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(Ministry of Power, Government of India)

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June 2015

Training Manual for Energy Efficiency Financing in India

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This manual is for Capacity Building of Banks and Financial Institutions For Energy Efficiency Project Financing and it is prepared by USAID PACE-D TA Program and submitted to Bureau of Energy Efficiency.

BUREAU OF ENERGY EFFICIENCY

(Ministry of Power, Government of India)

FOREWORD

The Bureau of Energy Efficiency (BEE) has been engaged in several initiatives to design and implement energy efficiency programs, including finance being made available for energy efficiency projects. As part of this initiative, BEE is working on launching two focal financial instruments: Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE). Both mechanisms aim to facilitate and accelerate the financing of energy efficiency projects.

One of the key barriers to energy efficiency financing in India is lack of awareness amongst banks and financial institutions on appraising risks and benefits of energy efficiency projects due to which loan officers typically refrain from giving loans against the promise of future energy savings. There is a critical need for loan officers and risk managers to have knowledge of characteristics and business models of energy efficiency projects, implementation models of energy saving companies, security structures, etc. which would enable them to assess energy efficiency projects in a more realistic manner.

In this context, BEE, with support from the USAID PACE-D Technical Assistance Program, has developed a training manual for energy efficiency financing. This manual aims at introducing the banks and financial institutions to the key issues involved in the appraisal and assessment of energy efficiency projects. This manual is planned to be disseminated widely amongst banks and financial institutions, and will be distributed at the various energy efficiency financing training programs that are organized.

I thank all the experts who have contributed to this compilation. I also thank the USAID PACE-D Technical Assistance Program for developing the training manual.

I hope the manual will facilitate knowledge sharing between stakeholders and scale up financing of energy efficiency projects in India.

Ajay Mathur
Director General
Bureau of Energy Efficiency

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Market Opportunity and Business Models for Energy Efficiency Projects

1. Introduction to Energy Efficiency

1.1 Background

Energy efficiency is recognized as the most cost-effective solution to meet the rapid growth in energy demand. Energy efficiency enhances energy security while moving towards reducing the energy supply/demand gap. Since there are savings in energy consumption, which otherwise would have been generated from fossil fuel-based generation, energy efficiency also plays a vital role in mitigating climate change. Thus, energy efficiency paves the way for economic development without compromising on present needs.

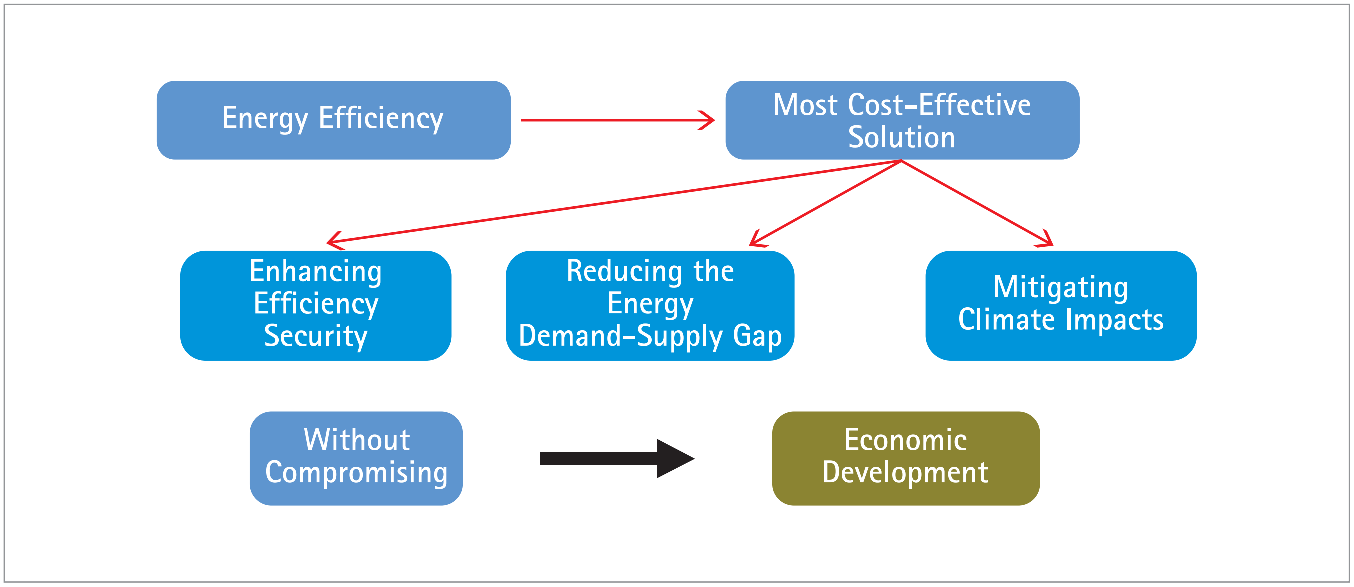


Figure 1: Role of energy efficiency in economic development

2. Studies on Market Potential for Energy Efficiency

2.1 World Bank Study[1]

A study by the World Bank for three countries, viz. India, China and Brazil, indicates that these countries have high potential for energy efficiency projects with energy savings potential of around 50 billion kWh, for which investment potential is to the tune of INR 14,000 crores.

A study done by the Confederation of Indian Industry (CII)/Indian Renewable Energy Development Agency (IREDA)[2] indicates that estimated annual savings potential is around INR 3,750 crores and investment potential for energy efficiency is about INR 8,250 crores in India.

2.1.1 National Productivity Council (NPC) Studies for the Bureau of Energy Efficiency (BEE)

NPC has carried out an energy savings potential study state-wise. Agricultural pumping, municipal pumping, street lighting, commercial buildings and SMEs are the potential sectors considered in the study. The studies estimate a savings potential of 15 percent or 75 billion units. Investment potential estimated at 4-year payback would be around INR 150,000 crores.[3]

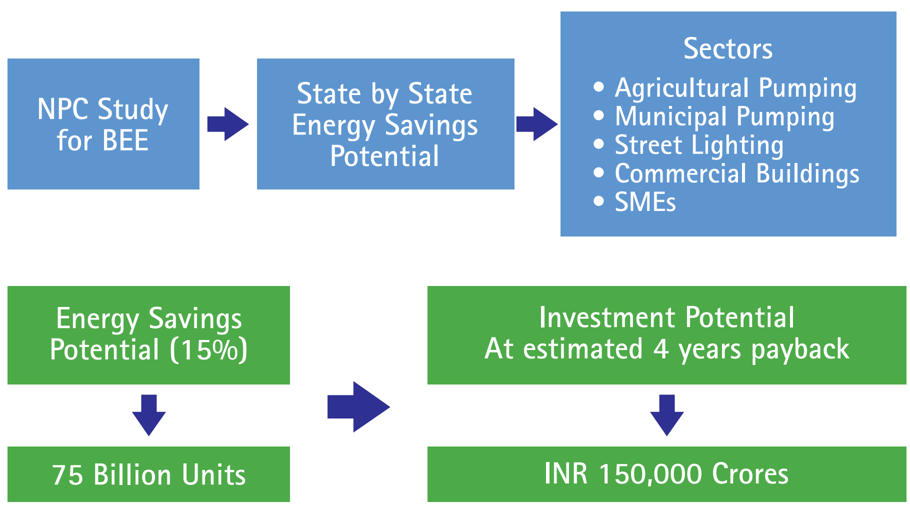


Figure 2: NPC energy saving study-methodology

[1] http://wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/02/18/000333037_20080218015226/Rendered/PDF/425290PUB0ISBN11OFFICIAL0USE0ONLY10.pdf (Page 154)

[2] http://www.ireda.gov.in/writereaddata/IREDA-InvestorManual.pdf (please refer introduction)
https://www.iea.org/Textbase/npsum/EEMR2014SUM.pdf (Page 21)

[3] http://www.dnaindia.com/analysis/editorial-dnaedit-focus-on-efficiency-2022458
http://superefficient.org/Tools/~/media/06113D85B77F4D02A016BF5E7D67223D.pdf

2.1.1.1 Survey for Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE)

BEE, in partnership with USAID PACE-D TA Program, with the support of the Alliance for an Energy Efficient Economy (AEEE), conducted a survey to generate potential pipeline of energy efficiency projects. This survey, conducted based on data available with energy service companies (ESCOs), also determined the possible role for PRGFEE and VCFEE in promoting energy efficiency finance for ESCO projects. The survey findings indicated that the ESCOs anticipate undertaking energy efficiency investment in 237 projects[4] over the next two to three years across industry facilities, municipalities, buildings and other facilities.

For these 237 projects, the break-up across the various technology streams is given in Figure 3.

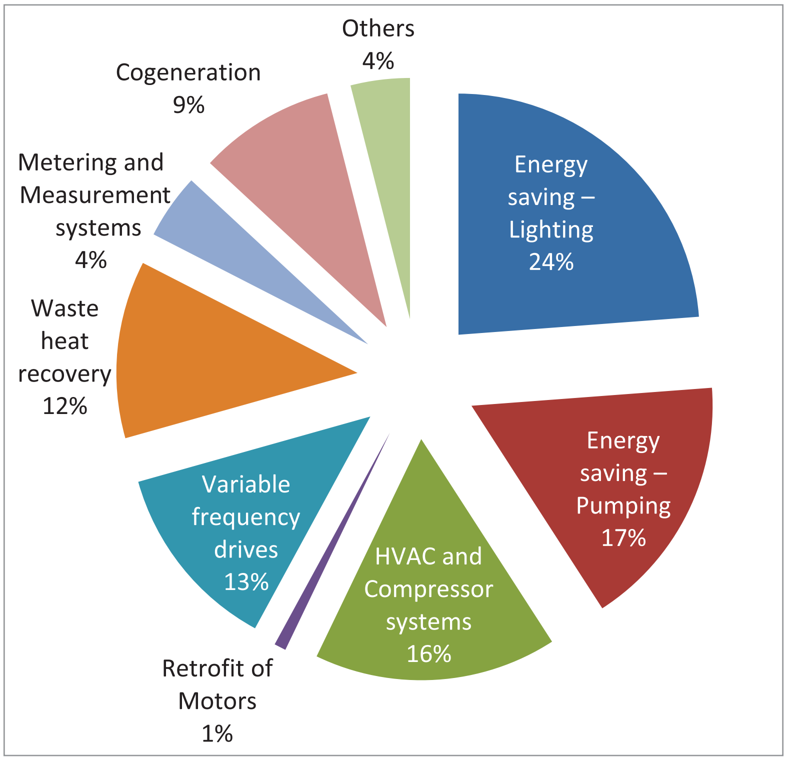


Figure 3: Distribution of projects by technologies

2.2 Requirement for Debt Financing[4,5]

Survey respondents had expressed the need for debt financing for close to 45 percent of their projects for the next two to three years.

The requirement for debt financing of each project ranges from INR 45 lakhs to INR 3 crores for various projects in the next two to three years. For debt financing, the total requirement is estimated to be INR 232 crores.

2.2.1 Requirement for Equity Financing[4,5]

Out of the projects in the pipeline, the respondents had expressed the need for equity financing for 10 percent of the total projects. The requirement for equity financing ranged from INR 5 lakhs to INR 25 crores for the next two to three years. The total requirement for equity has been estimated to be INR 96 crores.

[4] For calculations, the total number of projects in pipeline is taken as 237, obtained from survey
[5] Development of a pipeline is an evolving process and can vary with respect to the market conditions

3. Barriers to Energy Efficiency

Though the reports have indicated high potential for energy savings, the ground reality is different, in that the actual energy efficiency achieved is reported as extremely low compared to the potential. Figure 4 shows the different types of barriers that constrain energy efficiency.

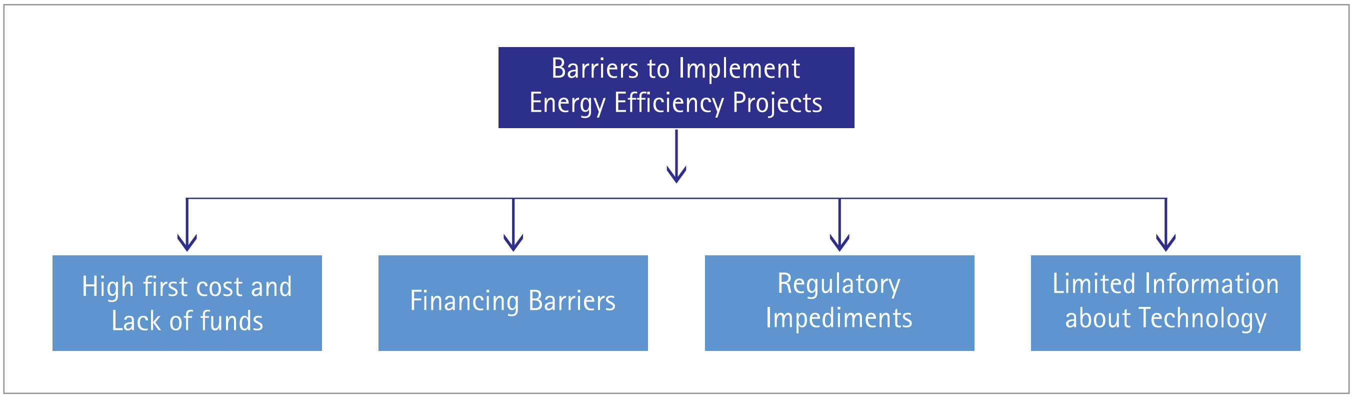


Figure 4: Barriers to energy efficiency

1. **High first cost and lack of funds** - Lack of lifecycle cost analysis at the end-user level and large initial costs act as barriers to energy efficiency projects when compared with lower cost less-efficient devices. There is some reluctance to utilize internal funds for procurement of the equipment or products needed for energy efficiency project implementation, both in the public and private sectors in the country. As such, the uptake of energy efficiency is very limited due to the need for external financing, which is often difficult to obtain.

