A REVIEW OF THE ENERGY EFFICIENCY (EE) MARKET FUNDING CONSTRAINTS AND ASSESSMENT OF POSSIBLE EFFECTIVE FINANCING MODELS FOR EE PROJECTS IN THE SOUTH AFRICAN MARKET REFLECTING ON LESSONS FROM OTHER MARKETS.

Cyprian Marowa

Title

A review of the energy efficiency (EE) markets funding constraints and assessment of possible effective financing models for EE projects in the South African market: reflecting on lessons from other markets.

Cyprian Marowa

Thesis submitted in partial fulfillment of the requirements for the degree of

Master of Management in Finance and Investment

(BMC014)

Faculty of Commerce, Law and Management

The Witwatersrand (WITS) Business School

University of the Witwatersrand

2 St David`s Place, Parktown,

Johannesburg 2193

P.O. Box 98, Wits 2050,

South Africa

Date: May 2011

Supervisor: Dr. Thabang Mokoaleli-Mokoteli

Declaration

I, Cyprian Marowa, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfillment of the requirements for the degree of Master of Management in Finance and Investments in the University of Witwatersrand in Johannesburg. It has not been submitted before for any degree or examination in this or any other University.

Cyprian Marowa

Signed at WITS - JOHANNESBURG

On this 24th day of May, 2011

Acknowledgements

The author acknowledges;

- The good Lord, our Creator for the gift of life
- My parents for the insight that education frees the mind
- My family and kids for the support during the period of this research
- My supervisor Dr Thabang Mokoaleli-Mokoteli, for the critical guidance given on the designing of the framework and the development of the research.

Abstract

This research project paper reviews research papers, policy documents and case studies of energy efficiency (EE) projects completed in developed and developing EE markets to establish the key factors driving the EE markets. Further analysis of existing financing models and products for implementing the EE projects by lenders and investors was carried out, with inferences drawn on possible financing models for use in South Africa. The United States of America, United Kingdom, Brazil, India and South African EE markets are contextualized with reference to structure, constraints and participant complex interrelationships, in particular the apparent slow uptake or reluctance by lenders to fund such projects in developing EE markets despite the evident substantial policy and financial support. The behavior of lenders suggests the classical information asymmetry problem between lenders (buyers of future project cash flows) and project owners or developers (borrowers) selling future EE project cash flows, specifically in developing EE markets. The researcher suggests financing model modifications that may be adopted for the South African market drawing on appropriate features of existing financing models in other markets.

Keywords

DOE - Department of Energy; DSM - Demand side management; EE - Energy Efficiency (EE); EPC - Energy Performance Contracts; ESCO - Energy Savings Company; Financing Model; GHG- Green house gas; GSM - Guaranteed Savings Model; Kwh - Kilowatt per our; MW- megawatt; Qualitative analysis; Renewable Energy; SPV - Special purpose vehicle; SSM - Shared Savings Model

Table of contents

Item			*Page*
Title			ii
Declarations			iii
Acknowledgements			iv
Abstract			v
Table of contents			vi
List of tables			ix
List of Figures			x
Chapter	**1**	**Introduction**	**1**
Chapter	**2**	**Literature review**	**7**
	2.0	**Introduction**	**7**
	2.1	**Energy and gross domestic product (GDP) growth**	**7**
	2.2	**The EE markets overview**	**8**
	2.3	**Cost curve – energy efficiency markets**	**9**
	2.4	**Theory of information asymmetry**	**12**
	2.5	**Imperfect information**	**14**
Chapter	**3**	**Overview of different energy and EE markets**	**16**
	3.0	**Introduction**	**16**
	3.1	**The USA electricity sector overview**	**16**
	3.2	**The USA EE market**	**18**
	3.2.1	**Current barriers to EE market USA**	**19**
	3.3	**The UK electricity sector overview**	**20**
	3.4	**The UK EE markets**	**21**
	3.4.1	**The UK financial markets**	**22**
	3.4.2	**Current barriers to EE market UK**	**22**
	3.5	**The Brazil electricity sector overview**	**23**
	3.6	**The Brazil EE market**	**24**
	3.6.1	**Brazil financial markets**	**25**
	3.6.2	**Current barriers to EE market Brazil**	**25**
	3.7	**The India electricity sector overview**	**26**
	3.8	**The India EE markets**	**27**

	3.8.1	The India financial markets	28
	3.8.2	Current barriers to EE market India	30
	3.9	The South African electricity sector overview	30
	3.10	The South African EE markets overview	32
	3.10.1	The policy interventions	34
	3.10.2	The South African financial markets	34
	3.10.3	Current barriers in EE markets South Africa	36
Chapter	4	Financing solutions in EE markets in USA, UK, Brazil, India and South Africa	37
	4.0	Introduction	37
	4.1	Generic models for funding EE market projects	37
	4.1.1	Performance contracting	37
	4.1.2	Shared savings (ESCO) model	38
	4.1.3	Guaranteed savings model	39
	4.2	Current financing models in the USA EE markets	40
	4.2.1	Traditional debt (loans or bonds)	40
	4.2.2	Tax-exempt lease purchase agreement	41
	4.2.3	Capital lease	41
	4.2.4	Lease or bond pools	41
	4.2.5	On bill financing	42
	4.2.6	Tax lien financing (PACE)	42
	4.2.7	Power purchase agreements	43
	4.2.8	Energy efficient mortgages	43
	4.2.9	Green lease structures	43
	4.2.10	Ratepayer EE/DSM programs.	44
	4.2.11	Master lease agreement (MLA)	44
	4.2.12	Capital markets	45
	4.2.13	Bonds	45
	4.2.14	Certificates of participation (COPs)	46
	4.2.15	Receivables purchase agreements (RPA)	47
	4.3	Current financing models in UK EE markets	48
	4.3.1	White certificates Energy Savings Certificate (ESC), Energy Efficiency Credits (EEC)	48
	4.3.2	"Intracting" Model	49
	4.4	Current financing models in Brazil EE markets	50
	4.5	Current financing models in India EE markets	52
	4.6	Current financing models South Africa EE markets	53

Chapter	5	Integrated analysis of EE markets and macro Country data	54
	5.0	Introduction	54
	5.1	EE markets parameters USA, UK, Brazil, India and South Africa	54
	5.2	Energy data analysis	60
	5.3	Macro data analysis	61
	5.4	Recommended model for EE market in South Africa	64
	5.4.1	Project finance	64
	5.4.2	Discussion of the model in the South Africa context	67
Chapter	6	Conclusion and Recommendation on South African EE market	70
		References	72

List of tables ***Page***

Table 1	Brazil estimated technical potential for EE market	***24***
Table 2	South Africa estimated technical potential for EE market	***33***
Table 3	Qualitative data analysis EE market developments, ownership and contracts	***57***
Table 4	Qualitative data analysis EE market parameters	***58***
Table 5	Energy data analysis	***60***
Table 6	Key macro indicators	***63***

List of Figures ***Page***

Figure 1	Global greenhouse gas (GHG) abatement cost curve	***10***
Figure 2	Marginal emission reduction costs for the global energy system	***11***
Figure 3	South Africa DSM and EE activities	***33***
Figure 4	The EE performance contracting framework	***37***
Figure 5	Shared savings model	***39***
Figure 6	Guaranteed savings model	***40***
Figure 7	Structure of the financing model of the city of Stuttgart	***49***
Figure 8	Schematic of adapted model preferred in Brazil EE market with PROESCO	***51***
Figure 9	SPV based project finance structure for EE markets in South Africa	***65***

Chapter 1: Introduction

Energy efficiency (EE) is defined as the implementation of projects or technical programmes as tools or technological interventions to reduce the energy used by specific end-use devices and systems, typically without affecting the service provided to an entity. Effectively and importantly it is the means of using less energy to provide the same or greater level of energy services (Eskom, 2009; Department of Energy (DOE), 2006; Ehrhardt-Martinez and Laitner, 2008; Roberts, 1979; Longwell, *et al*, 1995). By implication EE entails reduction of energy consumption growth and most developed economies energy authorities have elevated EE as a national agenda objective with the European Community`s Energy Policy stating, that EE as an absolute long term objective which all countries must continuously strive for (European Economic Community (EEC), 1976; Haydock and Arbon, 2009).

In 1979, Roberts, identified the key broad opportunities for saving energy through EE projects, stating generally that they fall under four headings firstly, better insulation of buildings, secondly, improved efficiency of energy use in industry, thirdly, extensive use of combined heat and power systems in conjunction with district heating and finally, extensive improvement in motor vehicle efficiency (McKinsey & Company, 2009). Further research has concluded that the implementation of all EE technical options could, by turn of the twenty first century reduce energy demand in European Community countries by 33% without restraining economic growth (Roberts, 1979; McKinsey & Company, 2009; Energy Information Agency (EIA), 2008).

Beyond mere savings EE is linked to the global warming phenomenon, in that most energy is derived from fossil fuel use in power generation plants, with coal being the largest input resource used in the United States of America (USA), South Africa and many countries across the globe (Longwell, *et al*, 1995). The use of coal and other fossil fuels has led to excessive production of green house gases such as CO_2 which are conclusively linked to global warming (Roberts, 1979; McKinsey & Company, 2009; EIA, 2008). To date there are increasingly strict requirements for the reduction of greenhouse gases or environmental management of coal generated waste streams, in particular to reduce CO_2 emissions through increased efficiency

(Longwell, *et al*, 1995; McKinsey & Company, 2009). Examples of the EE technologies/tools used in either commercial, industrial, transportation, utilities and domestic buildings include, automated efficient lighting controls, optimised cooking conversions, geyser blankets, solar water heating, smart metering, motor efficiency (includes motor right sizing and replacement), heating, ventilation and air conditioning (HVAC), variable speed drives (VSD), heat pumps, public lighting efficiency and ripple compressed air controls. These technologies are complex to understand and in most cases specialist companies named Energy Savings Companies (ESCOs) with experience and requisite qualifications carry out these projects (DOE, 2010a; United States Environmental Protection Agency (USEPA) , 2007; USDOE, 2010).

A case study of how these tools may be implemented to achieve EE saving targets is the Empire State Building case by Johnson Controls LLC, a global ESCO company which implemented EE retrofits to the Empire State Building to achieve an 38% reduction in energy consumption per annum, the project had a payback period of 3 years, saving the building owners USD4.4 million per annum in energy costs, the capital deployment for the EE project was USD13 million (Johnson Controls, 2009). In South Africa few test cases under implementation include the Johannesburg Supreme and Family courts, Central Police, Pretoria Zoo and South Africa Broadcasting Corporation. These EE projects require funding equalling R4.37 million with claimed savings of R3.49 million annually to give a payback period of 1.25 years (Johnson controls, 2009).

The reason why EE projects are different from other capital investments from a funding attractiveness perspective is that EE projects do not needed budgetary or capital allocation from Government or owners of buildings for their execution. Subject to the market`s provision of initial capital for retrofits, EE projects use the resultant energy savings achieved to repay initial outlay. The savings programme is achieved through energy performance contracting (EPC) which has been used successfully in government and private sector operations in the USA, United Kingdom (UK), Canada and Europe for over 20 years, but is relatively new in South Africa and other developing markets (DOE, 2010a).

In the USA, the Federal Government alone has in place US$5 billion worth of upgrade contracts that are predicted to deliver over US$1 billion in energy savings per year. This is achieved without any impact on the Federal Budget, as these projects are funded through third parties, that are separate independent entities who assess the business opportunities on their own merit and may make an independent decision to invest or not to invest based on their own shareholder requirements on prerequisite returns. Any EE loans or investments are repaid using the guaranteed savings negotiated with the energy performance contractor, hence no need for a budget allocation from the fiscus. A further US$750 million has been invested in private sector contracts covering schools, hospitals, airports, manufacturing and petrochemicals (USDOE, 2010; Ehrhardt-Martinez and Laitner).

In Canada, the Federal Buildings Initiative has resulted in energy upgrades to 5,500 buildings resulting in a 16% reduction in energy use and 18% reduction in greenhouse gas emissions. Energy performance contracts are now also being used in other countries around the world, including Japan and Thailand (Haydock, 2002; USEPA, 2007; Alliance to Save Energy (ASE), 2007). In Australia, there is a growing capacity to provide this service. New South Wales Government has taken a lead by facilitating the efforts of the Sustainable Energy Development Authority (SEDA). The New South Wales Government has already contracted more than A$9 million worth of upgrades in facilities such as regional hospitals, the Australian Museum and the New South Wales State library. The Department of Commerce and Treasury are also actively supporting energy savings by means of Energy Performance Contracting (EPC) by offering grants to the government departments (Haydock and Arbon, 2009).

In South Africa the Department of Public Works has taken the lead and awarded four shared savings contracts for the regions: Western Cape, South Gauteng, North Gauteng and Free State. The Western Cape and South Gauteng contracts have already resulted in energy cost savings of more than R40 million since 1998. However, this is a very small percentage of the total energy savings potential still remaining in South Africa's Government buildings or public sector market

(DME, 2005b). It is therefore very important to have the commitment and the support of all the parties involved to give a free rein to and maintain the remaining energy savings potential still existing in the government buildings EE market of South Africa (DOE, 2006).

The importance of EE in a South African context is cited in the 2008 National Energy Efficiency Strategy of South Africa, which sets a final national electricity energy demand reduction of 12% of MW/hr generating capacity or about 3000MW/hr by 2013 and 8000MW by 2025 (DME, 2005a; DOE, 2010b; Eskom, 2009; Eskom, 2010). This is equivalent to the combined capacity of Medupi and Kusile power stations under construction at an estimated cost of ZAR355 billion or the equivalent of 10% of the nation`s annual nominal GDP in 2009, at ZAR1,960 billion. (Eskom, 2009; Eskom 2010; DOE, 2006; IMF, 2010; NERSA,2009).

South Africa`s energy constraints are well documented, with Eskom the national utility citing demand exceeding supply by 2011 (DME, 2005a; Eskom, 2009; Eskom, 2010). The constraints have led to supply interruptions (black outs and load shedding) impacting negatively on the country`s economic growth prospects (Eskom, 2009; Eskom, 2010; NERSA-ERP2, 2009). In order to reverse the capacity shortage and ensure security of supply Eskom has initiated two key initiatives namely the building of new power plants under the Built Programme and demand side management (DSM) incorporating the EE programmes policy to be implemented by the National Energy Efficiency Agency of South Africa (NEEASA) and for operation by 2012 (Eskom, 2009; Eskom 2010; DOE, 2010b; DME, 2005a).

Most facilities owned by government or private companies face challenges of maintenance with budget allocations usually not adequate to keep pace with ever increasing maintenance costs. In most cases, the International Institute for Energy Conservation (IIEC) cites that this has led to facilities going on a downward spiral of deferred maintenance (Zobler and Hatcher, 2003; U.S. DOE, 2010a; Johnson Controls, 2009; Zobler, *et al*, 2009; International Institute for Energy Conversation (IIEC), 1998). Governments globally have tried to address the situation by creating an environment that attracts long term financing for EE projects within a clear understanding

that, repayments to lenders/investors can and must only come from the energy savings to be achieved (US-EPA, 2007; Zobler, *et al* , 2009; USDOE, 2010; Haydock, 2002; Poole and Stoner, 2003). The problem is that to achieve improved EE, initial capital investments have to be made. The IIEC research report (1998) has shown that EE projects compete with more traditional investments such as industrial expansions and are perceived to be more risky (Taylor, *et al*, 2008). Further EE projects require an experienced technical partner to guarantee the savings and an audit process to validate the claimed savings. The US Department of Energy report also shows that EE projects are perceived to be too small and the legal and regulatory frameworks in developing countries are deemed not compatible with performance contracting. The irony is that, the EE projects have the appeal of scale, as citing that about 38% of all energy produced globally is used in buildings, hence there is significant potential for significant savings and development of a EE market (Houser, 2009a).

This Research Report reviews the significant parameters of the EE markets in the USA, UK, Brazil, South Africa and India. The research compares EE market drivers and other developments such as shortage of power generation capacity, GDP growth, inflation, support policy and financial markets structures in order to group the markets by their similarities with a view to extrapolating funding models or parameters that may be drawn for use in the South African EE market. The Research Report discusses the constraints in the South African market and recommends financing model adaptations that may facilitate and accelerate the uptake of EE projects by funders. The report hypothesizes the existence of information asymmetry between potential EE project funders (banks), who are buyers of EE future cash flows and borrowers i.e ESCO project developers or EE project implementers or owners selling EE project cash flows. This observation seems more defined in EE markets that are still underdevelopment, despite the observed compelling incentives such as tax rebates or direct rebates on EE project investments in the South African EE markets.

This research paper analyses the characteristics and interrelations of the EE markets in established markets such as USA, UK and developing markets such as Brazil and India, using

existing research and policy papers. In analyzing these characteristics and interrelations, parallels are drawn with the EE market in South Africa and recommendations drawn on suitable financing models for use in EE projects by institutions and firms operating in South Africa.

Specifically the objectives of this study are, firstly to investigate and analyse the EE markets and factors constraining the implementation of EE projects in South Africa; secondly, to review and analyse the financing models used in USA, UK, India and Brazil for implemented EE projects and thirdly; to recommend a suitable model or adaptations to existing financing models for use in the South African EE market. Furthermore in recommending an approach to funding of EE projects in South Africa, the report gives focus to the benefits of significant implementation of EE projects. The benefits of full scale implementation of the EE projects are clearly quantified in terms of energy savings at 3000MW/hr by 2013 and 8000MW/hr by 2025 (Eskom, 2009; Eskom 2010; DME, 2005b), the equivalent cost of 3000Mw/hr exceeds USD1.5 billion. Postponement of such projects is likely to be an expensive decision, given the opportunity lost or not taken. The question is then how to structure and fund the initial capital investment in EE projects that will make the envisaged energy savings.

The research applies to private and public sector institutions whose purchasing procedures are strongly guided by the complex provisions of the Public Finance Management Act (PFMA) and National Treasury regulations (PFMA, 1999; Department of Finance (DOF), 2001). These regulations may preclude the use of certain funding models, as they require tendering procedures that usually delay implementation of EE projects. Typically, there may be only one or two specialist companies in a particular EE market niche, and the tender processes required may frustrate the securing of the services.

Using the format adopted by Ojah and Mokoaleli-Mokoteli (2009), this study has used qualitative research methods of gathering in depth knowledge and assessment of factors that currently both support and constrain the implementation of EE projects in the EE markets in other countries.

