, 2008). Bundles could be several commercial or residential buildings, or multi-project facilities. The bank, the ESCO, or even the government could act as the project aggregator. In India, the banks have developed a 'cluster' approach for energy efficiency lending, whereby template loans have been developed for batches of projects in the same geographical location, in the same industrial sub-sector, or using the same types of technical innovations (Environmental News Service, 2006; Taylor et al., 2008). Streamlining approaches for small projects through standardized project approval parameters could also improve access to funding for smaller projects (Roy, 2006).

4.2.6 *Specific EE financing programs with finance teams*

ESCOs would benefit from specific EE financing programs, as have been established by banks in India (Sridharen, 2005) and Thailand (APEC Energy Working Group, 2006b). These programs clearly identify the terms of EE lending and create a clear one-stop location for ESCOs or their clients to apply for financing. In-house EE project departments or finance teams with engineers and analysts to help assess the technological risk associated with projects, as in Thailand, would also be helpful (APEC Energy Working Group, 2006b).

4.3 Energy efficiency programs and laws

Government energy efficiency programs and laws matter, and are a key driver of energy efficiency activities and ESCO industry success in many developed and developing countries. General energy efficiency programs, such as building codes, smart metering, energy audits, energy efficiency incentives, demand-side management, or energy efficiency obligations will all increase interest in ESCOs (World Energy Council, 2008). Enforcement of energy efficiency laws, and ensuring that energy costs are not kept unnaturally low are also important (CRISIL, 2004; Dhingra and Julena, 2005).

The types of measures that could be implemented could include, but are not limited to:

4.3.1 Eliminate energy price subsidies

Energy prices are a critical incentive for energy efficiency improvements. Eliminating domestic price subsidies would be a key step in promoting ESCO business (Vine, 2005; Urge-Vorsatz et al., 2007).

4.3.2 Create energy agencies

Energy agencies can play a key role in promoting ESCO activity. They can serve as central source of information and coordination on energy efficiency policy and ESCOs. They can be critical to supporting other public officials in public sector ESCO demonstration projects and other ESCO promotion activities (Urge-Vorsatz et al., 2007).

4.3.3 Market based mechanisms

Market based mechanisms include incentives for energy efficiency improvement, domestic emissions trading for energy efficiency (Karrir, 2005). Tradable white certificates, also known as Energy Savings Certificates (ESC), or Energy Efficiency Credits (EEC) are making an appearance in some countries (i.e. Italy, France and Great Britain) (EuroWhiteCert, 2007; Metz, 2007; Urge-Vorsatz et al., 2007). Under these schemes, energy producers, suppliers or distributors are required to deliver savings to the final user equivalent to some set target. If they do not, they must pay a penalty. White certificates are given to those who can demonstrate energy savings. These certificates can be kept or sold to producers, suppliers or distributors who cannot meet their own targets.

4.3.4 Energy efficiency promotion programs

Energy efficiency promotion programs include energy efficiency information programs, demand-side management programs, smart metering, and requirements for energy audits in public and private buildings (Urge-Vorsatz et al., 2007).

4.3.5 Energy efficiency targets and obligations

Targets and obligations for energy efficiency with fixed deadlines are more stringent than energy efficiency programs. Energy efficiency targets can be set through many approaches including building codes, requirements to improve the energy efficiency in public buildings (World Energy Council, 2008) and/or numerical targets for energy consumption reduction through the ESCO route (Dhingra and Julena, 2005). Country-wide annual percentage reduction in energy consumption requirements can also be set, which has been done in the European Union, as well as requirements for utilities to invest a certain percentage of revenues in energy efficiency on an ongoing basis, as in Brazil (Urge-Vorsatz et al., 2007).

4.5.6 Subsidies and tax rebates

Some approaches to encouraging ESCOs through subsidies and tax rebates include income tax rebates on payments made to ESCOs or on EE projects, service tax exemptions on energy audit fees, subsidies for energy audits and five year tax holidays for ESCOs (Cherail, 2005; IREDA, 2006b; Urge-Vorsatz et al., 2007). There is dispute on the value of subsidies. Some argue that subsidies are counter-productive and inhibit the growth of commercially sustainable solutions in the market (Taylor, et al., 2008).

4.3.7 ESCO institutional frameworks

ESCOS would also benefit from having clear institutional frameworks for their business operations that recognize their more unique position selling equipment, providing services and engaging in financing. These frameworks should specify options for taxation and in general reduce some of the institutional challenges associated with starting an ESCO. The central government has helped with this in China, contributing to the success of China's ESCO industry (Taylor, 2009).

4.3.8 Restructured electricity industry and major industries

Deregulation of the energy supply industry domestically brings in competitors and forces utilities/energy suppliers to take a greater interest in promoting energy savings for their customers to make themselves competitive (Lee et al., 2003). In the short term, this can cause a drop in interest in ESCOs due to decreases in energy prices. But these decreases are often temporary (Urge-Vorsatz et al., 2007). Deregulation can force energy supply companies reorient themselves somewhat from energy supply companies to energy solution companies, focused more on services and less on products. This can be both positive and negative for ESCOs. It can cause utilities to establish their own ESCOs, which serves to increase overall ESCO activity in a country, but creates more competition for existing ESCOs (Urge-Vorsatz et al., 2007). Removing state monopolies on other industries increases competition and puts pressure on companies to improve efficiency (Vine, 2005).

