Guidelines for Financing

Energy Efficiency Projects in India

A reference guide for Banks and NBFCs

September 2017

BUREAU OF ENERGY EFFICIENCY
(Ministry of Power, Government of India)

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This Guide is reference material for loan officers in Banks and Financial Institutions for Energy Efficiency Project Financing. It was prepared by USAID PACE-D TA Program and submitted to Bureau of Energy Efficiency (BEE).

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सत्यमेव जयते

ENERGY IS LIFE
BEE
CONSERVE IT

ऊर्जा दक्षता ब्यूरो
(भारत सरकार, विद्युत मंत्रालय)

BUREAU OF ENERGY EFFICIENCY
(Government of India, Ministry of Power)

FOREWORD

India has made a voluntary pledge for reducing 33-35% of emission intensity by 2030 compared to 2005 level as a part of its Intended Nationally Determined Contribution (INDC). This will require massive capital investment, estimated at around USD 2.5 trillion, to meet the target. A major part of these funds will be required for financing and deployment of energy efficiency (EE) and renewable energy technologies for sustainable growth.

The Bureau of Energy Efficiency (BEE) has taken up several initiatives to strengthen the market for energy efficiency including innovative mechanisms to scale up financing of energy efficiency projects in India. It has created two financial instruments--the Partial Risk Guarantee Fund for Energy Efficiency and Venture Capital for Energy Efficiency—to help financial institutions actively engage with industries, large commercial establishments, and project implementation agencies and provide funds for energy efficiency projects across the country.

Banks, Financial Institutions (FIs) and investors have a critical role to play as India embarks on its low-carbon journey. Due to the inherent nature of EE projects, FIs have difficulty in grasping the complexities of these projects, and do not actively pursue these projects. As several EE projects are smaller in size it further limits the banks from financing of EE projects. Thus there is a need to encourage FIs to encourage and scale EE financing. It is not only important for them to understand the specific nuances of energy efficiency financing but also appreciate how to appraise such projects.

In the present scenario, due to the limited understanding of EE projects, the FIs assign higher risk rating to EE projects, which leads to higher interest rates, thus reducing the attractiveness of EE projects. With a view to improving the understanding of assessment and appraisal of EE projects, BEE has been working with the USAID PACE-D TA Program to develop a reference guide that can help the investment community better understand energy efficiency projects and take informed credit decisions. The 'Reference Guide for Banks for Financing Energy Efficiency Projects' will facilitate banks and financial institutions in evaluating, appraising and financing energy efficiency projects. In particular, it will help them understand the risk mitigating strategies, financing structures and implementation models.

I am confident that this reference guide will go a long way in accelerating the deployment of energy efficiency projects in the country, and help India meet its INDC targets.

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ACRONYMS

Acronyms	Definition
ADB	Asian Development Bank
AEEE	Alliance for an Energy Efficient Economy
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
DB	Development Bank
DES	Detailed Energy Study
DPR	Detailed Project Report
DSCR	Debt Service Coverage Ratio
DSRA	Debt Service Reserve Account
DSM	Demand Side Management
EA	Energy Auditor
ECBC	Energy Conservation Building Code
ECM	Energy Conservation Measure
EE	Energy Efficiency
EEP	Energy Efficiency Project
EER	Energy Efficiency Report
EESL	Energy Efficiency Services Limited
EFC	Expenditure Finance Committee
ESA	Energy Service Agreement
ESCO	Energy Service Company
ESI	Energy Savings Insurance
ESM	Energy Savings Measure
ESPC	Energy Savings Performance Contract
ETP	Effluent Treatment Plant
EXIM	Export Import Bank of India
FA	Financial Agreement
GBS	Gross Budgetary Support
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Green House Gases
HP	High Pressure
HVAC	Heating Ventilation Air Conditioning

Acronyms	Definition
ICED	Indonesia Clean Energy Development
IFC	International Finance Corporation
IGA	Investment Grade Audit
INR	Indian Rupees
IPMVP	International Performance Measurement and Verification Protocol
IREDA	Indian Renewable Energy Development Agency
IRR	Internal Rate of Return
kWh	Kilowatt Hour
LED	Light Emitting Diode
LFIs	Local Financial Institutions
LOI	Letter of Intent
LPG	Liquefied Petroleum Gas
MSME	Micro Small and Medium Enterprises
mtoe	Million Tons of Oil Equivalent
M&V	Measurement and Verification
MRV	Measurement Reporting and Verification
NBFC	Non-banking Financial Company
NG	Natural Gas
NGO	Non-Government Organization
NMEEE	National Mission for Enhanced Energy Efficiency
NPA	Non-Performing Asset
NPV	Net Present Value
O&M	Operations and Maintenance
PAR	Performance Assessment Report
PAT	Perform Achieve and Trade
PCRG	Partial Credit Risk Guarantee
PFC	Power Finance Corporation
PFI	Participating Financial Institution
PRGFEE	Partial Risk Guarantee Fund for Energy Efficiency
PTR	Performance Tracking Report
PCRA	Petroleum Conservation Research Association
R&D	Research and Development
SIDBI	Small Industries Development Bank of India
SME	Small and Medium Sized Enterprises

Acronyms	Definition
UNFCCC	United Nations Framework Convention on Climate Change
VCFEE	Venture Capital Fund for Energy Efficiency
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
VSK	Vertical Shaft Kiln

1. ENERGY EFFICIENCY OPPORTUNITY AND BARRIERS

1.1. Energy Efficiency Opportunity in India

Energy efficiency (EE) means using less energy to achieve same or higher level of output and/or services. An "Energy Efficiency Project" (EEP) includes activities to identify inefficient or wasteful energy used in a facility. Once these are identified, the project implements steps to reduce or eliminate the inefficiencies without affecting the output generated or the services provided. An EEP typically bundles one or more energy efficiency technologies and/or energy saving measures (ESMs) within an end-use energy consuming facility. This facility can be verified and implemented within a specified capital cost and savings.

It is globally known that EE is the cleanest and cheapest source of energy. In addition to reduced energy consumption, the local pollutants and green-house gas (GHG) emissions are also eliminated by EE to achieve regulatory requirements and government targets. The inefficient equipment should be replaced with more efficient ones to lessen the energy consumed at the Host's current level of production or comfort. This can be accomplished by applying proven, off-the-shelf infrastructure technologies like improved boilers, motors, lighting, and so on.

The most attractive feature of EEPs is that no-risk technologies can be financed from reductions in a Host's existing operating expenses (through savings). EEPs are commercially attractive investments without government subsidies (i.e. feed-in-tariffs) often applied to renewable energy projects (i.e., solar, wind) to achieve their GHG emission reduction targets.

Given the negative impact of higher energy consumption on energy security, energy supply-demand balance, and local and global environmental effects, it is imperative to use energy in the most efficient manner possible. At an enterprise level, EE will reduce operating costs and enhance cash flow and profitability of the company (energy cost savings go directly to improve the bottom line). At the national level, consuming energy efficiently will reduce energy imports, and thus contribute to the economic well-being of the country.EE also benefits society by reducing the adverse environmental impacts of energy use[1].

The investment needed to implement market-based approaches to unlock EE opportunities is currently estimated to be about INR 160,576 Crores. The sector wise distribution along with the investment potential from EE programs is given in Table 1.

[1] http://cuts-citee.org/pdf/CONBEE_DraftReport.pdf

Table 1: Sector Wise Investment Potential for Energy Efficiency [2]

Sector	Investment potential (INR crore)	Rationale
Residential	74,237	• The investment potential has been formulated covering deployment of energy efficient lighting, Energy efficient ceilings fans and energy efficient room air conditioners programs in various cities, towns and villages.
Commercial Buildings	1,139	• The incremental cost for making Commercial buildings, Government-owned offices, Government-owned hospitals and privately-owned hotels has been taken into account to improve energy efficiency.
Municipal Street lights	25,200	• Taking into account investment under the National LED Street Lighting Programme (SLNP) as well as requirement of public lighting infrastructure in remote areas, the investment figures has been projected.
Agriculture	30,000	• The cost of the deployment of energy efficient agricultural pumpsets has been considered.
Industry	30,000	• During the 1st cycle of Perform, Achieve and Trade (PAT) Scheme, investment of INR 24,517 crores was made by the industry so as to comply with the mandatory specific energy reduction targets. • Based on the learnings, additional investment has been projected for taking forward energy efficiency effects in industrial sector.
Total	**160,576**	

PAT Cycle - I has witnessed an energy saving of 8.67 million tonne of oil equivalent (Mtoe) against the targeted energy saving of 6.886 Mtoe which is about 30 percent more than the target.The cycle contributed in emission reduction of 31 million tonnes of CO_2 and avoided generation of 5,635 MW resulting in monetary savings of INR 37,685 crore. It has also contributed in investment of INR 24,517 crore for EE technologies by Designated Consumer (DCs) under PAT. In this regard currently in the PAT Cycle - II, 621 DCs from 11 sectors have been included in the scheme[3].

As per the Planning Commission report[4], the projected energy saving potential in the Twelfth Plan is 13.18Mtoe which consists of a saving of 6.2 Mtoe from the seven energy-intensive industries (DCs), 1.75 Mtoe from SME sector and 5.23 Mtoe from thermal power stations. Avoided capacity addition due to EE achieved as on 2014-15 in the 12th plan period is 16,900 MW[5].

[2] Information shared by BEE office.
[3] http://pib.nic.in/newsite/PrintRelease.aspx?relid=159670
[4] http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol2.pdf (Page no 157 of the document)
[5] Information provided by BEE on avoided capacity-energy savings achieved as on 2014-15 in 12th five year plan

Table 2: EESL Estimates of DSM Programs

Sr. No.	Sector	Number of Projects	Estimated Investments (INR Cr.)	Estimated Annual Savings million kWh(mkWh)	Annual GHG Emission Reduction(tCO_2)
1	Domestic Efficient Lighting Program (DELP)	6	1,800	46,845	39 Million
2	Municipality Demand Side Management	15	3,200	5,520	5.9 Million

Source: Adapted from the Presentation "EESL Business Model to Scale up Energy Efficiency Implementation in India" by Mr. Saurabh Kumar, Managing Director, EESL, June 18, 2014, Mexico

EEPs represent a good business opportunity for financial institutions (FIs) banks, and non-banking financial companies (NBFCs).EEPs apply long-standing, proven technologies and have relatively short payback periods that directly improve the cash flow and bottom line of the end-use organizations who are the gatekeepers implementing them. EEPs are low-risk financing opportunities for banks, NBFCs and local FIs (collectively called LFIs), compared to many of the conventional projects that LFIs are currently financing. In fact, financing EEPs enhance the capability of a current borrower to repay its existing loan.

The major advantages for LFIs to finance EEPs include:

- **Profitability:** EE lowers the energy intensive company's vulnerability to energy prices and thereby enhances its profitability or bottom line.
- **Creditworthiness:** A company initiating EEP works in a financially healthy environment and enjoys better creditworthiness.
- **Competitiveness:** Energy efficient companies have a competitive advantage over less energy efficient firms.
- **Low-Carbon:** EEPs result in a low carbon footprint and companies adopting them become more sustainable.
- **Environmental:** Energy efficient companies are able to better comply with environmental regulations and be prepared for future environmental challenges which might impact their business directly.
- **Public Relations:** Energy efficient enterprises will be viewed more positively by stakeholders and thus are less prone to risk otherwise arising from a negative environmental public perception.

1.2. EE Barriers in India

EE can play a vital role in the Indian economy due to its significant cost savings and new business potential. However, the large scale adoption of EEPs and technologies has remained limited throughout India due to various barriers. In fact, many potential Project Hosts have not considered implementing EEPs in their facilities, which is why EE opportunities are so abundant for long-standing and proven EE technologies. The major barriers are as follows:

1. **Policy barriers:**
   a. Various policy initiatives are voluntary and thus their adoption is limited.
   b. In spite of rapidly evolving EE policies, not many are actively implemented.

2. **Institutional barriers:**
   a. Institutional bodies for promotion and implementation of EEPs are constrained in terms of capacity to support large scale implementation.
   b. Energy Service Companies (ESCOs), which have an important role in scaling up the implementation of EEPs, mostly lack the institutional and financial capacity to deliver effective EEPs.
   c. Life-cycle cost analysis is not performed by potential Project Hosts in their purchasing decisions resulting in higher EE initial costs (first cost hurdle); this is a critical barrier for large-scale implementation of EEPs.
   d. Issues of "split incentives "between an "owner" of the equipment and "renter" or "user" of the equipment. The "owner" purchases the energy equipment whereas the "renter" enjoys the benefits (energy savings) from the use of such equipment. This is particularly evident in the construction sector, where a builder builds a property for selling purpose and has little incentive to invest in EE projects.
   e. Internal funds are generally not readily available for EEPs, or are not viewed as a priority when compared to core business activities.

3. **Project (EEP) barriers:**
   a. Baseline: Defining an energy and baseline for EEPs is challenging because of general lack of available data due to insufficient measuring, metering and recording practices. Even if data is available, challenges remain as regards its acceptability with various stakeholders. Adjustments due to dynamics (plant utilization) and variables (seasonality impact) are very complex for Project Hosts to understand.
   b. Operations and Maintenance (O&M) Cost Savings: O&M is not easy to define due to lack of available data for the EE equipment being retrofitted, and is considered incidental to the EEP benefits.
   c. Lack of Knowledge on Measurement and Verification (M&V) Protocols: M&V protocols are needed to confirm post-EEP implementation benefits in terms of energy and other cost savings.

4. **Financing barriers:**

   India's current EEP financing situation is the same as Asian countries. LFIs are reluctant to finance EEPs on the needed non-recourse project basis because of perceived high risk, small market potential and high transaction costs due to small transaction sizes. LFIs lack in internal EEP evaluation capacity. Therefore, they are not willing to invest the time or resources to learn about EE or develop the internal evaluation capacity needed to assess the risks and cash flow benefits of EEPs.

   LFIs on the whole prefer traditional corporate, asset-based loans and are less willing to provide project-based loans for EEPs. They fundamentally do not have confidence in the savings being achieved or measured and thus do not consider their future cash flows as increased credit capacity in their loan structures. This is the main reason why LFIs do not

offer ‘non-recourse’ project financing[6]of EEPs in India. Other reasons include: The process of evaluating financial returns from EEPs are quite complex and; LFIs are experiencing a communication gap with Project Hosts and project developers due to lack of standardized contracts, agreements, and project proposal templates in the Indian market.

Unfortunately, with the low resale value of EEP assets, the LFIs’ traditional lending approach requires any borrower to provide non-EEP assets or third party guarantees as collateral to LFIs, making it difficult for Project Hosts or other implementing entities to secure financing of EEPs. This includes the nascent ESCO industry in India, which has small service companies, lack the financial depth to provide the high levels of collateral or strong borrower’s balance sheets needed to secure financing of their EEPs under a shared savings orEnergy Savings Performance Contract (ESPC).

This financing barrier is compounded by the fact that most private sector Project Hosts place a low priority on investing internal capital or utilizing their business credit capacity for EEPs versus for their business activities. This is because EEPs are not able to compete (both in size and IRR) with core business investments. This is coupled with the fundamental belief by most Project Hosts that EEPs are ‘utility’ infrastructure type of investments, which only need to be replaced when a break down occurs.

In summary, the unattractive requirement for Project Hosts to use their existing core business credit capacity to finance EEPs with LFIs, coupled with a low priority and a general lack of confidence in savings being achieved, has resulted in a significant barrier for India to be able to tap into the huge EE opportunity of its industrial sector.

For eliminating the barriers in EE project financing, the sector should be included under priority sector lending and banks should have a dedicated desk for lending to EE projects promoted by either Project Host of energy service companies.

[6] This is a loan where the LFI gets repayment from project cash flow and not from other assets of the borrower.

2. EE STAKEHOLDERS

The major EE stakeholders involved in the development, implementation and financing of EEPs are:

1. Project Hosts: Project Hosts are the commercial, industrial, residential, municipal and institutional organizations that use energy in various forms and for various activities in their facilities. They are the owners or operators of facilities (Project Host) where an end-use EEP is installed and can be classified into the following major categories, each of which have different financing requirements to be considered:
   a. Private Sector - Buildings
   b. Private Sector - Industries
   c. Public Sector – Central Government
   d. Public Sector - Local Government

2. Project Developers:
   a. ESCOs
   b. Vendors
   c. Contractors
   d. Project Hosts

3. Financial Institutions:
   a. Commercial Banks
   b. Development Financial Institutions
   c. International Lending Agencies
   d. NBFCs

4. Not-for-Profits:
   a. Non-Government Organizations
   b. Government Agencies
   c. International Agencies

4. Product and Service Providers:
   a. ESCOs
   b. Equipment
   c. Technology
   d. Contractors
   e. Consultants

A summary of each EE stakeholder's role, their respective benefits and concerns in implementing EEPs is provided in Table 3.

Table 3: EE Stakeholder Role, Benefit and Concerns[7]

Stakeholder	Role	Benefit	Concerns
Project Hosts	1. Provide site where EEPs are installed 2. Pay for EEPs (from reduced current operating costs)	1. Capital cost can be paid from savings 2. Reduced energy/operating costs 3. Reduction in GHG emissions 4. Increase competitiveness 5. Incorporation of technological change	**Private Sector:** 1. EE is low priority for available capital (Industries have less than one year hurdle rate) 2. Do not want to impair their credit capacity 3. Long-term agreements 4. Industries want competitive pricing (products/interest) **Public Sector:** 1. Competitive bidding complexities 2. Energy budget "Disincentive" 3. "High Risk" versus "No Reward" for staff 4. Political influence and changes 5. Multi-year commitments
Project Developers	1. Identify, develop and implement EEPs	1. New revenues and profits	1. Identify and get commitment from viable Project Hosts 2. Identify and get project financing commitment 3. Implement and operate EEPs within budgets 4. Ensure savings from EEPs are achieved
Financial Institutions	1. Commercial banks – Finance EEPs 2. Development Banks (DBs) – Provide or facilitate development of financial products and services needed for LFIs to provide in market place	1. New product with higher margins and growth opportunity 2. Provide additional value to existing project hosts 3. Support Government energy and environment goals 4. Leverage funding from other sources	1. Different from traditional 'asset-based,' corporatelending approach 2. Limited knowledge about EEPs 3. Small transactions = High transaction costs 4. DB's facilitate but do not provide sustainable solution
Not-for-Profits	1. Promote/Facilitate EE 2. Assist in removing policy/EE concerns 3. Help develop EE programs, codes and standards 4. Provide technical assistance	1. Improve energy use and environment 2. Provide sustainable environment 3. Reduce dependency on fossil fuels 4. Improve national energy security	1. Limited funding and scope 2. Targeted goals and objectives 3. Not sustainable solutions
Product and Service Providers	1. Provide product and services needed to implement the EEPs	1. New revenues and profits	1. Getting paid 2. Being able to perform work without major interruption

[7] Thomas K. Dreessen: EE Finance Capacity Building Workshops for ADB, Indonesia Export Import (Exim) Bank, United States Agency for International Development – Indonesia Clean Energy Development USAID-ICED Indonesia ESCO Regulations.

3. PURPOSE OF THIS DOCUMENT

It is not practical to solve all the challenges to achieve massive scale of EEPs implementation that would be needed in EE domain to meet India's GHG reduction targets. However, this Guide addresses what is widely recognized as one of the most significant barriers facing the widespread implementation of EEPs, lack of 'commercially-attractive' financing of EEPs from LFIs. This is not caused by unavailability of funds, as there is plenty of local-currency funding capacity and liquidity at LFIs. Also there is a large disconnect between current lending practices of most LFIs and the commercial reality that Hosts are reluctant to use their core business credit capacity to finance EEPs[8]. Consequently, the focus of this document is to shed light on this barrier by familiarizing LFIs and Project Hosts with the benefits and risks of financing EEPs and providing new appealing EE lending and savings insurance products.

This EE finance document aims to serve as a reference guide (EE Finance Guide) for LFIs in India to gain a better understanding of EEPs and risk mitigating methods that they can apply in evaluating the benefits and risks of financing EEPs. Its purpose is to guide LFIs to become more disposed to provide commercially-attractive loans of EEPs to owners of facilities where the EEPs are installed (Project Hosts), to ESCOs, vendors and contractors who develop and implement EEPs for Project Hosts.

[8] Thomas K. Dreessen: EE Finance Capacity Building Workshops for ADB, Indonesia Exim Bank, USAID-ICED Indonesia ESCO Regulations.

4. KEY ELEMENTS OF EEPs

4.1. Common EE Technologies

The predominant EE technologies implemented in buildings and industrial facilities include[9]:

- High efficiency lighting
- Heating ventilation air conditioning (HVAC) upgrades
- New automated building and HVAC controls
- Variable speed drives (VSDs) on motors fans and pumps
- High efficiency chillers
- High efficiency boilers and burner upgrades
- Heat recovery and steam traps
- Power factor correction
- Fuel switching
- Water conservation; i.e., toilets, showers, faucets

The following technologies are mostly unique to industrial facilities:

- New automated process controls
- Compressed air systems
- Waste heat recovery from process air and water
- Combined heat and power (cogeneration)
- Process equipment upgrades and other changes
- Water recycling and recovery of methane from waste water treatment

It is important to note that all of the above technologies have been operating for 30 years or more in the market place. They are extremely proven, very reliable and very low risk in terms of their ability to deliver the level of estimated efficiencies.

Also, an extensive list of EE technologies, with energy saving potential and the name ofequipment suppliers in India is provided onSmall Industries Development Bank of India (SIDBI) website:.
www.sidbi.in/sites/default/files/products/Annexure%20D%281%29%20ESEL%207.5.pdf

Indicative ESMs and technology for different industries are presented in **Annex 1**.

4.2. Unique EEP Characteristics

Financing an EEP is very different from many other traditional investments and requires a completely different set of skills and operating model to ensure the targeted internal rate of returns (IRRs) are realized. Unlike investing in a company or in real estate, where achieving the targeted IRR is heavily dependent on the realization of an asset's future market value assumed in the initial evaluation. EEPs are not dependent on any future market value. EEPs

[9] As per the International Energy Efficiency Financing Protocol ("IEEFP") published by the Efficiency Valuation Organization at www.evo-world.org/

that replace inefficient equipment in existing facilities of a Project Host have a specific implementation cost and finite savings benefit. The targeted IRR on EEP investments is totally dependent on an ability to properly: 1) evaluate the detailed technical and financial aspects of the estimated savings and costs of each EEP to determine if it can be implemented, operated and funded as designed, and 2) manage the project's implementation and operation to ensure the targeted savings are achieved. To ensure savings are sustained throughout the repayment term, the fund manager must M&V the savings through actively managing the ongoing operation of EEPs after implementation.