2. **Financing barriers**
   a. Lack of non-recourse finance for energy efficiency projects - A large number of financial institutions (FIs) do not perceive energy efficiency measures as a separate project. Thus, they are unwilling to provide loans without any lien on assets of the parent entity. This makes it difficult for the implementing organization to raise finance for such projects, as most organizations utilize their borrowing limits for their core businesses.

   b. Perceived difficulty in evaluating financial returns of energy efficiency projects - Banks and FIs may have difficulties in evaluating financial returns from energy efficiency projects since energy efficiency savings are to be calculated using baselines and present consumption. This hinders the availability of both debt and equity finance for energy efficiency projects.

   c. High transaction costs due to small project size - Energy efficiency projects are relatively small in size and have a high transaction cost, compared to other conventional lending by banks and FIs. This not only makes energy efficiency projects less attractive for conventional bank financing, but also limits the interest of international FIs (such as multilateral and bilateral donor organizations) to whom the scale of financing is important.

   d. Small project size - In order to increase project size, small energy efficiency projects are often bundled together and this makes evaluation more complex due to different technologies being included in the overall project.

e. High project development costs ("soft costs") - Soft costs such as project preparatory costs and pre-financing costs such as detailed project report (DPR), feasibility report, consultant, measurement and verification (M&V) of energy efficiency projects are high when compared to their investment scale.

f. Difficulties in collateralizing project assets - Since energy efficiency projects are mostly not standalone and are integrated with main operations of industry, collateralizing project assets becomes more difficult.

g. Limited appraisal experience - Bankers/FIs have very limited experience in appraising energy efficiency projects and assigning credit risk ratings.

h. Poor creditworthiness of borrowers - In some cases, due to absence of track records on loan applicants or non payment of existing outstanding debts which means poor creditworthiness of borrowers, project funding has not been taken forward.

I. No standard contracts/agreements - Due to non-availability of standard contract agreements for energy efficiency projects, unlike for renewable energy projects wherein power sale agreements are generally based on tariff policies, most bankers/FIs find it difficult to approve energy efficiency projects.

j. Limited availability of formal M&V approaches - Though there are internationally structured and accepted M&V approaches, the concept of adapting these protocols to the Indian context with associated reduced costs of M&V is a missing link.

k. Getting new bankers poses procedural constraints - Some part of existing cash flows may be already pledged to existing bankers, and hence if a new banker has to finance an energy efficiency project, there are procedural issues that come in the way.

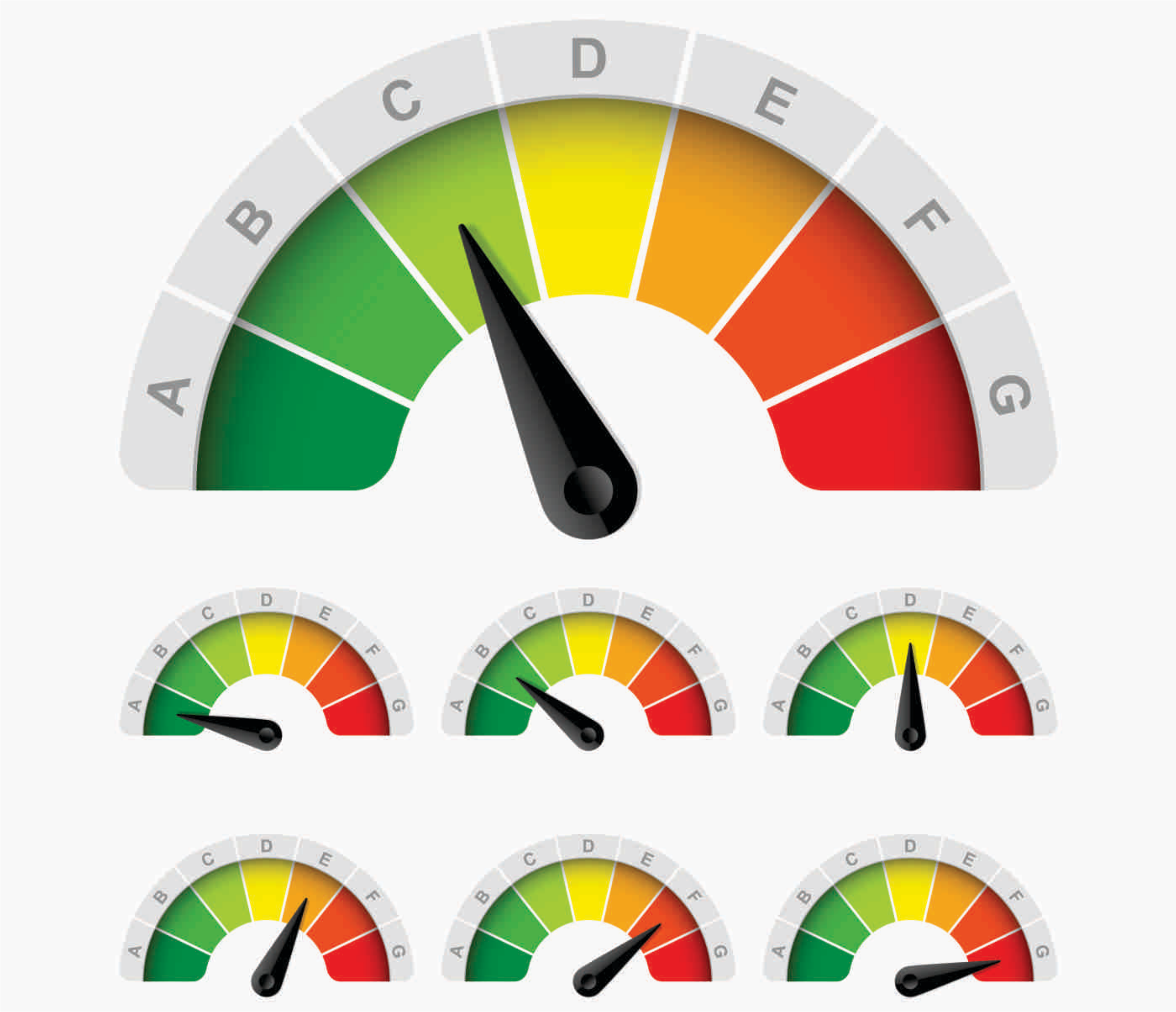
3. **Policy and institutional barriers:** Procurement generally prescribes lowest cost selection criteria. There are institutional difficulties in procuring high efficiency equipment at higher costs. The Government of India has created an institutional structure for promotion and implementation of energy efficiency bodies such as BEE at the national level and State Designated Agencies at the state level. These institutions generally assist in pilot projects and leave the scaling up to state agencies. Policy incentives at the central and state levels have been reported as a constraint in increasing energy efficiency activities.

4. **Technological barrier:** There is limited information available to consumers on performance of various technologies for energy efficiency. While equipment suppliers are adopting measures to meet this gap, there is still more to be done.

Some of the options to overcome barriers for investment in energy efficiency projects are discussed below.

- Using proven technologies - Installation of proven technologies would result in lesser failures and thereby, lesser technical and financial risks.
- Project bundling - Bundling small projects to increase project size would minimize risk in terms of investment and operation.
- Customized financial products - Project proponents can opt for customized financial products, as these would be structured to each investor type and thereby risks in terms of interest and repayment will be minimized.
- Rigorous project appraisal - Complete and rigorous project appraisal by FIs/Banks at the application stage level will minimize the risk in interest payment and repayment.
- Innovative ways to collateralize projects - Bankers/FIs can come up with innovative methods to collateralize projects in order to minimize risk in terms of payment surety and guarantee.

- Standard contracts and agreements - Documents such as standard contracts between the supplier and host, host and ESCO, and standard loan agreements for projects considering scenarios such as full collateralization, 50 percent collateralization and nil collateralization, are required as reference material for bankers/FIs to approve energy efficiency project loans.
- Formal third party M&V - Formal third party M&V could assure investors regarding energy savings and thereby improving cash flows.



4. National Mission for Enhanced Energy Efficiency and Energy Efficiency Financing Platform

The National Mission for Enhanced Energy Efficiency (NMEEE) has been established under the National Action Plan for Climate Change (NAPCC). The Ministry of Power (MOP) and BEE were tasked to prepare the implementation plan for the NMEEE. The Mission spelt out the following four new initiatives to enhance energy efficiency, in addition to the programs on energy efficiency being pursued by MOP and BEE. They are:

1. A market-based mechanism to enhance cost-effectiveness of improvements in energy efficiency in energy intensive large industries and facilities, through certification of energy savings that could be traded. [Perform Achieve and Trade];
2. Accelerating the shift to energy-efficient appliances in designated sectors through innovative measures to make the products more affordable. [Market Transformation for Energy Efficiency (MTEE)];
3. Creation of mechanisms that would help finance demand side management programs in all sectors by capturing future energy savings. [Energy Efficiency Financing Platform (EEFP)]; and
4. Developing fiscal instruments to promote energy efficiency [Framework for Energy Efficient Economic Development (FEEED)].

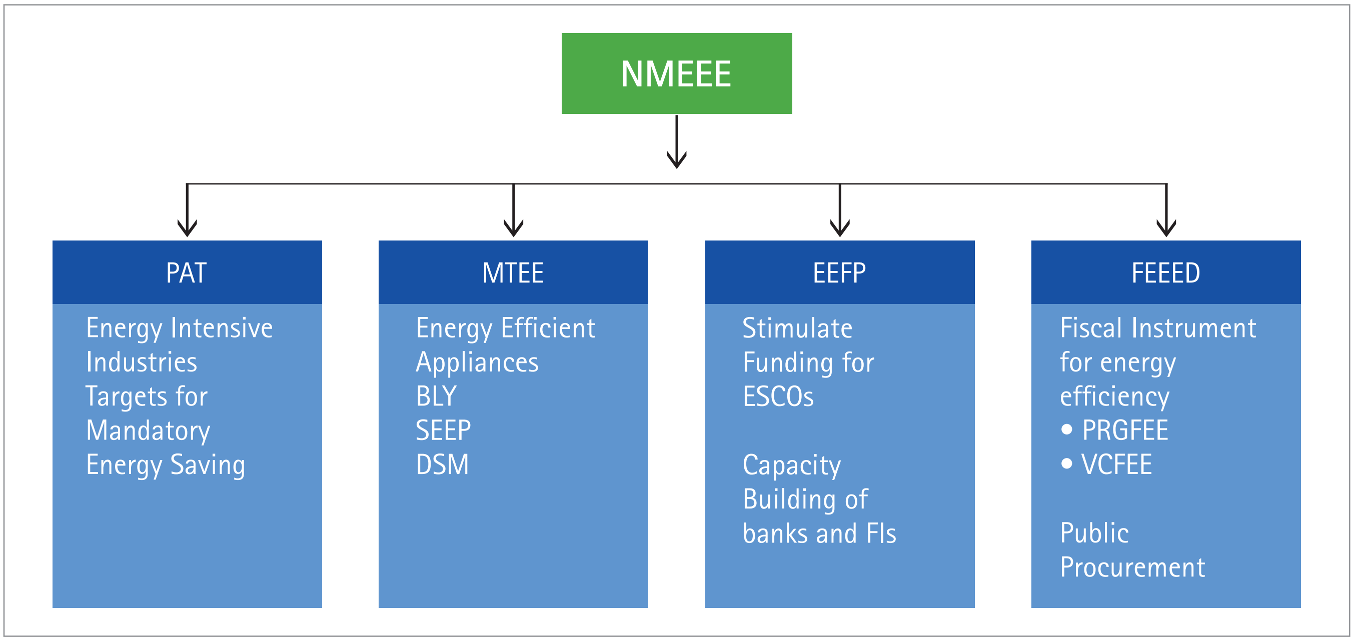


Figure 5: NMEEE initiatives

4.1 Energy Efficiency Financing Platform (EEFP)

NMEEE's third initiative is the Energy Efficiency Financing Platform (EEFP), which allows for the creation of mechanisms that would help finance demand side management programs in all sectors by capturing future energy savings. EEFP will have these components as given in Figure 6.

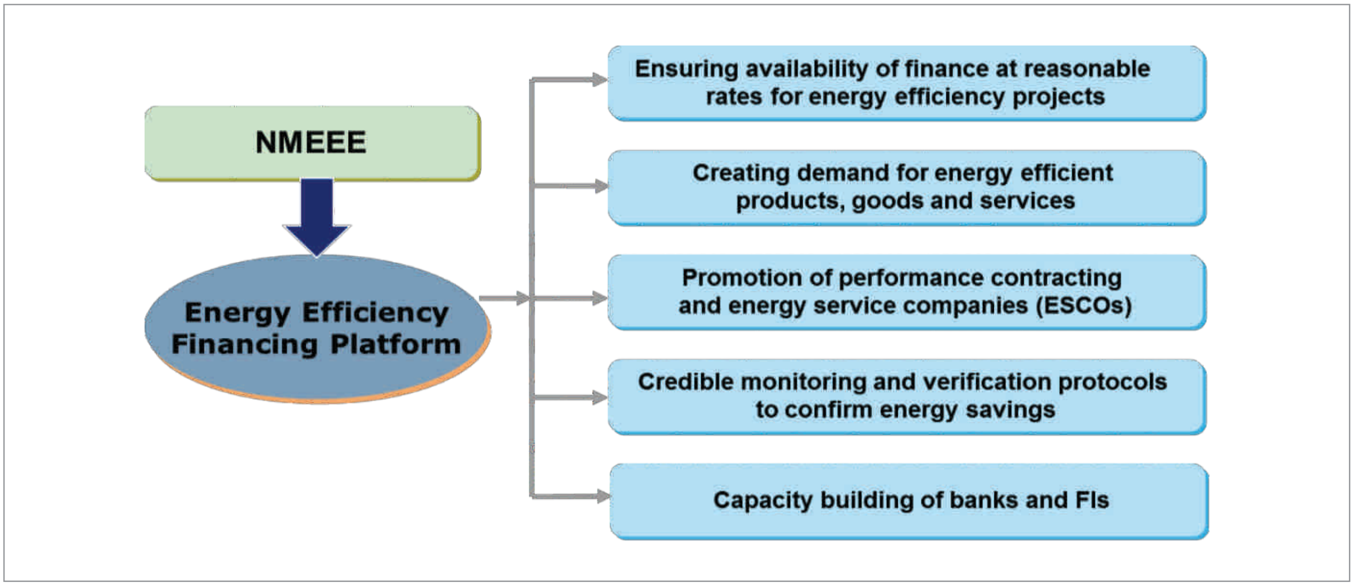


Figure 6: EEFP Features

Under the Framework for Energy Efficient Economic Development (FEEED), BEE proposes to launch two fiscal instruments to promote energy efficiency - the Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE).

BEE has undertaken the following measures, in addition to those related to implementing demonstration projects in government buildings, in order to stimulate the market.

- Putting in place a government-supported standard methodology that covers the entire project chain from audit to performance measurement and verification
- Designing a standard performance contract
- Designing appropriate financial mechanisms to fund projects
- Implementing projects and evaluating their impact
- Building capacity in ESCOs and project owners

In an effort to facilitate EEFP, BEE has signed memorandum of understanding (MOU) with with PTC India Ltd., SIDBI and HSBC Bank. PTC India Ltd. has commenced financing of several building energy efficiency projects such as in Rashtrapati Bhavan Estate, ESIC Hospitals at Rohini and East Delhi, AIIMS, Safdarjung Hospital. Similarly, SIDBI has taken up project preparation of energy efficiency projects in 25 SME clusters, which will then be offered financing.