4.4 ESCO and energy efficiency capacity and human resources

Building ESCO and energy efficiency capacity and human resources is critical to long term ESCO success. This has to happen on multiple levels. First, clients need to develop a greater awareness and understanding of energy efficiency and ESCOs through information distribution and training. Second, ESCOs require capacity building and information sharing regarding new technology, financial institutions and appropriate approaches to contracting. Finally, there needs to be a level of energy efficiency human resources within the general population created through educational institutes and other training programs so that potential ESCOs and clients can hire and maintain appropriate people.

4.4.1 Information distribution and training for clients

Information distribution and training for potential clients regarding energy efficiency, energy efficiency projects, financing and ESCO services is considered to be critical to increasing demand for ESCO services (Langlois, nd; Vine, 2005). Efforts need to be focused on changing attitudes and creating an atmosphere of partnership and trust (Dhingra and Julena, 2005). Information needs to be disseminated to potential ESCO clients in all sectors (public, industrial, residential and commercial) in a *sustained* manner (Dhingra and Julena, 2005). Politicians, decision makers and facility managers in all sectors need to understand that energy efficiency measures can reduce costs. Some of the types of information that could be provided include:

- Information regarding energy efficiency in general (World Energy Council, 2008);
- A database of potential sector specific EE improvements (Karrir, 2005);
- Information regarding ESCOs and their roles, including information regarding demonstration projects (Lee et al., 2003; World Energy Council, 2008);
- Directives and guidelines on ESCOs for facility managers (Lee et al., 2003); and
- A comprehensive list of ESCOs in the country including a description of their projects and services (Vine, 2005).

Information dissemination can be undertaken in multiple ways by multiple parties, including government agencies, ESCO associations, or individual ESCOs. Some approaches to distributing the information include:

- Undertaking general energy efficiency awareness campaigns (Urge-Vorsatz et al., 2007);
- Establishing domestic think tanks with government/industry/academia to work to remove barriers and create a roadmap to success (Karrir, 2005);
- Engaging in capacity building activities for industries and energy managers in industries on ESCOs and ESCO projects through workshops, training courses, and exhibitions (Lee et al., 2003; Dhingra and Julena, 2005; Karrir, 2005; Vine, 2005);
- Establishing small focused industry groups on energy efficiency, to engage industry in a sustained manner (Dhingra and Julena, 2005);
- Creating internet based energy efficiency information portals such as "ESCO magazines" (Urge-Vorsatz et al., 2007);
- Creating incentives for politicians to focus on energy efficiency by focusing on the cost saving potential and the positive climate change implications; and
- Establish relationships with existing industry associations to provide information on EPC and ESCOs (Urge-Vorsatz et al., 2007).

4.4.2 *Capacity building for ESCOs*

ESCOs benefit from capacity building, networking and sharing of experiences in multiple ways. Capacity building and information sharing could be provided through educational institutes, international conferences, international partnerships, training programs, workshops, and manuals (Sharma, 2005; Urge-Vorsatz et al., 2007; World Energy Council, 2008). ESCOs need capacity building and information sharing regarding:

- Financial institutions and identification of potential funding sources including: private banks, commercial financial institutions (especially those already familiar with EPC), international development agencies (i.e. World Bank, Asian Development Bank, GEF), venture capital firms, partners, special purpose vehicles and leasing companies (Vine, 2005; Valavan and Bhatia, 2005);
- Appropriate corporate structures, especially the need to maintain a sufficient number of financial experts on staff (Hansen, 2009a);
- Contracting approaches, best practices, success stories, benchmarks, monitoring and verification and other tools and guidelines (Urge-Vorsatz et al., 2007); and
- New technology, and more advanced technological applications (possibly under the Technology Cooperation Agreement Pilot Project under article 4.5 of the Climate Change Convention) (Lee et al., 2003).

ESCO associations play a key role in this capacity building (Sridharen, 2005). ESCOs with better technological and financial capacities could be encouraged to play a leadership role in the market (Lee et al. 2003). Energy agencies also engage in these types of capacity building in some countries (Urge-Vorsatz et al., 2007). International partnerships and cooperation among ESCOs and ESCO associations are also critical to this type of information exchange and capacity building (Urge-Vorsatz et al., 2007; Hansen, 2009a). ESCOs in developed countries could play an advisory role in countries where they do not wish to fully engage in a joint venture (Lee et al., 2003). Joint ventures with ESCOs in developed countries to undertake demonstration projects or regular projects could help local ESCOs gain a foothold, develop business experience, and take on larger projects (Lee et al., 2003). International conferences (i.e. ESCO Europe, ESCO Africa, ESCO Asia) already form a critical element of the ESCO information exchange network. Websites such as www.clearcontract.net in Europe are not only serving as repositories of information on contracting approaches, but also on technology and tools.