To complicate things for Project Hosts and LFIs, with the exception of waste heat (or gas) recovery power projects ("WHRPs") in industrial facilities, energy savings of EEPs cannot be measured with a simple meter because energy savings reflect the absence of energy use. Such can only be accurately determined from measurement before and after an EEP has been implemented. Furthermore, merely a simple direct comparison of 'metered' energy use before and after an EEP is implemented reflects many other variables unrelated to the EEP that could create large energy usage, especially in an industrial Host facility. Reliable M&V of EE savings can only be done with the establishment of the savings M&V Plan prior to the implementation of the EEP that establishes a realistic 'Energy Baseline' applicable to the facility conditions then in existence. The 'M&V' on EEP savings is equivalent to the 'Meter' on a power plant's kilowatt-hours (kWhs) generated, and it is the only reliable way to report the achieved EE savings.

The other unique characteristics of EEPs include:

- **Wide range of low-risk, proven technologies:** Most of these are proven technologies, with substantial evidence of successful implementation, internationally as well as in India.
- **Relatively small project size:** The capital costs of many projects falling below "less than INR 1 Crore" category is making it difficult (and not interesting) for bankers to finance. This financing opportunity is small when compared to other traditional opportunities.
- **Limited collateral value:** The primary value of EEPs is their ability to deliver long-term savings; the underlying equipment has very little market value for use by LFIs in meeting their traditional collateral needs.
- **Relatively short and simple payback periods:** Generally, the payback period is one to five years, which should make it easier to finance, but often LFIs are not too keen on lending small amounts for short term return projects coupled with lack of familiarity with the EEP appraisal complexities.
- **High proportion of project development costs: (also known as transaction costs).**EE projects have a relatively high proportion of "soft costs" that banks/FIs are reluctant to finance. These "soft costs" include the costs of project evaluation, project development, and contract negotiation; as well as costs of equipment replacement, plant shutdown, and training of maintenance personnel. These "soft costs" increase the financial resources required by EE project developers.
- **Range of business models for implementation:** with increasing interest in performance based approaches.
- **Manageable risks:** In most cases that can be controlled with proper tools. This requires collaboration between LFIs and ESCO/Host on how to manage these risks.

- **An Investment Grade Audit:** (IGA) is required, or in case of small EEPs, key elements of it.
- **M&V Plan:** is required along with the related baseline to measure and verify the savings achieved.

4.3. Primary Implementation Models

There are various types of models for a Project Host to implement EEPs. The adoption of a particular model is contextual and will depend on many factors such as type and scale of project, capacity of Project Host, maturity of the model, etc. Broadly, the models can be divided into two types: (a) corporate lending model; and (b) performance contracting model.

4.3.1. Implemented by Project Host

The implementation of comprehensive EEPs is generally adopted by large companies. These companies either have the internal capacity to identify the EEPs themselves or they hire a third party energy auditor (individual or firm). The energy auditor reviews the Project Host's existing facility systems and processes, identifies EE opportunities, and then prepares a detailed IGA which provides all details related to the savings and implementation costs for each of the final ESMs selected. Many EEPs are implemented by Project Hosts themselves and thus referred to as 'corporate lending model'.

Under this model, the financial commitment is made by the Project Hosts and the energy auditor is limited to being a technical advisor. Some audit-based models also include a success fee for the auditor, linked to actual realization of their estimated energy savings.

LFIs can use their traditional corporate finance procedures securitized by the Project Host's balance sheet, or guarantees or assets that have liquid collateral value. For the Project Host and the lender, the EEP is a normal capital expenditure eligible to be funded by a regular corporate loan.

4.3.2 Implemented by ESCO

A second model for implementation of EEPs is the 'performance contracting model' and is implemented by ESCOs. Solutions to many of the barriers and risks of implementing EEPs can come from vendors, contractors and ESCOs whose business model is to 'develop', finance and implement multiple EE technologies on a bundled basis at Project Host's facilities, and to raise payment for their services on the savings being achieved from the EEPs. The core fundamental concept of the ESCO business model is that the Host does not have to take any of the implementation risks for the EEPs and is only responsible to pay for the EEP's capital cost from actual savings it realizes from the EEPs.

ESCOs are sophisticated EEP developers responsible for an unusually wide spectrum of tasks, as they identify, design and finance the EEPs; install and supervise the maintenance of most of the EE equipment/technologies; measure and monitor the project's energy savings; and assume the performance risk that ESMs perceive in EEP will reduce the 'Project Hosts' energy and operating costs at a sufficiently high level to repay the capital

costs. ESCOs must perform rigorous M&V on the energy savings over their EEP's financing repayment term in order to prove the achievement of savings to the Project Host and manage its risk of the estimated savings being achieved.

ESCOs provide their services under a model called ESPC, which is a form of innovative financing for capital investments that allows funding of EEPs to be paid from savings. These models are normally used by ESCOs. Performance guarantees are given by the ESCO in terms of level of energy service or the level of cost and/or energy savings. In certain models, the savings are split between the ESCO and the host who could potentially reinvest savings into additional EE improvements.

The single greatest benefit of the ESCO model is the ease of selling it to Hosts because of the "no risk", "no investment" and "paid-from-savings" proposition. The Shared Savings structure is the most beneficial to Hosts because they assume no risk, no obligation to repay the Lender (thereby not impacting their credit capacity) and they do not have to pay the ESCO if savings are not sufficient to pay the debt service. The ESCO model also benefits Hosts by eliminating the technology risk versus doing it themselves, because the ESCO provides engineering-based savings and financial proforma estimates, the majority of which they are willing to guarantee. Another benefit is that many EEPs include infrastructure-related improvements that need to be carried out in any event. This can lead to the Project Hosts being able to eliminate or significantly reduce their internal capital budget for improvements.

Like most project developers, ESCOs distinguish working capital from project financing. Working capital is used for general corporate purposes and for the front end development of EEPs prior to construction, and project financing is used to pay for the ESCOs capital cost investment in the EEPs. Consequently, the need for project-based and non-recourse financing of the EEPs they develop and implement is essential to the viability of the ESCO industry in India.

The typical time for an ESCO to implement an EEP with a Project Host under the ESPC model can be anywhere from 12 to 24 months as illustrated below[10]:

- Initial call to feasibility agreement 2 to 3 Months
- Complete investment grade audit 2 to 6 Months
- Close ESPC agreement and project financing 2 to 3 Months
- Total development time 6to 12 Months
- Project commissioning time 6 to 12 Months
- Total project implementation time 12 to 24 Months

The typical steps for an ESCO to develop fund and implement an EEP under the ESPC model is shown in Table 4.

[10] Thomas K. Dreessen: EE Finance Capacity Building Workshops for ADB, Indonesia Exim Bank, USAID-ICED Indonesia ESCO Regulations.

Table 4: ESPC Development Cycle for an EEP

Sr.No.	Step	Remarks
1	Initial meeting with Project Host[11]	Assuming a third party, ESCO is developing and implementing the EEP, ESCO screens the Project Host for interest and EEP opportunity.
2	Is Project Host credit worthy	Obtain credit assessment of analysis by a prospective LFI for long-term EEP financing. If Yes, go to Step 3. If No, no further actions.
3	ESCO reviews energy usage data provided by Project Host	ESCO collects historical energy use for two to three years and checks for any anomalies.
4	ESCO conducts walk through audit	ESCO performs a walk through audit of site to observe operating conditions and asks questions relevant to EE opportunities.
5	ESCO prepares energy efficiency report (EER)	EER provides approximate scope of savings and cost reduction potential and is used to screen potential ESMs to be included in EEP.
6	Present EER to Project Host	Key assumptions and figures are confirmed upon which potential savings are estimated.
7	Do energy savings justify an EEP to be implemented under an ESPC?	If Yes, go to Step 8. If No, no further action is taken.
8	ESCO signs Letter of Intent(LOI)	ESCO presents a LOI to Project Host containing terms and conditions for ESCO to carry out an IGA. It includes such things as scope of work, IGA fee reimbursement and minimum criteria to be met by IGA such as IRR for Project Host, minimum savings and so on.
9	IGA, also known as a Detailed Energy Study (DES), is prepared by ESCO	ESCO takes four to eight weeks to complete the IGA.
10	IGA meets minimum criteria in LOI	If No, ESCO stops work with no IGA fee paid by Project Host unless Project Host elects to continue to Step 11. If Yes, go to Step 11.
11	Project Host agrees to implement EEP in IGA with ESCO	If No, Project Host pays IGA fee in LOI. If Yes, go to Step 12.
12	ESCO secures financing of EEPs	If No, and no fault of Project Host, ESCO stops work with no IGA fee from Project Host. If No, due to fault of Project Host, Project Host pays IGA fee in LOI. If Yes, go to Step 13.
13	ESCO and Project Host execute ESPC Agreement and ESCO implements EEP	If No, Project Host pays IGA fee in LOI If Yes, go to Step 13
14	Post implementation - M&V	-

See Section 5 for more details on the ESCO business model.

[11] The project hosts are the residential, commercial, industrial, municipal and institutional organizations that use energy in various forms and for various activities in their facilities.

4.4. Investment Grade Audit

As per the Energy Conservation Act 2001, Energy Audit is defined as "the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption". It is an inspection, survey and analysis of energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s). It provides a benchmark (reference point or baseline) for managing energy in the organization.

An IGA or DES is a detailed report defining the various energy and cost saving measures (ESMs) and the capital cost investment required for the implementation of ESMs. It also provides details about suppliers of the proposed EE technologies identified, contact information, and financial analysis. The purpose of an IGA is to provide Project Hosts, lenders and investors with all the critical information needed to evaluate the technical and economic feasibility of an EEP.

An IGA is the foundation for the successful implementation and financing of an EEP on a sustainable basis. It documents the details of all estimated savings and costs for each energy savings technology or measure to be implemented in an EEP. The details include all major calculations, assumptions and most importantly, the M&V methodology to be followed in calculating the savings realized by a Project Host. In a project, savings-based funding becomes the basis for payments being made by the Project Host to an ESCO, lender and/or investor.

An IGA should minimally include:

- Description of the energy profile of each facility[12]where the EEP is being implemented, to include a list of current major energy consuming equipment, how and where most of the energy is consumed by type of fuel or utility.
- Description of each proposed measure in the EEP, including detailed calculations and assumptions supporting estimated savings, operating costs and design/build and any other project costs (must include contractor/vendor cost quotes and contract terms).
- Detailed energy baseline for each impacted fuel/utility and a reconciliation of estimated savings for each ESM to the Project Host's current energy consumption and costs.
- Description of the EEP's equipment and responsibilities of all major parties during and after construction completion, including the Project Host, ESCOs, contractors, vendors, and/or other implementing entities.
- Detailed savings calculation methodology and the related M&V Plan to support any Project Host payments.

A template for table of contents for an IGA Report is given in **Annex2**[13].

In India, companies choose energy auditors based on the accreditation carried out by the BEE which has developed clearly specified criteria for entities that are eligible to become

[12] Facility corresponds to any type of buildings such as municipalities, government buildings, private buildings, industries, institutions etc.,

[13] Thomas K. Dreessen: EE Finance Capacity Building Workshops for ADB, Indonesia Exim Bank, USAID-ICED Indonesia ESCO regulations.

energy auditors[14]. An energy auditor shall be considered for accreditation if, he/she is a certified manager and has passed the examination in "Energy Performance Assessment for Equipment and Utility Systems" conducted by the Bureau, besides meeting other criterions[15].List of accredited energy auditors[16]and certified energy managers[17] is published on BEE website.

4.5. Savings M&V

M&V is essential to confirm the energy savings of EEPs and to validate that the anticipated or guaranteed performance has been achieved. M&V is required to calculate achieved energy savings with any degree of accuracy or reliability and is essential to quantifying the benefits of an EEP for the existing parties by reducing uncertainty. It is especially important for ESPCs in terms of reducing savings dispute and the related resolution costs.

The energy savings of EEPs are calculated in a unique manner as savings are based on the absence of energy use and thus cannot be directly measured like kWhs generated from the traditional power or renewable energy supply-side project. Savings are determined by analyzing the measured energy use after implementation of an EEP versus the energy baseline, representing the energy usage and rates in effect prior to the implementation of EEP.

An adequately prepared M&V Plan is required for EEPs and must include a set of basic definitions, terminology and procedures so that all stakeholders are at the same level of understanding. It allows for corrective steps or remedial measures at appropriate stages to avoid any default in the repayment of principal and interest. It also improves the communication and understanding among the project implementing parties.

There are several common factors affecting the saving performance of EEPs that M&V attempts to overcome:

- Predictability, measurability factors such as weather, occupancy, equipment intensity, ability of ESMs to deliver savings, implementation effectiveness, occupant - cooperation, equipment deterioration and life.
- Evaluating savings uncertainty - Instrumentation error, modeling error, sampling error, planned and unplanned changes.
- Minimum energy standards - To achieve minimum energy standards by smaller firms and start up organization would be difficult.
- Energy prices - Fluctuation in energy price is an issue in M&V.

[14] www.beeindia.in/energy_managers_auditors/documents/exam/Draft%2013thExam_advertisement.pdf

[15] More details on Bureau of Energy Efficiency Regulations (qualifications for accredited energy auditors and maintenance of their list), 2010 are available at: http://beeindia.in/energy_managers_auditors/documents/accreditation/Procedures%20for%20Qualifications%20for%20Accredited%20Energy%20Auditors%20and%20Maintenance%20of%20their%20List.doc

[16] http://www.beeindia.gov.in/content/accredited-energy-auditors. Accessed on October 18, 2016. For latest list please refer to BEE website

[17] http://www.beeindia.gov.in/sites/default/files/energy-managers.pdf. Accessed on October 18, 2016.For latest list please refer to BEE website

- Credible third party verification is crucial for M&V, any third party issues should be resolved and corresponding clauses should be added to the M&V document to smooth processes.
- Baseline adjustments should be carried out based on acceptable protocols.

An overview of M&V follows with more detailed explanations provided in **Annex3.**

4.5.1 M&V PROTOCOLS

The major protocols developed in the marketplace for measuring and verifying savings of EEPs are as follows:

- The International Performance Measurement and Verification Protocol (IPMVP) is a document containing generally accepted principals to measure, verify and calculate the energy savings of EEPs contained or referenced in virtually all other protocols. IPMVP provides guidelines, definitions and an overview of current best practice techniques for verifying the results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. It is often referenced as a best practice protocol and is a Normative Reference in TC257 documents of ISO 500001. The core principles of IPMVP are summarized in IPMVP Core Concepts and can be downloaded at: www.evo-world.org/.

- The central U.S. Federal M&V Document, the Federal Energy Management Program's (FEMP's) M&V Guidelines: Measurement and Verification for Federal Energy Projects, Version 3.0, provides procedures for quantifying the savings resulting from the installation of energy conservation measures. www.eere.energy.gov/femp/pdfs/mv_guidelines.pdf

- *California Public Utilities Commission Energy Efficiency Evaluation Protocols* has been developed by the state of California to monitor energy usage, and energy savings.www.cpuc.ca.gov/nr/...f01a.../caenergyefficiencyevaluationprotocols.doc

- The Australasian Energy Performance Contracting Association (AEPCA) and the Australian Department of Industry, Science and Resources published a comprehensive guidebook, the Australasian ESPC M&V Guide, used in Australia for M&V of performance contracts.www.industry.gov.au/energy/Documents/best-practice guides/energy_bpg_energy_performance_contracts.pdf

- The CDM methodologies are the M&V methodologies approved by the United Nations Framework Convention on Climate Change (UNFCCC).http://cdm.unfccc.int/methodologies/index.html

In general, the above protocols should be considered as living documents that may need to be updated and revised periodically as evaluation approaches change and technology evolves.

4.5.2 Calculation of Energy Savings

Achieved energy savings from an EEP in a commercial building or an industrial plant facility are determined by comparing energy usage before and after the EEP's complete installation. The period before is referred to as the baseline and the period after is referred to as post-installation or the performance period. The determination of savings includes adjustments for independent variables that affect energy usage in the facility but are not caused by or related to the EEP. These kinds of adjustments include changes between the baseline and performance period for such things as weather and occupancy conditions for commercial buildings and the type of products manufactured, number of operating shifts, raw materials consumed and load requirements for industrial facilities.

The analysis of energy usage for baseline and post-installation conditions in determining savings can be accomplished by applying one of IPMVP's four M&V options, as explained below in Section 4.5.4.Selecting the best option and determining the desired level of accuracy within each option for calculating the potential savings, depends on the complexity of the ESMs, the potential for performance changes, and the estimated value of savings.

4.5.3 Baseline

A baseline is considered as a reference as it allows the ESCO/Host to compare the energy performance (consumption) before (baseline period) and after (performance period) a change is made to the site or system.

The baseline usually establishes the "before period" by capturing a site or a system's total energy use prior to implementing ECMs/ESMs. The baseline estimation should account for energy affecting factors both external and internal like temperature or production volume. If the baseline is not established before implementing the ECMs/ESMs, it is difficult for the ESCO/Host to justify the investment made on ECMs/ESMs due to its absence to estimate the energy savings and costs.

The reasons for establishing the baseline serve are:

1. It provides a clear picture and a summary of the performance of site or system before and after implementing the ECMs/ESMs. The difference in energy consumption between the baseline period and the performance period with respect to standard environment factors for both the periods, decides the outcome of the implementation of the ECMs/ESMs.
2. It allows ruling out the factors not affecting the energy performance levels of site or system.
3. It facilitates energy and costs forecasting through simulation by altering the values of the energy affecting factors.
4. It enables monitoring and verifying savings from energy efficiency projects.

The level of efforts vary in establishing the baseline for site or system as it is based on the various factors namely, the source, amount and the cost of energy consumed, the operating efficiency of the equipment(s), the production or usage levels, the external factors (the

ambient conditions – largely weather and occupancy), etc. Therefore, it is essential to identify and finalize the key energy affecting factors during the baseline estimation. The energy audit is the key step in establishing the baseline. A rigorous methodology for data collection and its analysis and documentation based on the established practices will enable the establishment of a robust baseline.

During the baseline establishment process, it is critical to identify the impact of change in the key factors affecting the baseline energy performance. This is essential as it facilitates a change, an update or modification in the baseline to reflect the conditions prevailing during the performance period (i.e., after the implementation of ECMs/ESMs).

A robust baseline will allow relevant parties (Hosts, ESCOs, and Financing Institutions) to make timely and informed decisions besides true assessment of performance. The most difficult aspect of M&V for project host is to understand that the baseline energy consumption needs to be changed, updated or modified to reflect the changes in the environment of ECMs. The same is illustrated in the following example.

The energy consumption, and hence savings, of a new energy efficient chiller is directly related to the amount of conditioned space the chiller is servicing. If the host has constructed an extension to its facility and has air-conditioned the extended space using the same systems serviced by the new chiller, it is reasonable to expect that the chiller will consume more energy. By understanding the relationship of conditioned space to cooling requirements, the baseline energy consumption can easily be adjusted and accommodated by modifying the baseline and guaranteed energy savings.

A good M &V Plan should stipulate the following in detail as regards the baseline:

- Baseline energy consumption of the existing systems (prior to introduction and implementation of ECMs).
- Formulas and procedures for determining baseline energy consumption.
- Adjustment factors to be applied to the baseline energy consumption. These are factors that could reasonably be expected to increase or decrease energy usage, outside the control of the ESCO, such as changes in outdoor temperature for air-conditioning, increase in production or changes in occupancy.
- Formulas and procedures for determining the post-ECM installation energy consumption.
- Procedures for performing the statistical validation and level of anticipated accuracy of results.

The energy savings are determined by calculating the difference between the energy measured in the baseline period (pre-retrofit) and performance period (post-retrofit) after accounting for differences in non-ECM factors between the two periods.

In general, the equation for estimating the energy savings is:

Savings = (Baseline Energy Use - Post Retrofit Energy Use) $\pm$ Routine Adjustments $\pm$ Non-Routine Adjustments

Where,

Post Retrofit Energy Use = Energy consumption measured before the energy saving project implementation period

Baseline energy = Energy consumption measured during the baseline period

Routine Adjustments = Adjustments due to regular changes in independent variables (e.g., changing weather conditions, varying production levels)

Non Routine Adjustments = One - off or infrequent changes in energy use or demand occurring due to static factors (e.g., alterations to equipment's, extremes weather changes)

The inclusion of adjustments is one of the critical elements of the M&V process. This is a step often overlooked or ignored by project hosts seeking a quick and low cost outcome.

The following example illustrates the importance and the need for adjustments.

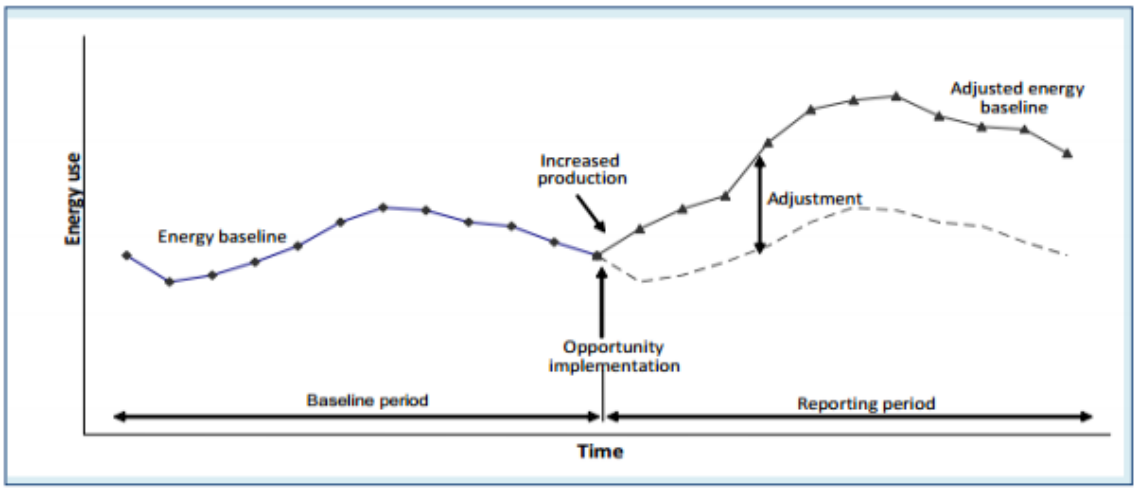

Figure 1: Energy consumption during baseline and project period

The actual post - retrofit energy consumption (in equivalent kWh) of the manufacturing unit is found to be greater than the actual baseline energy consumption even after the implementation of ECMs. In other words, it appears that the retrofit project has failed to save energy.