Chapter 2: Literature review

2.0 Introduction

In this chapter, Section 1 discusses the link between energy generation capacity per country and GDP growth per country, Section 2 gives an overview of the EE markets, Section 3 discusses the EE markets cost curve economics for different EE activities as potential contributions to EE savings and Section 4 discusses the information asymmetry theory as observed in EE markets to explain the observations in most developing EE markets.

2.1 Energy and Gross Domestic Product (GDP) growth

Research has shown that the demand for energy is correlated to country`s economic growth (GDP) with empirical evidence suggesting a causal relationship between energy consumption and GDP growth. (Strategic Finance Group (SFG), 2007). The link of energy to GDP derives from the decomposition of GDP into its constituent parts, namely the national consumption of goods and services (power). Also energy production is linked to national investments in capital goods such as power plants; a further link is through the government spending on power and labour (Blanchard, 2009). The relationship is studied by looking at income elasticity of energy consumption and is extensively studied in the literature. Fiebig, *et al* (1987) used cross-section data of aggregate energy for thirty nations and found income elasticity of between 1.24 and 1.64. Using time series data for OECD countries, Kouris (1983) found for primary energy demand a short run income elasticity of 1.08 for the period 1961-1981. Many researchers have found that a 1% increase in GDP is associated with a long run increase in residential energy consumption of 0.41% (Hickling, 2006; Mahadevan and Asafu-Adjaye, 2007; Narayan and Smyth, 2005). The determinants of electricity demand are the real price of electricity, real income per capita, interest rates, temperature variables and consumption expenditure per capita. A 1% increase in real income is associated with a 0.37% increase in consumption (Hickling, 2006).

In most developing African countries, where energy supply is a huge concern and given that electricity embodies the key to productive advancement, Jaunky (2006) established the income

elasticity of electric power consumption in 15 of these countries using panel data techniques. He found short run positive and statistically significant elasticity, with average p-values of 0.02, however long run electricity consumption is inelastic and considered as a necessity in the long run.

In South Africa, the recently adopted EE policy sets to recover a significant amount of capacity 3000MW by 2013, which capacity would cost over USD20 billion to install as a new power plant. Hence in the context of broad energy supply and demand, EE markets are an integral and increasingly important part of energy supply dynamics. Recoverable EE potential is conservatively estimated at 20%-30% across many segments, and is certainly the most cost effective way of meeting the demands of sustainable development of many developing countries in terms of power supply for economic development given the positive strong correlation cited above by Jaunky (DOE, 2010b, Eskom, 2010). Our interest therefore is in the efficient use of energy for each similar unit of production, leveraging further economic growth from the energy savings and in turn increasing economic growth prospects.

2.2 The EE markets overview

The inter-relationships in the EE markets are complex and have parties with different interests (DOE, 2010a; Poole and Stoner, 2003; DME, 2005a, Taylor *et al*, 2008). Researchers globally and policy makers in South Africa acknowledge the complexities of meeting all parties' expectations in the EE markets, with the Department of Energy in 2010 issuing a new specific policy to kick start and support the implementation of EE projects (DME, 2005a; DOE, 2010a).

The observations are that despite the reported expected high returns and the benefits cited for implementing EE projects, in emerging markets countries, projects are still not widely implemented. DeCanio and Watkins (1998) suggested that firm specific characteristics determined the uptake of investment opportunities and projects by investors or lenders despite the rational thinking that profit maximizing firms should undertake all investments with a positive Net Present Value (NPV). Other researchers put it down to the lenders' perceptions of

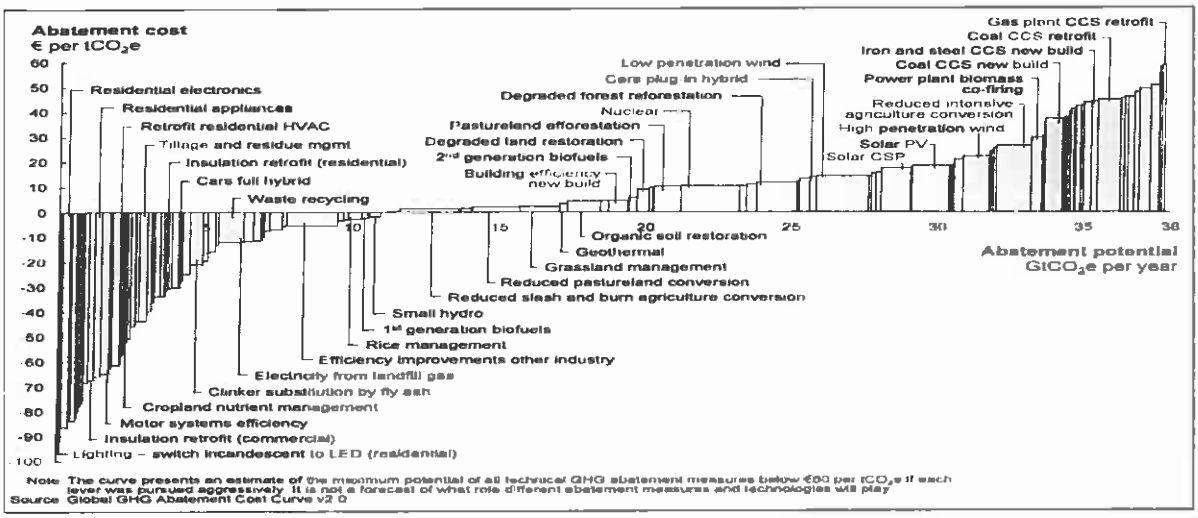
higher risk on EE investments (Taylor, *et al*, 2008). Spulber (2002) suggested one cause as being market structural organization, as he showed that markets with competing suppliers provide incentives for efficient investments. In EE markets could it be the entry of competing intermediaries in the form of funding programmes by state controlled companies, may most likely enhance complementary investments in EE projects by incumbent financial institutions? The benefits from increased investments in the EE markets and the improved efficiency will create better returns in the long run. This is the hall mark of the USA and UK, EE markets.

The essential arguments by Taylor, *et al*, (2008) are for the provision of fundamental market conditions in terms of price and returns so that EE projects can use the same lender intermediation markets as other investments. In situations where markets are imperfect or in-efficient, efforts and instruments designed to clear market imperfections should be implemented. The focus should be to deliver EE investment projects, in order to reduce transaction costs, perceived high risks and financial intermediation system barriers. The three key ingredients for delivery of EE projects are therefore sufficient technical capacity, financing and sufficient incentives for the energy using enterprise to reduce or optimize consumption (Taylor, *et al*, 2008; IIEC, 2008).

2.3 Cost curve - energy efficiency market

In order to understand the paradigm and uniqueness of EE opportunities, reference is made to a landmark research by McKinsey & Company (2009). In the broad context of energy efficiency, McKinsey & Company published a landmark study of abatement costs for global opportunities. The goals of energy efficiency projects may be defined interchangeably as increasing energy security, or improving economic productivity, or reducing the impact of climate change. Energy efficiency is among the most cost-effective solutions available to consumers, businesses, policy makers, and investors (Ehrdart-Martinez and Laitner, 2008; McKinsey & Company, 2009) to achieve the three factors described above. Technically the three are addressed through the same type of solutions.

Figure 1. Global greenhouse gas (GHG) abatement cost curve.



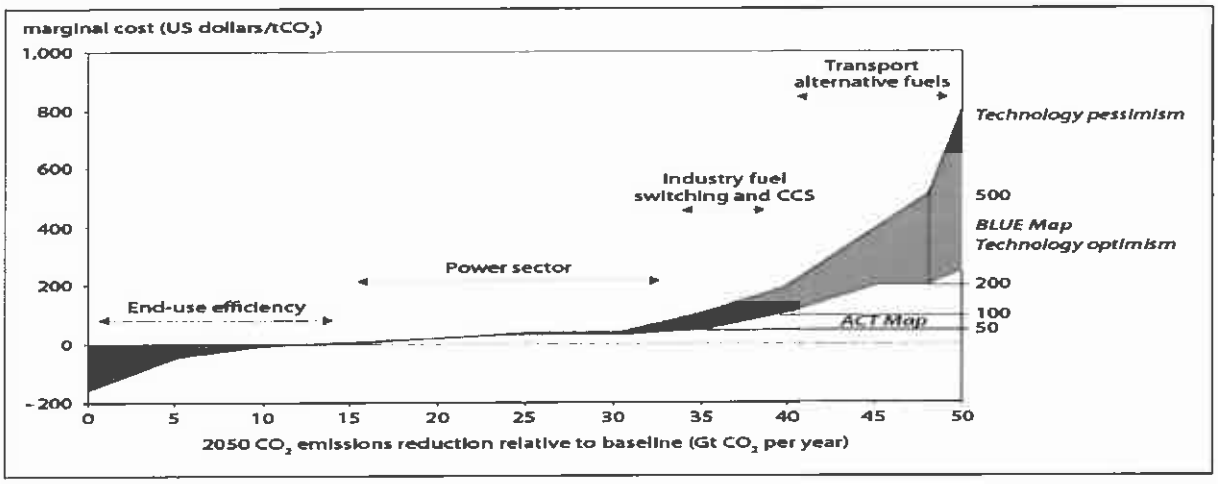
Source: McKinsey & Company, 2009

Figure 1, shows from left, least cost to right, high cost options of technologies to achieve energy efficiency savings. As an example, lighting switching from incandescent to LED is the lowest cost and best option to achieving EE savings, compared to say power plant biomass fuel switching.

The cost curve is the blue print for policy makers or EE practitioners on what to prioritize in terms of improving the energy efficiency or cut greenhouse gas emissions. The reality is that there are a wealth of individual investment options available at positive NPV due to immediate savings cash flows (Houser, 2009a, Houser, 2009b; McKinsey & Company, 2009). Globally, buildings are the largest source of energy demand, and are the focus of any efforts to address energy efficiency. Heating, cooling and powering residential, commercial and government buildings consumes about 38% of all energy produced worldwide compared to 26% for transportation (IEA, 2008a). When including energy consumed in manufacturing the steel, cement, aluminum and glass is included, the percentage increases to 50%. With rapid urbanization and rising income levels in developing countries, energy demand in the buildings sector is set to continue to grow, hence the emphasis and opportunities in EE markets (IEA, 2008b).

These facts make building energy consumption the best, least cost target for maximal achievement of EE efforts (IEB, 2008b). The lowest cost mix of EE or emission abatement opportunities, given currently available technologies (EE), therefore looks to reducing energy demand in two ways, namely by reducing the amount of energy that buildings consume through improved efficiency and also by reducing emissions associated with that energy by switching from high carbon sources like coal to low carbon sources (IEB, 2008b; McKinsey & Company, 2009). Researchers (Houser, 2009a; House, 2009b; McKinsey & Company, 2009) are unanimous in claiming that energy efficiency technologies and projects have negative abatement costs because the NPV of the energy savings achieved through the investments more than offsets, the additional initial investment costs.

Figure 2. Marginal emission reduction costs for the global energy system



Source: IEA (2008a).

Figure 2, shows the marginal cost curve on EE technical opportunities per activity where in end use efficiency is least cost compared to transport alternative fuels. The blue print shown above demonstrates the extent of substantial EE opportunities with low economic costs by sectors.

To explain the slow uptake of these, "low hanging" fruit type of investments barriers have been cited in most EE markets with reasons given as to why the opportunities have not yet been converted to real profit globally and also as observed in the South African market. Research by Johnson Controls, (2009); Satchwell, *et al*; (2010) and McKinsey & Company (2009), has put

forward three key factors as the predominant reasons for reluctance to early conversion of EE opportunities in buildings in the USA. The first factor is the information asymmetry problem in which investors and occupiers of buildings do not have the same information on what technologies are available to implement EE projects. The second factor is information asymmetry on cost savings emanating from project savings and the benefits of achieving savings is not known by both agent and principal. Thirdly the factor of limited capital to implement projects given that the size of projects can be too small for consideration by large corporates. The three factors described above stem from the principal agent problem in which in most scenarios the investors do not occupy the building and hence do not pay the bills and hence lack of interest by them to effect changes that reduce the bills.

The net result of these factors is a form of market failure that leaves EE projects unimplemented despite their positive NPV. The economics of EE projects are thus shaped by a number of factors that includes perceptions, payback periods, limited capital, and the size and effect of projects. In each market innovative products need to be established that incentivize the implementation of EE projects.

2.4 Theory of information asymmetry

In an attempt to explain the observation of lack of investment in EE markets, despite the expected good returns, this paper hypothesizes the existence of information asymmetry between potential EE project funders or banks, who are buyers of EE future cash flows and ESCO project developers (borrowers) or EE project implementers selling EE project cash flows, especially where EE markets are still developing. In reality there is an "efficiency gap". The concept of efficiency gap refers to the difference between levels of investment in EE that *appear* to be cost effective based on economic analysis and the lower levels *actually* occurring in developing markets (Golove and Eto, 1996). The asymmetrical model was first conceptualized by Akerlof (1970) and can be illustrated as a situation where the seller of a good knowingly hordes that superior knowledge about the quality of the good and advantageously so, over the prospective buyer. Akerlof showed that information asymmetry can produce

adverse selection in the market, which in turn, results in stifling mutually advantageous transactions (or causing the malfunctioning of markets), especially in developing markets.

In their further analysis of the credit markets, Stigliz and Weiss (1981) showed that imperfectly informed lenders may ration the volume of loans to a market sector instead of simply raising lending rates. This trend is also observed in the South African EE market. To the extent that the South African EE market may have a defined microstructure, is disintegrated, has numerous players who are purveyors of complex product programmes and where the EE market is perceived as distinct from other investment micro-markets, it remains a market that sees inefficient investments (Spulber D.F, 2002).

In theory investors should be equally willing to invest in options offering the same expected returns for the same levels of risk and liquidity. Hence to explain the "apparent" unwillingness to invest in EE, market barriers to energy efficiency are cited. The gap can be viewed as reflecting two phenomena: firstly, a behavior of investors consistent with use of a discount rate in excess of that used for other equivalent transactions, and secondly, the under-investment in EE at market prices for energy versus underinvestment in EE because of the mis-pricing of energy resulting primarily from negative environmental externalities and regulatory failure, this is termed the disaggregation of the "efficiency gap" (Blumstein et al, 1980; Golove and Eto, 1996). Barriers to entry into EE investments therefore explain the difference between EE expected investments and actual investments.

International research cites significant different barriers to implementing EE projects in different EE markets. Johnson Controls, a global ESCO and the International Management Association (IFMA) surveyed over 1400 executives with budget responsibility (pre the recent financial crisis). They named capital availability and its cost, payback period/ROI, ownership, landlord/tenant split and technical expertise as the major (72%) reasons for not implementing EE projects in the USA (Johnson Controls, 2009; USDOE, 2010; Taylor, *et al*, 2008, Poole and Meter, 2006, McKinsey & Company, 2009).

Further evidence exists for misplaced incentives or principal agent problem in that the building owner does don't benefit from installing EE equipment instead it's the tenant who pays the energy bill who benefits from the EE investment. Further market structure is a barrier to EE investment in that powerful market participants (equipment manufacturers) may inhibit the introduction by competitors of cost effective products. Regulation of product prices may lead to mis-pricing energy forms impacting on investments in EE market. Historically set prices for energy were too low to incentivize the investments in EE markets, this despite the recent upwards shifts in energy prices globally (Golove and Eto, 1996).

In Brazil and India the key market constraints are lack of credit lines to ESCOs targeted for EE projects, as well as lack of technical and financial credibility of ESCOs from a lenders perspective. In-fact any landing requires tangible corporate and personal guarantees; short tenors (less than 1 year) for most lending by financial institutions, and issues relating to ESCO ownership (Poole and Meter, 2006). In India the problem relates to technical and financial credibility gaps.

In summary EE markets therefore have different profiles of market characteristics, constraints and support initiatives targeted at EE projects, yet nominal or stunted growth of the EE markets is observed, the fundamentals support the information asymmetry hypothesis as the explanation for observed low EE market growth rates.

2.5 Imperfect information

In the context of the theory of information asymmetry, for EE markets to work well and attract investments and eliminate the efficiency gap, participants in a potential exchange must be fully informed about the objects of exchange and about conditions in other markets, given that ideally information is perfect and costless (Harris and Carman, 1991). Ideally, knowledge of technological options, developments, current and future prices would be readily available. However a series of information market failures have been observed and identified, such as

absence of information, cost of information, accuracy of information and the ability to use or act upon information (Dolove and Eto, 1996). Even when EE projects information is available, it is expensive to acquire, requiring time costs, and expertise costs for an investor or lender to comprehend. These limitations are a cause for failure in the EE markets.

In the EE markets typically the presenter of the savings cash flows to the bank are the ESCOs, or project sponsors, who have vested interest in the projects. In essence those with project information have strategic reasons to manipulate it in order to inflate value. Self interest is an incentive for the provision of misinformation by sellers. Furthermore firms (lenders) may be limited (have "bounded rationality") in their ability to use, store, retrieve and analyze information, given the complexity of EE technological information relevant to investment decisions (Decanio and Watkins, 1993). This bounded rationality has been researched in firms by Decanio and Watkins, in 1993. Their research cited that "failures to complete maximization are to be expected". Thus the misplaced incentives, financing constraints and transaction costs market barriers are examples of market failures especially in the context of developing EE markets.

Chapter 3: Overview of different energy and EE markets

3.0 Introduction

This chapter reviews different EE markets in the USA, UK, Brazil, India and South Africa, with the purpose of highlighting the key factors in each particular market. The EE markets are reviewed with the assumption that they are an integral part of each market`s electricity sector.

3.1 The USA electricity sector overview

The USA energy market is large and is the cornerstone of the economy. It is the third largest industry in the USA with total expenditures for energy services expected to grow from USD1.2 trillion in 2010 to over USD1.7 trillion by 2030 (Miller, 2010; Energy Information Agency (EIA), 2010). There are more than 3,273 traditional electric utilities in the USA. Electric utilities include investor-owned, publicly-owned, cooperatives, and federal utilities. Utilities are regulated by local, state, and federal authorities, and in the case of many electric cooperatives, by their board of directors. The USA EE market is therefore large and complex.

The key energy consumer sectors are the residential sector, which includes private households and apartment buildings where energy is consumed primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, clothes drying, and other electrical appliances. The commercial sector includes nonmanufacturing business establishments. The industrial sector includes manufacturing, construction, mining, agriculture, fishing, and forestry establishments. The transportation sector includes railroads and railways where electricity is used for traction, including urban public transportation (EIA, 2011).