4.4.3 Energy efficiency human resources

Where local energy efficiency capacity is weak, it must be developed as a requirement for the success of energy efficiency projects. Countries need to have a building and energy managers and operation and maintenance staff with a strong understanding of energy efficiency, auditing and M&V (Shen, 2007; Hansen, 2009a). Capacity can occasionally be borrowed from other countries but generally relying on international consultants is not sustainable (ESMAP, 2006). Some approaches include:

- Foster the development of human resources by creating energy efficiency programs in post-secondary institutions (Dhingra and Julena, 2005);
- Create certifications in energy efficiency for energy managers both within companies and as individuals (Dhingra and Julena, 2005; Sharma, 2005);
- Encourage ESCOs to play an active role in training their clients in operations and maintenance of the equipment they are installing by building it into their service contracts (Hansen, 2009a); and
- Promote international exchange in terms of personnel training and technological exchange to promote greater energy efficiency and energy conservation cooperation and information exchange on EPC, demand-side management, and technological innovation (Shen, 2007).

4.5 Demonstration and ongoing markets for ESCOs

It is helpful to create a market for ESCOs with demonstration and ongoing projects so they can showcase their expertise and gain practical experience. This can be done through public and private sector demonstration programs as well as broader public sector energy efficiency programs, whereby the energy efficiency of a wide range of public sector buildings is improved on an ongoing basis.

4.5.1 Demonstration programs

Demonstration programs in the public and private sector increase awareness about energy efficiency, energy efficiency technologies, and ESCOs. They also increase ESCO capacity and are key to market creation (Lee et al., 2003; Karrir, 2005; Vine 2005; Langlois, nd; World Energy Council, 2008). Government demonstration programs have been central to ESCO success in developed countries (Taylor et al., 2008). To promote ESCOs, governments must do demonstration projects in public buildings/utilities and change public procurement laws as required to ensure that these projects proceed (Lee et al., 2003; Vine, 2005).

Demonstration projects should not just be limited to the public sector. Demonstration projects in the various industrial sectors, and utilities would be very helpful in promoting ESCO success (IREDA, 2006a). Governments could play a key role in identifying industrial customers or groups of customers and go through some of the first steps in terms of getting the clients commitment, defining their contracting and financing terms, basic information o their energy cost and consumption and use characteristics and then deliver to the ESCO community a qualified and decision ready customer (Vine, 2005).

4.5.2 Ongoing public sector energy efficiency markets

Beyond demonstration programs, public sector agencies (at the local, regional and federal level) have a key role to play in ESCO development. They are a major energy user and can be a significant proportion of the market (Vine, 2005). Public sector projects were critical for creating a core market for ESCOs in North America (Taylor et al., 2008). Public sector procurement laws must be changed as required. It would be helpful to create continuous demand in the public sector by planning projects out ahead including schools, hospitals, government buildings, military operations etc. (Lee et al., 2003). The municipal government sector also offers large untapped potential (Sridharen, 2005). One approach would be to make a certain percentage of government buildings open to EPC and divide the work up among ESCOs (Vine, 2005). Once ESCOs have proved their credibility on these projects, all public sector buildings should undergo EPC (Vine, 2005).

4.6 Accreditation and standardization of the ESCO industry

ESCO industries would also likely benefit from greater accreditation and standardization within countries. This could help improve trust on the part of clients and banks, if there are standardized processes, while making contract negotiation processes less challenging. Accreditation and standardization processes are already underway in many developing countries.

4.6.1 Pre-qualification or accreditation processes

Promoting ESCO pre-qualification or accreditation (or certification) organizations and processes is important to the success of an ESCO industry (Karrir, 2005; Sharma, 2005; Vine, 2005). Pre-qualification or accreditation is important for ensuring the ESCOs provide a reliable service, given past failures (Vine, 2005; Hansen, nd), but must involve the industry experts (Sharma, 2005). It improves trust regarding the reliability of ESCOs. Many countries have accreditation associations (i.e. US ESCO association, NAESCO, Chinese ESCO association, South African Association of ESCOs) (World Energy Council, 2008). Accreditation can also be run by government agencies and/or utilities (as in South Africa). In Europe, an effort is underway to identify qualifications for ESCOs and quality assurance systems for an EU-wide certification system (Vine, 2005; Urge-Vorsatz et al., 2007). Pre-qualification might be a slightly less onerous procedure whereby potential ESCO firms must satisfy transparent pre-qualification criteria before they can work in a particular country (Hansen, nd).

Potential accreditation/pre-qualification criteria could include range of services offered, financing and project management capabilities, technological and project design capabilities, and M&V capabilities (Sharma, 2005).

Accreditation programs are not without some issues. One major issue with this is rechecking ESCO companies who have been accredited or when an ESCO company undertakes a poorly done project (Hansen, nd). In addition, smaller ESCOs sometimes cannot afford accreditation (Urge-Vorsatz et al., 2007). Personnel also change over time, which means that the ESCO might no longer have the qualified people it had when acquiring accreditation. Training and certification for individuals within the ESCO industry could be a different approach that should be considered (Hansen, nd).