However, since the annual energy consumption is dependent on its annual production volume, in order to compare apples to apples, the baseline energy consumption needs to be adjusted to post-retrofit operating conditions. To forecast the energy baseline, the current energy baseline was adjusted for the production increase. The dashed line shows the forecast energy baseline, had the production level not been adjusted for an increase for the post-retrofit operation conditions (source: IPMVP 6).

Similarly, establishing a baseline for a "Greenfield" (newly built) energy efficiency project is critical for developing its M&V Plan. The establishment of a baseline for M&V of a Greenfield project can be based on some of the parameters listed in the following section.

Energy Regulations, Codes and Standards - The use of available energy regulations, codes, and standards is encouraged in order to provide a convenient, clearly defined, and consistent baseline energy use.

Common Practice - Under certain circumstances, the use of “standard practice” or “market standard” may be more appropriate for baseline development. The key issue is to have the actual baseline development process well-documented and replicable.

Performance of Similar Systems (or Buildings) without any of the Proposed Energy Savings Measures Implemented - The use of standard technologies are often documented for use in similar systems or facilities and in similar economic sectors. A similar system or facility which already exists in close proximity or with comparable conditions to the Greenfield project would likely have been duplicated if not for the EEDSM project planned for implementation.

A Benchmark Determined by a National Policy, Regulation of Administration and/orJurisdiction - This case is especially important when grant for a new (Greenfield) project is introduced.

Calibrated Simulation M&V Option - The calibrated simulation M&V option could typically be used if a baseline or reporting period data are unreliable or unavailable, as is the case for Greenfield EEDSM.

When using the calibrated simulation option, in all cases, the project baseline energy use must be determined by energy use simulation, calibrated to assessment period measured energy use. The baseline energy use shall represent the energy use which would have occurred if the EEDSM project had not been integrated into the design.

This means that the baseline for Greenfield projects should be developed using comparable data in a simulation representing conditions if the EEDSM was not integrated into the design. Greenfield project energy impacts are determined by comparing the assessment period energy use to the projected baseline energy use under similar operational conditions.

For a mixed Brownfield and Greenfield project, the M&V Plan needs to clearly define M&V activities and electricity metering strategies.

Energy data from a calibrated simulation option can take the place of the missing data, for either part or all of the facility. But the use of calibrated simulation option is not only restricted to where data availability is problematic. The measurement boundary could in some instances, be changed to the extent that sufficient data may be available to use the specific option. The use of this option would usually apply where the number of energy governing factors influencing the energy savings measure is more to use any other option.

4.5.4 M&V Options

There are four fundamental M&V approaches, globally referred to as IPMVP’s four options

that are summarized in Table 5[18]. If only a specific scope of system is measured and evaluated, not involving the whole system, it is considered as retrofit isolation. If the performance of a part or several parts of the facility affecting the whole facility and energy consumption are evaluated, this is a whole facility approach.

Table 5: IPMVP's Four Options

Retrofit Isolation	Whole Facility
Option A - Partial and/or one time measurement	Option C - Energy analysis of the whole facility
Option B - Periodic or continuous measurement	Option D - Computer simulation

Choosing an M&V option involves many considerations including the location of each ESM's measurement boundary. If it is decided to determine savings at the facility level, Option C or D may be preferred. However, if only the performance of ESM itself is of concern, a retrofit-isolation technique may be more suitable (Option A, B, or D). The energy quantities in different saving equations can be measured by one or more of the following techniques:

a. Utility or fuel supplier invoices or reading utility meters and making the same adjustments to the readings that the utility makes.
b. Special meters isolating an ESM or portion of a facility from the rest of the facility; note: measurements may be periodic for short intervals or continuous throughout the baseline or reporting periods.
c. Separate measurements of parameters used in computing energy use.
d. Measurement of proven proxies for energy use.
e. Computer simulation that is calibrated to some actual performance data for the system or facility being modelled.
f. If the energy value is already known with adequate accuracy or when it is more costly to measure than justified by the circumstances, then measurement of energy may not be necessary or appropriate. In these cases, estimates may be made of some ESM parameters, but others must be measured (Option A only)[19].

An overview of the above four M&V options is provided in Table 6.

[18] IPMVP coré concepts document at: www.evo-world.org/
[19] Section 6.1 of IPMVP Core Concepts.

Table 6: Overview of IPMVP Options[20]

IPMVP Option	How Savings Are Calculated?	Typical Applications
A. Retrofit Isolation: Key Parameter Measurement		
Savings are determined by field measurement of the key performance parameter(s), which define the energy use of the ESM's affected system(s) or the success of the project. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period. Parameters not selected for field measurements are estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter is required. The plausible savings error arising from estimation rather than measurement is evaluated.	Engineering calculation of baseline and reporting period energy from short-term or continuous measurements of key operating parameter(s) and estimated values routine and non-routine adjustments as required.	A lighting retrofit where: 1) Power draw is the key performance parameter that is measured periodically. 2) Lighting operating hours are estimated based on facility schedules and occupant behavior.
B. Retrofit Isolation: All Parameter Measurement		
Savings are determined by field measurement of the energy use of the ESM affected system. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.	Short term or continuous measurements of baseline and reporting period energy, or engineering computations using measurements of proxies of energy uses. Routine and non-routine adjustments as required.	Application of a variable speed drive and controls the motor to adjust pump flow. Measure electric power with a kW meter installed on the electrical supply to the motor, which reads the power every minute. In the Baseline period, this meter is in place for a week to verify constant loading. The meter is in place throughout the reporting period to track variations in power use.

[20] Table 2 in Section 6.1 of IPMVP Core Concepts.

IPMVP Option	How Savings Are Calculated?	Typical Applications
C. Whole Facility		
Savings are determined by measuring energy use at the whole facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period.	Analysis of whole facility baseline and reporting period (Utility) meter data. Routine adjustments as required, using techniques such as simple comparison or regression analysis. Non-routine adjustments as required.	Multifaceted energy management program affect many systems in a facility. Measure energy use with the gas and electric utility meters for 12 months baseline period and throughout the reporting period.
D. Calibrated Simulation		
Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility. Simulation routines are demonstrated to adequately model actual energy performance in the facility. This option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data. (Energy end use metering may be used to help refine input data.)	Multifaceted energy management program is affecting many systems in a facility, but, where no meter existed in the baseline period. Energy use measurement, after installation of gas and electric meters, is used to calibrate a simulation. Baseline energy use, determined by using the calibrated simulation, is compared to a simulation of reporting period energy use.

5. ENERGY SERVICE COMPANIES

BEE defines an ESCO as an organization engaged in a performance based contract with a Host firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner[21].

As stated above in Section 4.3.2, ESCOs provide one of the better solutions to many of the barriers and risks of implementing EEPs because they develop, finance and implement multiple EE technologies on a bundled and turnkey basis at Project Host's facilities and risk payment for their services on the savings being achieved from the EEPs. The fundamental core concept of the ESCO business model is that the Host does not have to fund any of upfront capital cost for the EEPs and is only responsible to pay for this investment from actual savings it realizes from the implemented EEPs. ESCOs provide their services under the ESPC model which is described below.

5.1 ESCO Services

ESCOs may provide a variety of services depending on the Project Host's capabilities and desire to manage the EEP itself or through a third party. Figure 2 illustrates the main services.

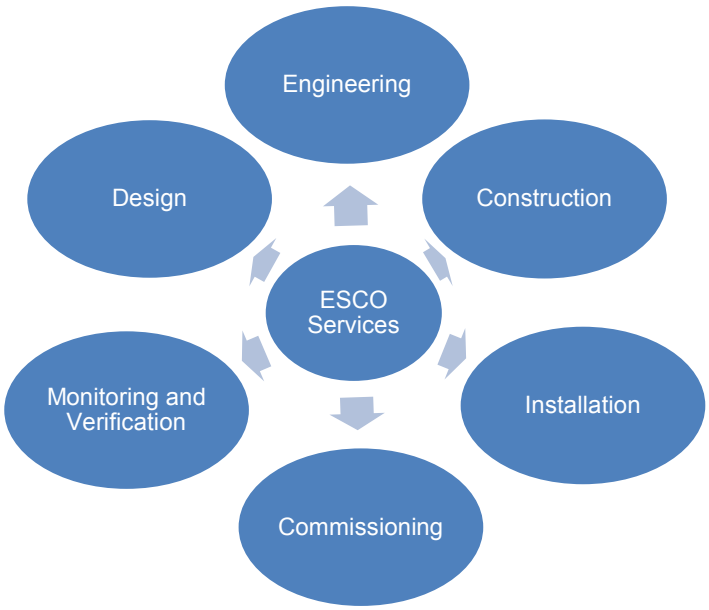

Figure 2: ESCO Services

ESCOs also provide other optional services as shown in Figure 2.

[21] www.crisil.com/ratings/energy-service-companies-gradings.html

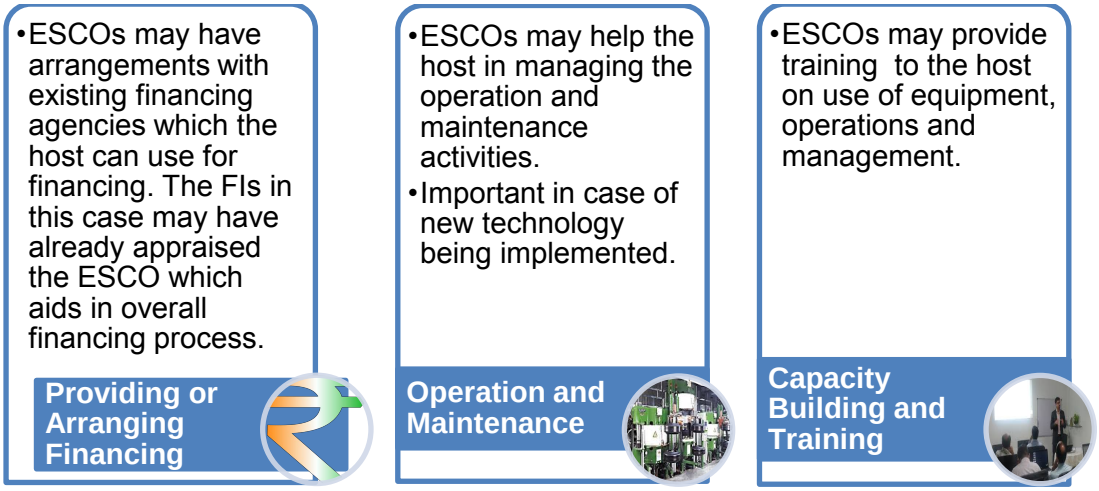

Figure 3: Optional Services Provided by an ESCO

ESCO Empanelment and Grading

BEE initiated empanelment of ESCOs to assist Project Hosts in implementing energy efficiency projects in their existing facilities.

In order to create a sense of credibility among the prospective agencies that are likely to secure the services of an ESCO as well as the financial institutions, BEE has undertaken a process of rating the ESCOs in terms of their capacity and experience in the implementation of energy efficiency projects based on performance contracting, availability of technical manpower, financial strength, etc. The rating exercise was done through SEBI accredited agencies of CARE, CRISIL and ICRA. The results of the exercise are being made available in public domain and to the various State Governments/SDAs, so as to facilitate them in implementing EE programs in their respective states.

The rating agencies developed an accreditation methodology which involved an assessment of business risk (track record and market position), organizational setup and financial capability of the organization and accrediting the ESCOs on a five point grading scale. The assessments of the ESCOs on each of the parameters are a holistic one, designed to evaluate the organizational capability for handling the ESCO assignment. Through the evaluation exercise the rating agencies have also provided their recommendations that would aid in overcoming barriers to performance contracting.

CRISIL, ICRA, and CARE Grading

Definition of the grading

CRISIL, ICRA and CARE define ESCO grading as “An ESCO grade reflects the rating agencies’ opinion on the ability of the graded energy service company to undertake energy efficiency projects.”

Methodology

CRISIL, ICRA, and CARE graded a set of ESCOs that have then been empaneled with BEE. The grading is expected to aid ESCOs in being able to successfully bid for energy service projects and to arrange financing for the execution of such projects.

The grading scale is defined below.

ICRA/CRISIL-BEE Grading	Definition
GRADE 1	Very High
GRADE 2	High
GRADE 3	Good
GRADE 4	Below Average
GRADE 5	Poor

The entities are accredited at a particular grade depending on the following cut-offs.

CARE-BEE Grading	Score
GRADE 1	85-higher
GRADE 2	70-84
GRADE 3	55-69
GRADE 4	40-54
GRADE 5	0-39

Criteria for Assessment

The parameters for assessment include:

- Years in the ESCO/energy management business.
- Number and nature of energy audits carried out till date.
- ESCO profile.
- Number of different industries served.
- Order book strength as measured by ratio of current order book/previous year's turnover.
- Number of energy management projects completed.
- Certification and quality systems.
- Technology tie-ups.
- Patents held by the company.
- R&D facilities.
- Constitution, ownership structure and parentage.
- Management evaluation and quality of organizational structure, internal control and systems.
- Employee strength in terms of numbers, qualification and experience.
- Number of certified energy auditors.
- Maximum number of projects handled at a time.
- Annual turnover from the ESCO/energy management business.

- Profit margins of the ESCO business.
- Overall financial strength as reflected by the capital structure and debt servicing indicators like net cash accruals/total debt.
- Receivables management.
- Financial flexibility arising from access to cash-flows/profits from other business.

A 100 point scale has been devised based on the above parameters. The weightages assigned to the various broad parameters for grading exercise are as follows:

Parameter	Weightage
Track Record and Market Position	40
Organizational Risk	25
Financial Risk	35

For carrying out the evaluation of the ESCOs on these parameters, CRISIL, ICRA and CARE have obtained data after carrying out meetings with key officials in the technical, marketing and financial functions of these companies. Further, feedback has also been taken from hosts as well as bankers.

BEE has empaneled139 ESCOs and the list of empaneled ESCOs is included as an Addendum to this report[22]. For the latest list of empaneled ESCOs, please refer to the BEE website[23].

5.2 ESCO Primary Business Models

Despite countless project-structuring options with Project Hosts for ESCOs, two performance-based financing structures have emerged as the most common ones used by ESCOs, which are Guaranteed Savings and Shared Savings.

Guaranteed Savings is the most commonly used structure employed in the United States and Shared Savings is mostly used in developing markets (like India).Other less-frequently used schemes are the Deemed Savings and Outsourced Energy Management Services models which are described briefly below and in more detail in **Annex4.** In all structures, ESCOs develop, implement and provide or arrange financing for the upfront EEP capital cost investments for the Project Hosts. Repayments from savings allow the Project Hosts to compensate the ESCO's ongoing costs (including M&V costs).

5.2.1. Guaranteed Savings Structure

Guaranteed Savings is an arrangement whereby the Project Host finances the EEP directly; typically with a third party entity (Lender), in exchange for the ESCO providing a guarantee to the Project Host that it will realize sufficient savings to cover its debt service payments to the Lender. If the realized savings fall short of the debt service payments, the ESCO will reimburse the Project Host for the shortfall. If the realized savings exceed debt service, the

[22] Information provided by BEE
[23] http://www.beeindia.gov.in/content/escos-0

ESCO typically shares a portion of the excess, usually expressed as a percentage share with the amount depending on the risk taken and the extent of ongoing services provided by the ESCO. It should be noted that under the Guaranteed Savings approach the ESCO bears no direct contractual obligation to repay the Lender, but that the Project Host does. In other words, the ESCO's guarantee is not a guarantee of payment to the Lender, but is a guarantee of savings to the Project Host.

The Guaranteed Savings structure is typically viable only in countries with a high degree of familiarity and confidence with EE technologies, local implementation expertise and the availability of commercially-attractive financing. The Guaranteed Savings concept is difficult to initiate in markets where EE is not well known or the ESCO concept is being introduced because it requires Project Hosts to assume investment repayment risk of the EEPs based on the savings performance of unknown EE technologies. This structure fosters the long-term growth of the ESCO and finance industries because it enables ESCOs, mostly SMEs, with limited credit history and capital resources, to develop and implement savings-based EEPs.

Guaranteed Savings evolved in the U.S. from the initial Shared Savings structure in response to government Project Hosts, who could access low-cost, tax-exempt financing and desired to significantly reduce interest costs. It was embraced by smaller ESCOs and financial institutions to allow them to grow their respective industries. The primary benefit of this structure is that it reduces financing cost and enables a lot more investment in the EEPs to be made for the same debt service level. The public sector normally prefers this structure in order to maximize the amount of infrastructure investment made in its facilities that can be repaid from utility costs in its operating budget.

5.2.2 Shared Savings Structure

Shared Savings is an arrangement whereby the ESCO (as opposed to the Project Host) finances the total upfront capital cost of the project and is totally responsible to repay the Lender. The Project Host pays a fixed percentage or amount of its realized savings from the project to the ESCO. This is sufficient for the ESCO to repay its debt service to the Lender (or equity IRR to an investor), to cover M&V costs, and to provide compensation to the ESCO for performing its ongoing services throughout the ESPC agreement term. Under this structure (as opposed to the Guaranteed Savings model), the Project Host has no contractual obligation to repay the Lender; but the ESCO does. It should be noted that this structure creates more risk for the ESCO because it requires ESCO to not only assume the project performance risk, but also Project Host credit risk. The Shared Savings approach typically requires an equity investment, which in combination with the higher risk assumed by the ESCO, carries a much higher finance cost than the Guaranteed Savings structure.

The Shared Savings structure is a typical introductory structure for developing markets like India because Project Hosts, with a lack of knowledge and confidence in EEPs and ESCOs, do not want to risk their core capital or credit capacity on EEP investments. ESCOs (mostly SMEs) are forced to raise substantial amounts of equity for their EEPs in order to grow, resulting in balance sheets that more resemble LFIs and leasing companies than what they are, service companies. However, it should be noted that even ESCOs with relatively large balance sheets (e.g., Siemens and Honeywell) are unwilling to assume the Project Host credit

risk required in this structure. Consequently, the Shared Savings structure limits long-term market growth for ESCOs and LFIs.

A more detailed description of the different ESCO business models is provided in**Annex4.**

5.3 M&V in an ESPC Agreement

The purpose of M&V in an ESPC Agreement is to minimize risks by reducing uncertainty and allocate risks to the Project Host, ESCO and the lender or investor. M&V is the last operational step in an ESCO business scheme and it must be specifically defined or explained in the M&V Plan included in the IGA. The M&V Plan should describe how the project's performance will be evaluated and by whom. The M&V Plan development includes the establishment of an energy baseline, which is a fundamental part of an EEP and must be detailed in the IGA. The M&V Plan development is an effort that requires cooperation between the ESCO and the Project Host. The results of M&V efforts need to consider the Project Host and ESCO's risks for cost-effectiveness purposes.

The Best Practice Guide to Energy Performance Contracts was developed by the Australasian Energy Performance Contracting Association (AEPCA) and can be downloaded at: www.industry.gov.au/energy/Documents/best-practice-guides/energy_bpg_energy_performance_contracts.pdf

Please refer **Annex 2** of the report on Developing Model ESCO Performance Contract for Industrial Projects[24] and **Annex 5** for M&V Template.

[24] http://shaktifoundation.in/wp-content/uploads/2014/02/Final-Report-ESCO-EPC1.pdf

6. FINANCING OF EEPS

6.1 EE Financing Frameworks in India

Current lending practices of LFIs in India are the same as in all other countries around the world. LFIs apply their traditional asset-based lending approach to EEPs, which limits the loan amount to a maximum of around 70 percent of the assets financed and requires collateral with a value in excess of the loan amount. Unfortunately, there is very little or no collateral value in the actual EE equipment that replaces inefficient equipment at a Project Host's facility. However, there is significant value in the long-term cash flow generated and realized by Project Hosts from the EEPs. The problem is most LFIs do not recognize, understand or believe that EEPs will generate the expected future savings; they are not willing to rely upon the newly-generated cash flow from the EEPs as a basis for Project Hosts to repay the EEP loans. Consequently, LFIs typically assign little or no value to the future cash flow generated and thus require Project Hosts to use their core business credit and collateral capacity to finance EEPs.

As stated in the Financing Barriers Section 1.2, this traditional lending approach by LFIs for financing EEPs is very unattractive to Project Hosts, ESCOs and other third parties and is thus one of the main barriers to the limited EEP implementation in India.

The Government of India launched two schemes - Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE) in 2015 to encourage the financing of EE projects with special emphasis on ESCOs.

The PRGFEE is a risk-sharing mechanism to provide FIs (banks/NBFCs) with a partial coverage of risk involved in extending loans for energy efficiency projects. The GOI has approved INR 312 crores for PRGFEE[25].The guarantee provided by the fund will directly support financing of energy efficiency projects by:

- Addressing the risks and barriers faced and/or perceived by the financial institutions to financing ESCOs for implementing ESPC-based EE projects in India.
- Engaging Participating Financial Institutions (PFIs) and building their capacity to finance EE projects on a commercially sustainable basis.
- Engaging commercial financial institutions and building their capacity to finance energy efficiency projects on a commercially sustainable basis.

MOP notified PRGFEE Rules in May 2016[26].