5. Policy Initiatives from BEE

BEE has been engaged in several initiatives to enhance the identification and successful implementation of energy efficiency projects, including finance being made available for such projects. Some of the initiatives are:

- **Perform, Achieve and Trade (PAT):** This is a market-based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification on energy savings that could be traded.
  - Targets for improvements in energy efficiency are set under Section 14 of the Energy Conservation Act, 2001 in a manner that reflects fuel usage and the economic effort involved. The Government, in March 2007, notified units in nine industrial sectors, namely aluminium, cement, chlor-alkali, fertilizers, iron and steel, pulp and paper, railways, textiles and thermal power plants, as Designated Consumers (DCs).

- **Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE):** This is a risk-sharing mechanism to provide commercial banks with a partial coverage of risk involved in extending loans for energy efficiency projects.

- **Venture Capital Fund for Energy Efficiency (VCFEE):** Established by the BEE, this is one of the financial instruments under the Framework for Energy Efficient Economic Development of NMEEE. The VCFEE provides risk capital support to energy efficiency investments in new technologies, goods and services.

- **Energy audits of Buildings, Municipalities and SMEs:** As a part of the Energy Efficiency Financing Platform, BEE also carried out investment grade energy audits of buildings, municipalities and SMEs with a view to build a bouquet of projects for investors to take up for implementation.

- **Performance Contracting-based Demonstration projects:** BEE, via its accreditation process, encourages the adoption of more energy efficiency projects through ESCOs. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risks associated with the project.

- **SME Program with SIDBI:** BEE has signed a MOU with SIDBI in order to provide financial support for implementation of the technologies identified in the MSME project DPRs assessed by BEE. Thus this collaboration would promote energy efficiency project financing.

Please refer to http://beeindia.in/index.php for more details.

In addition to the above, Energy Efficiency Services Ltd. (EESL) has been established to build markets for ESCOs in the country**.** EESL has already made substantial headway in identification and implementation of energy efficiency projects in partnership with some utilities and municipalities.

Energy Efficiency Financing Examples in India[6,7,8]

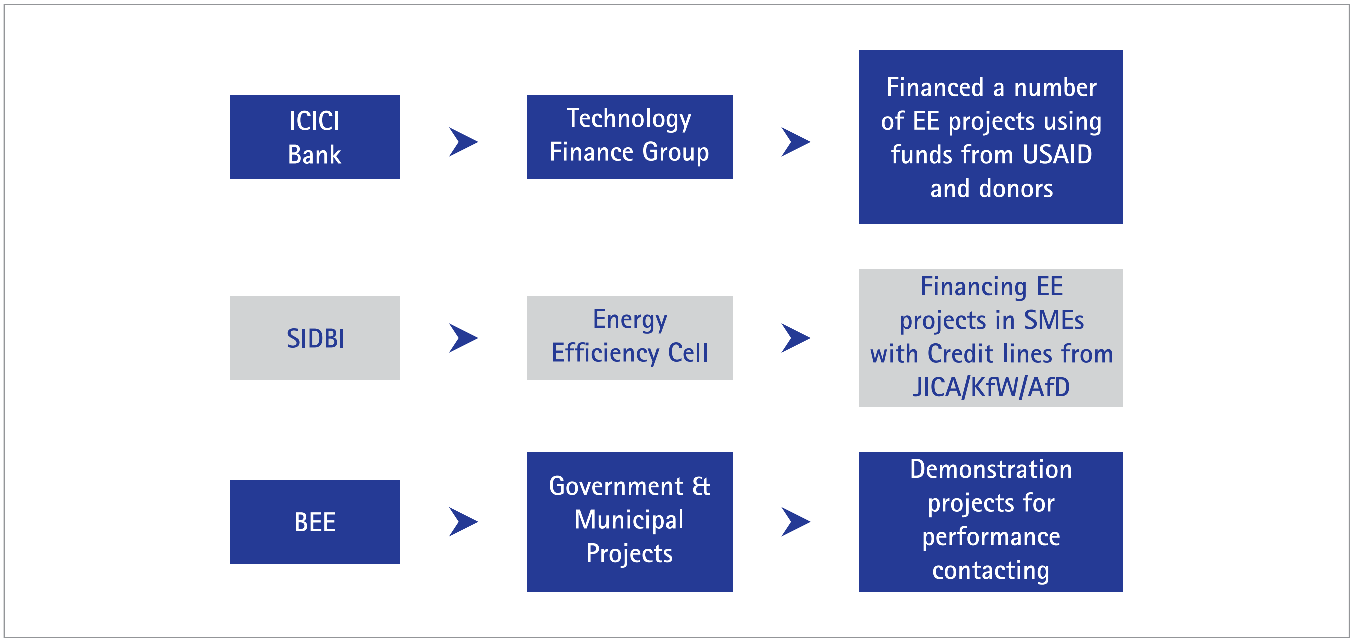


Figure 7: Energy efficiency financing examples in India

Among the financial institutions, the State Bank of India (SBI) and ICICI Bank have financed a number of energy efficiency projects. SIDBI has a designated energy efficiency cell for financing energy efficiency projects in the SME sector with credit lines from Japan International Cooperation Agency (JICA)/KfW/Agence Française de Développement (AFD).

BEE has funded energy efficiency projects in the government and municipal sector, which stand as demonstration projects for performance contracting.

Energy efficiency projects can be implemented in all major energy consuming sectors such as:

- Large Industries
- SMEs
- Commercial Buildings (offices, hotels, hospitals, shopping malls, etc.)
- Government Buildings
- Municipalities (street lighting, water pumping)
- Agriculture

[6] http://www.icicicommunities.org/environment2.html
[7] http://www.sidbi.com/?q=financing-schemes-sustainable-development-including-energy-efficiency-and-cleaner-production-msmes
[8] http://bee-dsm.in/PoliciesRegulations_1_4.aspx

6. Next Steps for Achieving the Potential

Access to finance has been identified as one of the key constraints in energy efficiency project implementation. There is action required from different stakeholders for working towards steps that could lead to realization of benefits from energy efficiency.

- **Management commitment to energy efficiency financing as a business line–** Banks/FIs strategically allocate or devise business line in the form of credit line to finance energy efficiency projects. Energy efficiency financing must be recognized as a full-fledged business opportunity with clearly identified resources for meeting targets.

- **Identification of target markets–** Banks/FIs, through their research cells, can evaluate market potential with respect to technology types, industry type and region to understand target market for financing energy efficiency projects.

- **Establishment of energy efficiency unit or cell –** To finance energy efficiency projects, Banks/FIs need to establish energy efficiency units or cells comprising personnel with relevant background, to assess project technology know-how and savings, a finance expert to assess pay-back period, debt-service coverage ratio, etc.

- **Understanding of energy efficiency financing and ESCO business models–** Banks/FIs need to build their capacity to understand different ESCO business models in energy efficiency financing. This can be achieved by interaction with ESCOs, industries and others who have implemented energy efficiency projects.

- **Identification of available government and donor incentive programs–** Banks/FIs can identify government programs such as donor incentive programs, subsidies, etc., and can link with the energy efficiency finance products, to accelerate energy efficiency finance and thereby deployment.

- **Development of customized financial products–** Customized financial products or tailor-made type products applicable to different types of customer such as small, medium and large scale enterprises, will actually increase energy efficiency project financing.

- **Training and capacity building of loan officers and risk managers–** Loan officers/managers and risk officers should undergo training and capacity building for smooth energy efficiency project appraisal and loan sanction. Loan officers and risk managers should be trained in all existing loan products of their banks and in the market, should have knowledge of different business models, agreement structures, project types and technology types.

- **Establishment of relationships with ESCOs and other energy service providers–** Banks/FIs should have regular interaction and discussions in forums with ESCOS and other energy service providers to understand ESCO expectations, energy markets and pricing, updates on technology and power sector, success and failure stories, etc. Simultaneously, ESCOs will get an opportunity to understand bank/FI terms and regulations, capacity and limitations in financing energy efficiency projects. This relationship building can smoothen energy efficiency project financing and thereby deployment.

7. Characteristics of Energy Efficiency Projects

Energy efficiency projects have certain characteristics that have key bearings on their implementation. They are:

- Energy efficiency projects range from simple and direct retrofits of devices, to complex process changes through technology upgradation.
- Energy efficiency activities such as retrofits can be completed in short time frames of 1-6 months.
- Energy efficiency activities can be achieved through well-established maintenance and standard operational practices.
- Energy efficiency project activities are modular in nature and can be added on as the demand for them increases across all consumer sectors.
- There already exists a wide range of energy-efficient technologies, most of them with substantial experience in successful implementation, internationally as well as in India .
- Energy efficiency projects are relatively small in project size, and cost less than INR 100 lakhs.
- Most energy efficiency projects have short payback periods, generally one to three years.
- The risk of failure of energy efficiency projects, through well-established technologies, is low.

8. Perform, Achieve and Trade (PAT) Scheme

The PAT scheme aims to reduce specific energy consumption (SEC) in the energy-intensive units which are designated consumers under the Energy Conservation Act. Some features are:

1. Targets would be percentage reduction of current SEC
2. Percentage reduction requirement based on:
   - Sectoral targets to achieve the national goal
   - Current SEC as a ratio of the best in the sector/groups within a sector
   - Unit-specific diversities
3. Target setting for the power generation and fertilizer sectors through the existing tariff-setting processes
4. SEC measurement and verification by BEE through designated verifiers

$$\textbf{SEC=} \frac{\text{Net energy input into the designated consumer' s boundary}}{\text{Total quantity of output exported from the designated consumer's boundary}}$$

Table 1: Sector-wise Energy Consumption and Energy Saving Targets under PAT Cycle-I (2012-2015)[9]

S.No.	Sector	No. of Identified DCs PAT cycle -I	Energy Reduction million toe
1	Aluminium	10	0.456
2	Cement	85	0.816
3	Chlor-Alkali	22	0.054
4	Fertilizer	29	0.478
5	Iron & Steel	67	1.486
6	Pulp & Paper	31	0.119
7	Textile	90	0.066
8	Thermal Power Plants	144	3.211
	Total	478	6.686

[9] http://www.powerexindia.com/PAT/Presentations/5Aug2011/Target%20Setting%20.pdf

8.1 Some of the energy efficiency measures generally deployed in industries are listed below:

- Replacement of inefficient industrial technologies with energy saving technologies and equipment, such as more efficient industrial boilers, kilns, and heat exchange systems.
- Recovery and utilization of by-product gas, waste heat in industries such as iron and steel, chlor alkali, and pulp and paper.
- Installation of highly efficient mechanical and electrical equipment, including lighting, motors, chillers, refrigeration units, pumps, heating and ventilation equipment, etc.
- Industrial system optimization to reduce energy use.

8.2 Examples of Energy Efficiency Projects in Cement Industry

- Improve kiln combustion efficiency by reducing the false air ingress at the preheater section and reducing marginally the sintering level of clinker
- Optimize the air flow to the grate cooler and reduce the vent air losses
- Utilize cooler vent air as primary air to the kiln burner
- Improve insulation at preheaters, ducts and kiln internally
- Replace the air-cooled turbulators with refractory-lined turbulators
- Generate electricity from the waste heat of pH exhaust and cooler vent streams
- Install variable frequency drives for fans in the production processes

8.3 Examples of Energy Efficiency in Buildings

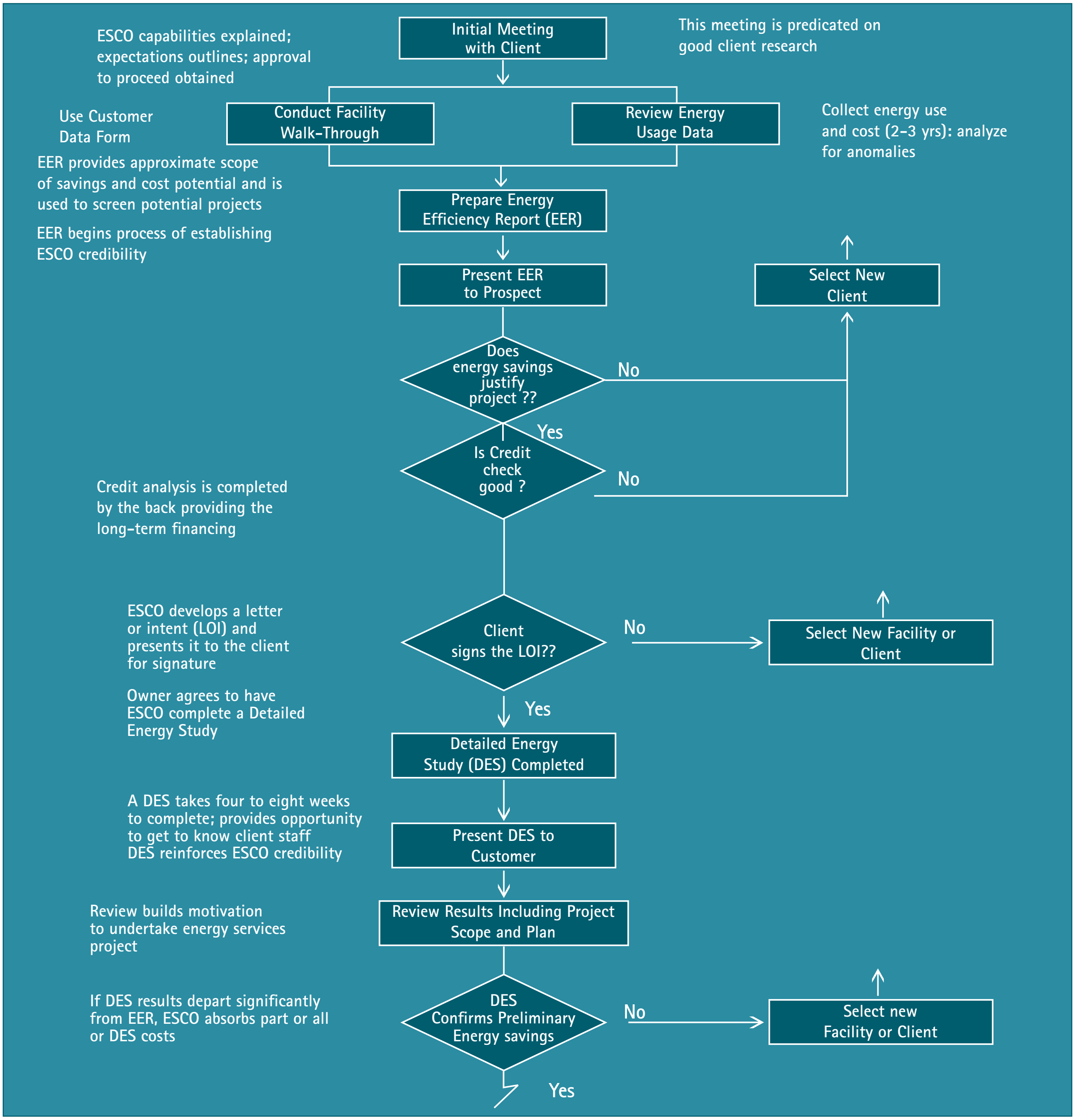
Energy efficiency in residential, commercial, and government buildings includes:

- Lighting
- HVAC (heating, ventilation, and air conditioning)
- Building envelope (insulation for roof-tops, walls, windows, doors)
- Renewable energy in buildings (roof-top solar PV, solar water heaters, and ground source heat pumps)

8.4 Examples of Energy Efficiency in Municipalities

- Water Pumping
  - Leak detection
  - Efficient pumping systems
  - Operational optimization

- Street Lighting
  - Efficient lighting
  - Controls
  - Solar systems



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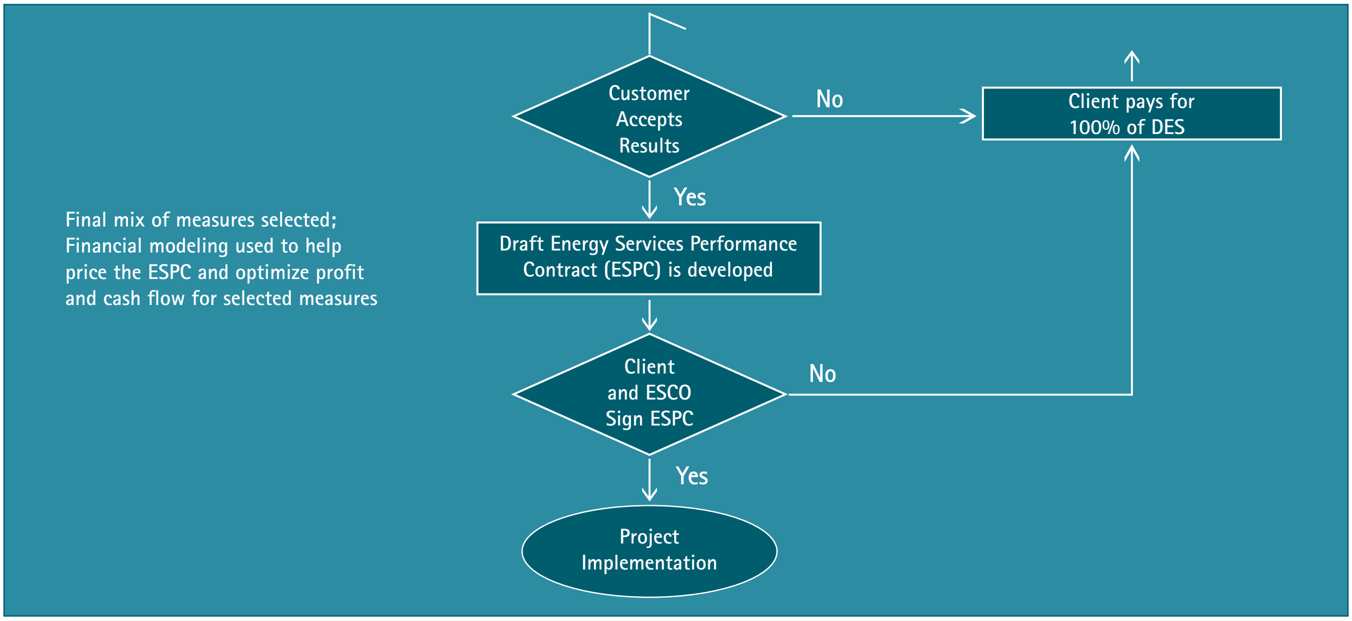


Figure 8 : Typical Energy Efficiency Project

8.5 Illustrative Project Examples

8.5.1. Street Lighting Project[10]

- Installation by ESCO of 486 street light controllers covering 19,000 street lights of Nasik Municipal Corporation
- Improvement in the existing electrical distribution network for :
  - i. Reduction in cable losses
  - ii. Power factor optimization
- Savings were shared for five years
- Annual energy bill prior to implementation – INR 5 crores.
- Achieved annual savings – INR 16 crores million on a capital investment of INR 16.6 crores.
- Payback period ~1.5 years

8.5.2. Optimizing output through input control based on AC load variations[11]

EPCOS, an electronic company, through Voltas, carried out retrofit work to optimize energy usage based on AC load variations. Retrofit measures included:

1. Primary and secondary chilled water circuits with constant flow pumps and variable flow, VFD-controlled secondary pumps.
2. Installing two -way flow control valves for the air handling units (AHU).

Working:

- Two-way valves are installed on the return water lines of the air handling unit and these operate automatically based on the AHU return air temperature.
- The opening and closing of the two - way valve changes the pressure difference across the secondary chilled water pump, which is sensed by the Differential Pressure Transmitter (DPT).

[10] ICICI bank case study presentation dated September 12, 2008
http://www.iiec.org/index.php/component/docman/doc_download/13-innovative-financing-mechanisms-for-ee-projects-in-india-icici-bank.html?Itemid=.
[11] http://www.mercindia.org.in/Presentations_PDF/Session%20I/Voltas_Presentation%20at%20NSE-BKC%20on%2018th%20Dec%2709_Joydeep.pdf

Table 2: Savings achieved in EPCOS project

Description	Results
Savings in electrical consumption measured by EPCOS	650 kWh/day
Operating days/year	300
Electrical tariff per kWh	INR 5.30
Savings per year	INR 10.335 lakhs
Simple payback period (CAPEX = INR 16 lakhs)	19 months

8.5.3. Food processing unit energy efficiency project funded by SIDBI (greenfield)

The company decided to set up a new unit for the manufacture of Herbal Food & Beverage Ingredients (chicory powder and liquid chicory) with an installed capacity of 1,200 MTPA.
Raw material: Chicory roots, washed, sliced and dried.

For the manufacture of chicory, the company decided to employ a process called agglomeration. This involves extraction of separate natural fibres from chicory root (enzyming process) and production of chicory granules with low density through special drying. The small pieces of chicory arriving at the factory would pass through the vertical extractor in running hot water and this would result in the production of extracted liquid.

This is treated with specific biotechnological enzymes and the purification takes place in a 35 ft tall pre engineered building, which would host a series of Reverse Osmosis (RO) and De-Mineralization (DM) units, compressors, and as well as boiling, evaporating and chilling units. The purified product would then be evaporated to form liquid chicory, and this would further be evaporated in special spray drying machines to form coffee granules and coffee powder

In view of the above, the company approached SIDBI in order to avail a loan for setting up the plant that would be equipped with the latest energy efficient technology. The total project cost was around INR 6 crores (term loan from SIDBI for INR 3.8 crores and INR 0.2 crores as sub-debt).

Table 3: Project details

Particulars	Description
Loan amount/Yr. of assistance	Term loan of INR 3.8 crores under 'SIDBI Direct Credit Scheme', INR 0.2 crores under 'DRCS as sub-debt'/2011
Borrower/Category	MSME - Manufacturing sector
Product/Industry sector	Manufacturing of herbal food and beverage ingredients/Food processing
Project location	Panchmahal, Gujarat
Annual turnover of the company	Not applicable (New Unit)

9. Energy Services Market in India

Offering the complete range of energy services has been suggested as the solution to increasing the pace of adoption and implementation of energy efficiency projects in the country. ESCOs have made significant contributions to the growth of energy efficiency business globally. Under the ESCO model, ESCOs provide a range of services, including energy analysis, design, installation, financing, and maintenance of the energy management and other technologies. ESCOs may also offer business and financing models under which customers effectively pay for the energy services from a portion of actual energy savings achieved. ESCOs receive payments based on demonstrable results (that satisfy the performance guarantees provided by the ESCO). In most ESCO models, a large part of the project risks are assumed by the ESCO.

Besides ESCOs, there are other energy service providers who provide a partial range of specialist services to industries and commercial establishments. These are:

- Energy auditors certified by BEE can also provide services for implementation of energy efficiency projects
- Equipment manufacturers and vendors can also provide ESCO services
- Engineering firms also extend their capabilities to provide performance contracting services
- Contract energy management companies also provide ESCO services to implement energy efficiency projects

The growth rate of the ESCO market in India has been very slow. The ESCOs face several constraints in their operations, in obtaining finances, besides facing credibility issues with clients. BEE has come forward with an empanelment scheme for ESCOs to promote energy efficiency through credible ESCOs. BEE has empanelled 125 ESCOs following a due process. An explanation of the different business models follows.

Host implementation: Many energy efficiency projects are implemented by the host itself based on recommendations by energy auditors for retrofits or change of energy-using equipment. Financial commitments are made by the project host based on energy audit output. Some audit models also include a "success fee" for the auditor upon achievement of energy cost savings.

9.1 ESCO implementation model: As mentioned above, ESCOs offer a variation of the following business models.

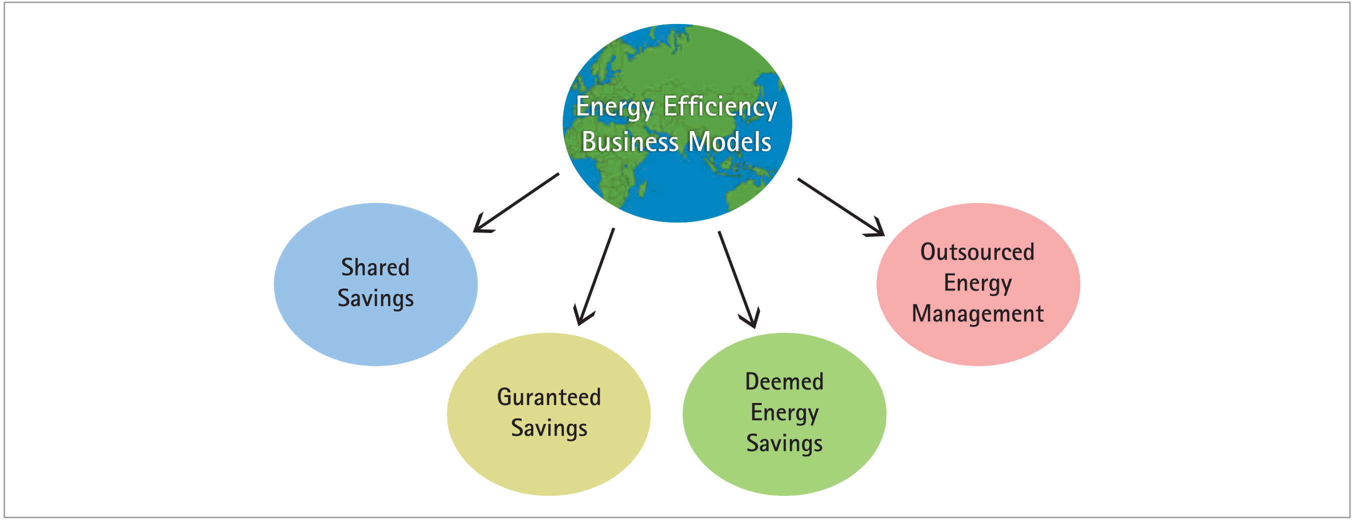


Figure 9: Energy services business models

9.2 Shared Savings Model

Energy Savings Performance Contracting (ESPC) approach is implemented on turnkey basis by energy services providers. ESCO services include design, engineering, construction, installation, commissioning, measurement and verification. ESCOs also undertake operations and maintenance, providing/arranging financing and training. The key criteria here are to share the value of the energy savings, and this is what constitutes the revenue stream for the ESCOs. The host agency gets to retain all the savings beyond the contract period.

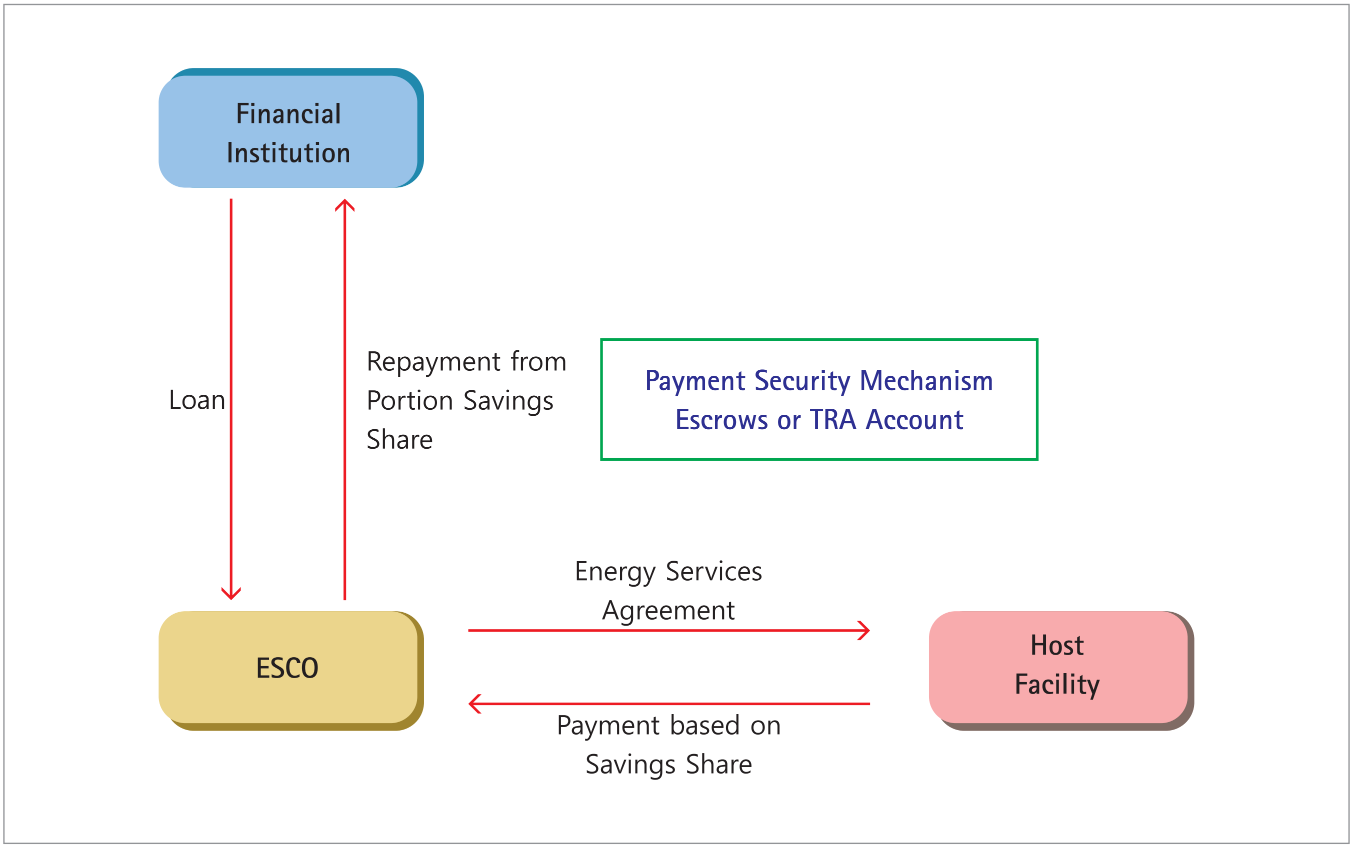


Figure 10: Shared savings model

9.3 Guaranteed Savings Model

ESCOs implementing the projects offer a guarantee in energy savings, and these translate to cost savings. The host pays ESCO a sum agreed upon, linked to the guaranteed energy savings from the energy efficiency project. If savings are lower than the guarantee, the ESCO pays the difference. If the savings are higher, the ESCO may get (but not entitled to) a bonus payment. The M&V protocol and terms of payment to the ESCO will be specified in ESPC. In this model, hosts may mobilize equity investment, and the FI will lend debt to the ESCO. The host then provides for loan repayments and interest to the FI from its savings.