Total net generation in the country in 2007 was 4,157 billion kWh, of which 2,504 billion kWh was generated by electric utilities. About 72% of generation in the USA comes from fossil fuels. Electricity generation from renewable sources other than water is growing in importance. The electric power industry and the Federal Energy Regulatory Commission (FERC) continue to implement the requirements of the Energy Policy Act of 2005. This Act sets the responsibility for overseeing operations, developing procedures, and enforcing mandatory reliability

standards in the electric power industry set up by a new electricity reliability organization (ERO) (EIA, 2011). These have shaped the EE markets within the USA.

The electric power industry has evolved from a monopolistic industry characterized by vertically integrated electric utilities providing generation, transmission and distribution service to consumers at cost-based rates to an industry where ownership and/or operation of generation, transmission and distribution facilities have been increasingly separated functionally or by divestiture of generating assets. Increasingly wholesale and retail electricity prices are determined by competitive market forces, subject to a regulatory framework that is based on rules that monitor market participants' behavior to ensure workable competition (EIA, 2011). The refinement of market structures and rules in organized wholesale markets has ensured substantial achievement of energy efficiency by most market players.

The Energy Policy Act of 2005 contained a number of key provisions that affected industry structure such as the establishment of a loan guarantee programme within the Department of Energy for advanced generation technologies including nuclear, coal and renewables, as well as other technologies enhancing the efficient delivery and use of electricity. Further the act allowed for the national average price of electricity to increase 19.7% from USD0.076 per kilowatt hour (kWh) in 2004 to USD0.091 cents per kWh in 2007, between 2004 and 2007 (EIA, 2011).

In summary generally the USA, energy industry offers compelling investment opportunities, since its transformation in the 1990s, primarily due to deregulation, and hence its state of flux (Hui-Yong, 2009; Miller, 2010). According to Miller (2010) and Hui-Yong (2009), the number of dynamics affecting the energy industry and creating unique investment opportunities included: the supply and demand imbalance, with original supply exceeding demand, due to high default and banks selling the assets at lower prices; financial distress leading to forced assets sales; asset write downs, leading to assets being sold at fractions of their original price; portfolio divestitures, and FDIC Bank liquidations to create liquidity. Thus energy and energy related

assets in the USA have continued to experience financial difficulties and thus creating opportunities for investors, set on acquiring fire sale assets. Furthermore, energy companies have continued to divest assets at discounted prices to obtain liquidity and retire project debt (Hui-Yong, 2009; Miller 2010).

3.2 The USA EE markets

The green energy sector (which includes EE) has experienced growth in the USA, driven primarily by technological breakthroughs, corporate pressure from global warming activists and venture investments. The government incentives announced in 2009, of $70 billion in tax credits, grants and loan guarantees have help to transform USA into a green powerhouse. Further, the climate bill mandates for 20% green electricity by 2020 (Lawton, 2007). The green energy market is thus projected to grow to $225 billion by 2016, a compound annual growth rate (CAGR) of about 15% (Makower, 2007).

The ESCO industry grew in 2008 with estimated revenues of USD4.1 billion despite the severe economic recession and general downturn in the broader US economy. The Public and institutional markets - government markets account for 84% of ESCO industry revenues in 2008 of USD3.4 billion. A substantial share (75%) of the industry activity is attributed to energy efficiency technologies (Satchwell, *et al*, 2010, Barbose, *et al*, 2009). It is reported that 75% of ESCO projects are performed through energy performance contracts. Most significantly in the USA market ESCO projects are becoming more expensive due to increases in ESCO labour and material costs and customer demand for more comprehensive mixes of technologies. (Satchwell, *et al*, 2010; Alliance to Save Energy (ASE), 2007; Goldman, *et al*, 2002).

There is a significant increase in EE activity in the USA at the state and federal level. The activities include the establishment by 18 states of statewide energy savings goals to be obtained from, an Energy Efficiency Resources Standards (EERS), regulatory directive to implement all cost – effective demand side resources (Barboose, *et al*, 2009). Further also a significant increase in federal funding for energy efficiency programmes as part of the American

Recovery and Reinvestment Act (ARRA) (Doyoon, 2010; Siedel, 2010; Smith, 2010). The USA, ESCO industry is recognized for its role in successful delivery of comprehensive energy projects. The industry has been established since pre 1985, going through significant phase and successive consolidations (United States Environmental Protection Agency (USEPA, 2007). The market is deemed a mature market compared to the Brazil or South African markets. The qualitative aspects of the USA, EE markets are summarized in Tables 3 and 4 on pages 57 and 58 respectively where it is compared to other markets in terms of historic development, market size, ESCO ownership, geographic scope of activities, project technologies, project contracts, market characteristics, market constraints, markets drivers, market and project trends on investments and market and project trends on energy savings.

3.2.1 Current barriers to EE markets USA

Whilst the USA EE market is deemed most efficient with the highest level of participants as well as the longest history in operation, market barriers to implementation of EE projects can be summarized as emanating from, the following aspects. Firstly the ESCO projects are increasingly becoming more expensive due to increases in labour and material costs and customer demand for comprehensive mixes of technologies (Satchwell, *et al*, 2010).

Secondly, more traditional barriers include the "principal agent problem" where in the investment decision has to be made by building owner who does not occupy the building and thus does not pay the energy bills.

Thirdly further information availability on potential energy savings is low, hence the lack of implementation (Houser, 2009a). Furthermore uncertainty about future energy prices impacting on potential savings has caused many businesses to halt on EE projects investments. This is particularly so given that EE projects investments have payback periods stretched out over the life of the investment (Houser, 2009a, Houser, 2009b). Some EE projects are deemed too small to warrant further attention, typically investments in compact fluorescent light bulbs or attic insulation.

The net result of the above factors is a market failure that makes it difficult to predict how market based policies will change behavior in some sectors. These factors account for the disconnect between what makes economic sense and the actual behavior of firms i.e. limited investment in the EE projects.

3.3 The UK electricity sector overview

The UK had installed electricity generation capacity of 85 gigawatts (GW) in 2007. Also in 2007,the UK generated 368.6 billion kilowatt hours (Bkwh) of electricity while consuming 345.8 Bkwh. Most electricity generation came from conventional thermal sources (78 %), followed by nuclear (16 %), other renewables (4 %), and hydroelectricity (1 %) (EIA,2011). The UK has a privatized electricity sector, where generators and distributors trade electricity on a wholesale market. There are several privately owned power producers in the country and the value chain is disintegrated with no major monopoly. The UK has slowly integrated the formally separate electricity markets of its component parts (EIA, 2011). Conventional thermal plants continue to provide the bulk of the electricity supply in the UK. According to the UK, Department of Energy and Climate Change (DECC), conventional thermal generation in 2009 consisted of natural gas (44%), coal (28 %), oil (1 %), and other (1 %).

The long-term trend in UK power generation has been a move from coal-fired plants to more efficient combined-cycle, gas-fired turbines (CCGFT). As a result, according to UK's Department of Energy and Climate Change, electricity generation from CCGFTs increased from zero in 1989 to 161 Bkwh in 2009 (EIA, 2011, Haydock, 2002). The UK government has introduced regulations that require electricity distributors to source a portion of their electricity supply from renewables (including hydroelectricity), which totaled 25,222GWh of electricity in 2009. Investments in wind power have increased substantially, aiming to take advantage of the natural geographic advantage that the UK has in this regard. Wind is the single largest contributor of electric power generation among the renewable fuels, followed by hydroelectricity and biomass (Haydock, 2002).

3.4 The UK EE markets

The key driver in UK and European markets for EE projects is the requirements EU Directives on low carbon energy systems and by implication higher energy efficiencies. Key challenges are the energy security, climate change and economic development (Base Agency for Sustainable Energy (BASE), 2006; European Community, Research, 2006). In the UK market ESCOs first transacted in the 1984s and in the last 3 years the number of ESCOs is decreasing perhaps showing the signs of a mature industry (Bertoldi, *et al*, 2007).

The EE market is completely regulated in terms of EU and UK specific regulations and standards. Examples include the EU Directive on energy end use efficiency and energy services, several ESCO status reports in the EU, and specific to the UK, there is the business enterprise and regulatory reform policy paper of 2003 and directive on energy performance of buildings (Department of Business Enterprise and Regulatory reform (BERR), 2008; Ürge-Vorsatz, *et al*, 2007). The UK, EE market has about 20 ESCOs and due to other national agency competing energy efficiency delivery tools, such as mandatory DSM, and grants voluntary schemes. Several types of ESCOS are available in the UK, with the contractual arrangement model being the most popular although it does not guarantee savings but merely offer cost savings for their service (Bertoldi, *et al*, 2007).

National energy agencies have also started businesses as ESCOs. The EE market in the UK also has the participation of public ESCOs, so the energy agency acts as an ESCO and implements EPC in certain fields. Public ESCOs accept more risky projects and smaller profit. The "intracting model" or Public internal performance contracting, is used as well. There is the association of ESCOs in the UK with over 104 members, of which only 11 are ESCOs. The sectoral focus of the EE markets in the UK are industry, private commercial and public buildings. The technical focus is on lighting, lighting control, HVAC plant replacement, decentralised boilers and controls as well as CHP (Bertoldi, *et al*, 2007). Key barriers to EE projects implementation include regulatory requirements on procurement to access the public markets as well as the lack of information and understanding of the ESCO and EPC contracting. The UK ESCO market has low

activity primarily because of other policy tools that provide the means to a high level of energy efficiency (Ürge-Vorsatz, *et al*, 2007).

3.4.1 The UK financial markets

The financing of EE projects is the least of problems in terms of constraints, with banks and the ESCOs having comparatively large access to funding energy saving projects. Funding is also available from international financing institutions such as World Bank and European Investment banks. The pooling of small projects has effectively ensured the success of the ESCO EE market in the UK achieving a balance off effect between attractive EE projects and non attractive EE projects (Bertoldi, et al, 2007).

3.4.2 Current barriers to EE markets UK

There is a lack of information and understanding of ESCO, and EPC concepts and their ability to unlock value in EE projects (Bertoldi, *et al*, 2007). Expectations are that the ESCO association in the UK should tackle this barrier by raising awareness and disseminating reliable information of these fundamental EE, aspects through demonstration projects. Information, training capacity building and development of trust is still necessary in the financial sector. The paramount issues to increase financing EE in the EK include switching by lenders from the evaluation of ESCO or project developer`s balance sheet to consideration of project risk profile, project profitability and the understanding of EE project concepts and procedures (Ürge-Vorsatz, *et al*, 2007).

Regulatory barriers are one of the key hurdles in the UK market, typically the impeding public procurement rules and accounting procedures have given project implementation problems. There are other policy tools that provide other means for high level achievement of energy efficiency and therefore compete with the ESCO models. In essence in the UK market EE has been promoted successfully through other instruments and measures to the disadvantage of ESCO models.

Thus the easy access to finance, accounts for some of the successes of the UK EE market relative to developing EE markets. Further more it seems, banks and clients are more open to funding energy savings projects due to elevated levels of information exchange on EE and RE projects. The enablers in the UK, EE market include use of demonstration projects, dissemination of information, supporting regulatory background and a well developed and informed financial sector. Further the pooling of small projects into a sizeable bigger group of projects has attracted funders as the net transaction costs are lowered due to the balancing of less profitable projects with more profitable projects.

The "Intracting model" has enabled less profitable projects in the public sector to be carried out. The key aspect of this model is the interdepartmental contracting within one parent company hence eliminating excessive margins on projects and smoother decision making. Further White tradable (clean energy) certificates have increased the attractiveness of EE investments by ESCOs due to the added value coming from the sale of certified savings.

3.5 The Brazil electricity sector overview

Brazil has a population of 192 million and GDP of USD1,575 million. The economy is dominated by services sector at 78% of GDP, with industrial and agricultural sectors at 17% and 5% respectively. Economic growth has been erratic since 1980, when there was a debt crisis and inflation is still very high affecting financial institutions growth and general economic behavior (Poole and Meter, 2006).

The electricity sector is predominantly hydro based (90%), with substantial biomass, coal and crude and natural gas reserves. Key factors determining the energy economy in Brazil include low conversion costs from primary energy to secondary forms used by consumers; substantial increases in fossil fuel prices since the 1990s and significant institutional changes in the electricity sector meant to stimulate private investment. (Poole and Guimararaes, 2001; Poole and Meter, 2006). Compared to USA the market is more volatile and is replete with new

changes and adjustments, as for example seen in the energy rationing experience in early 2000s.

3.6 The Brazilian EE market

In 2003, Poole and Stoner approximated the market size to be about US$2, 25 billion. The states avails funds for implementation of EE projects, this is done through a tax charge which is called the "public benefit wire charge", which is a 1% charge levied on all distribution utility sales. About 50% is used for EE projects and the balance of 50% is directed to other green projects (Poole and Stoner, 2003; Poole and Meter, 2006). Hence little money goes to independent ESCOs. This is an important difference from the USA market and perhaps the cause for the stunted growth of the EE market.

Table 1. Brazil estimated technical potential for EE market

Sector	Partial potential R$ million per annum	Full Potential R$ million per annum
Commercial	1,090	
Industrial	912	
Water and Sewage	283	
Government buildings	302	
Residential	125	
Total	**1,712**	**5,000 (US$2,250 Eqv)**

Source: Poole and Meter, 2006

Table 1, shows the estimated size of the Brazil EE market by industrial segments and the total market size.

The intention in Brazil is thus to introduce EE, performance contracts, and to provide the needed comfort to lenders through more secured cash flows. The third party engineering or technical guarantees are needed to secure lenders and justify viability of technologies, and provision of accurate cost estimates by ESCO, the design and build contractor. Finally the guarantees would add certainty that credit lines would be going to the intended and stated purpose (Poole and Stoner, 2003).

3.6.1 Brazil financial markets

The Brazilian financial markets are dominated by commercial banks. Capital markets are relatively weakly developed, with minimal evolution of both public and private markets. The requirement for bank security guarantees for any borrowing from bank is very strict (Poole and Meter, 2006). The majority of working capital transactions and all investment transactions require real guarantees (mortgage, trust receipt, pledge or bonds), besides personal guarantees of the shareholders.

Interest rates on credit are very high by international standards. The average tenor of loans to business is very short, at an average of 6 months (Poole and Guimararaes, 2001; Poole and Meter, 2006). Given the above restrictions the volume of credit compared to GDP is very low. This demonstrates the difficulty for companies in general in obtaining financing in the country, reflecting on possibly why there is low uptake of EE projects (Poole and Meter, 2006).

3.6.2 Current barriers to EE markets Brazil

The difficult of raising debt for projects is the greatest impediment to the investment in EE projects in Brazil due to high interest rates and inflation. The cost of equity required by venture capital investors in Brazil is close to the average return of EE projects, so without leveraging the invested capital through debt, so as to reduce the average cost of the capital employed, investors are reluctant to enter the sector. In addition, ESCO owners would be reluctant to lose control of the projects, in the event that more equity comes from the venture capital companies.

Barriers to EE markets growth include the perceptions that ESCOs are services companies, leading to investors such as fund managers not being willing to invests in ESCOs, which impacts on EE market growth (Poole and Meter, 2006). The perceptions on services companies derives from the following facts: that services companies grow more slowly than assets production companies; that services companies margins are lower due to higher tax on payrolls and finally that completion is deemed high (Poole and Meter, 2006). Investors such as venture capital

companies deem ESCOs as too small to be of any interest and due diligence costs are substantially high. Venture capital companies prefer amounts greater than USD500,000 per investment. Project sponsors in Brazil could use Special Purpose Vehicles (SPVs). However these appear to be of limited interest a for most EE projects primarily because projects are usually too small for this approach.

These difficulties have prompted new approaches in Brazil which are still under trial and include, such approaches as the hybrid debt/equity model or ESCO finance companies which need dedicated teams of specialist to implement and assess performance in projects.

An alternative approach would be the use of a receivables funds, which are regarded as lowering costs of capital and which provide significant tax advantages, compared to SPVs. They are structured to purchase future flows from energy performance contract receivables. The legal framework is in place in Brazil. However difficulties may arise when the project risks are not fully understood in the EE market, the cost of capital is high and minimum size participation per project is too high (Poole and Meter, 2006). Despite the difficulties Brazil EE market stakeholders, specifically the state is carrying out trials for a number of potential solutions to overcome the barriers to EE investments.

3.7 The India electricity sector overview

India has a GDP of USD 1.23 trillion, and is currently the world's fourth largest economy in Purchasing Power Parity (PPP) terms and the fifth largest energy consumer in the world. India has a population of 1.1 billion people and India has had sustained growth rates of 9% for the last three consecutive years. Furthermore, the GDP is likely to continue to grow at rates above 5% in the longer term (KPMG, 2009; IMF, 2010).

The energy policy of India is predominantly controlled by the Government, through ministries of power, coal and renewable energy and administered locally by Public Sector Undertakings (PSUs) (EIA, 2011). About 70% of the electricity consumed in India is generated

by thermal power plants, 21% by hydroelectric power plants and 4% by nuclear power plants. More than 50% of India's commercial energy demand is met through the country's vast coal reserves. Due to the fast-paced growth of India's economy, the energy demand has grown an average of 3.6% per annum over the past 30 years (EIA, 2011).

In December 2010, the installed power generation capacity of India stood at 165,000 MW and per capita energy consumption stood at 612 kWh. The Ministry of Power is the apex body responsible for coordination administration of the electrical energy sector in India. Generation of electricity is by 4, PSUs and several state-level corporations. The Ministry of Power provides funding to national schemes for power projects. These Central Public Sector Enterprises provide loans for both public sector and private sector companies and projects involved in building power infrastructure. Electricity losses in India during transmission and distribution are extremely high and vary between 30 to 45% (Thukral, 2006).

In the period 2004-05, electricity demand outstripped supply by 7-11%. Due to shortage of electricity, power cuts were common throughout India and adversely effected the country's economic growth. Current installed capacity of thermal power is 108GW which is 64.6% of total installed capacity. Renewable energy in India is a sector that is still underdeveloped. The share of RE in the energy sector is less than 1% of India's total energy needs. In brief, the key issues that India`s energy sector faces are large and rising dependence on fossil fuels imports and unreliable power supplies and power sector inefficiencies (Thukral, 2006). Furthermore important matters on the Indian energy scenario includes, improving power sector performance, using alternative sources of power and rationalizing energy prices (Thukral, 2006).

3.8 The India EE markets

The EE market started in the mid 1990s when three ESCOs were established. The present industry comprises of consultant and vendor ESCOs. India has power generation strategies with a focus on the utilization of electricity with focus on demand side management, load

management and technology up-gradation to provide energy efficient equipment and gadgets. In India multilateral organizations have supported the development of several EE programmes and the Government has legislated the Energy Conservation Act, of 2001, which provides for the establishment of Bureau of Energy Efficiency (Thukral, 2006).