[25] Brochure on PRGFEE, prepared by BEE with support from USAID-PACE D TA

[26] http://www.beeindia.gov.in/sites/default/files/PRGFEE%20rules%20notified_26%20May%202016.pdf

Table 7: PRGFEE Eligibility and Guarantee

Eligibility[27]
Seek to achieve demonstrable energy savings and mitigation in emissions of greenhouse gases
Propose a viable method to monitor and verify energy and greenhouse gas emission savings
Be a new project, not refinancing existing projects or any outstanding obligations of the eligible borrower
Use viable technology and be developed with competent energy audit/feasibility studies
Project must be implemented by BEE empaneled ESCO on performance contracting mode where there is a defined agreement which link payment to certain level of energy savings. The sectors covered under PRGFEE include government buildings, private buildings having multistorey commercial or multistorey residential accommodations, municipalities, small and medium enterprises and industry.
Minimum 70 percent of the eligible loan amount should be towards the cost of the investments required for implementation of the EE project. The project can be a joint project of Renewable Energy and Energy efficiency with a component of 50 percent for the cost of the investments required for implementation of the EE project as above and 50 percent for RE and other costs.
Loan amount below INR 5 Lakh will not be considered under PRGFEE
Guarantee Available
PFI can take guarantee from the implementing agency (IA) before disbursement of loan to the borrower.
The Fund shall give a guarantee for a maximum 50 percent of the loan, subject to the principal amount actually disbursed, provided, by the PFI and in case of EE account becoming NPA, the fund shall: • Cover the first loss subject to maximum of 10 percent of the total guaranteed amount • Cover the remaining default outstanding principal amount actually disbursed amount on pari-passu basis up to the maximum guaranteed amount. PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower i.e. ESCO subject to payment of guarantee fees. The Guarantee for any one project shall not exceed INR 10crores per project or 50 percent of the sanctioned loan amount (subject to the principal amount actually disbursed), whichever is less. The PRGFEE Guarantees issued in favour of the PFIs shall not be deemed to automatically cover any top-ups or additional loans provided to the Borrower.
The maximum tenure of the Guarantee will be five years from the date of first disbursement of the EE Loan or the last date of the operational period of PRGFEE i.e. FY 2025-2026 whichever is earlier.

The Venture Capital Fund for Energy Efficiency (VCFEE) provides equity support in EE projects government buildings, private buildings (commercial or multistorey residential buildings) and municipalities. The Government of India has approved INR 210 crores for VCFEE. It allows private venture fund players to capitalize the transaction costs associated with specific EE investments. This fund helps to maximize the investment in EE sector and creation of market for innovative EE technologies. The main beneficiaries of VCFEE are ESCOs and companies that are planning to carry out the EE projects successfully.

[27] http://www.recpdcl.in/prgfee/projects.html

Key features of VCFEE include:

- The fund will invest in the form of equity.
- A single investment by the fund shall not exceed INR 2 crores.
- The fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15 percent of total equity required, through Special Purpose Vehicles (SPV) or INR 2 crores, whichever is less.
- The total life of the fund will be 10 years from the date of commencement.

With these financing tools it is expected that a sustainable market for EE projects shall be created and all the stakeholders shall be benefitted.

World Bank launched the *Partial Risk Sharing Facility (PRSF)* in 2015 to provides guarantees to the Participating Financial Institutions (PFIs) i.e., Banks/NBFCs for the EE loans. Under this financing scheme guarantee of maximum 75 percent or Rs.15 crore whichever is less may be extended for EE projects. SIDBI is Implementing Agency for PRSF and apart from this scheme there are following several other schemes in India which provide financial support to SMEs and MSMEs for implementing EE projects:

i) SIDBI financing schemes
ii) Canara Bank Scheme for Energy Savings for SME
iii) Bank of Baroda scheme for financing EE project
iv) State Bank of India (SBI) project Uptech

However, in the comments received from the Indian Banks Association, it was suggested that the guarantee coverage of 50 percent in PRGFEE should be enhanced to 75 percent, so that banks can take active interest for financing EEPs. Indicative list of EE bank loan schemes and funds are provided in Annex 6.

6.2 EEP Financing Structures

6.2.1 Project Host Loan

Most EEPs are funded by Project Hosts using their own internal capital or traditional asset-based corporate loans from their existing bankcreditlines, thus depleting their business credit and capital capacity. LFIs typically assign little or no value to the future cash flow generated and thus require Project Hosts to use their core business credit and collateral capacity to finance EEPs. Due to very little or no collateral value in the actual EE equipment that replaces inefficient equipment at a Project Host's facility, LFIs consider loans for EEP as project host loan as unattractive preposition.

Another structure where the Project Host secures a loan with an LFI is under the ESCO's Guaranteed Savings structure, described in Section 5.2.1, whereby the ESCO provides a guarantee to the Project Host and it will realize sufficient savings to cover its debt service payments to the Lender. Although, this does not eliminate the need to use a Project Host's business credit and capital capacity, it does remove its risks associated with the EEP being properly implemented and more importantly that the debt service payments will be repaid from savings and not from current operating profits.

In rare cases, vendors are willing to essentially provide a loan to Project Hosts for EE equipment that they manufacture under an installment sale type of an arrangement. Vendors typically will only do this on relatively small non-integrated equipment/technologies that carry reasonable profit margins and can be inexpensively removed and then sold or redeployed by the vendor at its original selling price. There are limited examples of major EE equipment that would be applicable to such motors or power factor correction devices.

6.2.2 New LFI EEP Loan Product[28]

A new option currently being used in Indonesia (and Jordan) should be considered for LFIs in India. It is a savings-based EEP loan product for LFIs to provide commercially-attractive loans on EEPs implemented by Project Hosts, ESCOs or other EEP implementers. Such an EEP loan product is structured to:

- Not impact Project Hosts' core business credit capacity.
- Not require core business collateral.
- Generate sufficient positive cash flow to motivate Project Hosts to implement EEPs.

The main features of an EEP loan are:

- The EEP loan is provided in addition to the Project Host's existing, approved lending limit; resulting in increased credit capacity.
- The EEP loan amounts equals at least 75 percent plus of the Turnkey Cost to develop, implement and finance the EEP (not just the equipment cost).
- The repayment term equals at least two times the EEP's simple payback (capital cost/annual savings) to provide sufficient IRRs to be attractive to Project Hosts.
- All savings and capital cost of the EEP must be supported by a properly-prepared IGA.

[28] Developed by Thomas K. Dreessen for a government bank in Indonesia and a commercial bank in Jordan

- EEP savings must be measured and verified using industry-accepted M&V methods that comply with IPMVP or equivalent protocols.

Benefits:

To LFIs:
- Provides a new EE lending product to finance EEPs at reduced risks.
- Provides new value-added services to current hosts.
- Accelerates the volume of EEPs financed.
- Provides 'Measured' energy and GHG emission reductions.

To Project Hosts:
- Limits impact on "core business" capital and credit capacity.
- Removes risk of future cash available to repay EEP loan.

To Project Developers:
Provide access to debt financing from LFIs (Guaranteed Savings ESPC structure).

If this new EEP loan product were to be developed for India's LFIs, it would help to close the significant gap of LFIs not offering attractive EEP financing to Project Hosts, ESCOs and other potential EEP developers and implementers.

6.2.3 ESCO Shared Savings Funding

The ESCO Shared Savings structure described in Section 5.2.2 requires that the ESCO (as opposed to the Project Host) provides the finance (either from its own sources or through a third party lender or investor) to fund all of the upfront capital cost of the EEP. The Project Host has no contractual obligation to repay the ESCO's lender or investor; it does, however, pay a majority of the savings from the EEP to the ESCO over the ESPC agreement term. In addition to removing the Project Host's risks associated with the EEP being properly implemented (like Guaranteed Savings), the Shared Saving structure's most unique benefit is that it does not require the Project Host to use any of its business credit and capital capacity.

6.3 Types of Collateral and Guarantees

The common types of collateral provided for EEP loans are as follows:

- Land, buildings and other assets of the borrower.
- Guarantees from a 'Guarantor' who is approved by the lending LFI.
- Earmarked or securitized cash inflows to pay debt service.
- Structured cash collaterals such as deposits or escrowed amounts at the LFI.
- Deposit of post-dated checks in accordance with scheduled debt service payments.

The common types of guarantees available for EEP loans include:

- A corporate guarantee from the borrower, or its parent company.

- A personal guarantee for the benefit of the borrower; it could be a company's owner, CEO, board member or any other person willing to provide a guarantee for the benefit of the borrower.
- A partial credit risk guarantee (PCRG) provided by governmental agency, a multi-lateral or development bank (like the International Finance Corporation (IFC) or a financial institution. The PCRG is typically a risk sharing mechanism to provide commercial banks with partial coverage of risk involved in extending loans for energy efficiency projects.

6.4 EEP Appraisals

6.4.1 Technical

LFIs should consider carrying out the following in their technical appraisal of an EEP:

- Evaluate EE technologies.
- Evaluate EE savings including the estimation procedures.
- Evaluate implementation/work plan as provided in the DPR.

The criteria for carrying the technical appraisal of an EEP is provided in Table 8.

Table 8: Criteria for Technical Appraisal

1. Technology Evaluation	Key Consideration(s)	Source
Technology/ Equipment	a. Technology has a successful track record of implementation in the country and internationally b. Technology is best-in-class (amongst the top five in EE) c. Technology is certified by a government recognized entity d. O&M Plan	i. List of entities where technology has been implemented in past three to five years ii. Certificate from the government recognized entity iii. Technical feasibility report
Technology/ Equipment provider	a. Reputation and track record of the technology supplier in the industry b. Availability of after sales services and spare parts c. R&D facilities and availability of accredited trainers	i. List of installations of proposed EE technologies in the past three to five years by the provider ii. Performance certificate from leading labs/institute iii. Performance satisfaction letters/declaration from industries utilizing the technologies iv. Capability statement and annual reports
2. Energy Saving Estimate	**Key Consideration(s)**	**Source**
Verification of savings	The IGA report follows BEE guidelines and includes the below: a. Estimation of baseline consumption b. List of assumptions and estimation methodology c. Potential risks and mitigation plans	i. IGA Report

Auditor qualifications	a. Auditor is an accredited entity recognized by BEE b. Minimum three to five years of experience in conducting IGA in the relevant industry c. Auditor is empaneled with Indian Renewable Energy Development Agency (IREDA), Petroleum Conservation Research Association (PCRA), Power Finance Corporation (PFC or the LFIs)	i. BEE accreditation certificate ii. List of industries where audits have been conducted iii. Letter of empanelment
3. Implementation /Work Plan	**Key Consideration(s)**	**Source**
Implementing entity	a. Successful track record of implementation of similar projects in the industry b. The work plan provides details whether the implementation is carried out under routine maintenance or partial/full facility shutdown is required	i. Certificates for successful and timely completion of projects
Work plan	Work plan protects the Project Host against delays by incorporating penalty clauses for any deviation from implementation conditions or timeline.	i. Past track record of completion of project of similar nature

6.4.2 Financial

In a financial appraisal of the project, the past record of the promoters (Host or an ESCO) should also be examined by LFIs with reference to financial statements viz. Profit and Loss Account; Balance Sheet and Cash Flows for at least past three years. The banks/FIs may consider stipulations in their terms of sanction with different margin requirement for different types of ESCO models. For instance, in performance guarantee business model, where host is the borrower supported by cash flow from other sources, less margin and more cash security may be considered for lending purpose. In shared savings model, where ESCO is the borrower relying on cash flow only from ESCO projects, more margin and less cash security may be considered.

The financial appraisal of an EEP should cover the following as presented in Table 9.

Table 9: Criteria for Financial Appraisal

Financial Appraisal	Key Consideration(s)	Source
Financial Analysis	a. Investment requirement b. Project cost, O&M cost, capital costs, working capital, debt-equity structure, source of equity, loan and interest repayment c. Energy savings costs d. Project simple payback period e. Project Internal Rate of Return(IRR)/ Debt Service Coverage Ratio (DSCR)/Net Present Value (NPV, cash flow, interest coverage ratio	• IGA report certified by auditor/third party • Project cost- quotations from technology suppliers • O&M cost – 2-5 percent of project cost, with annual escalation of 5-10 percent as per supplier norms or inflation rate • Project IRR/DSCR/NPV as per individual bank regulations and policies • Pay Back Period(Reference: IREDA Manual)

Financial Appraisal	Key Consideration(s)	Source
Financial Structure	a. Contribution from Project Host or by ESCO as project equity b. Type of ESPS model proposed c. Borrower's past experience in ESPS model d. Types of financial arrangement provided by the borrower for the proposed model e. Does the proposed financial structure represent the best case scenario in terms of financial parameters? If no, the bank can ask the borrower to prepare options for analysis of various possible combinations of debt, equity, term loan, ESPC/ESA tenure f. Total deployable net worth of ESCO for project funding	Project documents and other relevant financial documents
Nature of Contracts With Suppliers, Implementing Entities	a. Terms of ESA signed between ESCO and vendor/suppliers fixed price b. Penalty clause for any delay in services c. Terms of ESA signed between ESCO and Project Host d. Allocation of part of savings for repayment of loan and whether it is a fixed component for variable payment based ESPC	ESA agreement mutually executed by ESCO and vendor/supplier
Sensitivity Analysis	a. Best/Worst case scenarios for project cost escalation, fuel cost, tariff, reduced savings, escalation in O&M cost b. Feasibility of the project on economic parameters in the base case scenario c. Feasibility of the project on economic parameters on the worst case scenario	
Sharing of Savings Between Project Host and ESCO	a. Allocation of a part of savings for repayment of loan and whether it is a fixed component in case of variable payment to ESPC	

Greenfield EE Project Assessment

Greenfield EE project needs extensive evaluation for the contribution of EE element in whole facility. There is no set yardstick to measure investment for EE segment and EE savings in a Greenfield facility. However, SIDBI under various credit lines has designed products for both Greenfield and retrofit EE projects to meet the unique needs of MSMEs.

The Japan International Cooperation Agency (JICA) has extended a Line of Credit[29]to SIDBI for financing energy saving projects in MSMEs sector. The project is expected to encourage MSME units to undertake energy saving investments in plant and machinery to reduce energy consumption, enhance energy efficiency, reduce CO_2 emissions, and improve the profitability of the units in the long run. The list of equipment's eligible for financing under

[29] www.smeforum.in/index.php?view=article&catid=36%3Aacross-the-globe&id=171%3Asidbi-financing-scheme-for-energy-saving-projects-in-msme-sector&format=pdf&option=com_content&Itemid=110

JICA credit line is available in the public domain. The list can be used for screening the sub-projects for deciding their eligibility for coverage under the JICA's Line of Credit and the list would be the primary criteria for the sub-projects. Also, the EE unit under the Greenfield facility should contribute greater than or equal to 50 percent of the project cost and should have a minimum investment grade rating from SIDBI.

7. EEP FINANCING RISKS AND MITIGATING STRATEGIES

7.1 Project Host Risks

The credit worthiness of a Project Host needs to be evaluated by LFIs before they consider financing as an EEP. Most importantly, the Project Host's credit risk should be assessed from the outset, before investing time or resources to evaluate whether or not to finance an EEP. This is a threshold requirement because no matter how well an EEP performs, if the Project Host is not creditworthy or goes out of business, the LFI, ESCO or investor will not get its investment or loan for the EEP repaid. Consequently, a LFI, ESCO or investor must be satisfied with the credit worthiness of the Project Host before proceeding.

LFIs are capable of assessing and structuring loans, and evaluate collateral and guarantees as needed to mitigate risk associated with the long-term creditworthiness of their borrowers (Project Hosts). Therefore, this EE Finance Guide addresses project risks only and not the Project Host credit risk.

Each stakeholder in an EEP should be aware that there are various types of risks. LFIs have limited understanding in financing EEPs and technologies. This can become an issue in the case of default, which in turns leads to increased NPAs. Asset ownership and recovery is a serious concern and at times it will be difficult to pinpoint the reason for default-commercial or non-performance default. Designing an ideal and responsive repayment mechanism remains a challenge for many contracts.

However, even if the Project Host is deemed credit worthy there is still a risk in term of its inability or unwillingness to repay a loan in the event that an EEP performs poorly. FIs should regularly monitor the financial positions of projects/borrowers to ensure that the borrower continues to be in a healthy financial position and can continue to return the loans in a timely manner. The sections below address some of these types of risks in financing EEPs.

7.2 EEP Performance Risks

The major types of project-related risks of EEPs are illustrated in Figure 4.

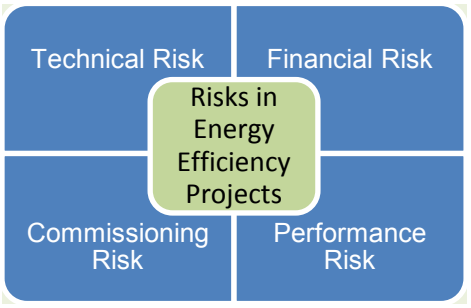

Figure 4: Type of Project Risks

EEPs might not perform adequately enough to repay debt service and may not be in a position to provide the expected savings under the following circumstances:

- The EEP was not technically well-conceived.
- The EEP was not properly installed.
- The EE equipment fails to perform.
- The savings estimate and/or the M&V Plan and related savings calculations are not clearly defined and/or transparent or were not based on measureable criteria.
- Insufficient or an absence of on-going monitoring and M&V.

7.3 EEP Performance Risk Mitigating Strategies

The major risk of financing EEPs occurs where some portion or all of a loan is based on savings and the actual savings are not sufficient to repay the loan's debt service amount. To mitigate this risk, a detailed evaluation must be performed on the estimated savings of the EEP before it is implemented. Unfortunately, evaluating this savings (performance) risk and other risks associated with EEPs are not typically known to LFIs and not a part of their normal corporate lending and risk evaluation procedures.

The performance risks of EEPs can be classified into three major project phases:

1) Development
2) Implementation
3) Operation

The risks associated with each phase can be managed successfully by experienced EEP implementation experts. A brief list of the major risks and simple solutions commonly employed during these phases is provided in Table10.

Table 10: Major EEP Risks and Solutions[30]

Risk (by Phase)	Solution
1) Development Phase: • Estimated savings and capital costs not realistic • Host does not implement the project	• Properly-prepared IGA • Development costs funded or reimbursed by Host
2) Implementation Phase: • Not installed according to IGA specifications • Cannot be installed for the estimated capital cost or within completion deadline • Local regulatory requirements are not met • Technology/Equipment does not work properly	• Execute design/build contracts with qualified vendors and contractors which include all IGA specifications and appropriate recourse for non-performance of the EEPs
3) Operation Phase: • Equipment does not operate as intended • Savings cannot be measured and verified • Savings are not achieved • Changes in Host's facility or operations • Required O&M is not performed	• Include extended warranty coverage in all vendor/contractor contracts • Implement M&V Plan • Establish energy baseline for easy adjustment to operating changes

[30] Thomas K. Dreessen: EE lending guide for banks to ADB

Some of the project management procedures that should be used to minimize any performance risks are summarized below:

a) Detailed project review to assess the level of the following risks:
   - Technologies employed (any unproven technologies should be rejected unless 100 percent backed by financially-viable vendor/contractor).
   - Reasonableness of savings and cost estimates.
   - Ability to measure savings and M&V methodology which is agreed to by the Project Host.
   - Contract language, if savings-based repayment is part of the loan, to ensure proper distribution of risks between Project Host, contractors and if applicable the ESCO.
   - Constructability by the vendor, contractor or ESCO.
   - Equipment warranties from the vendors.

b) If ESCOs are involved to develop and implement the EEPs, they will also assume the performance risk of the EEPs by providing a savings guarantee equal to the related debt service required to repay the lender, and they will also perform most of the on-going M&V on the EEPs. If the actual savings generated is less than the savings guarantee, the ESCOs who provide the guarantee will make up the shortfall. The Project Host should only select the most reputable ESCOs to minimize the risk associated with the performance guarantee. An ESPC should be evaluated based on the following considerations:

   - Does the ESPC specify the formula of payment from Project Host to ESCO?
   - Does the formula take into consideration any impact of tariff revisions, if any, during the project cycle?
   - Is the M&V protocol and terms of payment to the ESCO agreed upon?
   - Is the payment formula based on M&V parameters?
   - Does the payment formula match the financial proposal structure?
   - Does the ESCO receive any additional payments if savings exceed the agreed savings?

c) If necessary and to the extent possible, EEPs can be restructured to minimize any risks that threaten achieving sufficient savings to repay the LFIs. This can include many options such as reducing debt service to a very low level of estimated savings, or revising the construction drawdown schedule based on the construction completion, and so on.

d) If an ESPC is involved, step-in rights should be provided if the ESCOs fail to meet timelines and milestones.

e) In a savings-based loan or ESPC agreement, the lender must have suitable tri-partite contractual protection between the Project Host, the Lender and the ESCO for performance and payments throughout the ESPC and/or loan agreement to ensure each agreement backs the other.

f) Standardized agreements should be structured to protect the interest of borrowers and lenders against payment defaults. All default provisions must be well documented.

g) A zero tolerance policy towards non-compliance of M&V and payment procedures should be enforced as the LFI needs to be assured that M&V is robustly designed to capture all the key data and address all the requirements.

h) It is a good practice to protect the lenders' interests directly in the ESA itself. The debt service portion should be structured separately within the performance scheme.

7.4 New Energy Savings Insurance (ESI) Product[31]

A new ESI product is also needed in India to guarantee the LFIs and Project Hosts that the estimated savings from financed EEPs will be sufficient to repay the loan. Providing an ESI product is critical for LFIs to willingly offer project-based lending and additional funds to Project Hosts beyond already-approved credit lines, based on the estimated future cash flow of end-use EEPs. The ESI coverage ensures LFIs that the expected new future cash flow will be available to Project Hosts for repaying the EEP loan, and therefore, allowing the LFI's credit committee to include such future cash flows in their calculation of a Project Host's credit capacity. Without ESI coverage, Project Hosts will be required to use their existing core business lending capacity to fund EEPs. Few Project Hosts, if any, can afford to use these funds; for those who can afford to apply these funds, not many are willing to do so.

Benefits:

***To LFIs*:**

- New EE lending product to finance EEPs at reduced risks.
- New value-added service to current hosts.
- Accelerate the volume of EEPs financed.
- Provide 'Measured' energy and GHG emission reductions.

***To Project Hosts*:**

- Limits impact on "core business" capital and credit capacity.
- Removes risk of future cash available to repay EEP loan.

To Project Developers:

- Provides access to LFIs financing of their EEPs on a **Guaranteed Savings** basis.

7.5 ESCO Risk Mitigating Strategies

When the ESCO is a borrower under the Shared Savings structure, the following risk mitigating strategies should be deployed:

- Ownership of EEP equipment: A fixed portion of the revenue stream from the payments received by ESCO (from the Project Host) can be assigned to LFI.
- Even though the ESCO is the borrower, it must still examine the Project Host's creditworthiness to assess its paying capacity as this directly affects the ability of the

[31] Thomas K. Dreessen: EE finance capacity building workshops for ADB, Indonesia Exim Bank, USAID-ICED Indonesia ESCO regulations, etc.