4.6.2 *Standardized contracts and monitoring and verification*

Standardization of contracts, or contract provisions, monitoring and verification protocols and dispute resolution mechanisms would improve client and financial institution understanding of ESCOs and concerns about the reliability of ESCOs (Karrir, 2005, Vine, 2005). Requirements for investment grade audits at the outset also would facilitate ESCO success (Hansen and Brown, 2003). These measures also would improve time and cost effectiveness (Vine, 2005; World Energy Council, 2008).

Standardization of contracts has been a challenging task because many companies consider their contracting approaches to be unique and proprietary (Vine, 2005). Most ESCOs prefer standardizing contract provisions rather than entire contracts. The North American ESCO Association (NAESCO) is concentrating on standard language for a set of key contract provisions (Vine, 2005). These should include: clear definitions of when the project is to be completed, payback periods, minimum guaranteed savings for client, sharing mechanisms for additional revenues, the savings calculation methodology, baseline consumptions including correction factors, definitions of statistical techniques to be utilized in developing forecasts of baseline consumption changes based on changes in consumption profiles (Dhingra and Julena, 2005).

Other possible approaches to improving the contracting process include establishing a peer review process for contracts from government agencies, industries and ESCOs (Dhingra and Julena, 2005). Energy contract clearinghouses such as www.clearcontract.net, which operates in eight Central and Eastern European countries, could play a role in improving standardization of ESCO contracts. The contract clearinghouse manages energy performance and delivery contracting knowledge, and integrates that knowledge to create energy contracting standards (Clearcontract, 2008). It also fosters local energy contracting capacity and documents success stories (Clearcontract, 2008). A key goal is to reduce transaction costs and improve transparency for both the client and the provider of services (Clearcontract, 2008).

The development of industry acceptable monitoring and verification (M&V) protocols would also assist in the development of ESCO industries (Karrir, 2005; Vine, 2005). The International Performance Measurement and Verification Protocol (IPMVP), developed by the Efficiency Valuation Corporation (EVO), a non-profit organization is a good model to consider. The IPMVP defines standard approaches to measuring energy savings (Cowan, 2005). A key issue associated with M&V protocols is the trade-off between accuracy and cost (Cowan, 2005). It has been suggested that making M&V requirements as simple as possible in the beginning reduces transaction costs and gets clients interested. As the ESCO industry develops, M&V protocols can be made more advanced and accurate (Lee et al., 2003).

4.7 Innovative ESCO models and approaches to ESCO development

There is also a need to consider more innovative models in terms of providing energy solutions through ESCOs, particularly in developing countries. The EPC ESCO model has worked well in North America, but the same business model is not necessarily suited to other countries, particularly developing ones (Cowan, 2009). It is important to be flexible in considering innovative ESCO models in other countries. These include:

4.7.1 ESCOs that provide other services

In addition to energy efficiency performance contracting, ESCOs could undertake a wide variety of other energy or building management services that might make them more appealing as total service providers to clients in developing countries. Some options include:

- Allowing for *Super ESCOs* that provide gas and electricity as well as their traditional services. This has been a trend in some US states. However there have been some concerns raised regarding predatory ESCOs convincing consumers to switch to them as an energy supplier, and then experiencing higher energy bills.
- Promoting ESCOs that in addition to energy efficiency services, offer *broader packages of sustainable energy options* including renewables and biofuels (Hansen, 2009a). This could include encouraging models whereby ESCOs work together to provide complete multi-faceted solutions for large clients (Taylor, 2009).
- Having ESCOs undertake *property and asset management* with EPC allowing them to combine contractual issues with rentals, net leases and operation and maintenance. Dalkia already does this in some developing countries, including Brazil (Day, 2009).
- Having ESCOs combine *building management* with energy efficiency or leasing with energy efficiency (World Energy Council 2008). Companies that own large buildings often outsource the operation and maintenance of their buildings. ESCOs that offered combined facility management and/or leasing with EPC could fill a market niche (Urge-Vorsatz et al., 2007).
- Creating ESCOs that also act as *equipment leasing* organizations. Existing companies might be persuaded to lease energy efficiency equipment, or new companies might have to be created (Vine, 2005). Joint ventures with energy efficiency equipment manufacturers is also a possibility to share knowledge of newer EE concepts, as well as potentially risk sharing (Sharma, 2005). However EE vendors sometimes push their own products and often do not wish to share risks or provide performance guarantees (Sharma, 2005).
- Establishing ESCOs as long-term "energy advisors" to core clients (Taylor, 2009).
- Promoting ESCOs that provided greater *bundling* of ESCO projects. Bundling projects may be a key component of getting banks to finance projects, or being able to undertake the

projects through the Clean Development Mechanism. Bundling may also be key in getting ESCOs to view some projects as viable. Bundling can also be critical to reducing transaction costs and making smaller scale projects, particularly in the residential and commercial sectors more doable. Bundling can be geographical (based on buildings or industries in close proximity), technological (focused on technology clusters with widespread industrial application) and industrial (focused on certain types of industries) (CRISIL, 2004). In India, banks have relied on geographical or industry specific clusters to reduce transaction costs (ESMAP, 2006). Banks, ESCOs or government agencies can act as the bundler.