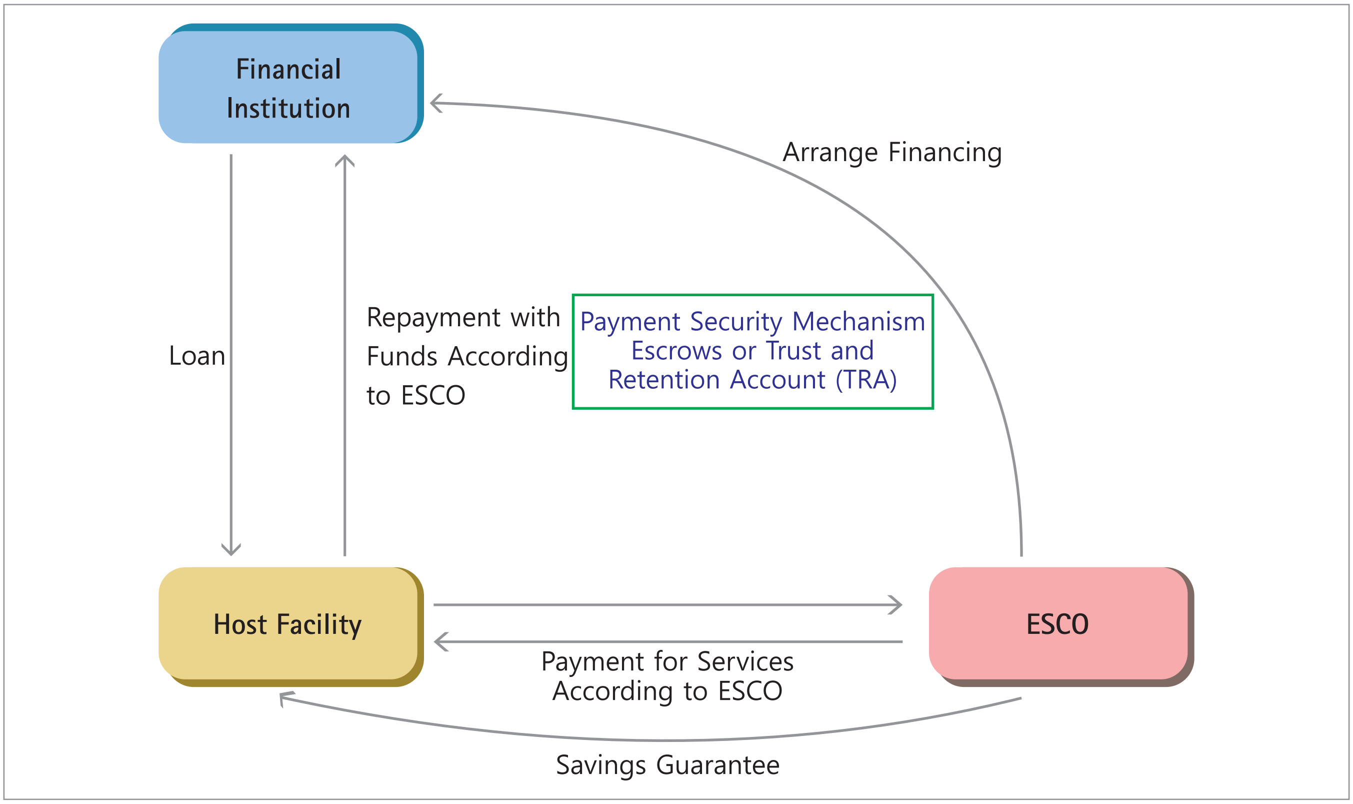


Figure 11: Guaranteed savings model

9.4 Deemed Energy Savings Model

Similar to the shared savings model, ESPC will be executed between the ESCO and host facility with a fixed price for services provided and financial agreement will be executed between the ESCO and FI for debt. The former will make loan repayments and interest from host and utility/government payments. The ESCO will execute the agreement between itself and the government or utility, for which it receives payments based on deemed savings.

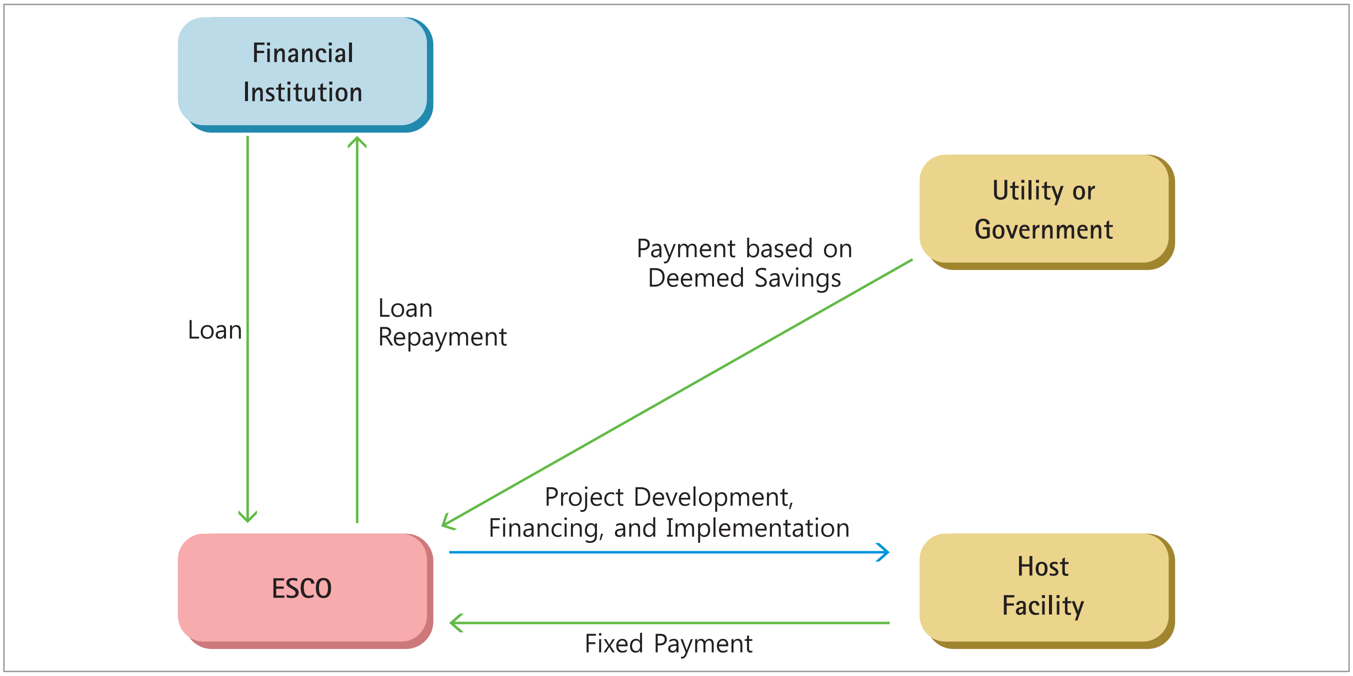


Figure 12: Deemed energy savings model

9.5 Outsourced Energy Model

This model is also known as energy supply contracting. An agreement will be executed between the ESCO and host facility under which the former takes over operation and maintenance of the energy using equipment in the host facility. The ESCO will set the output such as steam, heating/cooling, lighting to the host facility at an agreed price, generally fixed over a long period of time. It invests in all equipment upgrades, repairs, etc., to improve energy efficiency. Ownership typically remains with the host facility.

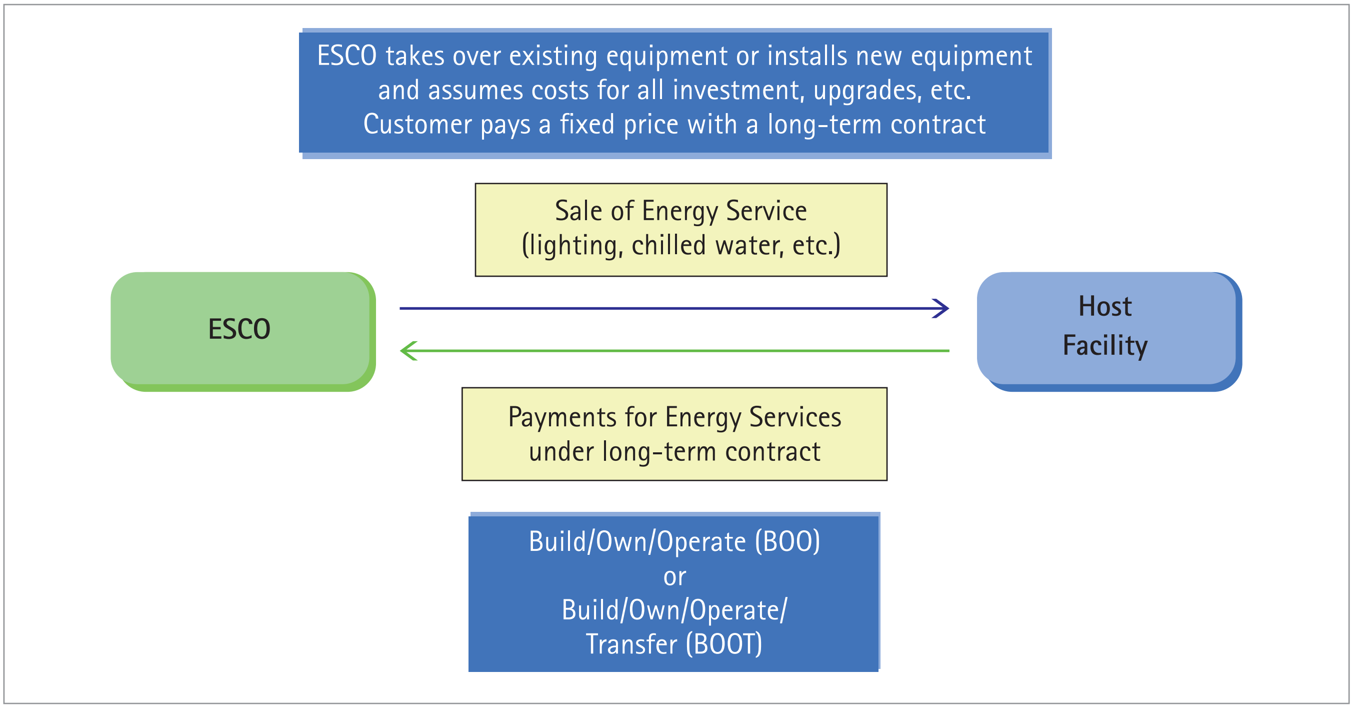


Figure 13: Outsourced energy model

10. Structure of Energy Service Performance Contract

The following are the key components of the energy service performance contract (ESPC):

- Recitals – indicative listing of events/actions
- Definitions – meaning of terminologies
- Covenants – agreements
- Term – period
- Scope of Work – a formal agreement document that specifies all the details of a contract between a service provider (vendor) and the customer. It clearly documents the project requirements, milestones, deliverables, end products, documents and reports that are expected to be provided by the vendor
- Facilities – project site or site(s)
- Construction – action of building or implementing
- Operation and Maintenance – refers to project operation and maintenance
- Financing and ownership of assets – financing (debt/equity) details and ownership details
- Energy Savings – terms related to energy savings
- Billing and payment – details on billing of energy/heat savings and payment
- Transfer of financed assets – Terms on transferring assets and settlement between ESCO and host after loan repayment period
- Force Majeure, Events of Default & Termination: unforeseeable circumstances that prevent someone from fulfilling a contract. Also on terms on events that trigger default and way out rules for termination
- Dispute Resolution – processes briefed to resolve disputes between parties
- Insurance – an arrangement by which a company or the state undertakes to provide a guarantee of compensation for specified loss, damage, in return for payment of a specified premium
- Technical Matters – related to technical process on savings, equipment, warranty, etc.,
- Measurement and Verification process and steps should be mentioned in ESPC

Part 2

Project Appraisal: Technical and Financial

11. Introduction to Energy Efficiency Projects Appraisal

Energy efficiency financing has been identified as a key constraint in achieving the potential of energy efficiency. BEE, under the NMEEE, has framed the EEFP for identification of schemes that would assist end-users and the nation in getting the benefits from reduced energy consumption.

Certain key considerations are essential for increasing financing for energy efficiency projects. These include:

Strengthening technical competencies

End-users, service providers, and FIs need to strengthen their competencies on understanding benefits of energy efficiency, knowledge of energy efficiency technologies, and the process of carrying out analysis to establish financial viability. With rapid advancement of technologies, there is a need to keep updated on the developments and to be able to identify the role for these technologies in their facilities.

Evolving technical appraisal techniques for energy efficiency projects

While conventional financial calculations are to be carried out to ensure that debt servicing can be satisfied, there is a need for evolving specific technical appraisal methods for different types of energy efficiency projects. For instance, energy savings have to be calculated using a before and after scenario, and variations in energy consumption can occur if there is a change in the basic consumption parameters.

Adopting the cash flow approach for financing

Traditional financing has been based on balance sheet approach, where the strength of the borrower's balance sheet is crucial to lending decisions, and is not so much dependent on the internal rate of return (IRR) or payback of the project per se.