ESCO's repayment ability.

- The ESPC could be structured to include fixed payments for servicing the debt to the LFI. In Shared Saving contract, a fixed portion of the variable payment to the ESCO needs to be allocated to service the debt to LFIs.
    - Creating an escrow for the Project Host's payments (Trust and Retention Account) is possible when the Government is the borrower.
    - When establishing recourse to an ESCO or its parent company, the bank may require co-signing of the loan by the promoter of the ESCO or its parent company.
    - Establishing cross-default provisions for portfolio of projects in the event of an ESCO holding multiple EEP loans from LFIs for multiple projects, and where one project defaults in repayment, the LFI may require an alternative provision of securing repayment from successful projects' cash flow to meet such defaults. LFIs may require the ESCO to deposit payments from all successful projects into its account so that it has control over payments and withdrawals.
    - Establishing cash reserves for servicing the debt, repairs, and others.

8. CONCLUSIONS

As previously stated, few LFIs in India have actively engaged in financing EEPs, and virtually no LFIs provide attractive financing terms to Project Hosts. For their part, LFIs are neither familiar with the unique complexities of EEPs nor are they interested in investing the time to learn how to properly evaluate the risks and benefits of financing EEPs due to the relatively small transaction size involved.

Attractive EEP financing is constrained by all of the above barriers. As a result, a large scale implementation of EEPs in India will be very problematic. There is an urgent need from all stakeholders to remove key barriers for large scale EE implementation in India. This could be achieved by enabling LFIs to: (i) understand the benefits and risks of EEPs and its implementation models, (ii) improve their capacity for effective project evaluation and monitoring, and (iii) know-how to take corrective actions post-financing.

To overcome their lack of familiarity with the unique complexities of EEPs, LFIs should provide loans that involve ESCOs implementing the EEPs because they assume all the project development, implementation and performance risks. Most importantly, they can guarantee to the LFIs that the Project Host will achieve sufficient savings to cover its debt service payments to the LFI.

However, as previously stated, a project-based, non-recourse EEP loan structure is essential to the viability of the ESCO industry in India.

In closing, it is hoped that by using this EE Finance Guide, LFIs will become more familiar and comfortable with lending to EEPs on a project-finance (versus corporate) basis in order to motivate Project Hosts, ESCOs and other project developers to implement/fund EEPs and create a meaningful market demand for EE. It is also hoped that in future, this EE Finance Guide will prove invaluable to many more LFIs as they begin to view the addition of EEPs as a way to expand their loan portfolios.

According to comments received from IBA, the schemes for capital investment subsidy or interest subsidy for the project hosts for implementing such EE Projects as available to TUFS from the Ministry of Textiles and CLCSS from SIDBI will go a long way in handholding complicated project financing to the project hosts, ESCOs and banks.

ANNEX-1: PRIORITY INDUSTRY SECTORS FOR EEPS

Target Sector	Sub-Sector	Indicative ESMs and Technologies
Large Scale Industries	Cement[32]	• Multistage pre-heaters and pre-caliners use waste heat from the kiln to pre-heat and pre-process the kiln feed • Use of better insulating refractories • Replacing vertical shaft kilns with more efficient suspension pre-heater kiln system • Installation of newer cyclones in a plant with lower pressure losses • Conversion to high-efficiency grate coolers • Substituting fossil fuel with waste oil or oil sludge • Use carbide slag as raw material for cement production • Use of high efficiency motors and drives in cement kiln
Large Scale Industries	Pulp Sector[33]	• Installation of energy efficient high capacity chippers • Installation of extended delignification cooking system • Installation of Elemental Chlorine Free bleaching with Oxygen Delignification system to reduce consumption of ClO_2 • Modification of pulp mill washers in order to avoid the usage of vacuum pumps • Installation of advance control system for pulp mill section • Replacement of centrifugal screen with pressure screen in stock preparation • Installation of high efficiency refiners • Installation of vacuum blower(s) instead of vacuum pumps • Replacing mechanical governor with electronic governor in steam turbines
Large Scale Industries	Glass Industry	• Installation of Variable Frequency Drive (VFD) for Combustion Air Blower • Installation of Variable Fluid Coupling for cooling blowers in furnace • Replace the existing inefficient cooling blowers with energy efficient blowers • Avoid recirculation through the stand-by blower of throat cooling • Reduce pressure settings of HP air compressors catering to furnace combustion requirements • Improve insulation of the walls of the boiler and reduce radiation losses • Installation of automatic voltage stabilizer in street lighting feeder and optimize operating voltage • Replacement of aluminum blades with Fiber Glass Reinforced Plastic blades in cooling tower fans • Installation of dual speed motors/VSD for cooling tower fans
Large Scale Industries	Miscellaneous[34] (Oil Refineries,	• Good desalting practices, lower operating temperatures, pressure and steam stripper optimization, installation of

[32] http://ietd.iipnetwork.org/content/cement

[33] (2008). National Best Practices Manual in Pulp and Paper Industry, Confederation of Indian Industry (CII).

[34] http://www.envirocentre.ie/includes/documents/SEI_ManagingEnergy.pdf

Target Sector	Sub-Sector	Indicative ESMs and Technologies
	Sugar, Automobile, Pharmaceutical[35])	process control systems • Boilers and furnaces - proper combustion control with appropriate instrumentation, well maintained burners, insulation and refractory as per standards • Petroleum and Natural Gas (PNG) and Liquefied Petroleum Gas (LPG) based generators to substitute diesel • Industrial processes - heat losses minimized by good insulation, waste heat recovered for further use in the plant • Equipment - replacing obsolete items with high efficiency equipment • General - routine data collection, regular energy performance and improved maintenance
SME[36]	Includes Various Sectors (Textile, Rubber, Pulp and Paper, Plastics and Polymers)	• Compressed air - fixing the leaks in the system, setting equipment at right pressure level • Lighting - maintain and clean light fixtures, using efficient lamps, installation light controls and replacing old lamps • Use of energy efficient motors, use of variable speed drivers and right lubricants for motors • Replace conventional tunnel with roller kiln • Alumina brick insulation for Electric Arc Furnace • BEE 5 Star rated air conditioner and refrigerators • LEDs • Installation of high efficiency recuperators • Industrial furnace in aluminum industry
Ceramic[37] Industry		• Installation of automatic interlock between the brushing dust collection blowers and the glazing lines • Operating the Vertical Shaft Kiln (VSK) exhaust fan with damper control and avoid air infiltration • Improve combustion efficiency of VSK by optimizing excess air levels • Arresting air infiltration in spray drier system • Replacement of LPG with Diesel firing in the spray drier • Reducing of idle operation of hydraulic press pump by installing suitable interlocks
Copper Smelter[38]		• Reduction of idle running hours of feed conveyors by automation • Installation of correct size pump for slag granulation pump/cooling tower pump • Utilize the heat of smelter furnace exhaust gases to preheat the blower air • Installation of waste heat recovery system for anode furnace exhaust and utilize to preheat combustion air • Installation of variable speed drive for smelting furnace induced draught fan • Installation of variable fluid coupling for convertor plant induced draft fan • Installation of variable frequency drive for lime recirculation at scrubber exhaust system of anode furnace

[35] www.indiaenvironmentportal.org.in/files/file/aeee%20energy%20efficiency%20final.pdf

[36] *Energy Efficiency Measures.* SIDBI

[37] IREDA Manual

[38] IREDA Manual

ANNEX-2: TEMPLATE FOR IGA REPORT

ATTACHMENTS:
Qualification of ESCO, Contractors, Vendor and Other Implementing Entities, as well as Supporting Cost and Warranty Proposals

Below is a brief description of what should be included in each section of the above Table of Contents.

1. Executive Summary:Should be no more than one page describing at minimum:

1.1. How the proposed EEP will be implemented and operated (and by whom)?

1.2. How it’s estimated savings will be achieved and measured and verified; benefits to Project Host (financial and other)?

1.3. Responsibilities of Project Host and other parties.

1.4. If implemented by an ESCO, all relevant commercial and other terms to be included in an ESPC.

2. Energy Profile of Each Facility: Where the EEP is proposed to be implemented and to include:

2.1. Facility Description:Summarize size, age and type of activities at each facility.

2.2. Description of major energy equipment and systems.

- Provide a detailed description of the system controls including control types, temperature set points, boiler pressures, lighting and other technical aspects.
- Add information regarding the types of refrigerant and air quality problems noticed, refrigerant monitors required in the equipment room, the type and number of years remaining allowed for the refrigerant, and so on.
- Discuss potential problems in systems and designs.
- Discuss the installed system for the purpose and or process served. (Or how it willprobably change in the future).
- Add the conditions found on the site, which may influence the decision regarding project implementation, or those that may be unknown to building owner and/or operators.

2.3. Utility Summary:Summarize the energy that has been used in the analysis (at a minimum over the last year) and where possible, use graphs to include:

- Energy use index
- Monthly consumption profiles
- Demand profiles
- Energy use history

3. Proposed EEP:For each ESM, provide the following:
3.1. Existing situation describing the basis for the ESM opportunity.
3.2. Proposed ESM describing complete details of the proposed ESM: What it is; how it will achieve the savings; basis for cost estimates and other major operating or other type of characteristic; concept design and project schedule.
3.3. M&V Plan explaining how the savings will be measured and verified.
4. Estimated Cash Flow and IRR:Prepare the tables below and provide a narrative explaining them and their benefits to Project Host.

TABLE 1: EEP Savings and Cost Summary by ESM
TABLE 2: EEP Cash Flow

IGA Checklist[39]:

- Are energy rates used to estimate savings based on actual historical costs, rate structures and consumption levels?
- Has energy usage been reconciled/balanced to one full year of historical energy data, separately for different fuels and preferably by square foot/meter?
- Are operating hours for different areas in the facility clearly identified and taken into consideration?
- Is major energy consuming facilities clearly identified and taken into consideration in the energy balance?
- Is the basis for implementation costs clearly identified?
- If modeling software is used, are the inputs and outputs clearly identified so that another expert can approve work?
- Is it clear why and how savings are achieved for each measure?
- Is it clear what form of retrofit is proposed and what are the advantages?
- Is it clear where the retrofit will take place?
- Have all potential EE measures been addressed?

[39] Dr. Ahmad R Ganji and Bruce Gilleland, 25th WEEC, October 2002, Atlanta, Georgia, USA).

ANNEX-3:M&V DETAILS

The main M&V concepts are described in Section 4.5.**Annex 3** contains a more detailed description of the basic framework and operational aspects of measuring and verifying the energy savings and other monetary benefits for EEPs implemented in both industrial and commercial facilities. They broadly define the techniques to be used in determining the appropriate M&V method. This Annex presents an outline of procedures, which can be applied to the same project in all geographical areas, and at various levels of accuracy and cost.

Definitions of a few special terms unique to M&V are:

- **Baseline:** Energy performance measured before energy performance improvement actions are implemented.
- **Independent Variable:** A parameter outside the control of an owner or operator of a facility that is expected to change routinely and have a measurable impact on energy use of a system or facility and on savings from an ESM.
- **Measurement and Verification or "M&V":** The process of using measurement to reliably determine actual savings created by an ESM. This is also known as **"MRV"** - measurement, reporting, and verification.
- **Savings:** Value for reduced energy, water or demand determined by comparing measured use or demand before and after the implementation of an ESM, making suitable adjustments for changes in independent variables and other applicable conditions.
- **Deemed or Stipulated Savings:** Reflect saving values that are stipulated based on the engineering calculations using typical equipment characteristics and operating schedules developed for particular applications, without on-site testing or metering. This approach is designed for use with some lighting efficiency and controls projects, cooling equipment projects, and window film applications.

Baseline

The energy baseline is the most critical component of M&V, and it can be affected by many factors. Establishment of the energy baseline forms the basis for all energy saving calculations. Baselines are set based on the historic data for a pre-defined period of time, which can range from three months to a year. There are internationally accepted methods for carrying out such calculations and these may need to be modified on a case by case basis.

The baseline is used to account for any changes that have occurred during the performance period, which may require a baseline adjustment. One cannot go back and re-evaluate the baseline since, in effect, it will no longer exist once the inefficient equipment or systems are replaced. Therefore, it is critical to document and capture the baseline accurately before EEPs are installed.

Baseline documentation should include:

a) Identification of the baseline period.
b) Baseline energy consumption and demand data.

c) Independent variable data coinciding with the energy data (for example, production data, ambient temperature).
d) Static factors coinciding with the energy data:
    1) Occupancy type, density and periods.
    2) Operating conditions for each baseline operating period and season, other than the independent variables.
    3) Description of any baseline conditions that fall short of the required conditions.
e) Details of adjustments that are needed for the baseline energy data to reflect the energy management program's expected improvement from baseline conditions.
f) Size, type and insulation of any relevant building envelope elements such as walls, roofs, doors, windows.
g) Equipment inventory.
h) Equipment operating practices.
i) Any design, installation, calibration, and commissioning and any special measurement equipment that is needed under the plan.
j) Significant equipment problems or outages during the baseline period.

The baseline documentation typically requires a well-documented short term metering activity. The extent of this information is determined by the measurement boundary chosen or the scope of the savings determination. If whole-facility M&V methods are employed, all facility equipment and conditions should be documented.

a. Baseline Period: Care should be taken in determining the baseline period. The baseline period should be established to:

- Represent operating modes of the facility - The period should span a full operating cycle from maximum energy use to minimum.
- Fairly represent operating conditions of a normal operating cycle.
- Include only time periods for which fixed and variable energy-governing facts about the facility are known. (The extension of baseline periods backwards in time to include multiple cycles of operation requires equal knowledge of energy-governing factors throughout the longer baseline period in order to properly derive routine and non-routine adjustments after ESM installation.)
- Coincide with the period immediately before commitment to undertake the retrofit. (Any period from further back in time would not reflect the conditions existing before retrofit, and therefore, may not provide a proper baseline for measuring the effect of ESM).

b. Baseline Adjustment: There are two types of adjustment in the baseline:

- Routine adjustment - For any energy governing factors expected to change routinely during the reporting period (such as weather or production volume), a variety of techniques can be used to define the adjustment methodology. Techniques may be as simple as a constant value (no adjustment) or as complex as a several multiple parameter non-linear equations each correlating energy with one or more independent variables. Valid mathematical techniques must be used to derive the adjustment method for each M&V Plan.
- Non-routine adjustments - For those energy governing factors which are not usually expected to change (such as: the facility size, the design and operation of installed

equipment, the number of weekly production shifts, or the type of occupants). The associated static factors must be monitored for change throughout the reporting period.

M&V Decision Making Tools

The *IPMVP Core Concepts* document contains the following two Annex to assist in determining which of the four options is best suited for an EEP:

- Annex A: Option Selection Process Diagram
- Annex B: ECM Project Characteristics

M&V Costs

The main purpose of M&V is to demonstrate the performance and validation of savings. The appropriate level of accuracy of the M&V is typically based on the level required to protect the project investment or performance guarantees being provided.

Selection of M&V approach requires several considerations, such as:

- The project costs
- The expected savings
- The savings uncertainty or risk that may occur
- The allocation of risks between the parties
- The contract period and type of contract, and if an ESPC, whether it is a guaranteed performance (fixed payment) or shared savings (variable payment)
- The number and complexity of dependent and independent variables that need to be measured or calculated for analysis purposes
- The availability of existing data collection systems (for example, an energy management system)

The M&V costs are affected by the type of ESM, how the savings are achieved and the level of accuracy and the type of technology being implemented. A full-fledged M&V may cost from 5 to 10 percent of the EEP investment amount. It ultimately depends on a trade-off between accuracy and cost of the M&V. In ESPC contracts, where payments are based on the actual savings, a more accurate M&V is required. Simple approaches are generally preferred to reduce costs and minimize potential for disputes but should be tailor-made to the contract.

The cost to perform the M&V necessary to determine the savings depends on several factors, such as:

- M&V option selected.
- Complexity of the project and number of interactions between different ESMs.
- Amount of energy flow available within the system boundaries around the affected equipment.
- Detailed levels of monitoring to be carried out and the existing conditions.
- Type and complexity of measurement equipment.
- Representative sample size used for measuring equipment.

- Level of engineering needed to create and support stipulations in Option A or mathematical models.
- Number and complexity of independent variables used in the mathematical model.
- Measurement duration and reporting frequency.
- Review or verification processes of the reported savings.
- Required professional qualification experience of the personnel to perform the M&V.

Table 11: M&V Options

Option A	Number of measurement points Complexity of the stipulations Frequency of post-retrofit inspections
Option B	Number of measurement points, tools and instruments Measurement frequency
Option C	Number of the measurement, tools and instruments Number of independent variables needed in calculating the energy data variability
Option D	Number and complexity of simulated systems Number of field measurements needed to provide input data Professional simulator's expertise related to the achievement of calibration

- **Who pays for the M&V?** If the Project Host performs or engages a third party to perform the M&V, they pay the M&V costs. If an ESCO conducts or engages a third party to conduct M&V, the M&V costs are a part of the ESCO's costs. In either case, the M&V costs are an integral element of EEP's cost, and this needs to be accounted for in the project budget and financing plan. Although, the M&V approach specified in the Energy Services Agreement is agreed between the ESCO and Project Host, the lender or investor needs to understand and approve the M&V approach and its associated costs. This should be a key part of their due diligence process in determining the reasonable achievement of saving estimates and any related new cash flow available to the Project Host for the repayment of debt or the investment for EEP. Therefore, it is important to involve the lenders early in the M&V Plan development process.

M&V Risks

An important factor in the selection of M&V Plan is an assessment of the project risks. Some of the major risks in ESCO projects can be categorized as follows:

- Uncertainty Risks
- Performance Risks
- Usage Risks
- Energy Cost Risks

The purpose of M&V activities is not only to minimize the risks to bring them to an acceptable level but also to help allocate responsibilities to the parties who can exercise control over each risk. All risk factors play different roles in creating uncertainty.

A brief summary of each of the risks mentioned above is provided in the following.

a. Uncertainty Risks

Uncertainty risks primarily relate to the inability to quantify savings accurately and consistently. Savings are estimated by comparing the energy consumption and operations before the installation of EEP to the conditions experienced after, raises uncertainty can be caused by several things that include, but are not limited to errors in measurement and sampling techniques used. While a number of parameters can be measured, it is often not cost effective for every piece of equipment to be measured.

Sampling techniques are often used and these can create an additional level of uncertainty. Sampling variation occurs in the energy usage or use of the related equipment, and it can be caused by many random factors. Simplifying assumptions is sometimes used when it is too difficult to conduct measurements or to estimate a parameter, or to explain additional uncertainty.

All these factors can increase the risk of determining the real savings produced from an EEP. In M&V, the goal is to minimize uncertainty to an acceptable level with the understanding that uncertainty can never be completely eliminated.

b. Performance Risks

Performance risks are associated with the impact on savings from performance of the new energy-efficient equipment that replace inefficient older equipment. It should be recognized that performance of the newly installed equipment will decrease over time, especially if the required routing and other operation and maintenance is not properly performed.

However, poor equipment performance can also occur due to an improper design, equipment selection or installation. One of the best ways to mitigate this risk is EEP to be implemented on a turnkey basis, under an ESPC, making the ESCO responsible for both design and ongoing performance of the equipment.

c. Usage Risks

Usage risks are associated with how much and how often the equipment is used and is typically affected by the following items, which can only be controlled by the Project Host or operator (Project Host):

- Operating hours (i.e., lighting, production time).
- Stand by time or usage schedule.
- Heating and cooling load.
- Production levels and product mix.

Since these factors can significantly affect the savings achieved from an EEP, the ESCO should not assume the performance risk for any changes in the baseline caused by them.

d. Energy Cost Risks

The primary project-related financial risks relate to future changes in energy costs, which are, in turn related to market conditions outside the control of the ESCO and the Project Host. If energy prices go down, the Project Host will benefit by realizing reduced costs on purchases of the applicable unit of energy on its entire facility.

However, the savings in an EEP are calculated by multiplying the units of energy saved by the applicable rate for each type of energy unit (kWh, coal, fuel oil, etc.). Consequently, if an ESCO mistakenly does not establish floor energy prices in the calculation formula of savings in its ESPC, the ESCO will unfairly be exposed to the financial risk of getting paid less than estimated even if the estimated units of energy are achieved. This is not equitable since the Project Host will be benefitting from the energy rate reduction for the total units still purchased for its facility. To minimize the uncertainty for long-term projects (especially ESPCs), the energy rate in the baseline and post-installation (retrofit) should be stated specifically in the M&V Plan.

To mitigate this risk, baseline rates must be used as the floor rates for calculating savings in an ESPC in order for the ESCO to obtain financing for the EEP. Using a floating energy price is an uncontrollable risk for ESCO that would preclude its ability to secure reasonable project funding.

Stipulation of Savings

Stipulation is the assigning of a constant value to a parameter that can be reasonably estimated to reflect the actual future conditions over an ESPC term. Stipulations in the M&V Plan must be agreed to between the ESCO and the Project Host as part of the assumptions used to estimate savings before and measure the savings after installation of an EEP stipulation is a fundamental element of Option A.

Stipulated values should reflect a reasonable estimate of the actual parameter being stipulated and should also be based on correct information sources, which are traceable, and well-documented, such as:

- Standard lighting table from a recognized source.
- Manufacturing specifications of equipment.
- Occupancy schedule of the building.
- Maintenance logs.
- Performance curves published by a recognized organization.

Even if the stipulated value is used in the measurement, equipment performance verification is still required (technically, the potential savings to be achieved). Note that, direct stipulations of energy savings are not recommended and that some form of ‘before’ and ‘after’ measurement is needed to comply with IPMVP.

Minimum Operating Conditions

Energy efficiency programs cannot be executed and implemented without agreement from the Project Host. Therefore, the M&V Plan should record the agreed conditions and stick to them subsequently. This includes factors such as the level of workspace lighting, air conditioning set point and the relative humidity as well as production outputs in an industrial facility.

Weather Data

Weather data is related to the environmental conditions of a building that can have a material effect on the equipment performance and targeted savings of an EEP. This should be included in the baseline and tracked during the Performance Period. This typically applies to commercial or administrative types of buildings and not industrial production facilities. Weather data is provided in 'degree days' and should be available at least on a monthly basis, and should be derived from an analysis or publication of a recognized institution. Calculating savings with weather data in certain conditions may not be possible. In these instances, a mathematical model will be required.