4.7.2 *New approaches to ESCO development*

The most common way of promoting ESCOs in developing countries has been to provide significant international funding to establish and finance North American type ESCOs. However this has not always been effective, particularly the promotion of the EPC component of the North American ESCO model, as has been discussed above. North American models of ESCO remuneration and creation must be adapted to some extent to local situations. New approaches to remuneration are already being undertaken in many developing countries with the outsourcing model in China and straight fee for service energy efficiency contracts in many other countries. Some possible additional approaches include:

- Developing *energy efficiency procurement examples* rather than forcing developing countries to adopt the EPC ESCO model. This allows local companies to define themselves as they wish in bidding on energy efficiency contracts. This approach is being undertaken by USAID in Egypt (USAID, nd). USAID is funding a pilot project to develop two energy efficiency service procurement examples in two buildings. Local companies were invited to bid on these contracts. The notion was instead of creating pre-defined ESCOs, the local market would be better able to step up and become energy service providers utilizing approaches more fitted to the services and expertise already available within the country (USAID, nd).
- Establish *performance-financing* whereby international agencies provide long-term financing for ESCOs once they have established a performance record (Cowan, 2009). This is a shift from traditional funding which focuses on paying for goods and services without monitoring to determining whether energy savings were achieved. ESCOs can often get short-term financing for projects from commercial banks to make the initial investment in equipment but have to pay it back too quickly making the project unviable (Cowan, 2009). If a model were established whereby they were guaranteed long-term international financing once they had proved energy savings, ESCOs in developing countries might improve their services and focus more on monitoring and verification. This is a model that has been applied by international agencies such as the World Bank in the area of health provision and is being applied in carbon funds, whereby results must be demonstrated before funding is received (Cowan, 2009).

5.0 Conclusions

ESCOs provide a promising opportunity to achieve greenhouse gas emissions reductions through energy performance contracting to increase energy efficiency in a variety of sectors in developing countries. The ESCO concept is a straightforward one, whereby ESCO remuneration is based on the amount of energy saved through the project, thereby reducing the risks of undertaking energy efficiency projects for clients. Large ESCO industries have been successfully operating in most developed countries in North America and Western Europe for many years. Nevertheless, for many years despite some moderate success stories in countries such as Brazil, and South Korea, ESCOs have yet to gain significant market share in most developing countries. The total ESCO activity outside the US in 2001 was estimated to be less than half that in the US. However China has become one notable exception experiencing a massive growth in the ESCO industry in the last few years, achieving an annual investment that at US $1billion, was half those of the US in 2007.

A large number of programs and mechanisms have been established to help facilitate the growth of ESCOs in developing countries. These include programs and mechanisms undertaken by international agencies, including most importantly, the World Bank, the European Bank for Reconstruction and Development (EBRD) and the United States Agency for International Development (USAID). These programs primarily involve funding for ESCO start-up, ESCO projects, partnership development, capacity building, and loan guarantees, and have been critical for jump-starting ESCO development in many developing countries. Within developing countries, governments, development banks, commercial financial institutions, utilities and ESCO associations have also played a role in ESCO development. Support from the developing country governments, in the form of funding, energy policy, and demonstration programs, is a key factor in ESCO success.

Despite all of the programs and mechanisms to facilitate the growth of ESCOs, they have only experienced moderate success in most developing countries, with the exception of China. While this may be in part because they are still in their infancy in many developing countries, a number of barriers serve to hinder ESCO expansion. Financing and administrative barriers are generally considered to be the most critical. However, all of the barriers are interrelated and often removing just one or two is insufficient. The following key barriers to ESCO success were identified:

- *Difficulty accessing financing* due to scarce capital and immature banking sectors, lack of ESCO awareness of how to access financing, lack of lender knowledge of ESCOs or perceptions that the ESCO and/or client is not credit-worthy, and commercial financing rules that are inconsistent with EPC including preferences for working capital, large projects, asset-based financing, commercial risk and short payback periods.

- *High administrative and transaction costs* including the technical challenges associated with designing projects and procuring equipment, complex and time-consuming contract negotiations, lack of a legal and institutional framework for ESCOs and complicated government procurement rules.
- *Government energy policy disincentives,* such as minimal energy codes or standards and artificially low energy pricing negatively affect energy efficiency investment.
- *Limited knowledge of ESCOs and reliability concerns* on the part of prospective clients and lenders with regard to what ESCOs do, energy efficiency in general, and the likelihood of achieving savings through energy efficiency measures.
- *Lack of human resources* within the ESCO and prospective clients, who have the requisite time and energy efficiency technology skill set to undertake large energy efficiency projects.
- *Client preferences for in-house solutions and other priorities* for a wide variety of reasons, including preferences to keep jobs in-house, prevent the divulgence of trade secrets, avoid temporary shut-downs and a general preference to focus on increasing market share and production, rather than energy efficiency.
- *Challenges of the EPC business model* including low profit margins, the uncertainties associated with remuneration based on guaranteeing savings, risks associated with clients who do not fulfill their end of the contract and the costs associated with preparing complicated bids that may or may not be successful.