Adapting financing mechanisms to energy efficiency business models

Energy efficiency projects are implemented either using internal resources, or through borrowing from FIs. Energy efficiency projects can also be implemented through the ESCO model, either through the guaranteed performance or energy shared savings models. In the second instance, there is an agreement between the client and ESCO on realization of energy savings, and resultant cost savings. This needs to be clearly understood, before analysis can begin.

Devising sound payment and security structures

FIs insist on security for their loans; their fundamental principle is to get adequate security for them to recover their loans, in case there is a default.

Standardizing energy services agreements

The ESCO model has been claimed as having the potential to change the market for energy efficiency projects. However, there has been limited progress, mainly due to the inherent risks in this model, primary being the agreements between the client and the ESCO that links payments to energy savings achieved.

11.1 General framework in project appraisal for energy efficiency projects

Fis have their own well-established process for appraising projects. They have enormous experience in financing the traditional way – through assessing balance sheets, potential increase in cash flows, and calculations on increased profitability due to the project being implemented. The projects are generally manufacturing or retail level projects that relate to establishment of new units, expansion in existing units, and modernizing plant and equipment. Energy efficiency is not a category with which the FIs are familiar with.

The appraisal process comprises the following.

a) **Promoter appraisal:** The promoter could be host or facility owner or ESCO. The financial strength of the promoter is of prime importance, considering that personal guarantees are a normal requirement in most financing agreements. If ESCO is the project promoter, then the promoter of ESCO will be appraised.

b) **Technical appraisal:** The technical feasibility of the project is to be assessed. Factors in this step include the use of the same or similar technologies by others in the industry, publicly available information on customer certificates, and test reports by reputed laboratories and standards institutions. Also relevant is the appropriateness of the technologies being installed for the customer's enterprise.

c) **Financial appraisal:** Ultimately, the FI has to recover the loans in the enterprise. Thus, calculations are carried out to establish the impact of the present financing on overall enterprise operations, on increase in revenues, possible reductions in costs, and the overall impact on bottom-line. Important parameters such as debt service coverage ratio (DSCR), internal rate of return (IRR) and payback are calculated for different scenarios. Based on the various numbers, FIs then assign a credit rating score to the borrower for the specific loan, and a final decision is made on go-/no-go for financing the enterprise, and of course the interest rate for the loan.

d) **Environmental appraisal:** All projects require an environmental impact assessment (EIA) to ensure that the activities do not impose negative impacts due to various discharges in the atmosphere, or into existing waste streams. Mitigation measures have to be identified and they should confirm that the existing standards for various environment parameters are not exceeded by the current activity.

e) **ESCO appraisal:** If the project is being implemented through an ESCO, then there is perhaps a need for assessing the capability of the ESCO to be able to implement the project. The revenue sharing agreements would also come under review, since this is what will ensure that cost savings occur and revenue streams will increase due to the project. In addition, the promoter of the ESCO will be separately appraised.

Risk identification, assessment and mitigation

The various calculations undertaken to establish cost savings, IRR and other financial parameters, need to be re-done for different scenarios, to determine their impact on the technical and financial parameters. In case some of the risks identified have a significantly negative impact on the project viability, there is a need to address these risks through appropriate mitigation measures. Scenarios could include a drop in savings, delays in commissioning, and other such factors.

12. Considerations in Project Appraisal

Project appraisal has a number of components, primary being technical and financial appraisal of the project, appraisal of the promoter and their contribution to the financing share, risk assessments, and other such aspects.

Who is the Borrower - Project Host or ESCO?

The project can be implemented either through the host enterprise themselves, or through the ESCO. In the case of the latter, there would be certain additional documentation requirement, in addition to the balance sheet and income expenditure statements. The additional documentation relate to experience of the ESCO on implementation capabilities, and financial security mechanisms.

What is the structure of payment obligation? There are different structures for payment obligations. These could be:

- Fixed, pre-established
- Variable, performance-based

If performance-based, what is the method for measuring/calculating performance/savings?

- Measurement & verification procedures
- Changes to the "baseline"
- Energy price risks
- Other factors influencing savings

What are the major risks? The risks could be categorized as:

- Technology - technology does not perform as per specifications;
- Project commissioning - project commissioning is delayed or faces problems;
- Price fluctuation - there is a significant price difference between planning and ordering;
- M&V - need for setting a credible methodology is important;
- Finance - financing risks due to high interest rates or demand of high guarantee/collaterals and;
- Energy price - fluctuations in energy price could negatively impact project financials.

13. Technical Appraisal

This is the first step in the overall assessment process. Some of the key questions to be assessed are:

Are the technologies/products proven?

Under this head, an evaluation of the products and technologies are assessed in terms of the credibility of the technologies, number of suppliers, purchaser experiences, reliability of the technologies, and availability of after-sales service facilities, among others.

Who has developed the savings estimates?

It is important to assess the method of savings calculation procedures, including if there has been any independent verification of the savings. Also, it is important to note if there are any user certificates on the savings realized. One of the key issues is: are the savings estimates realistic?

Are there any factors that may impact the savings?

There are a number of factors that could impact the actual savings. These generally include variations in load factors, changes in production patterns, and variations in fuel supply composition, apart from supply fluctuations. An analysis is to be carried out for these risks and uncertainties as it impacts on the savings estimates and project implementation plan.

Table 4: Key technical appraisal

Source	To refer
DPR or Investment Grade Audit Report	• Project technical details • Baseline energy consumption parameters • Procedure for measurement of savings • Project economics
Technology/Equipment	• Energy efficiency of the technology widely known – e.g. international or national certified • Supplier track record • Auditor recommendation of similar technologies in the past
Operations and Maintenance	• Ease of operating and maintaining the equipment • Any specialized training required on O&M of energy efficiency equipment

Table 5: Some proven technologies deployed across industries

Industry	Energy efficiency measures
Aluminium	• Variable frequency drive for spent liquor pump feeding to evaporator • Thermo-compressor and recover flash steam from pure condensate tank in evaporator section • Seal pot system for condensate recovery optimize excess O_2 in kiln by continuous monitoring • Replace old horizontal stud soderberg (hss) cells with modern point feeder prebake cells

Caustic Chloride Industry	• Variable frequency drive (VFD) with close feedback control in order to avoid valve throttling • Replace steam ejector with water ring vacuum pump for brine dechlorination • Installation of thermo compressor and utilize flash steam in the I-Effect heat exchanger • Install commercial cogeneration system for caustic chlorine industry • Conversion of mercury cell-based plant to membrane cell-based plant
Cement Industry	• Installation of high efficiency dynamic separator for raw mill • Replacement of the air-life with bucket elevator for raw-meal transport to the silo • Replacement of existing cyclones with low pressure drop cyclones • Install a high level control system for kiln operation • Variable speed fluid coupling for cooler ID fan and replacement with lower capacity motor • Replacement of existing cooler I grate with high efficiency cooler system • Installation of low primary air burner in place of existing conventional burners
Ceramic 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 spry drier • Reducing of idle operation of hydraulic press pump by installing suitable interlocks
Copper Smelter	• 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 • Install 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 ID fan • Installation of variable frequency drive for lime recirculation at scrubber exhaust system of anode furnace burners

14. Technical Risk Assessment and Mitigation

14.1 Risk Assessment and Mitigation

Four types of risks are associated with energy efficiency project implementation:

1. Technical Risk
2. Financial Risk
3. Commissioning Risk
4. Performance Risk

1. Technical Risk:

Technical risks are due to the following:

1. Imported technologies with unproven expertise in the country for operation and management
2. Relatively new technology
3. Seasonal variation – such as for biomass cogeneration

2. Financial Risk:

1. Details on financial risk are mentioned in the "Financial Appraisal" section

3. Commissioning Risk:

1. Lack of project management, limited or no construction and commissioning experience
2. Delay in acquiring licenses and approvals to implement energy efficiency projects

4. Performance Risk:

1. Lack of training in M&V
2. Lack of resource for executing M&V

14.2 Risk Mitigation

1. Assessing and Mitigation of Technical Risk

a) Confirm that the products, equipment and/or technologies are well-established and proven; review industrial benchmark and existing benchmark for the technology adopted
b) Review and assess prior experience of the implementing organizations with the technologies, equipment and products being proposed
c) Verify credentials of the energy auditors who have prepared the audit reports and technical estimates of savings
d) Assure that project meets the appropriate design standards specifications
e) Obtain client references, where appropriate, for similar project implementations
f) Use of contractors that guarantee their performance and offer fixed prices

2. Assessing and Mitigation of Commissioning Risk

a) Verify experience of project management and construction management organizations and individuals deployed in O&M
b) Assure that sufficient time has been allocated for permits and licenses
c) Verify ESCO's track record in implementing projects on time
d) Use lump-sum contracts with penalty clauses for failure to meet committed deadlines

3. Assessing and Mitigation of Performance Risk

a) Assure that ESPC contains performance guarantees (given by both the ESCO and the equipment suppliers) that are measurable
b) Review structure of performance guarantees to facilitate high standard performance
c) Assure that an adequate M&V plan is in place and approved by host and ESCO
d) Confirm that a baseline has been established for M&V
e) Use third-party M&V agent

15. Financial Appraisal

After the technical appraisal, this is the next step that will lead to a credit rating according to the internal processes of the FI. Financial appraisal should be exhaustive for the project per se, following which the overall financials of the enterprise are assessed. This appraisal of the project should include an assessment of:

- Project development costs
- Project capital costs
- Operating and maintenance costs
- Energy cost savings
- Other cost savings
- Escalation factors
- Financial structure
- Promoter (Facility owner/ESCO) equity investment
- Sharing of savings between host and ESCO

Based on the above costing, various standard calculations are undertaken to arrive at simple payback, discounted payback, financial IRR, DSCR and other such ratios. The FI then, using internal criteria for risk assessment and credit rating, assigns overall scores and recommends the project for financing with appropriate interest rates and other conditionalities.

Table 6: Key elements in financial appraisal

Key Element in Appraisal	Description
Project Costs	Does the proposal clearly define various projects costs required for decision making: • Development Costs • O&M Costs • Capital Costs • Energy Cost Savings
Financial Returns	Does the borrower plan clearly define financial parameters like: • Source of Equity • IRR • NPV - Net Present Value • Cash flow • DSCR (average and minimum) • Debt-equity Ratio • Payback Period • Interest Coverage Ratio
	Do the financial parameters allow for financing the project as per bank/FI guidelines?

Financial Structure:	Contribution from promoter or by ESCO as equity in the project
	Type of energy savings performances (ESPs) model proposed
	Does the borrower have past experience of ESPs models?
	Has the borrower provided various types of financial arrangements for the proposed model?
	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 analysis for various possible combinations of debt, equity, term loan, ESPC tenure, etc.
Nature of Contract with Other Third Parties (suppliers, contractors, installers, etc.)	Does the ESPC signed between ESCO and vendor/suppliers have a fixed price for services provided?
	Does the ESPC include the penalty clause for any delay in services provided?
	Does the ESPC signed between ESCO and installers/contractor have a fixed price for services provided?
	Does the ESPC include the penalty clause for any delay in installation from contractors?
Sensitivity Analysis	Is the project feasible on financial parameters on the base case scenario? Is the project feasible on financial parameters on the worst case scenario?
Sharing of Savings between Host and ESCO	Is a part of the savings dedicated to loan repayment? Is it fixed or variable component of ESPC?

The Central Electricity Regulatory Commission (CERC) recommended ROE for power projects is about 15 - 18 percent with debt/equity ratio less than or equal to 4: 1 (80 / 20). It is recommended that the individual bank use its own benchmarks for the above financial parameters when assessing the promoter's/promoter company's financial strength.

Table 7: Simple payback period of generic-type energy efficiency projects[12]

Generic type energy efficiency projects	Simple Payback (Years)	Example
Waste Heat Recovery (Generic)	0.5-1.5	Heat recovery in boilers and gensets
Fuel Shift or Change of Energy Source	0.5-1.5	Fuel shift from coal to biomass, change from electric heating to thermal
Cogeneration	0.5-3	Higher the % of back pressure steam lower is the payback
Electrical Distribution	0.5-1.5	Power factor improvement, transformer loss reduction.
Pumping	0.5-1.5	Proper selection of pumps and better system design
Automation	1.5-2	VFD installation, O_2 analyzer in boiler
Steam Distribution	<1	Condensate/Flash steam recovery

[12] http://www.ireda.gov.in/writereaddata/ee_appraisal_manual_final_2_0.pdf

Compressors	0.5-2	Change from reciprocating to screw or centrifugal chiller, matching of demand and generation parameters
Energy Efficient Motors	0.25-1	Induction motors in commercial buildings and manufacturing facilities
Lighting	0.5-2	Fixing LED in street lighting; industries; and government, commercial and residential buildings

(Source: IREDA Manual)

16. Case Study 1: Financial Analysis of Energy Efficiency Project – ESCO Involved[13]

As a part of the project, the company decided to replace the two 12.5 MVA transformers with 25 MVA transformers with on-load tap changing facility. This facility reduced the frequency of trappings, resulting in better production and quality, and saving in the consumption of electricity. As the drive systems at the mill already have in-built automatic voltage regulators, any substantial reduction in energy usage is not expected as a result of the project. When power quality is good, specific energy consumption averages between 550 kWh and 650 kWh per ton. Transformer loss has also come down with the replacement.