Balancing of Uncertainty and M&V Costs

There is no official method to identify the M&V approach that is the most cost effective for any given EEP. Thus, experience, ability to justify, and common sense is needed. In general, the annual M&V cost should not exceed 5 percent of the EEP's annual savings or 10 percent of the EEP's total investment.

Option A involves stipulations, resulting in fewer measurement points and lower costs versus Option B.

If the estimated savings of an EEP is at least 10 percent of the applicable facility's energy cost, and a number of ESMs have been installed in one area, then, generally, the cost for Option C will be less versus Option A or Option B. However, the disadvantage of Option C is that it does not verify at the component level and needs 6 to 12 months of data to demonstrate the savings achievement. Meanwhile, if there are many changes in the facility this may require a substantial amount of time to isolate the independent variable and reconcile achieved savings from the total facility energy costs.

Option D, the computer simulation method, is very expensive but maybe suitable when complex simulation modeling can be included in the design process of a major renovation or new construction.

M&V Plan

The M&V guidelines described above are to be used to develop the M&V Plan specifically for an EEP. The M&V Plan consists of an explanation of the M&V work to be performed, the ongoing measurements, savings and energy cost calculation methods, and all assumptions used in the savings calculation. The M&V Plan must be prepared during the feasibility study phase with a clear baseline. The key elements to be included in an M&V Plan are listed in Section 7 of the IPMVP Core Concepts document.

M&V provides a risk management tool to financing entities. If a proper M&V structure is implemented in a project, any issues arising later in the project cycle are more easily

managed. It also assures that these savings are continued year after year, after project implementation, through proper documentation and record keeping.

A selection of key elements of any M&V Plan is given below:

Description of EE Measures
➢ Document base conditions including energy and cost data
➢ Identification of post retrofit conditions
➢ Specify M&V process, analysis options, algorithms and assumptions
➢ Document data required for M&V
➢ Identify unplanned additions, changes to equipment's during and post retrofit
➢ Specify software if any to be used, budget and resource needs
➢ Reporting formats for energy savings, and cost reductions

M&V Information and Reporting

M&V information comprises the following:

Table 12: M&V Information and Reporting

Variables	Description	Source
Project site and measures	Details of site conditions and measures planned for EE	Site documents and IGA Report
M&V methodologies adopted	Type of M&V methodologies adopted as provided in table above	IGA Report
Details of calculations	• Data collection plan • Key assumptions • Energy rates	IGA Report
Baseline equipment and estimate for post installation conditions	• Equipment and space conditions • Key assumptions • Energy use relative to production • Adjustments needed for uncertainty	IGA Report
Metering	• Schedule of metering • Data validation	In case of metering, refer IGA Report
M&V activities	• Data analysis • Quality assurance and control • Report preparation • Certification by third party	M&V section of IGA Report

1. Project site and measures - This should contain information on project site and measures adopted.
2. M&V option selected - Document should contain options selected for M&V process
3. Details for calculations such as data collection plans, all underlying assumptions, energy rates should be included.
4. Baseline equipment and conditions should be provided in the document.
5. Plan for new equipment and assumptions should be given.
6. Metering schedule, data retrieval, data validation and sampling procedure should be explained.
7. Information on agency conducted M&V, quality assurance and quality control should be provided.
8. Initial and annual cost of M&V should also be included.

M&V Reporting

The frequency of M&V reports can be decided based on:

- Sustainability of the project
- The variance in the project impact
- The risk of not reporting on a monthly basis
- The costs associated with M&V reporting

M&V Responsibility

The M&V of energy savings can be performed by staff working for the Project Host or the ESCO, or by an energy auditor (accredited by the BEE, or empaneled with PCRA, IREDA or similar institutions).

ANNEX-4: ESCO STRUCTURES AND SELECTION PROCESS

As stated in Section 4.5, the Guaranteed and Shared Savings models are the primary ESCO structures used to implement an ESPC. The less frequently used Deemed Savings and Outsourced Energy Management Services models are depicted in Figure 4.

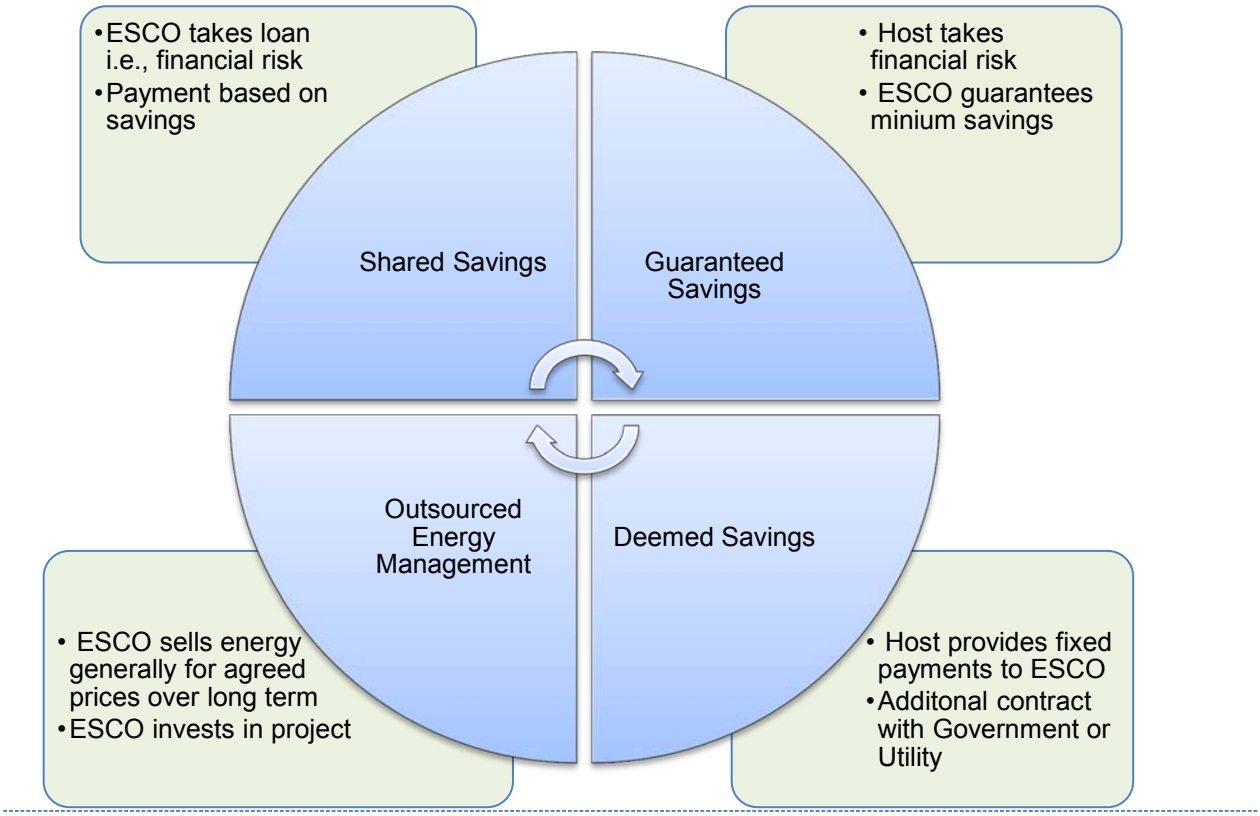

Figure 5: Types of ESCO Business Models

Shared Savings

Under the Shared Savings model, the ESCO finances the EEP either through its own funds, an investor's funds or by borrowing from a LFI. The ESCO assumes both the performance and Project Host credit risk, as the ESCO funds the EEP in exchange for a majority of savings being paid to the ESCO by the Project Host. The energy savings are divided and shared between the ESCO and the Project Host at a mutually agreed percentage for an agreed length of time.

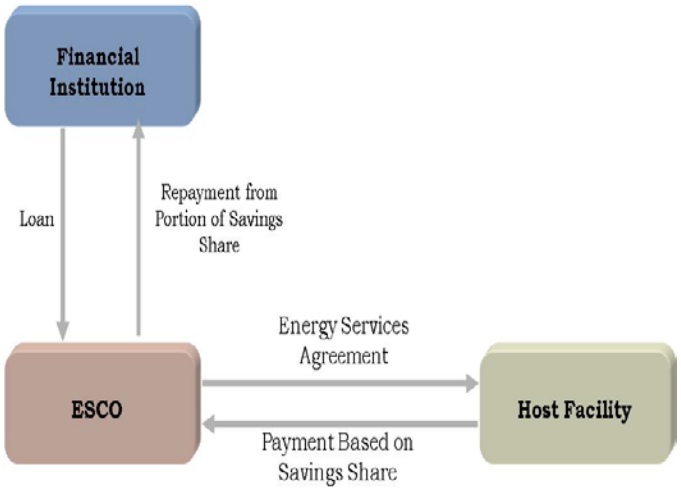

Figure 6: Shared Savings Model

The key features of the model are described in Table 13.

Table 13: Shared Savings Model

Key Agreement	Parties Involved	Key Features
ESPC	Between ESCO and the Project Host facility	• Specifies what services will be provided by whom, what types of equipment will be installed, who will be responsible for O&M, how M&V will be done, how payment will be done based on savings, payment terms, ESCO performance guarantee, warranties and other legal terms relative to the responsibilities of the ESCO and the Project Host. • The payment can be a fixed percentage or variable percentage of savings over a specific period based on various parameters. • ESCO finances project with generally no investment (or minimal investment) by the Project Host. • ESCO receives a share of the monetized actual measured energy savings from the project.
Financing Agreement (FA)	Between ESCO and LFI and/or equity investor	• ESCO equity investment, LFI debt financing. • Interest rate and term of loan. • ESCO repays loan from its share of savings. • Savings are sufficient for ESCO's profit and repayment to LFI. • ESCO may require payment security mechanism from Project Host to safeguard its savings payment.

Guaranteed Savings

In Guaranteed Savings, the Project Host arranges for financing of the EEP by borrowing funds from a third party LFI or leasing company. The ESCO has no contractual arrangement with the LFI but takes the project performance risk and guarantees the energy savings made. If the savings do not meet the mutually agreed figures/numbers, the ESCO covers the difference in performance as agreed in the ESPC agreement. Figure 6 illustrates the Guaranteed Savings model.

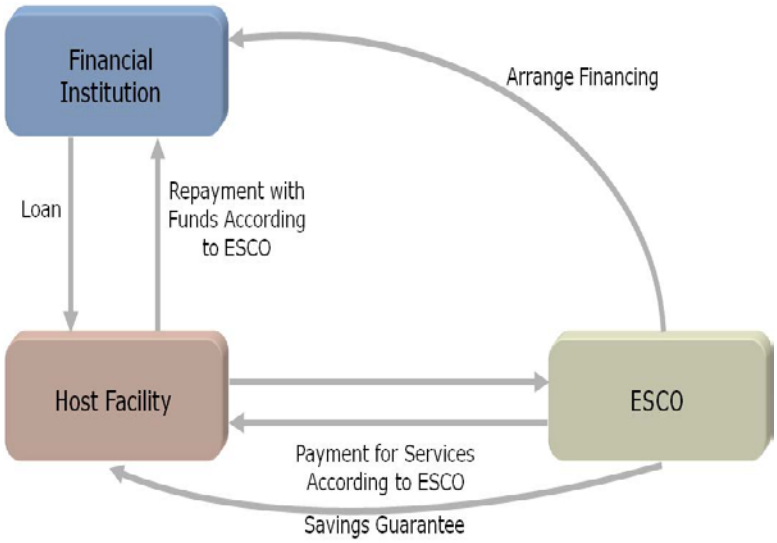

Figure 7: Guaranteed Savings Model

The key features of the model are shown in the Table 14.

Table 14: Guaranteed Savings Model

Key Agreement	Parties Involved	Key Features
Loan or Financing Agreement	LFI and Project Host	• Project Host makes an equity investment and secures term debt financing • Project Host makes loan repayments for the term of the loan • ESCO may assist Project Host to secure loan • LFIs may require payment security mechanism from the Project Host • As savings vary over time, LFIs may have to determine how to treat the variable cash flow
ESPC	Between ESCO and the Project Host facility	• Specifies what services will be provided by whom, what types of equipment will be installed, who will be responsible for O&M, how savings M&V will be done, how payment will be done based on savings, payment terms, ESCO performance guarantee, warranties and other legal terms relative to the responsibilities of the ESCO and the Project Host • ESCO implements the project and guarantees that the savings will equal Project Host's debt service payments to LFI • M&V protocol and terms of payment to ESCO are agreed upon • The payment can be a fixed percentage or variable percentage of savings over time; based on various parameters such as a onetime payment or paid over time

Deemed Savings

A Deemed Savings arrangement between an ESCO and Project Host contains a fixed price for services provided. The Financing Agreement (FA) is made between ESCO and the funding Financial Institution (similar to Shared Savings model). An agreement is signed between the

ESCO and the Project Host which ensures payments to the ESCO based on the deemed savings annually for the complete contract period. Fixed payment service models only work where the savings are not subject to downward variation due to Project Host's capacity utilization of the facility. These kinds of contracts are suitable for scenarios where a government utility is selling power below the cost of production due to various reasons. For utilities operating under these conditions, it is prudent for them to support EEPs which will result in less energy consumption by the consumers.(For example, EESL installing LED bulbs for Government of Pondicherry).Figure 7 shows a diagram of the Deemed Savings model.

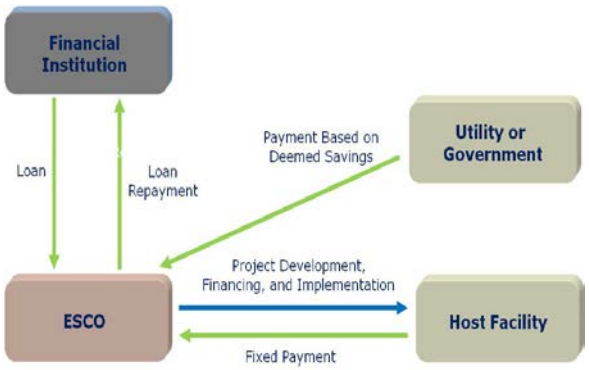

Figure 8: Deemed Saving Model

The key features of the model are provided in Table 15.

Table 15: Deemed Savings Model

Key Agreement	Parties Involved	Key Features
ESPC	Between ESCO and Project Host	• Similar to shared savings model. • Fixed payment by the Project Host for receiving ESCO's services. • Measurements are generally done for the first year. • Savings are proven as deemed savings. Annual payments are made for next 8-10 years for the duration of the contract based on deemed savings at a fixed amount. • Useful for projects where Project Hosts may operate at various operating capacity levels which determine varying levels of savings.
Financing Agreement (FA)	Between LFI and Project Host	• ESCO equity investment, LFI debt financing. • Interest rate and term of loan. • ESCO repays the loan from its share of savings. • Savings are sufficient for ESCO's profit and repayment to LFIs.
Deemed Saving Agreement	Between ESCO and Utility	• ESCO receives payment for deemed savings once the project is installed. • If annual savings are assumed to be X, the ESCO receives payment for a percentage of X for the complete contract period.

Outsourced Energy Management

The outsourced energy management model is also called an Energy Supply Contracting model. Under this model, there is a long term agreement between the ESCO and Project Host under which the ESCO takes over the operation and maintenance of the energy-using equipment or sub-facility in Project Host's facility and sells the output of the equipment/sub-facility to the Project Host. The ESCO sells the output of the equipment/sub-facility which can be lighting, steam heating, cooling, and so on, at a mutually agreed price (fixed/predictable price contract) for a defined period. Ownership generally remains with the Project Host but there may be cases where ESCO takes ownership of the equipment/sub-facility when ESCO also invests in the facility. Figure 8 illustrates a diagram of the Outsourced Energy Management model.

Example: An ESCO implements and funds a chiller for cooling water and distributes chilled water for its project host. The project host is assured of chilled water and makes payment based on the quantity of water used. The ESCO focuses more on quality of service by ensuring equipment upgrades to improve its own energy efficiency further which can add to its profits.

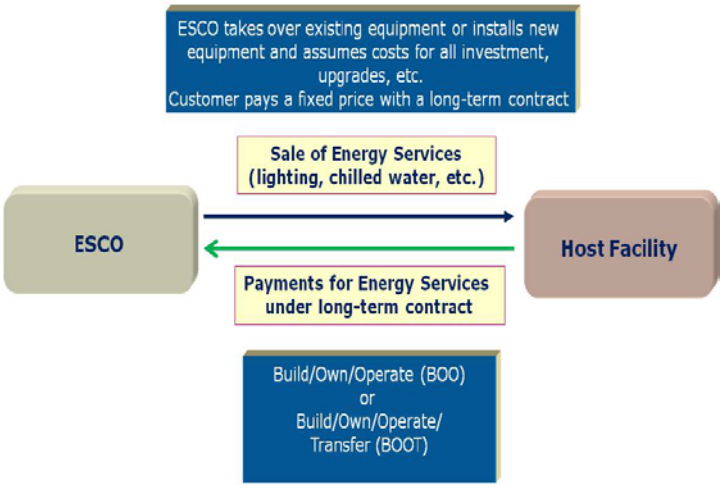

Figure 9: Outsourced Energy Management Model

The key features of the model are mentioned in Table 16.

Table 16: Outsourced Energy Management Model

Key Agreement	Parties Involved	Key Features
Energy Services Agreement	Between ESCO and Project Host	• ESCO sells the output (for example, steam, heating/cooling, lighting) to the Project Host at a mutually agreed price (generally fixed or predictable over a specific period of time)
FA	Between LFI and ESCO	• ESCO invests in all equipment upgrades, repairs, and so on, to improve energy efficiency • Ownership typically remains with the Project Host(however, in some cases, ESCO may assume the ownership of equipment)

The lender bank/FI for the ESCO projects (all 4 models) may consider provisioning of debt repayment by maintaining DSRA (debt service reserve account). While ESCROW accounts will predominantly include cash flows from ESCO projects and ensure that committed energy

savings are routed and appropriated towards discharge of liabilities in rank of their claims; maintaining additional reserve account for scheduled repayments may secure lending and can serve as an early warning signs for potential defaults.

The banks/FIs may consider stipulations in their terms of sanction with different margin requirement (promoter's contribution) for the 4 different type of ESCO models (e.g., in performance guarantee projects where host is the borrower and is supported by cash flow from other sources, less margin and more cash security may be considered for lending purpose. For Shared Savings model, where ESCO is the borrower relying on cash flow only from ESCO projects, more margin and less cash security may be considered).

Process for Project Host to Engage an ESCO

An ESPC approach to implement an EEP can prove to be very beneficial to many Project Hosts if executed in the right manner. There is no standard procedure to solicit or execute an ESPC with an ESCO; however, it is extremely important to have a clear understanding of the key ESPC terms and be fully aware of any potential legal or institutional hurdles.

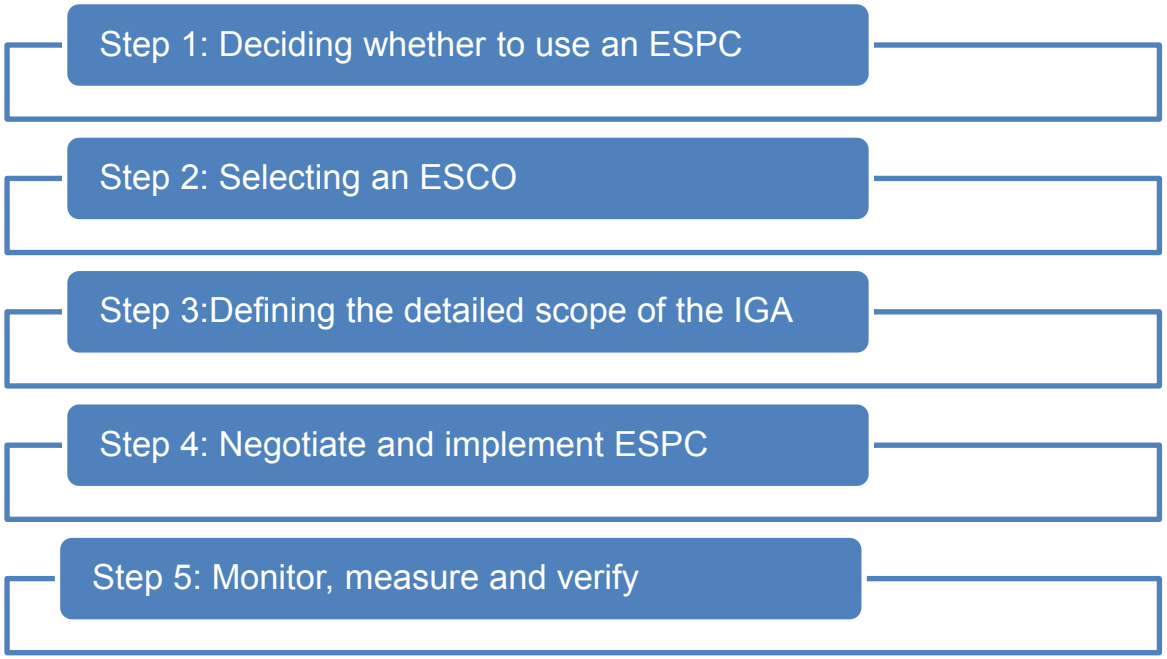

Figure 10: Project Development and Implementation Process by ESCO

Step 1: Deciding whether to use an ESPC

A Project Host that wishes to improve its EE performance needs to analyze whether it has the internal capabilities needed to conduct an IGA and implement its findings. Limitations can be related to technical (lack of expertise), financial (lack of financial resources) or organizational barriers (lack of focus or bandwidth). If they have limited resources, they can draw on support provided by an ESCO to implement EEPs at their site.

Step 2: Selecting an ESCO

Once the Project Host's management decides to proceed with an ESCO, the Project Host needs to identify an ESCO to carry out a preliminary study based on the expertise of the ESCO.

The Project Host can call for proposals from ESCOs to carry out the IGA on site. BEE also provides a list of empaneled ESCOs[40] along with their rating on their website to which the Project Host can refer to during the selection process. The selection process can be based on the proposal from ESCOs, their rating, their techno-commercial offer etc.

The Project Host may issue a LOI to the selected ESCO, which contains the terms and conditions of carrying out walk through audit, IGA such as scope of work, fee reimbursement structure, acceptable payback or IRR for Project Host for identified opportunities, etc.