High level estimates of EE potential in India allocate the potential in economic categories as follows: agriculture 30%, industry 25%, commercial 20%, residential 20% and transport 20%. In terms of investment potential, Wachter, (2009) cited India to have an investment potential of USD10 billion in energy efficiency projects leading to potential savings of 183.5 kwh per annum. Key to this realisation is the ESCOs and development of the EE market which has grown by 68% since 2008.

At a technical equipment level, EE potential shows that the greatest technical, economic and market potential to achieve EE savings is the change from incandescent to compact fluorescent lamp (CFL), followed by changes to refrigeration and motor (Thukral, 2006). The barriers for EE projects in India are the shortage of qualified technology and people for implementation of EE projects. In particular the under-laying reasons for the slow development of the market relates to a "technical credibility gap". This gap relates to how it is necessary for both the end user company and lender to have confidence in the savings audit report. In the absence of any confidence concerning the audit report, the lender is reluctant to fund the project. Finally the financial credibility gap relates to the lack of credit-worthiness of ESCOs as a reason for banks declining the funding of projects (Thukral, 2006; Taylor, *et al*, 2008).

3.8.1 The India financial markets

India has a broad and extensive net work of commercial banks and other financial institutions. A variety of lending products are offered including working capital and term loans for project financing. A group of banks across India have started to offer structured products to meet specialist borrowers' needs. With over 290 banks, the banks have shown a growing asset book, and a significant proportion of loans have led to defaults. The government of India policy

initiatives have encouraged banks to look at EE projects for funding with an increasing focus on Small and Medium Enterprises (SMEs) (Thukral, 2006). Generally the high levels of defaulting loans have led to tight credit policies hampering the development of EE markets.

In 2002, the India banks were approached to fund EE projects through the three countries energy efficiency (3CEE) project and some banks, started a specific programme to fund EE projects. A total of five banks initiated schemes whose objectives were to encourage EE investment in the SME sector. In particular the banks adopted the energy audit processes (Thukral, 2006). Deliberate schemes were instituted to marketing EE schemes to banks for support on agreed EE markets wide criteria such as, fit within conventional banking policy systems and methodologies, Projects should have been scalable and replicable and the financing structure was to have scope for the facilitation of commercialization of loan schemes.

Despite the concerted efforts to overcome the constraints to funding EE projects, there is little evidence on the ground showing that ESCOs were succeeding and the industry developing to any significant scale. This was so despite a host of Government of India incentives such as, tax holidays on EE projects. Recent initiatives include building energy efficiencies programmes, ESCO – Bank interactions and ESCO association developments (Thukral, 2006).

New business models have been proposed, such as the Local Industry Association (LIA) centric model approach in which the LIA would champion EE initiatives on behalf of their members. The scheme is meant to address issues of credibility as the LIA would facilitate interface between the ESCO and end user and lender (Taylor, *et al*, 2008). The Leasing-ESCO hybrid model is in trial, in which some existing credible ESCOs may adopt new smaller ESCOs, and the combined entities use a leasing approach to executing a EE project (Thukral, 2006).

3.8.2 Current barriers to EE markets India

In India the ESCOs have been unable to significantly penetrate the potential EE market and efforts are underway to strengthen the ESCOs in order to accelerate the EE effort (Thukral, 2006). The principal underlying reason for the lack of penetration is firstly the technical credibility gap, caused by a lack of confidence by banks and end user of the audit report usually deemed complex to understand. The perceptions are that certain energy savings are over stated. The other reason for lack of penetration is that of a financial credibility gap. It is believed that ESCOs would perhaps be more readily be accepted by end users if they were able to fund the equity component as well as raise debt for the EE projects themselves. The situation in India is that besides the vendor ESCOs (selling equipment) and usually linked to parent USA based ESCOs, the majority of Indian ESCOs are considered not credit-worthy by lenders. As a consequence there is no appetite for the projects.

Furthermore there is a perceived technical risk in the recommended EE projects, particularly so in the case of complex innovative technical solutions, where lenders and end users are uncertain about the energy savings benefits. Also common in India is the end user company that needs to implement the EE project may simply not be able to raise debt, especially public and municipal entities.

Suggestions put forward in India to enhance the implementation of EE projects include enhancing of project development capacity and mitigation of project implementation risks. This should find favour with banks that prefer to see a complete plan for project preparation and implementation.

3.9 The South African electricity sector overview

South Africa is a significant coal consumer and exporter and the energy sector is critical to the economy as the country relies heavily on its large scale, energy-intensive mining industry. South Africa has small deposits of oil and natural gas and uses its large coal deposits for most of its energy needs. As a result, carbon emissions are relatively high pointing to the extreme need for

efficient use of energy. The country also has a highly developed synthetic fuels industry, producing gasoline and diesel fuels from coal and natural gas. The economy has grown rapidly since the end of the apartheid era in 1994 and is now one of the most developed economies in Sub-Saharan Africa (DME, 2005b).

Eskom generates about 95 % South Africa's electricity, and has a total generation capacity of 50.2 Gigawatts (GW), 85 % of which is from coal fired plants (42.5 GW) including return-to-service and newly built plants. South Africa also exports electricity to neighboring countries through the Southern African Power Pool (SAPP). The electricity sector falls under the regulation of the National Energy Regulator of South Africa (NERSA) which replaced the National Electricity Regulator. Eskom is responsible for transmission of all of South Africa's electricity. NERSA is promoting private sector participation by encouraging investment on the part of independent power producers (DME, 2005a).

Rapidly increasing, electricity demand in South Africa has led the government to set out ambitious plans to expand the sector. Electricity demand continues to rise in South Africa and in recent years, and has outstripped the available supply infrastructure to the point where the country has suffered rolling blackouts.

In January 2008, the Department of Minerals and Energy and Eskom released a policy document, "National response to South Africa's electricity shortage". The plan includes work on the country's electricity distribution structure and the fast-tracking of electricity projects by independent power producers. The government is also investing heavily in new power projects with plans to generate an additional 22,000 MW by 2017.

To meet generation targets, and as a demand-side measure, electricity rates have been gradually increasing for all sectors, causing concern among the more energy-intense industries as well as households. In short the situation is precarious hence the need to look at efficient use of energy.

3.10 The South African EE markets overview

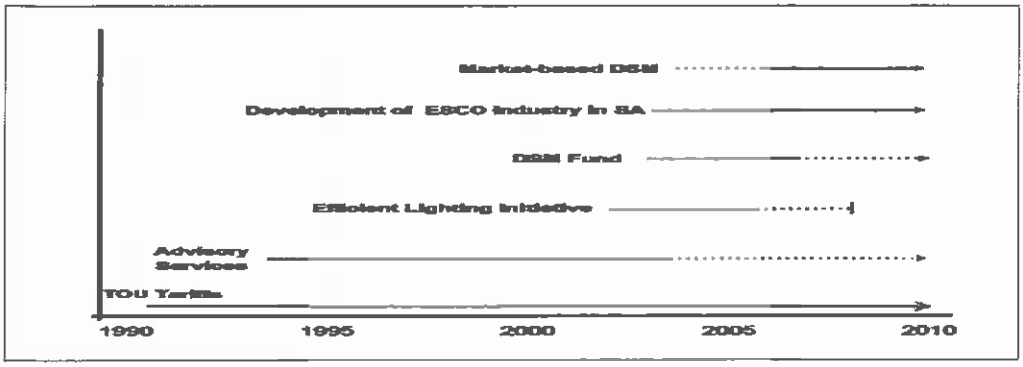
The EE market is in formation and traditionally energy costs have been low at prices of about USD0.03 /kWh (Eskom 2009), driven by marked economic growth of about 4%, the national utility has become stretched in terms of supplying power to meet the demand. The challenge is being addressed through expansion of supply options, returning to service of three power stations and Demand Side Management (DSM) programmes. Through a collaborative effort with Department of Minerals and Energy (DME) and the National Electricity Regulator (NER), South Africa has embarked on EE programmes. This is so on the back of energy price increase meant to help close the funding gap of the national utility BUILT program which is meant to increase capacity from current 40,000MW to 60,000MW in 25 years (Eskom, 2010).

In South Africa the economics of EE are improving due to the rapid increase in power prices, with simple payback on EE investments between 3 to 5 years (DOE, 2010a). It may therefore be self-financed from energy costs savings. Funding requirements of commercially viable immediate EE investments have been estimated at over USD100 million (IFC and AfDB, 2010).

The national targets for the energy efficiency projects are, a demand reduction of 12% (3,000MW) of current consumption by 2013, and saving about 8,000 MW capacity over 25 years (DME, 2005b; Eskom, 2010; Eskom, 2010b). This would equate to about USD0.72 billion equivalent savings over the next 5 years or an estimated accumulated market size of about USD3.5 billion by 2030 (Eskom, 2010b). This conservative estimation of EE markets across many segments in South Africa is about 20%-30% of actual energy demand and compares well with estimates in other markets. The EE plan has seen the birth of ESCOs, with an initial seed capital investment of USD6 million towards the operations of the ESCOs (DE, 2010; USDOE, 2010).

In figure 3 below is showing the EE activities and timeline since their inception, demonstrating the infancy of the EE markets in South Africa. The development of EE market ESCOs is shown as a having started only in the late 2003 to 2005 period. However advisory services in the EE sense started in the mids 1990s period.

Figure 3. South Africa, DSM, EE activities since 2002.



Source: Eskom, 2010

The EE market being in its infancy is currently dominated in activity by the national utility Eskom and the Department of Energy and NERSA (regulator) who dictates policies and sets EE targets as per the National Integrated Resource Plan (NIRP)(Eskom, 2010).

Table 2. South Africa estimated technical potential for EE market (Eskom, 2010b).

Sector	Demand (%)	Consumption (%)
Commercial	9.2	12.6
Industrial	35.4	37.7
Mining	11.6	15.0
Residential	35.1	17.2
Other	8.7	17.5
Total	**100**	**100**

Source: Eskom, 2010

Table 2, above shows high potential and categorization of EE savings targets in residential, industrial and mining operations which if implemented can lead to the 3,000MW capacity saving by 2013.

The EE programmes in South Africa include residential, commercial and industrial programmes. In essence the EE market in South Africa has modest levels of implementation, with only a modest 400MW capacity saved in 2006, and 900MW in 2009 (Eskom 2009, Eskom 2010). Since inception of the EE programmes to date about 2,350MW have been saved (Eskom, 2010).

3.10.1 The policy interventions

The EE markets are currently going through strong interventions by Government; through policy to support the EE initiatives driven by the Department of Energy through a programme for the electricity sector known as the Standard Offer Programme (SOP). The state offers to anyone who implements an EE project about USD0.07 per each kilowatt per hour (kW/hr) saved under the programme as a rebate. Since the implementation of the Electricity Regulation Act of 2006, every licensee is required to comply with EE standards and DSM standards on newly built properties. The Act`s objectives are to stimulate EE through enabling regulations and an institutional governance structure (Department of Energy (DE), 2010).

In terms of funding, the policy states that Government shall assist in mobilizing funding for ESCOs for EE interventions, but does not stipulate how the financial structure must link to the SOP, leaving the innovation to the financial institutions market (DE, 2010; National Energy Resource Agency (NERSA), 2010). In leaving the mechanism to financial markets, the state simply hopes to let markets develop the appetite and appropriate financial stimulus for EE projects. The rebate does not resolve the issue of technical complexity or information asymmetry which leads to lack of interest by financial institutions that also still perceive the projects as complex and risky. In short the returns on rebates are not adequate to compensate lenders, who must meet certain return rates on investments (IFC and AfDB, 2010).

3.10.2 The South African financial markets

The financial market in South Africa is advanced with near perfect information exchange. Broadly, the key members of the markets include the central bank, banks, microfinance institutions, insurers, funds and investments institutions. The markets include the money, bond, stock, foreign exchange and derivative markets. The central bank is strong and independent, and responsible for supervision and monetary policy, effected through interest rate changes. Although not comparable to the USA market it is probably run and monitored more prudently than the Brazilian and Indian markets (IMF, 2010).

For purposes of discussing the EE markets the South African financial markets are deemed capable of extending innovative solutions to such a market. The legal system is considered capable of handling key aspects of financing models such as performance contracting and project finance. There are differences in tax structures between South Africa on the one hand, and the USA, UK, Brazil and India on the other, which require different funding structures for EE projects.

The financial intermediaries in South Africa have not provided a significant support to EE projects, rather hesitant to finance EE through a specific product, but as secured broad loans to corporates (IFC and AfDB, 2010). It seems EE funding is associated with higher transaction costs relating to financial intermediaries lack of experience with the technologies and market approaches and the need for a specialized approach (IFC and AfDB, 2010). In particular the measurement and verification complex process, upon which any cash flow payments (in shared savings model) are predicated, is often pointed out as an increased cost to financial institutions (IFC and AfDB, 2010).

In addition banks do not have internal resources, to check and report on their client's activities. Further, the marketing stuff does not have the technical expertise to market and motivate for the funding of EE projects. As a result of the hurdles, financing on fully market rates does not provide banks a sufficient return to fund into EE projects as a business line. However in order to enhance the activities of the EE markets, it seems the IFC and African development bank (AfDB) have decided to extend an amount of USD150 million to support a programme of proposals for South African EE projects. The programme would support EE projects up to USD13.15 million for investments and USD1 million for advisory services. The programme seeks to encourage transformation of the EE sector, by establishing a source of funding for on-lending by South African financial institutions to small and medium sized industrial operations for investment in EE projects, specifically because in the South African market, individual EE investments are typically small. However in aggregate they offer significant potential for reduction of energy

consumption. The initial funding is seen to catalyze further growth of the sector without the need for additional subsidies (IFC and AfDB, 2010).

3.10.3 Current barriers in EE markets South Africa

Although EE investments typically have attractive economic rates of return, the EE private sector market seems not to have taken significantly to them (and, 2010). It seems the following are some of the identified short term barriers to private sector EE lending resulting in stalled progress. Firstly companies are uninformed about the energy savings potential and options when making new investments. Secondly South Africa`s low electricity prices, result in EE investments bearing long payback periods. Thirdly the nuisance value for non-energy intensive industries reduces the attraction of the returns and lack of suitable financing arrangements.
Finally the financial institutions related barriers in terms of the reluctance to provide EE financing as a separate credit line preferring to fund on-company`s balance sheet or past historical performance, citing higher transaction costs from increased risk.

Chapter 4: Financing solutions in EE markets in USA, UK, Brazil, India and South Africa

4.0 Introduction

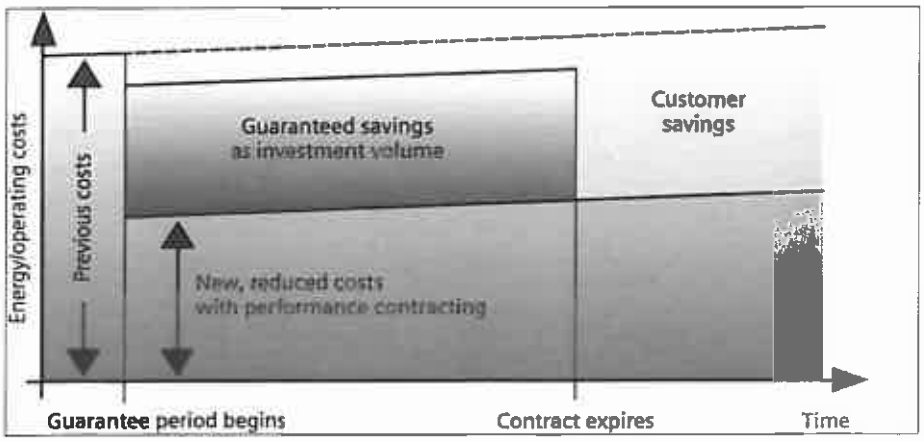
In Section 1 the key models for performance contracting and project executing EE projects in the USA, UK, Brazil, India and South Africa are reviewed. In Section 2 the variety of products available in the USA EE market which ranks as the biggest and most developed and efficient market for EE projects is highlighted. In Section 3 to 5 there are reviews of funding models used in other markets.

4.1 Generic models for funding EE market projects

4.1.1 Performance contracting (PC)

Due to its ability to overcome several key obstacles, performance contracting has been proven over the last several decades to be an effective enabler of energy efficiency. It is important to note that this approach is a turn-key solution to energy efficiency projects that supports securing financing at more attractive rates and terms. Under a performance contract, an energy service company assumes some performance risk over the project's lifetime by guaranteeing energy savings, water savings, operational cost savings, and/or technical performance of equipment (USDOE, 2010). The projects are typically designed such that the annual savings are greater than or equal to the required payments over the term of the contract. As a result of the guaranteed cash flow positive outcome, the lender is assured a lower risk of default.

Figure 4. The EE performance contracting framework



Source: Johnson Controls 2009.

Figure 4, above shows the profile of performance contracting with initial high operating energy costs before EE project implementation and the resultant savings after project implementation by the ESCO. The savings are the cash flow that lenders leverage on to finance the project, and these savings accumulate to project owner after an agreed period.

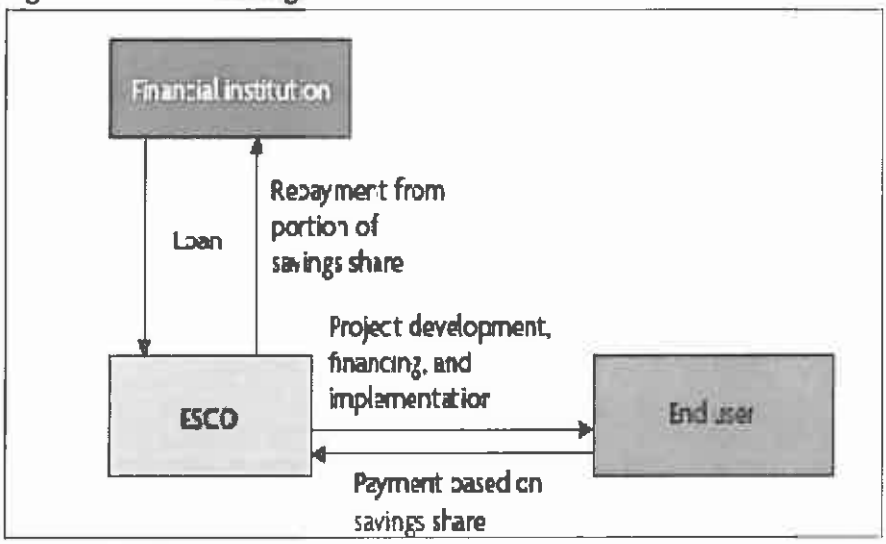
Energy performance contracts have been successfully developed in relation to conventional loans and shared-savings configurations and applied across a wide variety of organizations such as schools, hospitals, universities, governments, and even private corporations. The approach is also compatible with new models such as tax lien financing and green leases (Johnson Controls, 2009; Taylor, *et al*, 2008). Over 75% of energy efficiency projects are delivered through performance contracting. The institutional framework entails the ESCO, the project company and a financial institution. EPC is a turnkey service, sometimes compared to design/build construction contracting which provides customers with a comprehensive set of energy efficiency, renewable energy and distributed generation measures and often is accompanied with guarantees that the savings produced by a project will be sufficient to finance the full cost of the project (USEPA, 2007).