Despite the numerous barriers to ESCO industry development in many developing countries, there are measures that have been undertaken in many countries to facilitate ESCO success, and further measures that can be undertaken. Many of the ESCO models and lessons learned in developed countries and China can to some extent be applied in developing countries. However they need to be customized for the specific country and sector. ESCOs can help promote energy efficiency and greenhouse gas emissions reductions. But they are not a panacea may not be the best or only answer in all countries and all sectors. Moreover, even with all the appropriate financial and information support measures that are discussed below in place, there generally has to be an overall driver to create market demand for ESCOs. This driver can take the form of higher energy prices, firm national energy efficiency targets or some other form of demand. In the absence of such a driver, the measures outlined below are unlikely to provide sufficient market impetus.

Key measures that could facilitate ESCO industry success include:

- *Financing support structures and funding mechanisms* including dedicated debt agencies, concessional financing and grants, and loan guarantees to jump-start ESCO industries and enable domestic commercial financial institutions to eventually take over as the primary source of lending for ESCO projects.

- Fostering *domestic commercial financial institution support* for ESCOs including moving to cash flow-based or project-based financing, funding small projects or bundling projects and establishing specific energy efficiency financing programs and teams.
- Establishing *appropriate energy efficiency programs and laws* including eliminating energy price subsidies and creating energy efficiency agencies and energy efficiency obligations and incentives.
- Engaging in *ongoing information dissemination to potential clients* with regard to energy efficiency and ESCOs, with a focus on building partnerships and providing a clear "one stop shop" source of information that is updated regularly.
- Undertaking *ongoing capacity building for ESCOs* with regard to financing, contracting approaches, best practices, and technology with other ESCOs and clients, both domestically and internationally, through a wide variety of approaches including information dissemination, networking opportunities and training courses.
- Promoting *increased energy efficiency human resources,* both in ESCOs and at client-sites through training programs or certification programs.
- Engaging in *public and private sector demonstration programs* to build ESCO capacity and raise awareness through the creation of success stories.
- Creating *public sector energy efficiency programs* whereby all public buildings are required to undergo energy efficiency upgrades creating a continuous demand for ESCOs.
- Establishing *pre-qualification or accreditation programs for ESCOs* to provide reassurance to clients that ESCOs are reliable.
- Promoting the development or use of *standardized contracts and monitoring and verification protocols,* such as the International Performance Measurement and Verification Protocol (IPMVP), to improve perceptions of ESCO reliability as well as reducing administrative costs associated with contract negotiation.
- Encouraging *joint ventures* with multi-national ESCOs to help improve domestic ESCO capacity, increase their knowledge of new technologies and allow ESCOs to undertake large projects.
- *Restructuring the electricity industry* and other major industries to eliminate monopolies and increase competition, promoting greater interest in energy saving through energy efficiency.
- Promoting the geographic, technological or industrial *bundling* of smaller projects by either banks or ESCOs to increase the viability of small projects.
- Considering *innovative ESCO models* including super ESCOs, ESCO/building management models or ESCO/leasing company models.

The success of the ESCO industry in establishing a foothold in China in the last few years demonstrates that it is possible for the ESCO industry to be highly successful in some developing countries. It seemed as though there was a tipping point for the ESCO industry in China, a point at which the efforts put forth by the World Bank, Chinese government and local ESCOs reached a critical mass and the industry achieved a certain level of success that continues to build upon itself (Taylor, 2009). Long-term sustained growth of the ESCO industry still needs to be achieved in China, but early results are promising and suggest that barriers to ESCO industry growth can be successfully overcome in some developing countries.

6.0 References

APEC Energy Working Group. 2006a. Thailand Implementation Plan for International Energy Efficiency Financing Protocol. Efficiency Valuation Organization, Asia-Pacific Economic Cooperation.

APEC Energy Working Group. 2006b. APEC Energy Efficiency and Renewable Energy Financing Task Force Progress Report. EWG32, Yuzhno-Sakhalinsk, Russian Federation, 4–5 October 2006.

Armenian ESCO Assn. 2008. The Association of Energy Service Companies of Armenia. Website. Accessed October 23, 2008. http://www.armesco.am

Calemayer, James. 2008. 2008 President's Report. The South African Association of Energy Services Companies, January 31, 2008.

Cherail, Koshy. 2005. India's growing ESCo community. rediff News. Accessed October 23, 2008. http://in.rediff.com/money/2005/may/14guest.htm

Clearcontract. 2008. Clearcontract Clearinghouse for energy contracting. Website. Accessed October 14, 2008. www.clearconctract.net

Clinton Foundation. 2009. Combatting Climate Change: Clinton Climate Initiative: What We've Accomplished. Website. Accessed March 9, 2009. http://www.clintonfoundation.org/what-we-do/clinton-climate-initiative/what-we-ve-accomplished

Cowan, John. 2005. Global ESCO Issues. International ESCO Conference. Tansen Marg, New Delhi, June 1-2.