The selected ESCO then carries out a review of energy consumption and a walk through audit to determine key opportunities and prepares an EER to highlight key energy savings opportunities in the organization. At this stage, the analysis carried out by the ESCOs does not include cost or obligation to the Project Host if the Project Host is not willing to act on the opportunities identified due to various reasons. On the other hand, if suitable opportunities for EEPs are established but the Project Host decides not to proceed, payment may need to be made by the Project Host to the ESCO as agreed in the LOI.

Steps 3 to 5 are essentially the same as laid out in Section 4.3.2 which illustrates the ESPC Development Cycle for an EEP. A few illustrative ESPC projects are provided below.

Illustrative IGA

Table 17 shows a sample IGA audit results for a hypothetical EEP that can be implemented by a Project Host. It also provides total implementation costs, savings, payback and estimated useful life of each ESM (lifetime).

Table 17: Sample ESPC IGA

Sr.No.	Measure No.	Description	Estimate of Annual Energy Saving Potential		Cost Benefit Analysis		
			Percent	In INR (Lakhs)	Total Investment (INR Lakhs)	Simple Payback (Months)	DSCR
1	EE001[41]	Replacement of conventional cupola with dividend blast cupola in foundry (1)	35	22.5	90.4	48	7.06
2	EE002[42]	Replacement of old furnace system with recuperator and crude station in iron and steel plant (2)	60	31	93	36	12.61

[40] http://bee-dsm.in/Docs%5CAccreditedESCOs.pdf

[41] SIDBI success stories – case study 19

[42] SIDBI success stories – case study 26

ANNEX-5: TEMPLATE FOR M&V REPORT

Brief About ESCO, Facility Owner and Project Activity

- Name of ESCO company (Brief about the ESCO)----------
- Brief about the facility owner----------
- Brief about the project activity----------
- Objective of the project----------

Annex-5A: Project Outstanding Work Notice

Log No:	
Site:	
Date Issued:	

Sr. No.	Task	Done (X)
1		
2		
3		
4		
5		
6		

Expected Completion Date:	
Actual Completion Date:	
Additional Work Report	

Signed:	Date:

Entered In Record Book:	
Signed:	Date:

Annex-5B: Project Implementation Schedule and Process Downtime

(The Project Implementation Schedule and the Process Down Time will vary according to the nature and type of the activity of the organization)

Annex-5C: Project Boundary

To clarify the project boundaries, a full diagram should be added. The flow diagram comprises all possible elements of the existing facility and equipment installed for the energy saving. The project boundary encompasses energy input sources, energy consumption, and energy saving realized thorough the project.

Please Provide Project Boundary Chart (Including energy flow system)

Annex-5D: Summary of Existing and Energy Efficient Equipment

Summary of Existing System and Energy Efficient Equipment		
Direct on Site	Energy Saving Associated With the Project	Usage of Inefficient Equipment

Annex-5E: Details of Variables

Sr. No.	Variable	Value	Reference
1			
2			
3			
4			
5			
6			
7			

Annex-5F: Static Factor

Sr. No.	Static Factor	Value	Reference
1			
2			
3			
4			
5			
6			
7			

Annex-5G: Data Required for Monitoring Process

Sr. No.	ID Number	Data Variable	Data Unit	Measured (M), Calculated (C) or Estimated (E)	Recording Frequency	Proportion of Data to Be Monitored	How Will the Data Be Achieved (Electronic/ Paper)	For How Long Is Archived Data to Be Kept?	Comment
1									
2									
3									
4									
5									
6									
7									

Annex-5H: Month Wise Contracted Demand, Energy Consumption and Saving Details

Month	Apr	May	Jun	Quarter 1	Jul	Aug	Sept	Quarter 2	Oct	Nov	Dec	Quarter 3	Jan	Feb	Mar	Quarter 4
Contracted Demand (kW)																
Energy Consumption (Unit)																
Cumulative Energy Consumption (Unit)																
Energy Saving (Unit)																
Cumulative Energy Saving (Unit)																

Annex-5I: Month Wise Monetary Saving through Contracted Demand and Energy Saving Details

Month	Apr	May	Jun	Quarter 1	Jul	Aug	Sep	Quarter 2	Oct	Nov	Dec	Quarter 3	Jan	Feb	Mar	Quarter 4
Monetary Saving by Reduction in Contracted Demand (INR)																
Monetary Saving byReduction in Energy Consumption (INR)																

Annex-5J: Annual Energy Saving

Year	Annual Energy Saving (---Unit)	Annual Energy Saving Contracted Demand (kW)

Total Over Project Concession Period		

Annex-5K: Annual Monetary Saving

Year	Annual Monetary Saving by Energy Saving (INR)	Annual Monetary Saving by Reduction in Contracted Demand (INR)

Total Over Project Concession Period		

Annex-5L: Data Storage Index

Sr. No.	Documentation Index Reference Number	Hard Copy (H) or Electronic Copy (E)	Document Title	General Description of Document	Individual or Department Submitting This Information	Date Entered	Document Location	Back-Up Document Location
1	DPR	Detailed Project Report	Engineering					
2	Baseline Study	Baseline Study	Engineering					
3	Baseline Calculation	Baseline Calculation	Engineering					
4	Monitoring Plan	Monitoring Plan	Engineering					
5	Monitoring Workbook	Monitoring Workbook	Engineering					
6	Monitoring Equipment Maintenance Report	Monitoring equipment Maintenance Report	Engineering					
7	Environmental/Social	Environmental/Social Impact statements	Engineering					
8	Recorded Electricity Consumption With Project	Recorded Electricity Consumption With Project (kWh)	Engineering					
9	Calibration and Maintenance Records	Monthly Meter Calibration Records and equipment Maintenance Records as Required	Engineering					
10	Electronic Workbook	Electronic Workbook Energy Consumption Data	Engineering					
11	Verification	Records of Verification	Engineering					
12	Stakeholder	Stakeholder Comments	Engineering					
13	Energy Saving	Records of Energy Saving	Engineering					
14	Management	Records of Project Management Including Data Collection and Management System	Engineering					

ANNEX-6: INDICATIVE LIST OF ENERGY EFFICIENCY BANK LOAN SCHEMES AND FUNDS

Name of organization	Schemes of banks and web links
Canara Bank	Canara Bank – Energy Saving Loan Scheme for SMEs www.canarabank.com/english/Scripts/LoanProToMSMEnterprises.aspx
State Bank of India	State Bank of India – Project Uptech https://sbiforsme.sbi.co.in/SME/ProjectUptechActivities.htm;jsessionid=238E19C34D8B9ED81667155E548765DD.node1?execution=e1s1
SIDBI	Sustainable Finance Scheme, Green Loan Scheme, Financing End to End Energy Efficiency Investment in MSMES (4 E Financing Scheme), Scheme for Energy Efficiency Saving Projects in MSME Sector (JICA Phase 3) https://www.sidbi.in/?q=financing-schemes-sustainable-development-including-energy-efficiency-and-cleaner-production-msmesWorld Bank –GEF scheme https://www.sidbi.in/?q=world-bank-gef-project-financing-energy-efficiency-msmes KfW line of credit for financing EE project in MSME sector http://sidbi.in/sites/default/files/products/KfW%20Financing%20Energy%20Efficiency%20Projects%20in%20MSMEs%20and%20Cluster.pdf AFD line of credit for financing EE project in MSME sector http://www.afd.fr/lang/en/home/pays/asie/geo-asie/inde/portfolio/efficacite-energetique-ligne-credit-sidbi
Bank of Baroda –Scheme for Financing Energy Efficiency Projects	www.bankofbaroda.co.in/bbs/financeenergy.asp
World Bank	www.worldbank.org/projects/P100530/india-financing-energy-efficiency-smes?lang=en

Name of Organization and Funds	Web Link
SIDB I- Credit Guarantee Trust Fund Scheme for Micro and Small Enterprises – Partial Risk Sharing Facility	www.cgtmse.in/ Partial Risk Sharing Facility (PRSF)
An inter-Ministerial Group (IMG) Representatives from Ministries of Power, Coal, Chemicals & Fertilizers, Petroleum & Natural Gas, New & Renewable Energy and Environment & Forests. National Clean Energy Fund	http://pib.nic.in/newsite/PrintRelease.aspx?relid=124495
BEE - Partial Risk Guarantee Fund for Energy Efficiency	https://beeindia.gov.in/content/prgfee
BEE - Venture Capital Fund for Energy Efficiency	https://beeindia.gov.in/content/vcfee
Clean Investment Funds - Clean Technology Fund Investment Plan for India	https://www-cif.climateinvestmentfunds.org/fund/clean-technology-fund
NABARD- Implementing Entity Green Climate Fund (GCF)	www.nabard.org/NewsFiles/NABARD_accredited_as_the_first_National_Implementing_Entity.pdf
State Energy Conservation Fund Scheme	https://beeindia.gov.in/content/strengthening-sdas-state-ec-funds

ADDENDUM- LIST OF BEE EMPANELLED ESCOs

S. No.	Name of the ESCO	Grade
1	**Power Grid Corporation of India** Saudamini Plot No 2,Sector-29, Gurgaon– 122001, Haryana **Mr. S Victor** Ph:0124-2571941Extn:2608/09873549039 victor@powergridindia.com	1
2	**Carrier Air Conditioning & Refrigeration Limited** Narsingpur Kherki Daula Post, Gurgaon–122004, Haryana **Mr. Keshav Verma** Ph:09958103398 keshav.verma@carrier.utc.com	1
3	**Yantra Harvest Energy Private Limited** OfficeNo:101-103,Plot No:8,SurveyNo: 40,Ambedkar Road, Sangamwadi, Near RTO, Pune-411001, Maharashtra **Mr. Pranay Tagare** Ph:09604764696 pranayktagare@yantraharvest.com	1
4	**Philips Electronics India Limited** 7,Justice Chandra Madhabroad, Kolkata– 700020, West Bengal **Mr. Mohan Narasimhan** Ph:09818777980 mohan.narasimhan@philips.com	1
5	**Atlas Copco (India) Limited** Sveanagar, Mumbai-Pune Road Dapodi, Pune- 411012, Maharashtra **Mr. Avdhut Barve/Mr. Mahendra Singh Manral** Ph:09326107680/ 07875340938 mahendrasingh.manral@in.atlascopco.com	1
6	**Servo TechPower Systems Private Limited** D – 212,Sector2,DSIDC,Bawan Industrial Area, Delhi–110039 **Ms. Sarika Bhatia** Ph:09818680033 sarika78@servotechindia.com	2
7	**PricewaterhouseCoopers Private Limited** Building 10, Tower C, Floor 17th, DLF Cyber City, Phase II, Gurgaon – 122 002, Haryana **Mr. Manoj Kumar Bansal** Ph:09910154500 manoj.bansal@in.pwc.com	2

8	**Tata Projects Limited** TQ Services (A division of Tata Projects Ltd) 2nd Floor, Varun Towers 1, Begumpet, Hyderabad – 500 016, Telangana **Mr. Narayana Rao KVS** Ph: 040-6725 8851/ 07661062060narayanraokvs@tataprojects.com	**2**
9	**Reckon Green Innovations Private Limited** 120,1st Floor, LeftWing, AmritaVille, Opp.YashodaHospital, Raj Bhavan Road, Somajiguda, Hyderabad– 500082, Telangana. **Mr. Krishna Ravi** Ph:040- 40069198/09985333559 krishna@reckongreen.com	**2**
10	**REC Power Distribution Company Limited** 1016–1023, 10th Floor, DevikaTower, Nehru Place, New Delhi –110 019 **Mr. CMA Somya Kant** Ph:09968284083 somyak@recl.nic.in	**2**
11	**TUV SUD South Asia** C-153/1,Okhla Industrial AreaPhase-1, New Delhi–110020 **Mr. Tarun Kushwaha** Ph:011- 30889611/09560055124 tarun.kushwaha@tuv-sud.in	**2**
12	**Steag Energy Services (India) Private Limited** A-29,Sec-16,Noida-201301,Uttar Pradesh **Mr. Boben Anto** Head- Plant Services Ph:0120-4625000/09717298313 b.anto@steag.in	**2**
13	**India SME Technology Services Limited** E-1,1st Floor, Baluja House, Jhandewalan Extension, New Delhi –110 055 **Mr. Ajay Verma,** Senior Manager Ph:09953177076 istsl@techsmall.com/ ajay.verma@techsmall.com	**2**
14	**Energized Solutions India Private Limited** C-12/14,DLF Phase-I, Gurgaon –122002,Haryana **Mr. Dhruv Dhanda** Managing Director Ph:0124- 4257278/09810030107 dhruv@energizedsolutions.org	**2**
15	**Sri Vasuki Power Systems Private Limited** 7,Venkateshwara Nilaya, 2nd Floor, 3rd Main, Society Colony, Adugodi, Bengaluru- 560030,Karnataka **Ms. Bharathi** Ph:09900703500 bharathi@vasuki.in/ sureshbabu@vasuki.in	**2**

16	**UV Krishna Mohan Rao Associates** 6,Rajaji Nagar Mainroad,Madipakkam, Chennai– 600091,TamilNadu **Mrs. R. Seethalakshmi** Ph:08940987252 seetha@uvka.net/ girija@uvka.net	**2**
17	**Glow Green Energy Limited** 122,Gagan Vihar Extension,New Delhi– 110 051 **Mr. Aditya Malik** Ph:09910990565 adityamalik@glowgreen.in	**3**
18	**Alien Energy Private Limited** 8/105, 1st Floor, Nehru Street, Vishwas Nagar, Shahdara, New Delhi–110 032 **Mr. Vikas Jain** **Ph:**07840047518 accounts@alienenergy.in	**3**
19	**PGS Energy Services Private Limited** SCO 409-410,Sector35-C, Chandigarh–160035 **Mr. Pradeep Dhingra** Director Ph:017-24605017/09876105017 pd@pgsenergyservices.com	**3**
20	**Green Tree Building Energy Private Limited** H-19,Sector 63,Noida–201301,UttarPradesh **Mr. Anurag Bajpai** Director Ph:0120-4546339/09891852358 anurag@greentree-india.com	**3**
21	**Indona Innovative Solutions** 8/W11Railway Road Opposite Onkar FeedStore, Dinanagar, Distt- Gurdaspur, Punjab–143531. **Mrs. Hardeep Kaur** Ph:09999740051 hardeep@indinsols.com	**3**
22	**Shree Electricals & Engineers(India) Private Limited** Sr. No.253/1,PlotNo.4,PhaseII,MIDC, Hinjewadi, Pune– 411057,Maharashtra **Mr. Shrirang Erande** Ph:09975596730 shrirang@shreeelectricals.com	**3**
23	**Consmoright Consultancy Services Private Limited** 204/1,StreetNo:4,ThaparNagar,Meerut–250001,UttarPradesh **Mr. Hemant Gupta** Technical Consultant Ph:09358112345 cosmoright@gmail.com	**3**

24	**Shahi Instrument and Consultants** 1C, 20/1 Krishna Nagar, OppB4/211,Safdarjung Enclave, New Delhi–110029 **Mr. Prem Shankar** Senior Consultant Ph:09818397301 prem.shankar1@gmail.com	**3**
25	**Ganges Consultancy** 273/Y-1,Block Kidwai Nagar , Kanpur–208011,UttarPradesh **Mr. Anoop Kumar Gupta** Ph:09464005209/08510810909 gangesconsultancy@ gmail.com	**3**
26	**Alankit Limited** 4E/2,Jhandewalan Extension, New Delhi–110055 **Mr. Ankit Agarwal** Managing Director Ph:09899111661 ankit@alankit.com	**3**
27	**URS Verification Private Limited** F-31 Sector-6,Noida – 201301,Uttar Pradesh **Mr. Gagan Aggarwal** Ph:09718286360 gagan.delhi@urs-climate.com	**3**
28	**Elconn EnergySystems(I) Private Limited** 310,Dilkap Chambers, Behind Balaji Telefilms, Near Enercon House, Veera Desai Road, Mumbai– 400053, Maharashtra **Mr. Sujat Faxwala** Ph:09833636464 sujat@elconn.in	**3**
29	**NeevEnergy LLP** C-21,Soami Nagar (North), NewDelhi-110017 **Mr. Neeraj Ahuja/Mr. JitendraGuha** Ph: 09871193906/09990260600 jsahu@neevenergy.in/ jguha@neevenergy.in/nahuja@neevenergy.in	**3**
30	**KeselecSchréder Private Limited** 69,Friends Colony West, Mathura Road, NewDelhi–110065 **Mr. Siddhartha Srivastava** Ph:09350107985 siddharthas@schreder.co.in	**3**

S.No.	Nameof the ESCO	Grade
31	**ADD Technologies (India) Limited** 16,AppleVilla, 3rdfloor, Left Wing, Lalbagh Road, Bangalore–560027,Karnataka **Mr. Basavaraj Murgod** Ph:09448999842 basavaraj@add tech.in	3
32	**Smart Joules Private Limited** O-23JangpuraExtension,GroundFloor, New Delhi–110014 **Mr. Arjun P. Gupta** Ph:09811103484 arjunpgupta@smart joules.in	3
33	**eSmartSolutions Private Limited** c/o Dalal Desai and Kumana, 2ndFloor, Union Co-Operative Insurance Building, 23,Sir PM Road, Fort, Mumbai-400001, Maharashtra **Mr. Sudhir Deokute** Ph:09326299195 sudhird@esmartlighting.com	3
34	**Tech Mech International Private Limited** IE, S-505,Firstfloor, School block, Shakarpur, New Delhi– 110092 **Mr. Pushpendra Singh/Ms. Noopur Rastogi** Ph:09927900913/ 09412784588 engineers@techmech.co.in/ nr.snghl@techmech.co.in	3
35	**VIN Semiconductors Private Limited** 306/307,Marathon Max,LBS Marg,Opp.Nirmal LifeStyle, Mulund(W), Mumbai-400 080,Maharashtra **Mr. Amit Upadhyay** Ph:09930361376 amitu@vin led.com	3
36	**Greetude Energy Private Limited** FlatNo.93, Deshpande Puram Patliputra SNO. 42/2A, Karve Road, Kothrud, Pune–411004, Maharashtra. **Mr. Pratik Pradeep Hakay** Ph:09922634567 pratik@greetude.c om	4
37	**AcroVentures Private Limited** K-1/39, LGF Chittaranjan Park, NewDelhi–110019 **Mr. Ankit Agarwal**	4
38	**Seven Greens Solar Systems Private Limited** 33-34/1, Shree Ram Co-op Housing Society, Opp. Ram Mandir, Ram Mandir Road,Khernagar, Bandra East, Mumbai–400051, Maharashtra **Mr. Akshay Borkar** Ph:09820364573/09833668252 info@7green s.in	4

S.No.	Nameof the ESCO	Grade
39	**Olive Exports Private Limited** 3870A/10,KanhaiyaNagar, New Delhi– 110 035 **Mr. Shyam Jindal,** Director Ph:011-27386560/09312400900 oliveledlights@gmail.com /s.jindal@oliveled.in	4
40	**SEK Electricals Private Limited** Plot 211,GroundFloor, KH.NO- 25/1/1,Block–P,Mohan Garden, Uttam Nagar, New Delhi–110059 **Mr. Abhinav Chandra,** Manager Corporate Sales Ph:097175447743 abhniav@ledfy.in	4
41	**Shri Vaari Electricals Private Limited** No.C-37,TVK Industrial Estate, Guindy, Chennai– 600032,TamilNadu **Mr. G. Jayaraman,** Head of Operations Ph:09941905805 srivaari@gmail.com	4
42	**SPML Infra Limited** SPMLHouse,PlotNo:65,Sec-32,Institutional Area, Gurgaon–122001, Haryana **Mr. Deepak Kumar Jain** Ph:0124-3944555/09711308225 deepakjain@spml.com	4
43	**KBS Certification Services Private Limited** 414-424,Om Shubham Tower, Neelam Bata Road, NIT, Faridabad-121 001,Haryana **Mr. Nihar** Ph:0129-4034513/09560995212 nihar@kbsindia.in/ akhilesh@kbsindia.in	4
44	**Machine2 Machine Solutions Private Limited** 202,PlotNo.8-3-961/B, Srinagar Colony, Above SBI Bank, Hyderabad–500 073,Telangana **Mr. Karunakar Reddy** Ph:09642140141 reddyrajula@gmail.com	5
45	**Procorp Enertech Private Limited** ShedNo.109/4,IDA,Phase-2,Cherlapally, Lane 17, Ranga Reddy District, Hyderabad– 500051,Telangana **Mr. Rama Krishna** Ph: 09704282929 ramakrishna@procorpindia.	5

B. List of 94 Energy Service Companies (ESCOs) empaneled with BEE with Validity till 30th March, 2017

S.No.	Name of Organization	Grade
46	**Ingersoll Rand Climate Solutions Private Limited** Plot No.35,KIADB Industrial Area, Bidadi, Bengaluru–562109, Karnataka **Mr. Gopi Krishna** Ph:09535611688 Gopi.Javvaji@irco.com	1
47	**Schneider Electric India Private Limited** 4thFloor,Electrawing A, Exora Business Park, Marathahalli, Sarjapur Outer Ring Road, Bangalore– 560103,Karnataka **Ms. Bindu Thomas** Ph:09980549982 bindu.Thomas@schneider-electric.com	1
48	**Salzer Electronics Limited** Samichettipalayam(PO), Jothipuram (Via), Coimbatore –641047, Tamil Nadu **Mr. Sathishkumar** Ph:09500922351 sathishkumar@schnellenergy.com	1
49	**Swelect Energy Systems Limited** Numeric House,3rd Floor, Number-5, Sir PS Sivasamy Salai, Mylapore, Chennai–600 004, Tamil Nadu **Ms. Preethy** Ph:09944185399 preethy.c@swelectes.com	1
50	**Forbes Marshall Private Limited** A-34/35,MIDC Estate, H-Block, Pimpri, Pune–411018, Maharashtra **Mr. Virendra Gill** Ph:09823104290 vgill@forbesmarshall.com	1
51	**Larsen & Toubro Limited** Larsen & Toubro Limited, E&A, North Wing, Level- 4,Powai Campus ,GateNo-7, Saki Vihar Road, Mumbai- 400 072, Maharashtra **Mr. Joydeep Banerjee** Ph:09167006496 Joydeep.Banerjee@lntebg.com	1