Table 8: Assumptions in transformer replacement project

Particular	Unit	Quantity
Production	Ton	37,500
Current specific energy consumption in steel melting shop	kWh/ton	600
Current specific energy consumption in wire rod mills	kWh/ton	200
New consumption in steel melting shop	kWh/ton	570
New consumption in wire rod mills	kWh/ton	20
Total loss in old transformers	kWh/ton	200
Total loss in new transformers	kWh/ton	10
Energy charges	INR/kWh	3.5

[13] http://www.ireda.gov.in/writereaddata/ee_appraisal_manual_final_2_0.pdf
IREDA has presented this case study when the ESCO implements the project. Other scenarios have also been worked out for the same project, i.e. when the host implements the project (refer page 58). Equipment cost is obtained from vendor

Table 9: Baseline consumption

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Production ton in thousand	37.5	37.5	37.5	37.5	37.5	37.5
Pre-Implementation						
Consumption in Steel Melting Shop kWh in thousand	22,500	22,500	22,500	22,500	22,500	22,500
Consumption in Wire Rod Mills kWh in thousand	7,500	7,500	7,500	7,500	7,500	7,500
Losses in Transformer kWh in thousand	750	750	750	750	750	750
Total Baseline Consumption kWh in thousand	30,750	30,750	30,750	30,750	30,750	30,750

Table 10: Net savings after project implementation

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Post-Implementation						
Consumption in Steel Melting Shop kWh in thousand	21,375	21,375	21,375	21,375	21,375	21,375
Consumption in Wire Rod Mills kWh in thousand	7,500	7,500	7,500	7,500	7,500	7,500
Losses in Transformer kWh in thousand	375	375	375	375	375	375
Total Consumption kWh in thousand	29,250	29,250	29,250	29,250	29,250	29,250
Net Saving after Implementation kWh in thousand	1,500	1,500	1,500	1,500	1,500	1,500

Table 11: Cash Flow

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of Equipment INR in thousand	8,000					
Cost of Labor in Commissioning INR in thousand	1,500					

Other Charges (accounts) INR in thousand	500					
Total Investment INR in thousand	10,000					
Promoter's Investment (25%) INR in thousand	2500					
Loan (75%) INR in thousand	7500					

Table 12: Cash flow when host implements the project

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Estimated Energy Savings INR in thousand		5,250	5,250	5,250	5,250	5,250
Depreciation @ 8% as per MoP INR in thousand		640	640	640	640	640
Interest@11 INR in thousand		825	660	495	330	165
Operating Expenses (OM&R) INR in thousand		-	-	-	-	-
Pre Tax Net Savings INR in thousand		3,785	3,950	4,115	4,280	4,445
Post Tax Net Savings @ 34.61% INR in thousand		2,475	2,582	2,690	2,796	2,906
Add Depreciation INR in thousand		640	640	640	640	640
Add Interest INR in thousand		825	660	495	330	165
Salvage Value INR in thousand						480
Cash Inflow INR in thousand	(10,000)	3,940	3,882	3,825	3,768	8,511
Project IRR (%)	33.16%					
Principal Repayment to the Bank INR in thousand		1,500	1,500	1,500	1,500	1,500
DSCR		1.69	1.80	1.92	2.06	2.23
Payback Period (years)	2.57					

Table 13: Cost benefit analysis when host implements the project

Average Annual Savings INR in thousand	5,250
Investment INR in thousand	10,000
IRR	33.16%
Payback	2.57 years

Table 14: Cash Flow when ESCO Implements Project

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Estimated Energy Savings INR in thousand		5,250	5,250	5,250	5,250	5,250
ESCO Share (80%) INR in thousand		4,200	4,200	4,200	4,200	4200
Depreciation @ 8% as per MoP INR in thousand		640	640	640	640	640
EBIT INR in thousand		3,560	3,560	3,560	3,560	3560
Interest@11% INR in thousand		825	660	495	330	165
Operating Expenses (OM&R) INR in thousand		-	-	-	-	-
Pre Tax Net Savings INR in thousand		2,735	2,900	3,065	3,230	3,395
Post Tax Net Savings @ 34.61% INR in thousand		1,788	1896	2,004	2,112	2,219
Add Depreciation INR in thousand		640	640	640	640	640
Add Interest INR in thousand		825	660	495	330	165
Salvage Value INR in thousand						480
Cash Inflow INR in thousand	(10,000)	3,253	3,196	3,139	3,082	7,824
Project IRR	25.35 %					
Principal Repayment to the Bank INR in thousand		1,500	1,500	1,500	1,500	1,500
DSCR		1.40	1.48	1.57	1.68	1.82
Payback Period (years)	3.13					

Table 15: Cost benefit analysis when host implements the project

Average Annual Savings INR in thousand	5,250
Investment INR in thousand	10,000
IRR	25.35%
Payback	3.13 years

17. Loan Security Considerations

FIs have a number of considerations before the loan is approved and disbursed. For energy efficiency, some of the considerations are given below.

Most energy efficiency equipment has low collateral value- Unless the energy efficiency project relates to major refurbishments, or modernization, most energy efficiency projects are about replacing different equipment, such as motors, compressors, VFDs, etc., which have low collateral value. Recovering the loan through acquiring and sale of the asset may not yield much in terms of recoveries.

Equipment cost typically is 60-65 percent of total project cost- Of the total project cost, the soft costs of commissioning, M&V and other costs constitute about 30-40 percent. Thus, collateral from equipment costs alone will not be adequate for recovering the loan, in case of default.

Equipment generally uneconomical to remove and use elsewhere- The equipment, if taken out of the enterprise, is generally not accepted by any other enterprise for use, and has very little re-sale or recovery value.

Generally, FIs move towards taking first charge on the project equipment, and if the value of the equipment as assessed falls short of the security amount, then additional security is taken from other assets which are not mortgaged to any other loan. This is because, the total value of the equipment is not just the cost of the equipment, but also includes commissioning and other costs, for which the loan is taken. FIs normally take 60-75 percent of the total cost of the equipment, including commissioning and other costs for security purposes.

17.1 Loan Security-ESCO as Borrower

When the loan is given to the ESCO, there is additional documentation that may be required for ensuring that there is a continuous inflow of revenues from the energy savings sharing agreements, and that there is no delay or default in the payments from the client in whose premises the equipment is installed. Copies of the revenue sharing agreements are crucial to this step. Also important are the clauses that relate to how defaults in payment will be sorted out and the legal or other remedies that are planned for.

FIs have standard procedures to establish if the borrower is or will have reasonable cash flows to repay the debt that is given. This includes security on the equipment, looking at future cash flow streams and considering escrow accounts into which cash flows will flow in as first charge on revenues and other such documentation. Taking additional protection from credit guarantee schemes is an added way to ensure defaults are covered, at least in part.

In energy efficiency project financing, M&V becomes very crucial in establishing savings and thus the revenue streams that are expected. Also required are clear-cut mechanisms for resolving disputes and defaults in payments, which are generally taken through arbitration, and if not successful, then of course, the much avoidable litigation.

17.2 Strengthening Financial Capacity of Borrowers

- **Are they well-capitalized?**
  It is essential to have analysis of the balance sheet of the borrower to understand whether the company is equipped enough to bear capital expenses even during drastic circumstances.
- **Do they have parental company support or private equity/external investors on board?**
  If the present project application is financially not stable, is there any possibility to bring external investors or to have support from parental company or private equity?

- **Do they have well defined cash inflow sources?**
  Analysis on cash flows is important to understand revenue pattern of the company.
- **What is their financial capacity to meet time delays and cost overruns?**
  This is to understand the company's preparedness in case of time delays in commissioning and cost overruns during project construction phase.
- **Is the financial plan adequate to address both project and working capital needs?**
  It is important to understand the company's financial plan, and whether the current practice can address both project and working capital requirements.
- **How can the lender minimize recourse to non-project assets & personal guarantees?**

17.3 Devise Payment and Security Structures

Payment and security structures should be devised to address the following:

- To securitize or escrow cash inflows to service debt.
- To ensure suitable tri-partite contractual protection for performance and payments through ESPC.
- Lender should ensure ESPC or tri-partite contractual protection is in place for performance and payments.
- Follow best practices from equivalent bank asset products (e.g. rental securitization, power projects).
- Take risk coverage from partial risk guarantee facilities available in India such as PRGFEE, PRSF, etc.

18. Establishing Energy Efficiency Business Units

18.1 Functions of an Energy Efficiency Business Unit

- **Identify the target market characteristics:**
  To identify market characteristics, potential study of energy efficiency market with technologies currently in demand, etc.

- **Define typical project characteristics:**
  Typical project characteristics for each technology type should be defined for smooth facilitation of loan applications.

- **Develop innovative financial products for the market:**
  To identify and develop financial products to promote energy efficiency projects based on technology.

- **Facilitate the development of a pipeline of attractive projects with creditworthy customers:**
  To generate pipeline of projects with technologies that are currently in demand with creditworthy customers will accelerate penetration of energy efficiency projects.

- **Design and implement a plan for marketing, project investment preparation, and market aggregation:**
  To have concept paper and implementation plan ready for marketing, investment, etc., will increase investment in energy efficiency projects.

- **Develop project appraisal guidelines and procedures:**
  Development of project appraisal guidelines and procedures to evaluate energy efficiency loan applications and standardization will reduce time consumption in evaluation, which will accelerate investment in energy efficiency projects.

- To provide technical assistance to loan officers by organizing workshops, seminars, etc.

18.2 For Developing Financial Products

Credit characteristics such as deal size, economics and security package should be considered. It is also important to define loan offer(s) based on term, pricing, and required security structure, with guarantee. In addition, it is critical to analyze required parameters such as size of project, equity proportion and legal documents to develop and customize financial products for energy efficiency projects.

18.3 Customizing Financial Products

Customized financial products can be considered for development for different technology streams since the energy savings characteristics are quite different for each technology stream.

- Waste heat recovery and cogeneration
- Lighting, cooling and controls for buildings (particularly hotels, hospitals and shopping malls)
- Motors, pumps, etc. in industrial facilities
- Street lighting
- Municipal pumping

- Off-grid renewable energy projects
- Fuel substitution in industry
- Outsourced energy management

18.4 Working with ESCOs

- Establish relationships with qualified and BEE-accredited ESCOs and equipment vendors.
- To assess capabilities and experience based on services/products offered; business methods, target end-user market and customer profile, reference projects & current pipeline. This will enable loan officers to understand financing needs and capital demand.
- Select initial companies and projects to prepare for investment: provide finance structuring assistance and plan for further scale up.
- Structure multi-project finance facilities to reduce transaction costs.

18.5 Vendor Finance Programs

Establish relationship with equipment vendor(s) or manufacturer(s): Vendor offers deal pipeline to lender/lessor. Financing of projects can be marketed at point of equipment sale. Since vendor is aware of clientele, end-user credit screening and analysis process can be facilitated by vendor on behalf of lender. Vendors can help process loan/lease transaction and absorb some transaction costs. Vendor may act as lessor and match primary lease with assignment or sale/lease back with bank.

18.6 Establishing Credit Line with ESCOs

Establishing credit line with ESCOs to extend credit facility for financing current and future projects. This will provide an opportunity to revolve credit line based on signed contracts with customers. Drawdown conditions based on expected project costs and cash flows can be worked out with ESCOs. Lenders can also seek suggestions from ESCOs on specifying project economic parameters such as project size, debt/equity ratio, debt service coverage, sharing of savings, etc. Security could be combination of ESCO balance sheet, parent organization, and project cash flows.

For Master Loan Terms, the following procedures should be structured:

- Standard origination procedures
- Lender evaluates and approves end-user credit
- Standard sub-loan documentation
- Recourse to ESCO and to ESCO parent (if applicable)
- Construction finance; disbursement procedures
- Pricing and fees

For Security Requirements, the following procedures should be structured:

1. To assign values for project assets, contract rights and revenues
2. To analyze project flow of funds; escrow account and prioritize payments
3. To analyze debt service reserve considerations
4. To understand other recourse and collateral end-user credit standards
5. To check cross default provisions between projects

18.7 Environmental and Legal Appraisal

This is an important component of the appraisal process. At this stage, steps are taken to assess if there is any negative impact of the project implementation, including any discharges to the environment in the form of solid wastes and liquid wastes. Any issues relating to disposal of the waste materials of existing technologies are also to be considered. It is possible that the present technology may end up as second-hand equipment with another enterprise. Under the head 'legal', all necessary documentation that has to be submitted to various government agencies such as pollution control departments; Ministry of Environment, Forest and Climate Change, state governments; etc., are to be attached.

18.8 Financial Risk Assessment and Mitigation

Risk assessment and strategies for risk mitigation are important components of the financial appraisal process. Between the times the audit is carried out and the DPR prepared, and when equipment is ordered after following a tendering process, there are changes in the operating environment, which need to be taken into account before the energy efficiency financing is taken and the project actually goes through implementation. The risk assessment process should cover whether:

- Technical risk of the equipment or technology can be integrated with the other systems and can deliver output in a reliable manner;
- Performance risk, when the technology does not deliver what was promised in terms of energy savings;
- Commissioning risk- problems in commissioning the equipment could include integrating the equipment with the rest of the equipment; and
- Financial risk in terms of changes in equipment prices/energy prices not impacting the financials of the project negatively.

In addition, risk assessment should cover:

- Creditworthiness of both the host and the ESCO
- Examine the ESPC and ensure that it has adequate assurance for cash flows that will be used to repay the loan
- Establish payment security mechanisms such as escrow account or trust and retention account (TRA)
- Verify ESCO's track record in implementing projects on time

In conclusion, the project appraisal is what decides the overall credit rating of the project, which in turn decides the interest rate for the loan, and thus the financial feasibility of the project. It is important that all relevant factors are given due consideration, and that the borrower submits all documentation in support of the energy efficiency project that is to be financed.

Part 3

Measurement and Verification: International Best Practices & Case Studies

19. Introduction to Measurement and Verification (M&V)

19.1 Measurement and Verification (M&V)

M&V is the key activity based on which the host agency can determine if the energy efficiency project has resulted in any reduction in energy savings, thereby leading to cost savings as well. The M&V methodology has to be provided in the ESPC through a mutually accepted procedure, which should also be acceptable to the bank, if there is project finance involved. The elements of the M&V activity are as follows.

Responsible agency for M&V: M&V can be carried out by the project host, ESCO or third party. However, independent M&V studies by third parties are usually preferred by FIs and government agencies for reporting on results on energy efficiency and cost savings of the energy efficiency project. M&V is carried out as per a previously agreed methodology, which is specified in the ESPC.

Cost of M&V: The costs of M&V depend on the energy efficiency technologies and measures to be implemented, and the approach and methodology to be utilized. M&V costs usually vary between 5 to 10 percent of project investments. Ultimately, there is a trade-off between accuracy of the M&V and cost of M&V.

Who pays for M&V: If the project host implements the energy efficiency project on its own, with internal accruals, then the host agency would engage a third party to conduct M&V. The host directly pays the M&V costs.

If the project is implemented through the ESCO route, there are two options available:

- The ESCO can contract the M&V agency and also pay for the M&V costs and submit the report to the host.
- The host can also contract with the M&V agency and inform the ESCO regarding this engagement and seek the ESCO's cooperation in providing all assistance to the M&V agency.
- If the ESCO conducts or engages a third party to conduct M&V, the M&V costs are part of the ESCO's costs.
- In either case, the M&V costs are an integral element of the project cost and an allowance needs to be made in the project budget and financing plan for these costs.
- While the M&V is specified in the ESPC between the ESCO and host, the lender needs to understand and approve the M&V approach and costs.