4.1.2 Shared savings (ESCO) model

The shared savings model is applied as part of EPC in projects. The energy services company takes on the risk associated with the loan and receives a pre-agreed fraction of the dollar value of the measured savings over the duration of the contract. If there are no savings over a savings period, the building owner makes no payment for that period. Ownership of equipment transfers from the ESCO or finance partner to the building owner at the end of the contract (USEPA, 2007). The model therefore aligns incentives for deepest energy savings possible. This model presents a large risk profile for ESCOs, when utility rate increases; leading to monitoring and valuation disputes (Zobler, *et al*, 2009; Johnson Controls, 2009; Taylor, *et al*, 2008).

In Fig 5 below the bank lends directly to ESCO, which then uses the funds to develop the project. The end user makes regular payments to ESCO from the savings.

Figure 5. Shared savings model



Source: Taylor, et al, 2008

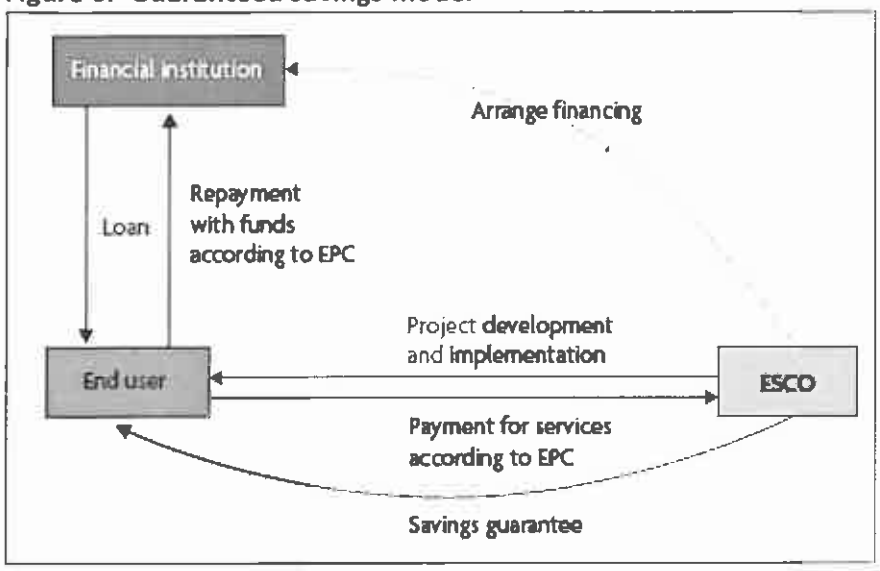
This model is widely utilized in EE markets and is preferred by financiers who adopt the project finance model/off balance sheet approach in ring fencing the project`s cash flow to ensure repayment (Johnson Controls, 2009). The model requires a strong in country legal system that can manage the complex legal structure of EPC. (Thukral, 2006; Zobler and Hatcher, 2003; Taylor, *et al*, 2008).

4.1.3 Guaranteed Savings Model (GSM)

In the guaranteed savings model, the debt group of products is carried by the project owner or sponsor who simply borrows against their balance sheet and implements the project. The savings are then shared between the parties and loan repayment to funders comes from the company`s overall cash flows.

Figure 6, below shows the funding of the end user by bank directly and the ESCO guaranteeing the savings which are then split in a pre-agreed manner. The bank takes the risk on the end user rather than the ESCO. The ESCO must guarantee delivery of the savings, this requires a strong balance sheet.

Figure 6. Guaranteed savings model



Source: Taylor, et al, 2008

The loans in GSM usually attract medium to high interest rates and limits project payback to owner's holding period (Poole and Stoner, 2003; USDOE, 2010, Haydock, 2002). In most EE markets where the owner of the building occupies the building this is the most favoured way of financing EE projects and its weakness is the unavailability of funding especially with government owned buildings (USDOE, 2010; USEPA, 2007; Zobler, *et al*,2009; Taylor, *et al*, 2008).

4.2 Current financing models in the USA EE markets

In this section, the characteristics of the individual products that are utilized in funding the EE projects in conjunction with the prior discussed models of performance contracting, shared savings and guaranteed savings are reviewed.

4.2.1 Traditional debt (loans or bonds)

The most straightforward and historically documented approach to financing energy efficiency is a conventional loan from an institutional lender in the private sector, or the raising of bonds for public entities. Loans or bonds provide the initial capital outlay for an energy efficiency project and are repaid over time as the building owner realizes energy savings (USEPA, 2007).

4.2.2 Tax-exempt lease-purchase agreement

One obstacle associated with both traditional debt and shared savings contracts is the negative impact of energy project debt on the balance sheet of the host entity. To avoid this problem, public facilities and non-profit entities use tax-exempt lease-purchase agreements or municipal leases, which provide a similar structure as conventional loans without encumbering the balance sheet. Because payment obligations under this type of lease are only for the current operating period, payments are considered an operating expense rather than a capital expense, and thus the municipal lease is not considered a long-term debt obligation. Once the lease term expires, the organization comes to own the equipment (Johnson Controls, 2009; USEPA, 2007).

4.2.3 Capital lease

Under a capital lease arrangement, the energy efficiency project is treated as capital equipment, which is owned by the project financier and leased over a period of time to the building owner. At the close of the contract timeline, the energy efficient equipment transfers ownership to the building owner. While the arrangement represents a capital asset on the balance sheet and requires the building owner to account for depreciation over time, it also provides tax advantages that lead to rates lower than market averages (USEPA, 2007)

4.2.4 Lease or bond pools

Some jurisdictions or agencies have developed funding pools for the purpose of enabling energy efficiency projects. These could be revolving loans offered on a waiting list basis to customers within a particular geographical location, or a collection of projects at multiple sites owned by the same organization such as a federal agency. By grouping together many projects over multiple sites, these pools are able to offer lower interest rates than would be available for a single project (Johnson Controls, 2009).

4.2.5 On-bill financing

On-bill financing (OBF) is another model that can be used to help building owners pay for energy efficiency improvements without burdensome initial capital outlays. These programmes are offered by the building owner's electricity and/or natural gas utility provider, which front the cost of the improvements and recoups it over time by incorporating loan repayment into future energy bills (ASE, 2007; Johnson Controls, 2009).

4.2.6 Tax-lien financing (PACE)

Tax-lien financing is a relatively new financing model for energy efficiency and renewable energy projects that is quickly gaining popularity. This model is also often referred to as Property-Assessed Clean Energy (PACE) bonds. Under the PACE model, property owners borrow money from a municipal agency to finance up to 100% of the upfront cost of energy efficiency and renewable energy project and repay the loan over 5-20 years through an added annual assessment on their property tax bill. While the original funding for these loans can be government bonds or private financing, the local taxing authority acts as the collections agent. The tax assessment stays with the property, not the borrower, upon sale of the property (ASE, 2007; Johnson Controls, 2009).

The PACE model overcomes several well-known barriers to the adoption of energy efficiency improvements. Financing spreads the first cost to create positive cash flow for building owners, so that monthly energy savings exceed their loan payments. Since the loan is attached to the property, not the borrower, it transfers with ownership, enabling owners to take on longer payback projects with deeper energy savings. Tying payment to the property also solves credit and collateral issues that have been a challenge in commercial real estate. It can also overcome the age-old owner/tenant split incentive problem because owners are allowed to pass-through property taxes (and, through PACE, the retrofit costs) to net lease tenants who also benefit from the savings (Johnson Controls, 2009).

4.2.7 Power purchase agreements

Power purchase agreements or structured finance funding provides a model for organizations to improve energy efficiency or benefit from onsite renewable energy systems with no up-front cost. Under this model, the energy efficiency or renewable energy assets are legally owned by an entity separate and apart from the owners of the facilities. Typically, a building owner allows a third party to install a solar photovoltaic system on its property and agrees to purchase the resulting energy at a specified price for an agreed-upon term, typically 15 to 20 years. The building owner benefits from a low and stable electricity price, a smaller carbon footprint, and a highly visible renewable energy technology on their premises. Additionally, the third-party owner can monetize any of the tax credits or renewable energy credits associated with the system's production to create additional value for the building owner. In another PPA application, a company hires an energy service company to install a high efficiency central heating and cooling plant and agrees to buy the chilled and heated water. Here, the energy savings over an old, inefficient plant may be substantial (USADOE, 2010).

4.2.8 Energy efficient mortgages

In some cases, investments in energy efficiency have been bundled with the financing of the property itself. This instrument, referred to as an energy efficient mortgage, has been promoted in the residential real estate industry for 15 years. It is also applicable in the commercial sector. By wrapping the cost of energy efficiency improvements into the cost of the property, the borrower can generally secure financing at lower rates (Johnson Controls, 2009).

4.2.9 Green lease structures

One of the most often cited barriers to energy efficiency is mismatched or "split" incentives between multiple parties such as building owner and tenant, where one party is responsible for making design or capital investment decisions and another pays the energy bill. There is a huge market opportunity for cost effective energy efficiency projects in these buildings if the incentives are aligned (USADOE, 2010). Many of the financing structures can be strengthened

and complemented by innovative new lease structures, often referred to as "green leases." These lease structures, motivate tenants to reduce consumption of energy and water, to produce less waste, and to choose environmentally friendly products, furnishings and office equipment. There are three key elements to a green lease for enabling energy efficiency projects. Firstly, triple-net lease where tenants both incur costs and reap the benefits of energy savings, the Sub-metering arrangement allows for separate tenants billing for metered energy use/demand and hence motivated to save and allow for capital cost pass through, that result in lower total operating costs (Zobler, *et al*, 2009).

4.2.10 Ratepayer energy efficiency/demand-side management programmes

Since the 1970's, the utility industry has implemented programmes providing financial incentives for their customers who install energy efficient equipment. With the advent of "public benefit charges" as surcharges on utility bills in many states and a "decoupled" regulatory structure for energy utilities, energy efficiency incentive programmes have been steadily increasing in both frequency and funding levels. Combined with a growing funding level at the federal and state levels, this trend is expected to continue as utilities and governments attempt to "purchase" energy efficiency as a resource (Johnson Controls, 2009).

4.2.11 Master lease agreement (MLA)

When a building owner wants to implement several projects in sequence, the owner can sign, up-front, a Master Lease Agreement (MLA). The MLA is like a lease line of credit that can be used for multiple EPCs or other efficiency projects to be implemented over a period of time by an entity with a large portfolio of buildings. The MLA contains the underlying framework for contractual terms that will govern all such leases. However, the commercial terms (interest rates, tenor, etc.) for each of the project-specific leases are not set forth in the MLA and must be established as each lease is executed under the MLA. By establishing the basic contractual terms and a schedule of projects to be funded in an MLA, the lessee can reduce the time and cost spent seeking funding for its full retrofit programme. Lessors and lessees can enter into

MLAs for commercial leases and TELPs. MLAs can include equipment other than energy efficiency equipment (Zobler, *et al*, 2009).

4.2.12 Capital markets

Under certain conditions, the building owner will receive optimal terms by seeking funding from the capital markets. While capital markets occasionally offer attractive terms (interest rate, tenor), the transaction costs of arranging the financing are typically higher, potentially leading to higher "all-in" financing costs. Building owners can access the capital markets via private placement or via public sale of securities (the latter must be registered with the Securities and Exchange Commission (SEC) and thus carry a greater burden of regulatory disclosure). Because of these higher transaction costs, building owners accessing the capital markets raise funds most efficiently when they offer larger bond offerings. Another strategy to minimize the effect of transaction costs is for the building owner to include their retrofit project financing as a part of a bond offering either already secured or in progress. In sum, the relative appeal of capital markets solutions will vary on a case-by-case basis (Zobler, *et al*, 2009).

4.2.13 Bonds

Bonds are a form of long-term debt obligation bought by multiple investors. An institution typically issues bonds with the assistance of one or more underwriters who are responsible for both structuring the offering and then placing the bonds with qualified investors, either through a private placement or through a SEC-registered public market offering (Zobler, *et al*, 2009, Firer, *et al*, 2008). Investors usually require security for their investment in the form of a general pledge of the institution's revenues (e.g. tuition revenue, student fees and charges, and endowment) or recourse to an economic asset. Under a "general obligation" bond, investors are granted access to the sum total of economic resources the building owner has available. Typically public entities could pledge access to future tax receipts as security, while educational situations could pledge access to their future tuition receipts and endowments (Johnson Controls, 2009, Zobler, *et al*, 2009).

When using a "revenue bond", in which an investors' recourse is limited to a specific project revenue stream, investors have the option to receive performance guarantees as additional security. The payment of debt service is still the building owner's responsibility, despite the ESCO's guarantee, and a lender wants to be sure that the owner will make the timely payment regardless of whether their energy costs are reduced. Transforming energy use savings into debt service payments depends upon the owner's ability to manage its operating budget to "capture" the savings, on the owner's ability to operate and maintain equipment properly so savings are realized, and on other factors such as utility rate fluctuations and changes in building use (Zobler, *et al*, 2009). The borrower's obligation to make those payments in a timely manner is absolute and not dependent on realization of the ESCO's projected energy savings. If savings fall short of the guaranteed level, guarantee payments from the ESCO should cover the cost of debt service, but this reimbursement to the building owner is made independently of the lending institution. In the USA, public institutions can benefit in the form of lower interest rates from the tax exemption investors enjoy on bond interest received from those institutions (Zobler, *et al*, 2009).

4.2.14 Certificates of participation (COPs)

Certificates of participation provide an efficient way for larger projects to get funded when no single investor is able or willing to underwrite the entire financing. After a leasing agreement has already been established between the owner and the lessor, the lessor then sells off equally sized pieces of the financing to a larger pool of investors. The proceeds from these sales are then forward to the ESCO or building owner to cover the up-front costs of the project. As the lessor collects payments on the lease, those payments are then passed onto the holders of the COPs on a pro rata basis as per their initial contribution. The lessor typically assigns the lease and lease payments to a trustee, who then remits the payments to the COP holders. Building owners seeking to do larger projects may have difficulties finding single investors willing to finance the entire obligation. This may be dealt with by dividing the original lease into smaller notes to be bought by other investors. Owning a COP thus represents the right to collect a percentage of the payments paid by the lessee to the lessor under the lease. The lessor is

effectively a conduit used to distribute the payments to other investors, made in proportion to their initial contribution (Zobler, *et al*, 2009). COPs can provide building owners with access to larger amounts of capital by syndicating out the investment, but not ownership, in a lease to a larger universe of investors. The larger deal provides a way to include a group of investors in a single financing. The larger financing sizes afforded by COPs also allow building owners to reduce the relative impact of the additional fixed, up-front, financing-related costs they would otherwise bear were they to execute a series of a smaller sized financings. This statement at least holds true for legal, printing, filing and registration costs, and costs associated with receiving voter or board approval (Zobler, *et al*, 2009).

Unlike bonds, COPs in most jurisdictions do not require voter approval before they are issued, making for a swifter and less costly transaction. While the ability to skip voter approval may make for a less costly and time consuming transaction than issuing bonds, setting up a COP system can impose higher one-time transaction costs than leasing arrangements. Public institutions can benefit in the form of lower interest rates from the tax exemption investors enjoy on bond interest received from those institutions (Zobler, *et al*, 2009).

4.2.15 Receivables purchase agreements (RPA)

A Receivables Purchase Agreement (RPA) is a lesser-known but effective method for getting an EPC project implemented. In this structure, the building owner pledges the projected future stream of project-generated energy and operational cost savings to the ESCO. The ESCO then sells this pledge of future cash flows, minus annual monies earmarked for operations & maintenance of the installed equipment, to a third party financier. In exchange for selling this future stream of funds, the ESCO receives a lump sum payment from the third party financier. The ESCO uses the proceeds from that sale to implement the EPC project. The amount of the ESCO's annual guaranteed savings, the total project price charged by the ESCO to the owner, and the discount rate applied to those cash flows by the financier determine the number of years that the stream of savings will be pledged (Zobler, *et al*, 2009).

The primary advantage of a RPA is the speed and ease with which it can be executed. Building owners facing a long waiting period to raise financing through other mechanisms might therefore find the RPA attractive, given the cost of delay (as calculated by the foregone savings). The primary disadvantage of a RPA lies in the possibility that the financier will apply a high discount rate in valuing thereby increasing the financier's return.

An owner may use a RPA as short-term bridge financing to get the project off the ground. Examples of building owners who may want to consider a RPA include public institutions waiting for voter approval on bond issuances and non-profit institutions waiting for approval from their conduit issuer to access tax-exempt capital markets. Another advantage of the RPA is that it can be structured so that the third party financier first holds the ESCO responsible for shortfalls in the cash flows in any payment period. The ESCO thus bears a greater and more immediate share of the "risk of performance" on the project as that performance is translated to a direct financial liability (USEPA, 2007). Under a RPA, the building owner legally owns the efficiency equipment, and its annual payments are accounted for "on-balance sheet" as capital expenses by the institution. Banks using a RPA will likely look towards the equipment and general economic resources of both the ESCO and the building owner for security (Zobler, *et al*, 2009). As observed the USA EE markets are fully developed with a myriad of funding structures, incentives, funding products demonstrating industry maturity. The market remains dominated by public sector institutions as clients and private companies as ESCOs.