Cowan, John. 2009. Personal communication with John Cowan. Environmental Interface Limited, March 2, 2009.

CRISIL (Credit Rating Information Services of India Limited). 2004. Market development and Lender's Perspective for ESCO Projects. EECE Conference. June 4.

Day, Frederick T. 2009. Personal communication with Frederick T. Day. Global MVO Consulting Services, March 27, 2009.

DEDE. 2008. List of ESCOs in Thailand. Thailand Department of Alternative Energy Development and Energy Efficiency. Website. Accessed November 29, 2008. www.dede.go.th/dede/fileadmin/upload/pic_sometime/List_of_ESCO.pdf

Dhingra, Suresh and Sarai Julena. 2005. International ESCO Conference. Tansen Marg, New Delhi, June 1-2.

du Pont, Peter, Chainuwat Prijyanonda, Anat Prapasawad. 2000. Thailand ESCO Market Development Project: Draft Final Report. November 28, International Institute for Energy Conservation.

Environmental News Service. 2006. Cutting Energy Waste in China, India, Brazil Could Avert Climate Change. Accessed October 14, 2008. http://www.ens-newswire.com/ens/may2006/2006-05-30-01.asp

Energy Futures Australia and Danish Management Group. 2005. Thailand's Energy Efficiency Revolving Fund: A Case Study. Prepared for APEC Energy Working Group, Asia-Pacific Economic Cooperation.

ESMAP (Energy Sector Management Assistance Program). 2006. Financing Energy Efficiency: Lessons from Recent Experiences with a Focus on Brazil, China and India. May 16, 2006, Washington, DC: International Bank for Reconstruction and Development/The World Bank.

Eskom DSM. 2008. Eskom DSM Website. Accessed October 21, 2008. http://www.eskomdsm.co.za/?q=ESCO_Implementing_DSM

EBRD (European Bank for Development and Reconstruction). 2005. Financing ESCOs in Transition Economies. EBRD Information.

EuroWhiteCert. 2007. EuroWhiteCert Project. Website. Accessed December 1, 2008. http://www.ewc.polimi.it/index.php

Goldman, Charles A., Nicole C. Hopper, Julie G. Osborn. 2005 "Review of US ESCO industry market trends: an empirical analysis of project data." Energy Policy, 33 pp. 387-405.

Govindarajalu, Chandra. 2006. Developing Financial Intermediation Mechanisms for Energy Efficiency: Findings on ESCO Development. World Bank, May 19, 2006.

Hansen, Shirley J. no date. The ESCO Experience: Lessons learned from around the world.

Hansen, Shirley J. and James W. Brown. 2003. The Investment Grade Energy Audit: Making Smart Energy Decisions. The Fairmont Press: Lilburn, Georgia.

Hansen, Shirley J. 2006. Performance Contracting Expanding Horizons. The Fairmont Press: Lilburn, Georgia.

Hansen, Shirley J. 2009a. Personal communication with Shirley Hansen. Hansen Associates, March 2, 2009.

Hansen, Shirley J. 2009b. ESCOs Around the World: Lessons Learned in 49 Countries. The Fairmont Press: Lilburn, Georgia.

Hobson, Peter. 2009. Personal communication with Peter Hobson. Senior Banker, European Bank for Reconstruction and Development. March 5, 2009.

International Finance Corporation, Alliance to Save Energy and India Bureau for Energy Efficiency. 2008. India: Manual for the Development of Municipal Energy Efficiency Projects. International Finance Corporation.

IREDA (Indian Renewable Energy Development Agency Ltd.). 2006a. "The ESCO Concept in the Indian Scenario." The Bulletin on Energy Efficiency, Vol 6, Issue 4-6.

IREDA (Indian Renewable Energy Development Agency Ltd.). 2006b. "The ESCO Business." The Bulletin on Energy Efficiency, Vol 7, Issue 1-2.

Kirai, Paul. 2007. Institutionalizing energy efficiency: Experiences from Kenya. Global Forum on Sustainable Energy-7, Vienna, Austria.

Karrir, Naval. 2005. ESCO Issues and Way Forward. International ESCO Conference. Tansen Marg, New Delhi, July 1-2.

Langlois, Pierre. nd. The Evolution of ESCOs in Developing Countries and Economies in transition, Quebec: Econoler International.

Lee, Myung-Kyoon, Hyuna Park, Johnwhan Noh and J.P. Painuly. 2003. "Promoting energy efficiency financing and ESCOs in developing countries: experiences from Korean ESCO business." Journal of Cleaner Production. 11 pp. 651-657.

Lockhart, Nina. 2009. Personal communication with Nina Lockhart. North American Energy Service Company Association, March 6, 2009.

Shen, Shen. 2007. Promoting EPC Mechanism and Strengthening Energy Conservation Cooperation in Northeast Asia. Senior Advisor, National Development and Reform Commission Energy Research Institute China, Director EMCA, October 2007.