S.No.	Name of Organization	Grade
52	**Voltas Limited** Voltas House –B, T.B.Kadam Marg,Mumbai-400033, Maharashtra **Mr. Thaliravan G** Ph:09004265009 thaliravan @voltas.com	1
53	**Honeywell Automation India Limited** Saphhire Second Floor, A Wing, Honeywell Automation India Limited 56&57, Hadapsar Industrial Estate, Pune-411013, Maharashtra **Mr. Tarun Ramrakhiani** Ph:09665025450/020-66780381 tarun.ramrakhiani@hoenywell.com	1
54	**Mitcon Consultancy and Engineering Services Limited** Agriculture College Campus, Next to DIC office, Shivaji Nagar, Pune411015,Maharashtra **Mr. Deepak Zade** Ph:09822684106/020-25530308 Deepak.zade@mitconindia.com	1
55	**Siemens Limited** 130,PandurangBudhkarMarg,Worli, Mumbai–400018, Maharashtra **Mr. Prashant Salvi** Ph:09892143056 prashant.salvi@siemens.com	1
56	**Pranat Engineers Private Limited** A- 16/6,OmSai Complex Link Road, Site- IV, Sahibabad Industrial Area,Ghaziabad-201 010, Uttar Pradesh **Mr. Akash Jain** Ph:011-22372828/22373565 akashjain@ali	1
57	**Rites Limited** RITES Bhawan, 1,Sector 29,Gurgaon-122001,Haryana **Mr. Mukesh Sinha** Ph:09810522556 mukeshsinha@rites.com	1
58	**Secure Meters Limited** E- Class Pratapnagar Industrial Area, Udaipur - 313003, Rajasthan. **Mr. Sharad Kumar** Ph:09999970306 sharad.Kumar@secureservices.co.in	1

S.No.	Name of Organization	Grade
59	**Enzen Global Solutions Private Limited** #90,Madiwala,HosurRoad, Bangalore-560068,Karnataka **Dr. Uma Rajarathnam** Ph:080-67123002/09880345888 uma.r@enzen.com	1
60	**Johnson Controls(I) Private Limited** 401-501, 4th&5th Floor, B-Wing, Business Square, Andheri-Kurla Road, Andheri(East), Mumbai-400093, Maharashtra **Mr. Nantha Gopalan** Ph:09900766800 nantha.gopalan@jci.com	1
61	**Tata Power Delhi Distribution Limited** CENCARE, Keshavpura,LawrenceRoad,Opp.C-2 Block, Delhi–110035 **Mr. Sugata Mukherjee** Ph:9971395275 Sugata.mukherjee@tatapower-ddl.com	1
62	**Wipro Eco Energy** Wipro EcoEnergy, Wipro Limited,#108/6,Shikari Playa, Jigni Main Road, Hulimangala, Electronics City, Bangalore, Karnataka. **Mr. Shawn Menezes** Head-Knowledge Management Cell Ph:07795001286 shawn.menezes1@wipro.com	1
63	**Development Environergy Services Limited (DESL)** No 819,8thfloor, AntrikshBhawan,22KasturbaGandhi Marg New Delhi– 110001 **Mr. Harish Kumar** Ph:09582940372 harishkumar@deslenergy.com	2
64	**Advance Metering Technology Limited (AMTL)** 207,ModiTower, Nehru Place, New Delhi– 110019 **Mr. Priyangana Borah** Ph: 09891341140 priyangana.borah@pkrgroup.in	2
65	**DRA Consultants Private Limited** 6,Tatya Tope Nagar, West High Court Road, Nagpur – 440015,Maharashtra **Mr. Mehul Ranade** Ph:09763712953 ranade@dineshrathi.com	2

S.No.	Name of Organization	Grade
66	**Elcomponics Technologies India Private Limited** C-78 A, Alakhnanda, Gangotri Enclave Pocket E, NewDelhi-110019 **Ms. Namita Choudhary** Ph: 08826028834 namita.choudhary@elcomponics.com	2
67	**Epic Energy Limited** 304, A Wing, Winsway Complex, Old Police Lane, Opposite Andheri Railway Station, Andheri(East), Mumbai–400069, Maharashtra **Ms. Aruna Joshi** Ph: 09767376537 aruna.joshi@epicenergy.biz	2
68	**Enfragy Solutions India Private Limited** T-2&8C, Millenium City IT Park, DN–62,Sector V, Salt Lake City, Kolkata–91,WestBengal **Mr. Deba Mukherjee** Ph:033- 30128485 deb.mukherjee@enfragy.	2
69	**Kirloskar Brothers Limited** Yamuna, Survey No. 98/3to7,Banner, Pune-411045, Maharashtra **Mr. Gajanan Sahasrabudhe** Ph:09921844433/020-27214342 Gajanan.Sahasrabudhe@kbl.co.in	2
70	**NAAC Energy Controls Private Limited** C-135, Phase-II (Extn.) (Hoisery Complex) Noida-201305,Uttar Pradesh **Mr. C M Kapoor** Ph:0120- 4221631/32/33 chanderrmk@naacen	2
71	**SGS India Private Limited** 226,UdyogVihar,PhaseI,Gurgaon–122016,Haryana **Mr. Sanjeev Kumar** Ph:09871794628 Sanjeev.kumar@sgs.com	2
72	**Bhagwat Technologies & Energy Conservation Private Limited** 5, Millenium Business Centre, 34 Corner Market, Malviya Nagar, New-Delhi-110017 **Mr. Anil Kumar** Ph:011- 26680036/64513006 ak@btecon.c	2

S.No.	Name of Organization	Grade
73	**Ascertiva India Private Limited** #432, Galleria Complex, DLF Phase IV, Gurgaon-122009, Haryana. **Mr. Harsh Agarwal** Ph:08800514242 harsh.agarwal@ascertiva.in	**2**
74	**Lloyd Insulations (India) Limited** 2,KalkajiIndustial Area,NewDelhi-110019 **Mr. K K Mitra/Ashu Sharma** Ph: 09313217709/ 09868970770 mktshu@lloydinsulation.comkk.mitra@lloydinsulation.com	**2**
75	**EKI Energy Services Limited** 325 Block C, Prem Trade Center, Maharani RoadIndore-452007, Madhya Pradesh **Mr. Manish Dabkara** Ph:09907534900 manish@enkingint.org	**2**
76	**Saket Projects Limited** Saket House, Panchsheel, Usmanpura, Ahmedabad–380013 Gujarat **Mr. Kaushal Shah** Ph:09974389922 kaushal@saketprojects.com; energy.kaushal@gmail.co	**2**
77	**Fugenic Computer Services Private Limited** #8-2-268/A/2/S1,RoadNo3, Banjara Hills, Hyderabad-500034 **Mr. V. Jagan Mohan Reddy** Ph:09652828384/04064586656 jvenna@fugenicservices.com	**2**
78	**Certification Engineers International Limited** D 101-106, 1st Floor, ITC Tower No.7,CBD Belapur Station Complex, Navi Mumbai–400614, Maharashtra **Mr. R L Bhutani** Ph:09920702097 rlbhutiani@ceil.co.in	**2**
79	**Crompton Greaves Limited** Kanjur Marg[E], Mumbai–400042,Maharashtra **Mr. Rashmin Rathod/Mr. Swaroop Bolar** Ph:022-67558551/09769353648	**2**
80	**APITCO Limited** 8thFloor, Parisrama Bhavanam, Fateh Maidan Road, Basheerbaugh, Hyderabad- 500004 **Mr. Srinivas Rao** Ph:09849398584 srineev@yahoo.com	**2**

S.No.	Name of Organization	Grade
81	**Energo Engineering Projects Limited** 249-C, Udyog Vihar Phase-IV, Gurgaon, Haryana **Mr. Priyaranjan Sinha** Ph:09811456950 sinha.priyaranjan@energoindia.com	2
82	**Elpro Energy Dimensions Private Limited** #6,7,8,Rajaji Nagar , IVth N Block, Dr.Rajkumar Road, Bangalore 560010,Karnataka **Mr. Ramesh Singh** Ph:09845046780 elproch p@gmail.com	2
83	**Darashaw & Co. Private Limited** A-238,Second Floor, Defence Colony, New Delhi 110024 **Mr. Naveen Kumar Mishra** Ph:09891372538 naveen-mishra@darashaw.com	2
84	**See Tech Solutions Private Limited** 11/5,MIDC InfotechPark, South Ambazari Road, Nagpur – 440022, Maharashtra **Ms. Sneha Gadre** Ph:07588015842 snehal.gadre@seetechsolutions.in	2
85	**Asiatic Traders** M11-12,NewSiyaganj, Indore– 452007, Madhya Pradesh **Mr. Puneet Doshi** Ph: 07312534011 pnd@asiatictraders.net	3
86	**Granzör Engineerings Private Limited** D38/B, Lower Ground Floor, Acharya Niketan, Mayur Vihar Phase I, Delhi–110091 **Mr. Ajay Kumar** Ph:09990671833 ajay@granzor.in	3
87	**IRC Engineering Services India Private Limited** 612,Chiranjiv Tower 43,nehru Place New Delhi **Mr. AP Chouhan** Ph:08860352791 hr@ircengg.co.in	3
88	**Nano Bright Solar Technologies Private Limited** Plot Number-98,Huda Heights, Road, Number 12,Banjara Hills, Hyderabad–500034 **Mr. Venkat Vedire** Ph:09848099646 venkat@nanobrightsolar.com	3

S.No.	Name of Organization	Grade
89	**Opel Energy Systems Private Limited** 36,Shastri Market, Indore–452007, MadhyaPradesh **Mr YD Chavan** Ph:09822002047 ganeshchavan@opelenergysystems.com	3
90	**Five M Energy Private Limited** 263,Sukhdev Vihar, New Delhi–110025 **Mr. Surinder Singla** Ph:09810087309 energyfivem@gmail.com	3
91	**ENCON (Energy Management Services Private Limited)** L–51,JVV,Hiranandani Garden, Powai–400076, Mumbai, Maharashtra **Mr. Surendra Kumar** Ph:0766363120 cdrskumar@yahoo.co.in	3
92	**GEARS Energy Solutions** H-375,Sitapura Industrial Area, Jaipur–302022, Rajasthan **Mr. Raj Kumar Bhutra** Ph:08696922133 raj.b@gearsenergy.com	3
93	**Kalycito Infotech Private Limited** 6/2 and 6/3,Trichy Road, Pappampatti Pirivu, Kannampalayam, Coimbatore–641103, Tamil Nadu **Mr. Muthu Kumar N** Ph: 08754029004 accounts@kalycito.com	3
94	**RMS Automation Systems Limited** C-138,NarayanaIndustrial Area, Phase I, New Delhi – 110028 **Mr. Dhananjay Singh** Ph:09811594879 dhananjay@rmsautomation.com	3
95	**STENUM Asia Sustainable Development Society** SFF 101,Palam Triangle, Palam Vihar, Gurgaon 122017,Haryana **Mr. Rajat Batra** Ph:09811051918 rajat.batra@stenum-asia.org	3

S.No.	Nameof Organization	Grade
96	**Excel Project Consultants Private Limited** CE-126, Sector–1,Salt Lake City,Kolkata-64, West Bengal **Mr. Pradip Sengupta** Ph:09433084854 psengupta @epcpl.co.in	3
97	**G-On Energy Controls** Plot No.1941,Sriram Nagar, Bhubaneswar– 751002,Orissa **Mr. Pradipta Kumar Panigrahi** Ph:09040221000 gonenergy2011@g mail.comgonenergy@rediffmail.com	3
98	**Krishna Engineers & Consultants** Plotno.4723,LaxmiVihar, Sainik School, Bhubaneswar– 751005,Orissa **Mr. Pramod Kumar Hati** Ph:09437256123 krishnaenergy@gmail.com	3
99	**Katyani Energy Solution Private Limited** B-13, Somdutt Chamber-1, Bhikaji Cama Palace, New Delhi-110066. **Mr. Mukesh Kumar** Ph: 09868615189 mukesh.kaju@g mail.com	3
100	**AllGreen EcoTech Solutions Private Limited** Advant-NAVIS Business Park,#7,Sector142,Expressway,Noida- 201301,UttarPradesh **Mr. Mayur Toshniwal** Ph:0120- 2459901 mayur@allgreenecotech.c om	3
101	**Shakti Prabha** C-2233,Indiranagar,Lucknow–226016,UttarPradesh **Mr. RajKumar Singh** Ph:09335248741 shaktiiprabha @gmail.com	3
102	**Enhanced Wapp Systems (India) Private Limited** 914-B,9th Floor,ParkCentral,Sec-30,Gurgaon-122001,Haryana **Mr. Abhishek Tripathi** Ph:08527196443 abhishek.tripathi@wa ppsys.com	3

103	**A-Z Energy Engineers Private Limited** 103-104, Krishna House, 4805/24,Bharat Ram Road Darya Ganj ,NewDelhi-110002 **Mr. P.P Mittal** Ph:09811402040 pp_mittal @yahoo.com	**3**
104	**Namdhari Eco Energies Private Limited** 5th Floor, S.B Tower, Sec-16A, Noida, Uttar Pradesh **Mr. Bali Singh** Ph:9711591550 bali@ecoen ergies.co.in	**3**
105	**Citelum India Private Limited** E-2, Defence Colony, Ist. Floor, New Delhi-110024 **Mr. Santosh Misra** Ph: 011-40762900/ 9811101677 santoshkmisra@hotmail.com	**3**
106	**Padmashtdal.Energy.Services.Private Limited** 320,Janaki Apartments,PlotNo:7,Sec-22, Dwarka, New Delhi-110075 **Mr. K K Jha** Ph:09810392563 kkjha6 5@gmail.com	**3**
107	**Energy Solution Company** C-938,Tower No-10,River Heights, Raj Nagar Extension, Ghaziabad–201003,UttarPradesh **Ms. Mala Sharma** Ph:09868984904/ 09868984867 energysolutioncompany@gm ail.com	**3**
108	**Darshan Institute of Engineering &Technology** At-Hadala, Rajkot Morbi Highway, Near Water Sump, Rajkot–363650,Gujarat **Ms. Shital Patel** Ph:09428465956 darshan.electrical @gmail.comshital.patel@darshan.co m	**3**
109	**Kehems Consultants Private Limited** VillageUmrikheda,12th K.M.,Indore-KhandwaRoad, Indore– 452020,MadhyaPradesh **Mr. Jitendra Gangrade** Ph:09893605850/ 07314228308 kehems@kehems.com	**3**
110	**Omne Agate Systems Private Limited** 99,Greams Road,Chennai-600006,Tamilnadu **Mr. Balakrishnan S** Ph:07401298244/ 044- 42120700 marketing@omneagate.com	**3**

111	**UNITECHASSOCIATES Private Limited** NewNo.13,MooparappanStreet,First Floor, T. Nagar, Chennai-600017,Tamilnadu **Mr. VRAJAN** Ph:044-42178888/9840499815 info@unitech.co.in	3
112	**Samudra Electronic System Private Limited** 12,ElectroniccSadanII,MIDCBhosariPune – 411026,Maharashtra **Ms.Yamini Thote** Ph: 09422007924 yaminit@samudr	3
113	**Shakti Pumps (India) Limited** PlotNo.401,402&413, Industrial Area, Sector-III, Pithampur, Dist.- Dhar,Madhya Pradesh **Mr. Piyush Patidar** Ph:07024110419 piyush.patidar@shaktipumps.com	3
114	**Energetic Consulting Private Limited** TMA House,2nd Floor, Plotno.6,MainRoad, Wagle Industrial Estate, Thane (W)400604, Maharashtra **Mr. Rajesh Deshpande** Ph:9322854470 rajesh@ecpl.co.in	3
115	**Zenith Energy Systems Private Limited** 10-5-6/B, MyHome PlazaMasabtank,Hyderabad-500028 **Mr. SRC Murthy** Ph:0849660979 murthy@zenithenergy.com	3
116	**Green Stratos Consulting Private Limited** PlotNo:59,Amar Co-op Society, Kavuri Hills, Madapur, Jubilee Hills, Hyderabad- 500033 **Mr. Vivek** Ph:07893812333 vivek@greenstratos.com	3
117	**OgniEsco** I&II Floor, Plot No 245, Sri Sai Square,Phase II, Kamalapuri Colony, Hyderabad **Mr. Uma Mahesh Kumar** Ph:09246113277 msuryadevara@ognigroup.net	3
118	**Siri Exergy and Carbon Advisory Services (P) Limited.** Plot no.93A,Janaki Enclave Saroornagar, Hyderabad **Mr. G. Subramanyam** Ph:09866324164 subramanyam@siriexergy.com	3

119	**Synergy Infra Consultant** II-2,DhruvataraApartments,6-3-652/D/27, Amrutha Estates, Somajiguda, Hyderabad **Mr. T. Ramakrishna** Ph:09949985840 ramakrishna@synergyinfra.com	3
120	**Enervision** Flat No.-802, EMP-06, Evershine Millennium Paradise, TakurVillage, Kandivali(E), Mumbai-400101,Maharashtra **Mr. Chinmoy Dutta** Ph:09920123966 chinmoy.dutta@enervisiongroup.com	3
121	**Energyca** F-110,B-Wing,Hemendra C.H.S, Gokhale Road, Naupada, Thane (W)-400602, Maharashtra **Mr. Vishwas Naware** Ph:022-25306149/25393126 naware_vishwas@vsnl.net	3
122	**BNN Power** 6-SatyamIndustrial Estate, Station Road,Govandi,Mumbai-400088,Maharashtra **Mr. Sudhir Modak** Ph:09323183173 bnnpower@yahoo.in	3
123	**Oxiona Energy Solutions(I) Private Limited** B-Wing,Room No.03, DEEP- REKHA Building, Opp. Ambe Medical Store, Mithagar Road, Mulund (E), Mumbai-400081, Maharashtra **Mr. Sadanand Manekar** Ph:09821646967 info@oxiona.co.in	3
124	**GK Energy Marketeers Private Limited** F No 350 ,B No25,LokmanyaNagar,LBS Main Road, Near Dandekar Bridge Circle, Pune-411030, Maharashtra **Mr. Gopal Kabra** Ph:09970450000 gopal@energymarketers.in	3
125	**Ganpati Electricals Private Limited** U-110,First Floor, Surya Arcade, Main Vikas Marg, Shakarpur, Delhi –110092 **Mr. PN Ru stagi** Ph:08860076124 gepl@ganpatielectricals.com	3

126	**Amplebit Energy Solutions Pvt. Ltd.** 1651,2nd floor,10th Main,HAL3rd Stage, Bangalore-560075,Karnataka **Mr. Anoop Kulkarni** Ph:080- 41510739 info@amplebitenergy	**3**
127	**G AInfra Pvt. Ltd.** 402, 4th floor, Man Upasna Tower, C-Scheme, Jaipur, Rajasthan **Mr. Gajendra Agarwal** gajendra@gainfra.com	**3**
128	**Energy India** 1, British India Street, Main Block, 1st Floor, Room , No. 103, Kolkata -700 069, West Bengal **Mr.Tarun Kanti Guha** Ph:09830105553 Energy.india1@gmail.com	**3**
129	**Avya Energy Ventures Private Limited** Flat No 502,NCLKaveri-1 Apartments, Shanti Nagar, Hyderabad–5000028 **Mr. Praveen** Ph:07032700512 ram@av yagroup.com	**4**
129	**Marathwada Institute of Technology** Beed Bypass Road, Aurangabad–431105, Maharashtra **Mr. K K Jadia** Ph:09422201327 kkjadia1944 @gmail.com	**4**
130	**eSmart Energy Solutions Private Limited** (formerly known as Shah Investments, Financials, Developments and Consultants Private Limited) c/o Dalal Desai and Kumana, 2nd Floor, Union Co-Operative Insurance Building, 23,Sir P M Road, Fort, Mumbai - 400001,Maharashtra **Mr. Joseph Maprayil** Ph:09763712953 jmaprayi l@gmail.com	**4**
131	**SGS Industrial Controls &SolutionsPrivateLimited** SGSHouse,B-100,Sector-64, Noida–201307,UttarPradesh **Mr. Vibhu Wadhwa** Ph:09818173834 vibhu@sgscontrols.com	**4**

132	**A2Z Infraservices Limited** Plot NoB- 38,Institutional Area, Sector - 32,Gurgaon–122001,Haryana **Mr. Salamat Khan** Ph:07838621302 salamat.k@a2zemail.com	4
133	**First Esco India Private Limited** 16,PrinceApartments,KirlampudiLayout,ChinnaWaltair Visakhapatnam- 530017,Andhra Pradesh **Mr. Vijaykumar Kunche** Ph:09985502589 vijay.kunche@gmail.com	4
134	**Intemo Systems Limited** B23/A, IInd Floor, APIIC Colony, Kushaiguda, Electronic Complex, ECIL(Post), Hyderabad- 500062 **Mr. K.Satyanarayana** Ph:09849161339 intemoindia@yahoo.com	4
135	**ADR Power Infrastructure Private Limited** 61,TajBuilding,GB Road,Delhi-110006 **Mr. Dinesh Gupta** Ph:09999006538 dineshgupta@adrpower.com	4
136	**Deccan Consulting Engineers Private Limited** B-98/5A (3rdfloor),Joshi Colony, IP Extension, Delhi-110092 **Mr. Hari Prakash** Ph:09810533235 harideccan@gmail.com	4
137	**MSME Technology Development Centre** Foundry Nagar, Agra, Maharashtra **Mr. Pravin Joshi** Ph:09760030043 prj.msmetdc@gmail.com	4
138	**Sai Solar Technology Private Limited** J 15, 2nd Floor, BS Complex, Bishanpura, Sector- 58, Noida – 201301, Uttar Pradesh **Mr. Rajesh Kumar** Ph:09910940459 info@saisolar.in	5
139	**Wind Stream Energy Technologies Private Limited** JanapriyaConstructions,FlatNo.312&313, Kubera Towers, Narayanguda,Hyderabad-500029 **Mr. Sridhar Bhamidipati** Ph: 09505843019 bsridhar@windstream-inc.com	5

138	**SaiSolar Technology Private Limited** J 15,2nd Floor,BS Complex, Bishanpura, Sector-58,Noida–201301,Uttar Pradesh **Mr. Rajesh Kumar** Ph:09910940459 info@saisolar.in	**5**
139	**Wind Stream Energy Technologies Private Limited** Janapriya Constructions,Flat No. 312&313, Kubera Towers, Narayanguda,Hyderabad-500029 **Mr. Sridhar Bhamidipati** Ph: 09505843019 bsridhar@windstream-inc.com	**5**

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