4.3 Current financing models in UK EE markets

4.3.1 White Certificates (Energy Savings Certificate (ESC), Energy Efficiency Credit (EEC)

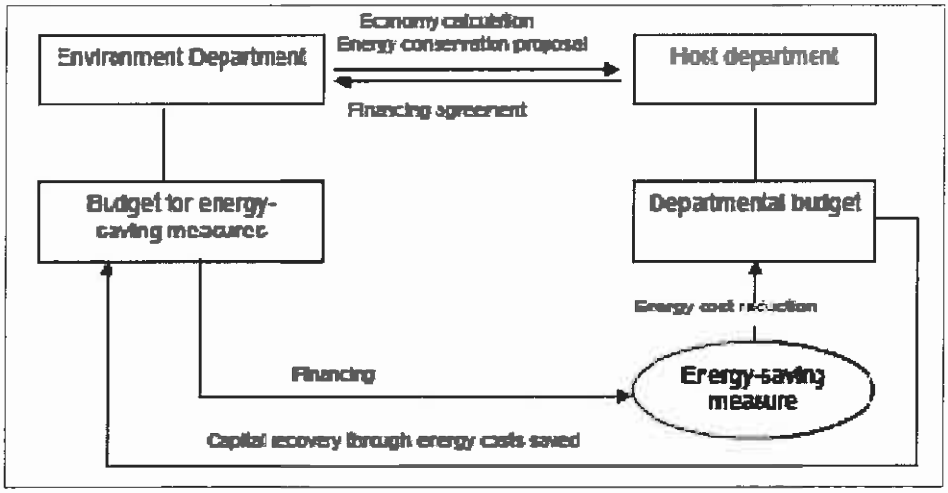
Using White Certificates is an increasingly popular financing model used in the UK, as well as the EU and is predicated on high market efficiencies for information interchange, opening out a market of the certificates. An agreed authority issues documents certifying that a certain reduction of energy consumption has been attained. Each certificate is a unique and traceable commodity carrying a property right over a certain amount of additional energy savings and guaranteeing that the benefit of these savings has not been accounted for elsewhere. The UK

has combined its obligation system for energy savings with the possibility to trade obligations and savings. Further in the UK, the Energy Efficiency Commitment programmes have set energy saving targets till 2012 (Bertoldi, *et al*, 2006).

4.3.2 Intracting Model

The "Intracting" model has proved successful for public buildings were low profitability is a barrier to implementation of many projects. It refers to interdepartmental contracting to achieve a projects desired outcome. Figure 7, below shows the organization of intracting arrangements where the Energy management department identifies the potential energy cost savings, and appraises the cost-effectiveness of the measure upon the basis of the approximate cost assessment provided by the construction department.

Figure 7. Structure of the financing model of the city of Stuttgart



Source: Stuttgart City Energy Management

In intracting arrangements, the contract partners of one department are the other departments who are locally situated and have autonomous undertakings and can administer their own buildings. Where the cost-benefit ratio makes it appropriate, meters are used to verify energy savings. Otherwise the potential savings are verified by means of calculation. Capital recovery is already stipulated in the financing agreement and capital recovery begins from the first year after implementation of the measure. It ends when the funds deployed have been repaid

without interest. From the funds thus returned, further projects can then be financed (Bertoldi, *et al*, 2006).

4.4 Current financing models in Brazil EE markets

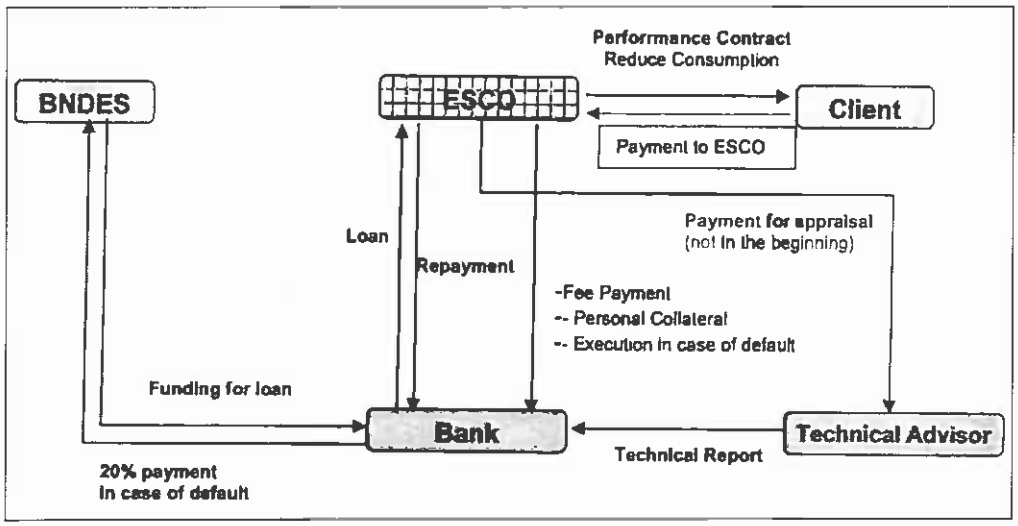
Where as in the USA various models are used depending on the project context, in Brazil, due to strict security requirement by banks and the state control of the market there is hardly any EE market. Poole and Meter (2006), suggested that due to the EE market structures in Brazil, which included legislation, consumer credibility from a banks perspective and ESCO risk profiles there is need to amend existing models. Poole recognized that in new emerging markets, to achieve significant commercial bank credit and investor financing is more demanding, hence the attempts to adapt the performance contracting model (Poole and Meter, 2006, Taylor, *et al*, 2008). Poole and Stoner (2003) recommended for the Brazil EE market to achieve implementation of the projects it should include use of specialized ESCO finance companies, investments funds and a National Guarantee facility.

The common thread in all structures or models is performance contracting (EPC), with ESCO providing guarantee of the technical performance and outputs of the project. Through EPC financing EE projects in all models are founded on the fact that the savings from implementing invest will exceed the initial investment hence giving the project a positive NPV (USEPA, 2007; Zobler and Hatcher, 2003). Performance contracting is therefore a foundation model for reducing risk and financing large-scale efficiency retrofit projects based on guaranteed energy savings.

In Brazil the financing of EE projects with bank credit is confronted with diverse problems. The high interest rates are a restriction. The impasse began with the credit rating of ESCOs and was made complex by the strict requirements for bank guarantees on certain credits, and ESCOs being their projects which would generally require provision of guarantees (Poole and Meter, 2006). Arrangements were made for a guarantee facility of USD3 million by BNDES (Brazil National Credit Agency), through a subsidiary, a state entity named PROESCO. Cover would be

up to 90% on the project investment. To be eligible the project needed to demonstrate energy savings. The adaptations to the financing models under the PROESCO were designed to permit rapid implementation and was seen by the market as a pragmatic approach to address the EE market need for guarantees. The requirement for strict personal guarantees remained, hence still limiting the number of loans per single ESCO. Further complications arose from the fact that the margin sought by banks was greater than most other investment options. The absence of an established process for the technical/economic evaluation of the projects was a threat to the success of the structure (Poole and Meter, 2006). In Figure 8 below the Client contracts ESCO to carry out EE project, the Banks lends money to the ESCO, and is guaranteed by BNDES, hence ultimate risk sits with Government agency. The technical advisor confirms the achievement of EE savings on the project.

Figure 8. Schematic of adapted model preferred in Brazil EE market with PROESCO.



Source: Poole and Meter, 2006

An approach that could give comfort to both bank and client was the introduction of performance bond on the project; alternatively the option was for the project developer to make a deposit into a secure account called ESCROW account. The deposit would be reimbursed after project completion ensuring a greater likelihood of completion of the project. For the development of the EE market in Brazil, innovative structures had to address the issues relating to, guarantees for credit lines from lenders, create special purposes vehicles (SPV),

lobby for new banking projects and make use of the guarantee facility. In addition measures to attract more equity capital or "risk" capital were envisaged to go a long way to spurring the EE market further. The success of the Brazilian model is still to be ascertained in the visible growth of the EE market.

4.5 Current financing models in India EE markets

Most ESCOs in India were formed out of equipment specialist companies and hence are predominantly technology driven and they lack legal and financial expertise for making in-house energy savings agreements. There are no suitable financial mechanisms that can provide comfort to all stakeholders in the EE transactions. The financial structures accepted thus far include performance contracting by a very small number of ESCOs (Thukral, 2006). In particular, the shared savings model is gaining prominence in the India EE markets, with only one transaction in India having been done, via the guaranteed model and even then, the guarantee was provided by the USA based parent of the ESCO (Thukral, 2006, Taylor, *et al* 2008). Increasingly in India Venture capitalist, are using performance contracts, with the aid of monitoring and valuation protocols as well as financial structures used successfully elsewhere in the carrying out EE projects. This strategy is synonymous with sponsors putting in equity to develop the EE projects (Thukral, 2006).

In the absence of bank support and without an effective funding mechanism, a number of ESCOs in India have mooted the idea of a guarantee fund. Again, this is similar to the Brazilian state guarantee mechanism. The purpose of the guarantee fund is to give banks security or guarantee on any lending directed towards a specific EE project. The guarantee covers the bank in the case of a default (Thukral, 2006). As was pointed out earlier, the EE markets in India are typically underdeveloped, despite the huge potential, as a function of the sizeable generation capacity.

4.6 Current financing models in South African EE markets

The funding models for South African EE market projects are not fully developed with the few projects carried out through direct funding from term loans on the balance sheet and from their own resources by project owners. With initial lack of interest from funders the Department of Energy (DOE) has suggested and put forward further incentives to the EE market to accelerate financial institution interest in the market (DOE, 2010a, DME, 2005a). The incentive scheme is the Standard Offer Programme, offering about R0.54/kWhr of energy saved (DOE, 2010a). This rebate offers an additional cash flow stream to financiers over and above the energy savings cash flows. The market therefore is still in its infancy and other funding models which include the shared savings (ESCO) and structured off balance sheet have yet to be successfully adopted.

Chapter 5: Integrated analysis of EE markets and macro country data

5.0 Introduction

Section 1 covers the comparison of the EE markets in the USA, UK, India, Brazil and South Africa shown in Tables 3 and 4. A qualitative approach is used by comparing the EE market features such as the historic development, approximate market size, the ESCO ownership and the geographic scope of activities. Further key market characteristics, market constraints, key market drivers, market and project trends on investment and savings are considered. Section 2 closes by reviewing each country`s key energy data and key macro indicators to attempt to form an opinion as to which country scenario is similar to the South African on. Section 3 suggests the use of project finance structures for South African EE projects. The analysis recognizes the major difficulty in drawing exact parallels with each of the country EE markets.

5.1 EE markets parameters USA, UK, Brazil, India and South Africa

In Table 3 on page 57, the historic development in EE market, market size, ESCO ownership, and geographic scope of activities, project technologies and project contracts are compared for USA, UK, Brazil, India and South Africa markets. The US EE market is most mature with standards, efficiencies and interventions optimized. The market could be regarded as perfect given the level of information interchange and the myriad of technical and financial products available for EE projects. The US industry growth rates demonstrate long-established stability, with growth rates at less than 30% per annum, compared to South Africa (85%) and India 63%, based on EE and DSM market size estimates of savings achieved. In this context the South African, Brazil and Indian markets seem comparable.

The USA, and UK, ESCOs have grown to be global players in the industry as exemplified by Honeywell, a large multinational corporate with a turnover in the 2009 financial year of over USD30 billion and most are subsidiaries of equipment manufacturers having gone through periods of consolidation. The composition of companies active in the USA and UK, EE market includes (ESCOs), energy service affiliates, associate energy service affiliate members, public

sector members and international members. The USA and UK, ESCOs also have a presence in developing markets.

The South African, Indian and Brazilian EE markets are more similar in that all these markets are strongly motivated and supported for growth by their governmental policy and subsidies such as the public benefit wire charge (PBWC) programme in Brazil, the standard offer programme (SOP) in South Africa and the guaranteed fund in India. Notably the "Guaranteed fund" in India is ESCO driven (Thukral, 2006). In emerging markets it seems the state directly administers the EE markets, hence effectively in these markets there are a few ESCOs.

In the USA and UK, various subsidies exist, and the primary market is the public institutions market through which government influences the activities and developments of EE market (USDOE, 2010; Bertoldi, *et al*, 2007). In all markets however the government offers direct and indirect rebates to EE projects sponsors. In the USA and UK EE markets the range of EE technologies is broad and complex, particularly reflecting the maturity of the industry and the extended years of support from research and development. In the contrary India and Brazil research has shown a limited range of predominantly energy efficiency, research and development and energy planning (Poole and Meter, 2006; Thukral, 2006). In South Africa, the project technologies are limited to EE technologies and load management (Eskom, 2010; DOE, 2010b). Moreover, in Brazil the EE programmes are administered separately for fuels and electricity by two parastatals namely Electrobras (PROCEL) for electricity and Petrobras (CONPET) for oil and gas (Poole and Meter, 2006). The ESCO market is substantially smaller and it seems none of the existing federal EE programmes have contributed substantially to creating a market for EE programmes as Poole and Meter (2006) has contended.

In South Africa, state intervention is by direct subsidies to stimulate the EE market specifically through the Department of Energy and the single national utility Eskom (DOE, 2010a). In India state interventions are through the Pre-EC act of 2001 and the EC act of 2001, which sought to introduce industry energy audits as well as fiscal incentives (Thukral, 2006). In the USA, the

federal market for public buildings is the largest, where shared savings and guaranteed savings contracts are the predominant contracts (75%). Viewed this way the South African EE market is substantially similar to Brazil and India EE markets due primarily to the distortions introduced by direct state intervention.

Table 4 on page 58, shows the EE market characteristics, constraints, drivers and trends. Whilst the ESCO model is common in all markets in Brazil, India and South Africa adaptations are necessary due to state administration of the market and the lack of funding support. The model has to be adapted to accommodate the role of the state guarantee programmes such as the state credit agency BENDES in Brazil in terms of addressing the guarantee requirements by banks. This model is still in formation in India and similarly in South African.

The introduction of the SOP by the South African Department of Energy, will hasten the participation of banks by their securing a portion of the cash flows (DOE, 2010a). South Africa has more choice in terms of funding models than India and Brazil; however the options are wider in the USA and UK markets, due to the advanced financial markets and support by Government. In the UK the main models is the market mechanism of White Credits awarded for reducing energy consumption (Department for Business Enterprise & Regulatory Reform, (BERR), 2008).

Table 3. Qualitative data analysis EE market developments, ownership and Contracts

Factors	USA (2004 -2011)	UK	Brazil	India	South Africa
Historic Development in EE market	• Pre – 1985, beginning of DSM, ESCOs established. • Emergence of EPC (1985-1993) • Success & Consolidation (1994-2002) • Pause and then fast growth (2003-present)	• First ESCO in 1984	• Emergence of ESCO (mid 1985s) • No evaluation yet	• Linked to USAID EMCAT programme of mid 1990 • Links with US ESCOs. • 3 ESCOs	• Research and Pilots in 1991 • Officially DSM initiated in 2002
Market Size	• Industry revenue $4.1 -$5.5billion • EE accounting for 75% of revenues • Growth approximated at 7% per annum • Public and Institutional markets 84% of revenue • Commercial & industrial market 7%	• Approx $1,5 billion (2007)	• Assessed at $1,2 billion • Total potential $2,25 billion	• Investment potential $3,0-$10 billion • 65% growth rate	• Assessed at $0.7 billion • 85% average growth rate over 5 years of Eskom DSM programme.
ESCO Ownership	• Total about 83 ESCOs • Independent ESCOs (61%) • Building Equipment manufacturers (13%) • Utility Companies (15%) • Energy/Engineering Companies (10%)	• 20 -24 ESCOs	• State Parastatals (90%) • Energy and Engineering Companies (10%)	• Less than 10 • Independent ESCOs • Parastatals	• Independent ESCOs • Engineering Companies • Less than 10
Geographic Scope of Activities	• Local (39% with 3% of revenues) • Regional (39% with 21% of revenues) • National (22% with 76% of revenues)	• National	• National (22% with 76% of revenues)	• Regional/National	• National
Project Technologies	• EE technologies (73% use, 75% of revenue) • Generators (6% use , 6% of revenue) • Renewable (10% use,14% of revenue) • Consulting (8% use, 3% of revenue)	• EE technologies • Renewable • Consulting • Load management	• EE technologies (55%) • R & D (40%) • Water use • Consulting & Services	• EE technologies • Renewable • Consulting	• EE technologies • Renewable • Consulting • Load management
Project Contracts	• Performance based (75%) • Design build & Engineering (EPCs) 22% • Consulting (3%)	• State Mandated (SOP) • Performance Contracts • Design build and Engineering (EPCs) • Consulting	• Utility resources • Mandated by state (90%) • ESCOs (10%)	• Guaranteed savings	• State Mandated (SOP) • Performance Contracts • Design build and Engineering (EPCs) • Consulting

US data source, Hopper, *et al*, 2005; Goldman, *et al*, 2002; Satchwell, *et al*, 2010. UK data source, ECEE, 2007; Bertoldi, *et al*, 2007. Brazil data source, Poole and Meter, 2006; Guin and Selman 2000. India data source, Thukal, 2006. South Africa data source, DOE, 2010a, Eskom, 2009, DME, 2005b.

Table 4. Qualitative data analysis EE market parameters.

Factors	USA (2004 -2011) Period	UK	Brazil	India	South Africa
Market Characteristics	• ESCO Model adopted significantly • Strong broad policy linked EE open market growth • Industry consolidation • 40 – 90 companies with 13 companies accounting for 90% of revenues • Large diversity of companies	• ESCO Model adopted • Strong broad policy linked EE open market growth • 20 companies	• Run by Parastatals • Electricity - PROCEL • Oil and Gas - CONPET • Wire charge on utility revenues	• ESCO Model • Generally small size or value of projects • Links with US ESCOs • Consultant ESCOs • Vendor ESCOs	• Under State Depart, state utility company • ESCO Model considered • New policy • USA based companies • Disintegrated small projects, companies
Market Constraints.	• Monitoring & valuation limitations • Shortage of skilled personnel • Specific market barriers • The federal and MUSH markets • The commercial real estate and Industrial market	• Alternative programmes	• Guarantee required on corporate loans • State control • Lack of appraisal capacity in banks	• No financing mechanisms • high interest rates • Lack of appraisal capacity in banks • No credibility	• Lack of funding appetite by FIs • Information asymmetry • Government led activity
Market Drivers	• Savings mandates (Government on public buildings) • Facility modernization (Government buildings) • Green buildings (federal and private market) • Climate change (National Governments) • Utility and capacity programmes	• Regulatory compliance	• State EE programmes, CONSERVE, PROCEL • Price Increases of electricity , gas & rationing • ANEEL wire charge • Banks -PROESCO guarantees on EE funding	• High energy costs • Insignificant vs. Energy Market • 63% growth rate	• Increasing power prices • No mandates on public institutions yet • Standard Offer Program (SOP) in 2010 • Rebate USD0.07/kWh
Market and Project Trends on investments	• Production costs important • Market barriers (contract rules and transaction costs) • Demand for retrofits	• State policy and incentives for Investments Standard Offer Programme (SOP).	• Flexibility on Guarantee constraints • Equity participation through Venture Capitallsts.	• Mainly EE projects	• State policy and incentives for investments Standard Offer Programme (SOP).
Market and Project Trends on Savings	• Customers willing to recognize savings • Methods to estimate savings • Change in costs • New technologies • Change to internal ESCO	• Customers recognize savings • Bank support for concessionary funding	• Customers recognize savings	• Customers recognize savings	• Customers recognize savings • Bank support for concessionary funding

USA data source, Hopper, *et al*, 2005; Goldman, *et al*, 2002; Satchell, *et al*, 2010; Barbose, *et al*, 2009. UK data Source Bertoldi *et al*, 2007. Brazil data source, Poole and Meter, 2006. India data source, Thukral, 2006. South Africa data source, DOE, 2010a; Eskom, 2009, 2010; DME, 2005b.