Metz, Bert. 2007. Climate Change 2007: Mitigation of Climate Change. Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Moreno, Eduardo. nd. Energy Conservation Service Companies Market Potential for Energy Efficiency, Brazilian Association of Energy Service Conservation Companies (ABESCO).

NREL (US National Renewable Energy Laboratory). 2005. Advancing Clean Energy Use in Mexico. Golden, Colorado: National Renewable Energy Laboratory.

Painuly, J.P., H. Park, M.-K. Lee, and J. Noh. 2003. "Promoting energy efficiency financing and ESCOs in developing countries: mechanisms and barriers." Journal of Cleaner Production 11 pp. 659-665.

Philippine Daily Inquirer. 2007. "Clinton climate initiative." Philippine Daily Inquirer. May 27, 2007. Website. Accessed March 18, 2009. http://opinion.inquirer.net/inquireropinion/talkofthetown/view/20070527-68126/Clinton_climate_initiative

Poole, Alan Douglas and Howard Gellar. 1997. The Emerging ESCO Industry in Brazil. The American Council for an Energy-Efficient Economy, Washington, DC. March, 1997.

REEEP (Renewable Energy and Energy Efficiency Partnership). 2007. Brazilian oil giant Petrobras helps customers reduce energy consumption.

REEEP. nd. Performance and Credit Risk Guarantees and Financing Mechanisms for ESCO-structured Energy Projects. Website. Accessed December 2, 2008. http://www.reeep.org/index.php?assetType=project&assetId=37

Roy, G.C. Datta. 2003. ESCO Projects-Perspectives. Presented at Business Shop for Energy Efficiency Projects, FICCI for WB/UNF program, New Delhi, June 27, 2003.

Roy, G.C. Datta. 2006. Financing ESCO Projects. Presented at Workshop on EE in Buildings and Building Code, Bureau of Energy Efficiency, New Delhi, October.

SAAEs. 2008. South African Association of Energy Service Companies (SAAEs). Website. Accessed December 2, 2008. http://www.esco.org.za/index.html

Sharma, K. K. 2005. Presentation on Development of ESCO, Performance Contracting Solution. Honeywell Automation India Ltd.

Sridharen, K.S. 2005. Status of ESCO Industry in India. UNEP/UNF-World Bank Three-Country Energy Efficiency Project. Workshop on ESCOs and Equity Financing. Bejing, China. April 13-15.

Storment, Scott. 2009. Personal communication with Scott Storment. Senior Officer, New Sectors, North American Development Bank. March 13, 2009.

Sugay, Ed. 2009. Personal communication with Ed Sugay. Energy and Environmental Solutions, Siemens, Building Technologies Division. March 12, 2009.

Taylor, Robert P., Chandrasekar Govindarajalu, Jeremy Levin, Anke S. Meyer, William A. Ward. 2008. Financing Energy Efficiency: Lessons from Brazil, China, India and Beyond. The World Bank, Washington DC.

Taylor, Robert P. 2009. Personal communication with Robert Taylor. Lead Energy Specialist, East Asia Transport and Energy Sector Unit, World Bank. March 16, 2009.

Taylor, Roger. nd. NREL International Program Overview. US National Renewable Energy Laboratory. US Department of Energy and Midwest Research Institute.

United Nations Development Program (UNDP). nd. UNDP-GEF Project Writeups: Energy Efficiency Improvements and Greenhouse Gas Reductions. Website. Accessed November 24, 2008. http://www.undp.org/gef/05/portfolio/writeups/cc/egypt_ee.html

United States Agency for International Development (USAID). nd. Procuring Energy Efficiency Services. Website Accessed November 18, 2008. www.usaid.gov/our_work/economic_growth_and_trade/energy/publications/projects/egypt_smes.pdf

Urge-Vorsatz, Diana, and Sonia Koppel, Chunyu Liang, Benigna Kiss, Gireesh Gooplan Nair, Gamze Celikyilmaz. 2007. An Assessment of Energy Service (ESCOs) Worldwide. World Energy

Council, March.

Valavan, V.T. and Debjani Bhatia. 2005. Key results of studies carried out under 3-country Energy Efficiency Project of World Bank/UNEP/UNF. International ESCO Conference, Tansen Marg, New Delhi, June 1-2.

Vine, Edward. 2005. "An international survey of the energy service company (ESCO) industry." Energy Policy, 33 pp. 691-704.

World Energy Council. 2008. Energy Efficiency Policies around the World: Review and Evaluation. World Energy Council Publications.

Yassin, Ibrahim. 2007. Energy Efficiency Policy in Egypt and its Perspectives. IFPEEI Workshop Proceedings, Bejing, June.

Zhao, Ming. 2007. EMCA and ESCO Industry Development in China. CTI Industry Joint Seminar: Successful Cases of Technology Transfer in Asian Countries. March 7-8th 2007, New Delhi, India. Zhao, Ming, Secretary General of EMCA (China ESCO Association).