USA market constraints relate to monitoring and evaluation limitations, perhaps having become inflexible over the years, and to the strong procedures for the acquisition of contracts in the huge government public markets (USDOE, 2010; Johnson Controls, 2009). In Brazil, the administration by government of the process was meant to streamline the processes but the government participation through state owned enterprises is a hindrance to the development of ESCOs (Poole and Meter, 2006). In India, uniquely the State is modestly involved and rather indirectly through legislation (Thukral, 2006). It seems therefore the South African programme is adopting an approach similar to partly as in Brazil, where the banking system reluctance as well as state interventions seem to be the key constraints. In particular, the South African banking system has taken a selective and slow approach to EE projects, hence the inducement by government to a secured cash flow, through the SOP rebate system (DOE, 2010a).

The market drivers for the EE markets are similar for Brazil, India and South Africa in that the state controls the ESCO`s in terms of accessing the large Government public sector market and the State has instituted rebate programmes. However a striking difference is the low price of power in South Africa and India when compared to Brazil. Researchers have established that low prices do not encourage the development of EE markets (McKinsey and Company 2009). In Brazil, India and South Africa the prices have stubbornly remained relatively low despite the high demand leading to the power shortages, unlike USA and UK markets. (Eskom, 2010; DOE, 2010b, Bertoldi, *et al*, 2007).

The market trends in USA and UK business are operations related and define requirements for higher efficiencies by project sponsors in particular for new buildings market (Barbose, *et al*, 2009; Haydock and Arbon, 2009). The EE market trends for projects in South Africa, India and Brazil relate to state interventions to encourage the EE markets typically the BENDES – PROESCO guarantee intervention scheme in Brazil, to encourage direct lending from banks, or the SOP and guarantee scheme or policy framework to kick start the EE market in South Africa and India respectively (DOE, 2010a; Thukral, 2006).

5.2 Energy data analysis

The key energy data is reviewed for USA, UK, Brazil, India and South Africa, for purposes of contextualizing the broader energy platform onto which EE efficiency is usually inserted. The relevance of generation capacity is that it points to the quantum of energy available post EE interventions. An accepted range of between 10-40% of national capacity may become available should the interventions materialize (McKinsey and Company, 2009).

Table 5. Energy Data Analysis

Energy Market	USA	UK	Brazil	India	South Africa
Total installed capacity (GW)	994.9	85	96.9	160	43
Total generated power per year (Bkw)	4,157	369	437	761	240
EE Market size billion (kwh)	**245**	**137**	**20.2**	**40.6**	**8**
Consumption per capita million (Btus)	308	156	51.2	17	111
Generation entities	multiple	multiple	1 (dominant)	State (dominant)	1 dominant
Price $ per kWh	0.11	0.20	0.17	0.09	0.07

Source IMF, 2010; EIA, 2010

Table 5 indicates that the South African market is the smallest of the 5 markets considered in terms of the cited potential size of EE market at about 8,bkWh capacity per annum over the next 10 years (Eskom, 2010), followed by Brazil, India, UK and USA.

Importantly the price of power is lowest in South Africa followed by India and the USA. The presence of a dominant state utility under which power is generated, and all EE programmes managed is similar in India, Brazil and South Africa. These same countries have recorded periods of power shortages. Furthermore the same countries are set on a path to significantly increasing energy demand (Poole and Meter, 2006; Eskom, 2010). South Africa`s energy profile, national energy price increase strategy, current low energy , single dominance of state power entity are remarkably more aligned to India and Brazil, than to the USA and UK. These parameters are the factors that determine which model may be successfully adapted for use and funding for EE projects.

5.3 Macro data analysis

Macroeconomic indicators point to the influence of fiscal policy and monetary policy (interest rates, exchange rates and inflation), on all markets activity. These factors are key determinants of EE market dynamics. Energy prices are linked to demand or consumption of electricity and the costs of financing EE projects are certainly determined by interest rates. Given that EE projects investments must compete with other company projects, the ultimate determinant for investment in EE projects is the expected returns (return on investment). Whilst the EE project cash flows may be reliably predicted the ultimate returns derive from the market factors especially each individual company`s weighted average cost of capital (Firer, *et al*, 2008). The determinants of cost capital are the cost of the weighted debt and the cost of weighted capital.

The key factors therefore for the countries considered include GDP per capita reflecting on possible consumption patterns or energy demand, inflation in relation to unit costs of power as well as the viability of implementing EE projects. Similarly government revenue (tax level) and expenditure on infrastructure determine the interest rates through the supply and demand influence of the infrastructure spend. Energy price levels provide an important incentive for energy efficiency improvements. Pricing reforms which lead to energy prices increases are considered as a major factor encouraging the success of many EE markets.

Inflation is significantly high in Brazil, impacting negatively on local borrowing terms and hence an impediment or barrier to the implementation of EE projects. On the other hand in South Africa the inflation rate is low and energy price levels are significantly still lower, perhaps explaining the late development of the EE market in South Africa. A range of factors has enabled the development of a successful ESCO industry in various countries such as the USA, and UK, in particular the high prices of power per kilowatt hour.

Gross domestic product and consumption per capita indicates the levels of development and also points to intensity of infrastructure from where potential EE savings may emanate. High GDP levels imply higher levels of country development hence a bigger EE market such as the

USA and UK and Brazil. From a consumption per capita basis South Africa is similar to India as per data Table 6 below. Government commitment to energy efficiency is important for ESCO success and specific programmes and policy tools for energy efficiency can facilitate the development of EE market to achieve the levels of efficiency such as is reported in the USA markets. Governmental leadership or at least commitment to EE is important for EE markets development. To the extent that government gross debt as a % of GDP may reflect liberal borrowing policies, that may hinder further rebates to EE projects, it would seem South Africa compares well with all the countries considered and therefore the failure of the macro factor to indicate impact on EE markets development.

Table 6 below shows the macro factors impacting on EE markets. The factors are inflation rate as linked to interest rate changes, government monetary policy, government fiscal policy and expenditure. These factors are the determinants of the ultimate value of any project through their impact on discounted future project cash flows from energy savings. Finally, specific to each company the macro factors impact on firms to effect different levels of business and financial risks per each project undertaken (Blanchard, 2009).

Table 6. Key macro indicators USA, UK, Brazil, India, and South Africa

Country	Descriptor	Units	Scale	2008	2009	2010	2011	2012
USA	GDP	U.S.$	Billions	14,369.08	14,119.05	14,624.18	15,157.29	15,824.69
	GDP/capita	U.S. $	Units	47,155.32	45,934.47	47,131.95	48,387.29	50,040.09
	Inflation	Index		215.247	214.549	217.59	219.675	222.657
	Inflation	% change		3.816	-0.324	1.417	0.958	1.358
	Population	Persons	Millions	304.718	307.374	310.282	313.249	316.24
	Govt income	% of GDP		32.383	30.37	30.324	31.498	33.052
	Govt exp	% of GDP		39.053	43.254	41.409	41.163	39.71
UK	GDP	U.S.$	Billions	2,679.01	2,178.86	2,258.57	2,395.48	2,497.56
	GDP/capita	U.S. $	Units	43,651.55	35,257.45	36,298.39	38,239.51	39,802.74
	Inflation	Index		108.5	110.8	114.211	117.094	119.085
	Inflation	% change		3.629	2.12	3.078	2.525	1.7
	Population	Persons	Millions	61.373	61.798	62.222	62.644	63.065
	Govt income	% of GDP		37.771	36.909	36.474	37.156	37.628
	Govt exp	% of GDP		42.675	47.167	46.645	45.235	43.994
Brazil	GDP	U.S.$	Billions	1,635.52	1,574.04	2,023.53	2,192.96	2,326.81
	GDP/capita	U.S. $	Units	8,625.58	8,220.36	10,470.90	11,249.82	11,839.71
	Inflation	Index	Million	315,296.9	330,742.9	347,252.0	363,384.1	380,251.6
	Inflation	% change		5.672	4.899	4.992	4.646	4.642
	Population	Persons	Millions	189.613	191.481	193.253	194.933	196.526
	Govt income	% of GDP		36.647	36.092	36.318	36.528	36.555
	Govt exp	% of GDP		37.956	39.331	38.018	37.768	38.213
India	GDP	U.S.$	Billions	1,260.62	1,236.94	1,430.02	1,598.39	1,762.29
	GDP/capita	U.S. $	Units	1,066.46	1,031.59	1,176.06	1,296.68	1,410.64
	Inflation	Index		141.667	157.083	177.798	189.653	198.555
	Inflation	% change		8.349	10.882	13.187	6.668	4.693
	Population	Persons	Millions	1,182.06	1,199.06	1,215.94	1,232.68	1,249.28
	Govt income	% of GDP		19.714	18.907	18.709	19.653	20.323
	Govt exp	% of GDP		27.158	28.534	27.884	28.166	28.496
SA	GDP	U.S.$	Billions	276.77	287.219	354.414	366.174	384.426
	GDP/capita	U.S. $	Units	5,684.68	5,823.58	7,100.81	7,249.41	7,520.52
	Inflation	Index		160.008	171.387	180.924	191.458	202.088
	Inflation	% change		11.504	7.111	5.564	5.823	5.552
	Population	Persons	Millions	48.687	49.32	49.912	50.511	51.117
	Govt income	% of GDP		28.937	26.901	26.524	27.048	27.562
	Govt exp	% of GDP		29.397	32.067	32.316	31.546	30.648

Source: IMF, 2010; Grey= projections.

5.4 Recommended model for EE market in South Africa

5.4.1 Project Finance

Project finance is defined by Dentone Wide Sapte (2004) , project finance legal specialist as;

> "any borrowing to finance a project, which is made by a single purpose company whose principal assets and business are constituted by that project and whose liabilities in respect of the borrowing concerned are not directly or indirectly the subject of a guarantee, indemnity or any other form of assurance, undertaking or support from any member of the group except as expressly referred to in the agreements".

The overriding aim behind citing this rather complex definition is to make it clear that the repayment of the loan in question is expressly limited to the assets of the project being financed; this perception could be the route to attempt the complex EE projects in South Africa, given the developmental nature of the market and the complex dynamics.

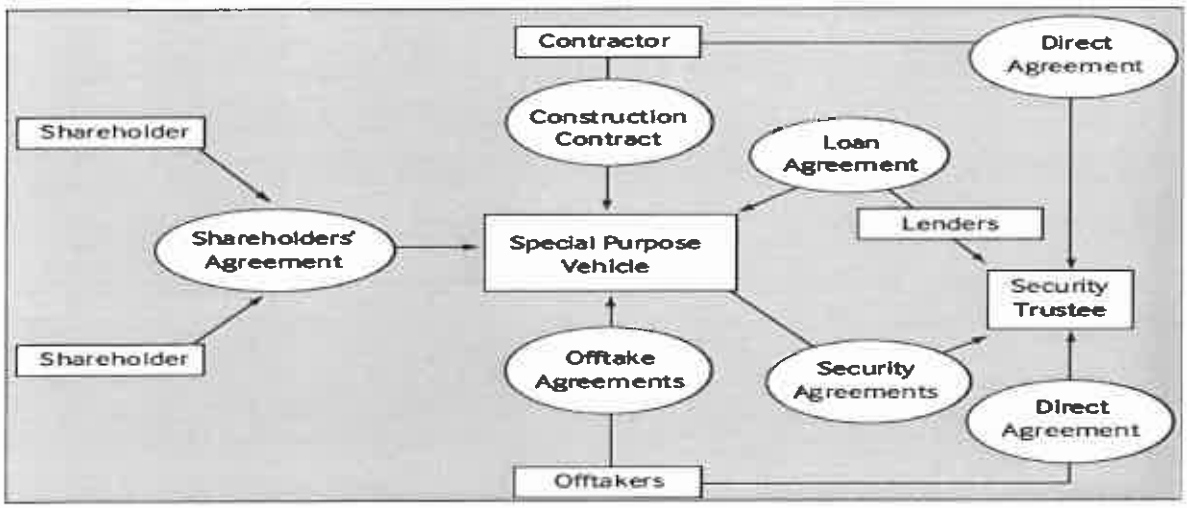
The IFC ad AfDB paper (2010) cites that South African Financial Institutions are hesitant to provide energy efficiency financing as a specific product line since they associate such funding with higher transactional costs as a result of their lack of experience with the technologies and market opportunities, and the need for a more specialized approach. Financial institutions will point to complicated reporting requirements on technical details as one component of increased costs for them and their clients. Additionally, banks do not typically have internal resources to evaluate such reporting from their clients and don't have scoring systems adjusted to the additional requirements; nor are their marketing staff trained to provide detailed product information or identify clients that are appropriate for energy efficiency projects.

The bottom line is that banks perceive the transaction (agency) costs associated with EE transaction as too high and not warranting the returns achieved. As a result of these transaction costs hurdles, real and perceived, banks have literally avoided championing the financing of EE projects, preferring to funding projects based on sponsor company`s balance sheet (i.e. using traditional corporate finance structures). This perhaps reflects the costs of information asymmetry in the South African EE market (Esty, 2003).

An approach to address this problem may lie in project finance based structure. As argued by Esty (2003, project finance structure reduces the cost of agency conflicts (caused by information asymmetry) and it reduces the opportunity cost of underinvestment due to leverage and incremental distress costs in sponsoring companies (Esty, 2003).

Project finance structures targeted at minimizing transaction costs are a possible option to financing EE projects in South Africa, given the rebate additional cash flow, rebate that may be used to improve project returns. The contractual structure in project finance has four major contracts governing the supply of inputs; firstly, expertise and service level agreements; secondly purchase of outputs (known as off-take or purchase agreements) in the case of EE projects the energy savings ideally to be contracted for a period exceeding the tenor of any borrowings; thirdly, project construction including equipment and engineering and procurement input, and finally, operations supported by maintenance contracts (Denton Wilde Sapte, 2004; Esty, 2003).

Figure 9. SPV based project finance structure for EE markets in South Africa



Source Denton Wilde Sapte, 2004

Figure 9, above shows the project finance model which illustrates different specialist agreements with different parties; each party is allocated the risk that they best disposed to

handle. The sponsors are separated from the project company or Special Purpose Vehicle (SPV). Construction is handled through an EPC contract allocated to specialist, security is allocated to security trustee on behalf of lenders, sales are signed and secured through off-take agreements and shareholders for SPV are bound by shareholder agreements.

Through risk allocation and contractual binds, project finance reduces asymmetric information and the structural framework and components fit well in a project Special Purpose Vehicle, isolated from the sponsor assets and operations. The structure if well designed can reduce net transaction costs and improve investment returns. Project finance is literally financing assets separately from other company activities and can clearly improve information flow. The key to understanding why project finance creates value is to recognize that firms bear "deadweight costs" (DWC) when they invest in and finance new assets. These deadweight costs namely (transaction costs, agency costs, distress costs, information costs, and taxes) result from capital market imperfections (Esty, 2003). Project finance with its separate incorporation, shields risk averse managers (lenders) in sponsoring firms from bad outcomes at the project level more effectively than corporate finance (Chemmanur and John, 1996; Brealey, Cooper, and Habib, 1996).

Cash flow is the key driver in project finance, thus unique to South African EE markets, is the additional rebate currently under SOP offer which should motivate banks to invest in EE projects. The rebate rate is determined by the long run marginal costs of supply or estimated subsidies necessary to attract commercial bids (NERSA, 2010). The SOP currently is a mechanism to acquire demand side resources energy savings by offering a predetermined rate for demand savings and annual energy savings. The SOP will be funded by the national utility and funds made available to project developers (ESCOs) to initiate projects. The project developers would be paid a performance based incentive per kWh of achieved savings. The rebate takes into account the avoided cost summed as avoided cost due to deferment of installed capacity plus the avoided operating cost plus the avoided primary energy cost less management and marketing cost. The current rebate rate is R0.5404/kWh (DOE, 2010b).

This paper suggests the adoption of the project finance model on the basis of a review of the major market drivers and constraints for the South African market. The model maybe adopted for the South African EE market, were currently three financing models are under trial namely shared savings (ESCO), own resources and on balance sheet term loans. Further enhancements include mixing funding sources, structuring payment schedules, credit rating and seeking out tax credits rebates and other government incentives, these could improve EE project investment profiles.

5.4.2 Discussion of the model in the South African context.

The markets reviewed have different barriers to implementation of EE projects and these barriers are related principally to information availability and interpretation of EE projects benefits. Lender reluctance is predominant in developing EE markets and it seems there is a compelling justification for EE policy interventions in these markets.

In the South Africa there is evidence of a renewed focus on EE from a policy support and regulatory framework perspective as highlighted earlier. The evidence suggests that transformation to a more energy productive economy is an imperative with policy makers and business leaders effecting the transformation through market dynamics and policy change. The rising energy prices are a key driver for the EE market, with Eskom having been granted increments of 24.8%, 25.8% and 25.9% in 2010, 2011 and 2012, respectively. South Africa's historically low electricity prices, resulted in the underdevelopment of the EE market. This has been due to long payback periods for investments in long-lived energy efficient equipment (e.g., HVAC systems, appliances, motors, and drives). Even within non-energy intensive industries, EE projects that are independent of larger capital investment programmes are often small in nature as a result; the easily accessible returns from such projects do warrant management attention given their limited impact on the overall company bottom line.

The four key factors triggering EE investments in most markets are, firstly, technical capacity by ESCOs to carry out the EE projects and within close proximity of the EE markets, secondly,

availability of financing mechanisms using internal funds as well as external funds (debt or equity), thirdly, incentives from national or regional authorities for implementers of EE projects, and finally, profit for the implementing ESCO or pressure from demand to energy supplier and EE project size, enough to warrant cost recovery.

In South African, Brazil and Indian markets there is a lack of suitable financing arrangements, incentives or return justifications for financial institutions to develop products suitable for financing EE projects. In these markets typically financial intermediaries assess the sponsor companies on their past overall financial performance and do not consider the expected improvement in net revenue (via reduced costs) which results from installation of new energy efficient equipment as material. Consequently, financing terms can be restrictive and unattractive for borrowers targeting EE projects. These observations explain the slow and low uptake of the EE projects in these markets.

The South African financial markets currently exploit project finance techniques to fund non EE projects which projects are materially bigger than the average size of EE projects. The costs associated with the project finance appraisal process may hinder application of project finance structures to EE projects. Trends observed in the UK and USA markets include the clustering of small sized EE projects into, an SPV which then applies for a global project finance facility for the suite of EE projects.

In order to promote the development of the ESCO industry, demand for EPC is needed, which can be created significantly by the public authorities as in the USA and UK. In the case of South Africa the EE market demand can be created by government taking a lead position in implementing EE projects in all its own stock of buildings. This may provide the catalyst to stimulate the general market and encourage the development of similar activities by the private sector. Evidence in the South African market suggests this approach has been adopted, selectively and on minimum Eskom EE and DSM programmes, with a need to expand it to the entirety of EE projects.

Programmes to raise awareness and to sufficiently support lenders on technical assessment of ESCO, can add as additional spurs in resolving the information asymmetry composite, leading to the support and sustainable development, of the EE market particularly in the private sector. This would be so because as discussed energy performance contracting requires deep know-how of energy, financing, buildings, and industry processes to be successful and more so within the project finance model. Measures to support the local/ national banking sector are of crucial importance in terms of creating a local banking system open and willing for EE financing along the same lines as the USA and UK markets.

The major hurdle for banks in South Africa as in Brazil and India is that they do not fully understand the EE industry hence the perception of the industry as a risky business. Banks prefer instead to fund the projects on predominantly asset-backed basis. Therefore, information dissemination and capacity-building are important for bankers as well as for ESCOs to help the former understand EPC and teach the latter how to deal with banks or financial institutions. This has been noted by the major development finance institutions in South Africa such as the IFC and AfDB who are only beginning to directly intervening in many EE markets by providing funding to South African financial institutions for specific deployment into EE markets.

Chapter 6: Conclusion and recommendations on South Africa EE Market

In conclusion government action through policies and laws is crucial to promoting the advancement of EE industry. However, legislative acts alone are not sufficient to ensure that resources are being used rationally to maximize the public interest in energy-related services. The ultimate EE initiatives must be market driven and based on projects viability and on a project finance model. In order to achieve such maturity the programme management and appraisal review processes, including meaningful stakeholder participation, are needed in order to successfully manage EE portfolios, particularly in a developing EE markets.

In South Africa the main aspects that require special attention to improve the performance of the policy initiated Standard Offer Programme are firstly, good governance practices applied to the administration and coordination of programme resources and efforts, secondly improved collaboration in, and leveraging of more resources for, energy efficiency activities and finally, program monitoring and independent appraisal of implemented projects. These parameters are similar to what is required for the success of a project finance model.

Notably there is no single market for EE services, instead the markets consist of hundreds of intermediaries and as a result many issues in these markets must be addressed in a highly disaggregated fashion with due considerations for the individual submarkets. The markets are not developed and therefore in the interim, multiple approaches should be tailored to particular circumstances to be successful. Since technology and institutional change is an enduring feature of EE markets, public policy must constantly be reviewed for continued appropriateness. The existence of market barriers provide the justification for policy interventions in developing EE markets. However a clear understanding of the markets and detailed investigation of the key drivers of the markets is an integral component of the effectiveness of the interventions.

A recommendation for direct EE industry support by national government through policy is strongly recommended. In particular ESCO, should be supported through participation in the

public institution market, this is so because that ESCOs are important anchor partners in EE, clean energy, sustainability and climate change mitigation initiatives in South Africa. It is especially so, if the ESCO has a proven track record of developing comprehensive projects that utilize energy efficiency, onsite generation and renewable energy technologies.

There is increasing interest and awareness in EE and clean energy in the market with most corporate and public authorities pursuing either sustainable energy or climate change mitigation initiatives. Given the ESCO long-standing relationships and track record with many institutional customers, they are well-positioned to work with corporates, their energy managers, and financial institutions in order to develop EE projects, and so they deserve key initial support through rebates or the correct legislative environment.

A further recommendation is made for use of project finance based risk sharing models that reduce the net cost of financing EE assets by reducing transaction costs. In particular lenders may use project finance models to reduce costly agency costs and the opportunity cost of underinvestment in positive NPV assets. The model demands key due diligence processes, key contractual arrangements, special purpose vehicles as well as security vehicles that give comfort to lenders. The recommendation is based on the facts about the South African market which require a risk sharing model that aligns risks to parties best suited to deal with the risk, this is the cornerstone of project finance model and its stringent due diligence processes.

References

Akerlof, G. A. (1970): The Market for "Lemons": Quality Uncertainty and the Market Mechanism. The Quarterly Journal of Economics, 84: 488-500.

Alliance to Save Energy (ASE), (2007): Guidelines to Financing Energy Efficiency Projects in the Commonwealth of Independent States. Washington DC: REEEP, Partnership.

Barbose, G., Goldman, C. and Schlegel, J. (2009): The shifting landscape of ratepayer-funded Energy Efficiency in the U.S. The Electricity Journal, 22(8):29-44.

Basel Agency for Sustainable Energy (BASE) (2006): Public Finance Mechanism to Increase Investment in Energy Efficiency – A Report for Policymakers and Public Finance Agencies. Basel: BASE, UNEP, DEFRA.

Bertoldi, P., Boza-Kiss, B., Rezessy, S., 2007. Latest development of energy service companies across Europe -A European ESCO update-. European Commission Joint Research Centre, Institute Environment and Sustainability, Report No.: EUR22927 EN. www.energy.eu/publications/LBNA22927ENC_002.pdf.

Blanchard, O. (2009): Macroeconomics, 5th Edition. London: Pearson Education Ltd.

Blumstein, C., Kreig, B., Schipper, L. and York, C (1980): Overcoming Social and Institutional Barriers to Energy Efficiency. Energy 5 (4):355-372.

Brealey R. A., Cooper, I. A. and Habib, M. A. (1996): Using Project Finance to Fund Infrastructure Investments. Journal of Applied Corporate Finance. 9. 3. 25–39

Business Enterprise & Regulatory Reform, (BERR), Department. (2008). Fifth Annual Report on progress towards the 2003 Energy White Paper "Our energy future-creating a low carbon economy". Ministry of State for Energy, UK.

Chemmanur, T.J., and K. John, 1996, Optimal Incorporation, Structure of Debt Contracts, and Limited-Recourse Project Financing, Journal of Financial Intermediation 5: 372-408.

Decanio, S. (1993): Barriers within firms to Energy Efficient Investments. Energy Policy, 21(9):906-914.

Decanio, S. J. and Watkins, W.E. (1998). Investment in Energy Efficiency: Do the Characteristics of Firms Matter? The Review of Economics and Statistics, 80. 1: 95-107.

Denton Wilde Sapte (2004): A guide to project finance: As downloaded on, Jan 26th, 2010. www.dentonwildesapte.com.

Department of Energy (DOE) (2010a): Revision of Regulatory rules for Energy efficiency and Demand Side Management (EEDSM) including Standard Offer Programme (SOP). As downloaded on 28th June 2010. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Department of Energy (DOE) (2010b): Policy to support the Energy Efficiency and Demand Side Management (EEDSM), Department of Minerals and Energy. As down loaded on 7th July, 2010. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Department of Energy (DOE) (2006): Energy Efficiency Savings projections. Report no.2.2.3-06. As downloaded on 7th July, 2010. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Department of Finance (DOF) (2001): National Treasury Regulations for departments, constitutional institutions and public entities. As downloaded on 12th January 2010. http://www.finance.gov.za/legislation/pfma/default.aspx.

Department of Minerals and Energy (DME) (2005a): EE Strategy of the Republic of South Africa. As downloaded on 7th July, 2010. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Department of Minerals and Energy (DME) (2005b): Capacity Building in Energy Efficiency & Renewable Energy. Report No. 6.1 Memorandum of Understanding.6: Memorandum of understanding. As downloaded on 14th October 2011. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Doyoon, K. (2010): Optimizing Cost Effective Energy Conservation Measures for Building Envelope. Journal of the Association of Energy Engineers. Energy Engineering. 107, 3. 70-80.

European Economic Community (EEC): 1976: Report on the achievement of the Community Energy Policy Objectives for 1985, COM (76)9. January.

European Commission (2006): Action Plan for Energy Efficiency: Realising the Potential (COM) 545. Brussels: European Commission.

Ehrhardt-Martinez, K. and Laitner, J.A. (2008): The size of the US. Energy Efficiency Market: Generating a More Complete Picture. Report no.E083. American Council for Energy – Efficient Economy. As downloaded on 14th October 2010. http://aceee.org.

Energy Information Administration (EIA). 2008. Energy Market and Economic Impacts of S.2191, the Lieberman-Warner Climate Security Act of 2007. Washington: United States Department of Energy.

Energy Information Agency (EIA) (2010): Energy Information. As downloaded on 13th October 2010. http://www.eia.doe.gov/emeu/international/elecprih.html.

Energy Information Agency (EIA) (2011): Energy Information. As downloaded on 13th November 2010. http://www.eia.doe.gov/emeu/international/elecprih.html.

Eskom Annual Report, (2009): As downloaded on 21st June 2010. http://www.eskom.co.za

Eskom Annual Report, (2010): As downloaded on 21st January 2011. http://www.eskom.co.za

Esty B. C. (2003). Why Study Large Projects? An Introduction to Research on Project Finance. European Financial Management, Vol. 10, No. 2, 2004, 213–224.

Goldman, C., J. Osborn, N. Hopper, and T. Singer, 2002. "Market Trends in the U.S. ESCO Industry: Results from the NAESCO Database Project" Lawrence Berkeley National Laboratory: LBNL-49601, Berkeley, CA, May.

Golove, H. W. and Eto, J. H. (1996): Market Barriers to Energy Efficiency: A critical reappraisal of the rational for public policies to promote Energy efficiency: California. Lawrence Berkeley National Laboratory, Report LBL-38059,

Harris, R. G. and Carman, J. M. (1991): The political economy of regulation: an analysis of market failures. In scaling the corporate wall. As downloaded on 21st January 2011. www.jstor.org/stable/3857523.

Haydock, H. (2002): Energy Efficiency in the UK 1990-2000. AEA Technology Environment. UK.

Haydock, H. and Arbon, J. (2009): Study on Energy Performance of Buildings. Policy Department Economic and Scientific Policy PE 416.208 European Parliament.

Hickling, R., (2006): Electricity Consumption in New South Wales: An application of co integration techniques to energy modelling and forecasting, TransGrid Economics Information Paper, 1-31.

Hopper, N., C. Goldman, J. McWilliams, D. Birr and K. McMordie Stoughton, 2005. "Public and Institutional Markets for ESCO Services: Comparing Programs, Practices and Performance" Lawrence Berkeley National Laboratory: LBNL-55002, Berkeley, CA, March.

Houser, T. (2009a): Energy Efficiency in Buildings: A Global Economic Perspective. Policy Brief: No. PB09-8. 1-5. Washington DC. Peterson Institute for International Economics.

Houser, T. (2009b): The Economics of Energy Efficiency in Buildings. Policy Brief: No. PB09-17:. 1-5. Washington DC. Peterson Institute for International Economics.

Hui-Yong, Y.(2009): Corus May Be Model as Investors Seek Troubled Assets. As downloaded on 21st October 2010.www.bloomberg.com/apps/news?pid=20601103&sid

International Institute for Energy Conservation (IIEC) and Export Council for Energy Efficiency (ECEE) (1998): Developing and Financing Energy Efficiency Projects and Ventures in Emerging Markets. Washington DC. IIEC Publications..

International Energy Agency (IEA). 2008a. Energy Technology Perspective 2008. Paris: Organization for Economic Cooperation and Development.

International Energy Agency (IEA). 2008b. CO2 Emissions from Fuel Combustion Vol. 2008 Release 01. Paris: Organization for Economic Cooperation and Development.

International Finance Corporation (IFC) and African Development Bank (AfDB) (2010): CTF private Sector Proposal Energy Efficiency Component a joint submission: South Africa Energy Efficiency Program (the "Program"). Johannesburg. As downloaded on 12th January 2011. http://www.afdb.org/en/news-and-events/article/afdb-approves-climate-investment-funds-implementation.

International Monetary Fund (IMF) (2010): Country Report. World Economic Outlook Database. As downloaded on 12th November 2010. http://www.imf.org/external/country/index.htm.

Jaunky, V. C. (2006): Income Elasticity of Electric Power Consumption: Evidence from African Countries. University of Mauritius.

Johnson Controls Inc (2009): Financing Models for Energy Efficiency and Renewable Energy in Existing Buildings. As downloaded on 12th May, 2010. http:// www.johnsoncontrols.com /InstituteBE.

Kouris, G. (1983): Energy consumption and economic activity in industrialized economies – a note, Energy Economics, 5. 207-212.

KPMG (2009). Report on oil and gas overview in India. As down loaded on January 21st 2011. www.indiaenergyportal.org/overview_detail.php.

Lawton, C. (2009): German Energy Giants Eye a Greener USA, Business Week, October 30. As downloaded on 26th November 2010. http://www.businessweek.com/globalbiz

Longwell, J. P., Rubin, E.S. and Wilson, J. (1995): Coal: Energy for the Future. Proceedings of Energy Combustion Science. Essevier Science Ltd. 21. 269-360.

Mahadevan, R. and Asafu-Adjaye, J., (2007): Energy consumption, economic growth and prices: A reassessment using VECM for developed and developing Countries, Energy Policy, 35. 2481-2490.

Makower, J. (2007): Clean Energy Trends- Clean Edge.

McKinsey & Company (2009): Pathways to a Low Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve. New York. McKinsey & Company.

Miler, K. (2010). The US Energy Market Overview. Energy Commentary. As downloaded on 12th January 2011. As downloaded on 12th December 2010. http://www.investorideas.com /RSS/feeds/Energy.xml.

Narayan, P. K. and Smyth, R., (2005): The residential demand for electricity in Australia: An application of the bounds testing approach to co integration, Energy Policy, 33: 467-474.

National Energy Resource Agency (NERSA) (2010): Energy Resource Planning ERP-2) Stage 4 Report. Supply and Demand Resource Alternatives and Reference Case. As downloaded on 12th October 2010. http://www.dme.gov.za/pdfs.energy/efficiency/startegy.pdf.

Ojah, K. and Mokoaleli-Mokoteli, T. (2009): Possible Effective Financing Models for Entrepreneurship in South Africa: Guides from Microfinance and Venture Capital Finance. Johannesburg: Wits Business School.

Poole, A. and Meter, S. A. (2006): Developing Financial Intermediation mechanisms for Energy Efficiency Projects in Brazil, China and India. Brazil Country Report. New York, World bank.

Poole, A. D. and Guimararaes, A. (2001): Financing of third Party Energy Efficiency Services in Brazil. Contribution to the Project: Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China and India. New York, United Nations Environmental Programme.

Poole, A. D. and Stoner, T. (2003): Alternative Financing Models for Energy Efficiency Performance Contracting Task Force. Rio de Janeiro. Eco-energy international, Boulder, Colorado and Instituto Nacional de Eficiencia Energitica.

Public Finance Management (PFMA), Act No.1 (1999): As downloaded on 12th January, 2010 http://www.finance.gov.za/legislation/pfma/default.aspx.

Roberts, F. (1979): The scope for energy conservation in the EEC. Energy policy. June, 1979.

Satchwell, A., Goldman, C., Larsen, P., Gilligan, D. and Singer, T.(2010): "A survey of the U.S. ESCO Industry: Market Growth and Development from 2008 to 2011". Berkeley, CA. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-3479E.

Siedel, R. (2010): A scalable Approach to Energy Improvements Using Energy Management and Control Systems. Strategic Planning for Energy and the Environment. 29. 4. 37-55.

Smith, P. L. (2010): Energy Savings Performance Contracting with New Construction equals Energy Security at White Oak. Journal of the Association of Energy Engineers. Energy Engineering. 107, 3. 51-69.

Spulber, D. F. (2002): Market Microstructure and Incentives to invest. Journal of Political Economy, 110. 2. 352-381.

Stigliz, J. F. and Weiss, A. (1981): Credit Rationing in Markets with Imperfect Information. The American Economic Review, 71, 3. 393-410.

Strategic Finance Group (SFG), (2007): The association between unexpected changes in electricity volume and GDP growth for residential customers. Frontier Economics. As downloaded 18th December 2010. www.frontier-economics.com.

Taylor, R. P, Govindarajalu, C., Levin, J., Meyer, S. A. and Ward, W. A. (2008): Financing Energy Efficiency. Lessons from Brazil, China, India and Beyond. Washington DC. The World Bank.

Thukral, K. (2006): World bank Report on Developing Financial Intermediation mechanisms for Energy Efficiency Projects in Brazil, China and India. India Country Report.

United States Department of Energy (USDOE), (2010): Choosing a Financing Vehicle for Energy efficiency Projects for Federal Sites. As downloaded on 25th May 2010. http://www.eren.doe.gov/femp.

United States Environmental Protection Agency (USEPA) (2007): Energy Star Buildings Programme. Introduction to Energy Performance contracting. As downloaded on 25th May 2010. http://www.eia.doe.gov.

Welman, C., Kruger, F. and Mitchell, B. (2005). Research Methodology. (3rd ed.). 193-207. Capetown: Oxford University Press.

Wachter, B. D. (2009): The vast potential of energy efficiency in India. As downloaded on 25th January 2011. http://www.leonardo-energy.org.

Ürge-Vorsatz, D., Köppel, S., Liang, C., Kiss, B., Nair, G. G. and Celikyilmaz, G. (2007): An Assessment of on Energy Service Companies (ESCOs) Worldwide. As downloaded on 23rd

November 2010. http://www.worldenergy.org/documents/esco_synthesis.pdf

Zobler, N. and Hatcher, K. (2003): Financing Energy Efficiency Projects. Government Finance Review. As downloaded on 7th June 2010, www.gfoa.org.

Zobler, N., Philips, M., Diamond, M. and Rogero, G. (2009): Energy Performance contracting Financing Options, EPC Toolkit for Higher Education. Washington DC.: Clinton Foundation.