19.2. Key Elements of M&V Plan

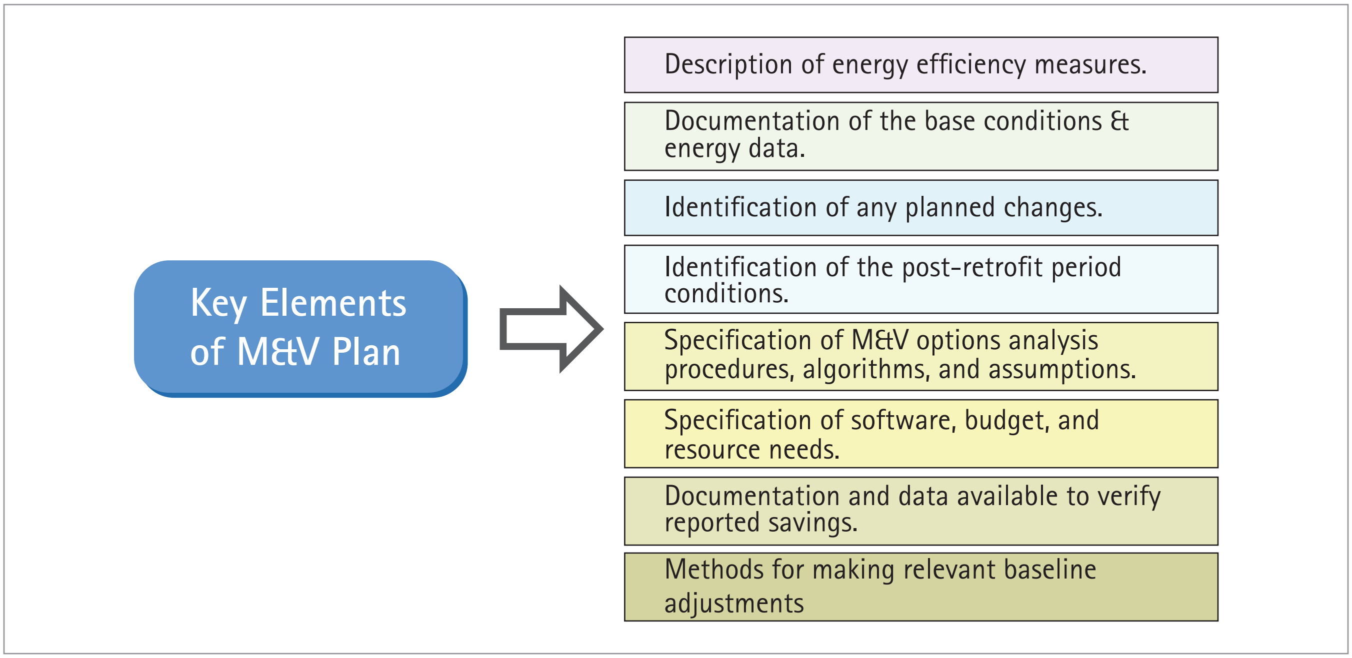


Figure 14: Key elements of M&V plan

19.3 Basic Concept of M&V

The M&V procedure is to calculate energy savings and cost savings.

First Step – Establish the Baseline Energy Use

Equation 1:

Savings = Baseline Energy Use
– Post -installation Energy Use
+/- Adjustments

Equation 2:

Cost Savings = $\text{Rate}_{\text{Baseline}}$ (Baseline Energy Use)
– $\text{Rate}_{\text{Baseline}}$ (Post Energy Use)
+/- Adjustments

Figure 15: Energy savings

19.4 Establishing Baseline Energy Use

Establishment of the baseline forms the crucial base for all energy saving calculations. Baselines are set based on historic data for a pre-defined period of time, which can be between three months to one year. There are internationally accepted methods for all such calculations and these need to be modified as may be applicable in each case.

Different Elements of M&V Methodologies

- **Deemed savings:** Participants agree to the unit energy savings from new equipment and savings calculations are based on **simple** formulas.
- **Bill data analysis:** Utility **bills** before and after installation are used to determine the savings.
- **Metering:** Meters are installed to **measure** the actual energy consumption of specific equipment of systems (before and after implementation).
- **Modeling:** When energy usage is influenced by a wide range of factors, **modeling** approaches are used to estimate energy consumption and savings.

19.5 M&V Protocols

CDM Methodologies – These are the methodologies approved by United Nations Framework Convention on Climate Change (UNFCCC). For more details, please access the following link - http://cdm.unfccc.int/methodologies/index.html

Deemed or Stipulated Savings: Savings values are stipulated based on 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 project such as lighting efficiency and controls projects, cooling equipment projects, and window film applications.

International Performance Measurement and Verification Protocol (IPMVP): This provides guidelines, definitions and an overview of current best practice techniques for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. The IPMVP is recommended by energy efficiency programs and often referenced as a best practice, including as a Normative Reference in ISO 500001 manual. For more details, please access the following link
http://www.evoworld.org/index.php?option=com_content&view=article&id=272&Itemid=379&lang=en

Australasian ESPC M&V Guide: The Australasian Energy Performance Contracting Association (AEPCA) and the Australian Dept. of Industry, Science and Resources published a comprehensive guidebook that is used in Australia for M&V of performance contracts.

U.S. FEMP M&V Guidelines: The central federal M&V document, the Federal Energy Management Program's (FEMP) 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. For more details, please access the following link - http://www1.eere.energy.gov/femp/pdfs/mv_guidelines.pdf

California Public Utilities Commission Energy Efficiency Evaluation Protocols: These protocols have been developed by California to monitor energy usage/energy savings. For more details, please access the following link -
www.cpuc.ca.gov/nr/...f01a.../caenergyefficiencyevaluationprotocols.doc

In general, the above mentioned protocols should be considered “living” documents that may need to be updated and revised from time to time as standard evaluation approaches and technology evolve.

19.6 M&V Information Document

1. Project site and measures: It 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, and 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 conducting M&V, quality assurance and quality control should be provided.
8. Initial and annual cost of M&V should also be included.

Table 16: Parameters in M&V

Parameters	Remarks
Baseline energy consumption	Energy consumption in pre-project scenario (across all fuels)
Estimated or guaranteed energy savings	Energy savings guaranteed due to implementation of energy efficiency project (across all fuels)
Cost savings	Cost savings achieved due to implementation of energy efficiency project (INR)
Energy meter calibration	Meter calibration frequency, Meter calibration details
Utility bills	Energy consumption bills prior to implementation of project and post implementation

19.7 Case Study: M&V Lighting Project

Option A

Baseline is 100 W light bulb and new lamp is 25 watt compact fluorescent

- Wattage verified by measurements/specifications
- Assume 3,000 operating hours per year:
  - Previous experience
  - Estimate by owner
- Calculated savings are:
  3,000 hr/yr * (0.1 – 0.025 kW) = 225 kWh/year

Option B

By installation of meters and measuring savings

- Install meters on lighting circuits (before lighting retrofit is implemented)
- Measure consumption before and after retrofit for a specified time period
- Calculate savings

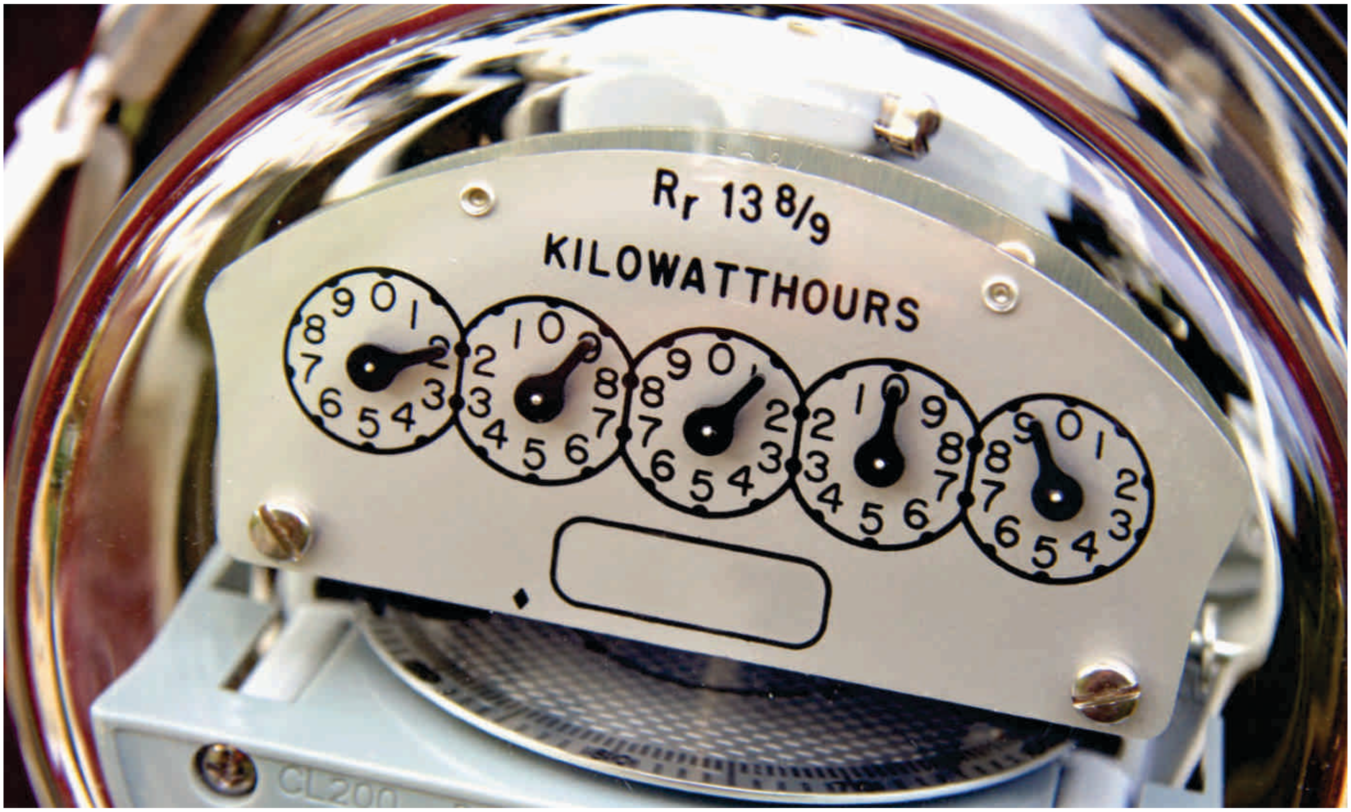
Option C

Based on utility bills before and after installation:

- Used when lighting is the dominant load
- Document baseline utility bill
- Obtain post-installation utility bills
- Calculate energy savings based on difference between baseline utility bills and retrofit installation bills

19.8 Common M&V Issues

- Factors affecting saving performance such as predictability, measurability, weather, occupancy, equipment intensity, ability of energy efficiency measures to deliver savings, implementation effectiveness, occupant operator cooperation, and equipment deterioration/life.
- Evaluating savings uncertainty – instrumentation, modeling and sampling errors; planned and unplanned changes.
- Minimum energy standards – to achieve minimum energy standards by smaller firms and start-up organizations would be difficult.
- Energy prices – fluctuation in energy price is an issue in M&V.
- Credible third-party verification is crucial for M&V – any third party issues should be resolved and corresponding clauses should be brought out in the M&V document for smooth processes.
- Baseline adjustments should be carried out based on acceptable protocols.



20. M&V Report Template

M&V Report Outline

[Note: All content called for in this outline is required (if applicable),
except items noted as optional.]

Contract #/Delivery Order #/Task #: (include as appropriate)
Performance Period Dates Covered: dd/mm/yyyy to dd/mm/yyyy
Contract year #: yyyy-yyyy

1. Executive Summary (not more than one page)

1.1 Project Background

1.1.1 Provide an overview of project background, including:

- Contract #/Delivery Order #/Task #/Modification # (as appropriate)
- Dates of relevant delivery order modifications
- Performance period dates covered
- Project acceptance date

1.2 Brief Project and Energy Conservation Measures (ECM) Descriptions

1.2.1 Provide an overview of what was done and how savings are generated.

1.2.2 Note any changes in project scope between the Final Proposal (including any relevant delivery order modifications) and as-built conditions as recorded in post-installation report.

1.3 Summary of Proposed and Verified Energy and Cost Savings

1.3.1 Compare verified savings for Performance Year # to Guaranteed Cost Savings for Year #. State whether guarantee is fulfilled for year. If not, provide detailed explanation.

1.3.2 Define performance period.

1.3.3 Summarize information in Table 1 and Table 2.

Table 1: Proposed Annual Savings Overview[1]

[Include all applicable fuels/commodities for project, e.g., electric energy, electric demand, natural gas, fuel oil, coal, etc.]

ECM	Total energy savings (kCal/yr)	Electric energy savings (kWh/yr)	Electricity peak time savings (kW/yr)*	Other energy savings (kCal/yr)	Total energy savings, Year # (INR/yr)	Other energy-related O&M cost savings, Year # (INR/yr)	Total cost savings, Year # (INR/yr)
VFD installation	NA	21,000	8,000	NA	190,000	NA	190,000
LED Installation	NA	7,000	2,000	NA	58,000	NA	58,000

Table 2: Verified Savings for Performance Year [#]

[Include all applicable fuels/commodities for project, e.g., electric energy, electric demand, natural gas, fuel oil, coal, etc.]

ECM	Total energy savings (kCal/yr)	Electric energy savings (kWh/yr)	Electric demand savings (kW/yr)*	Other energy savings (kCal/yr)	Total energy savings, Year # (INR/yr)	Other energy-related O&M cost savings, Year # (INR/yr)	Total cost savings, Year # (INR/yr)
VFD installation	NA	21,000	**8,000**	NA	192,200	NA	192,200
LED Installation	NA	7,000	**2,000**	NA	58,000	NA	58,000
Total Savings							**250,200**

[1] Values presented in the template-tables are for the purpose of understanding and not sourced from any reference material.

1.4 Savings Adjustments

- Provide summary of any energy and/or cost savings adjustments required.

1.5 Performance and O&M Issues

- Note impact of operating deficiencies or enhancements on generation of savings.
- Note impact of maintenance deficiencies on generation of savings.
- Detail any deficiencies that need to be addressed by ESCO or host.

1.6 Energy (thermal, electricity, fuel) and O&M Rate Data

- Detail energy and fuel used to calculate cost savings for this period.
- Provide performance period rate adjustment factors for energy, and O&M cost savings, if used.
- Report actual energy and fuel rates at site for same period (optional).

1.7 Verified Savings to Date

- Summarize information in Table 3.

Table 3: Verified Savings for Performance Period to Date

[Include all applicable fuels/commodities for project, e.g., electric energy, electric demand, natural gas, fuel oil, coal, etc.]

Year #	Total energy savings (kCal/yr)	Electric energy savings (kWh/yr)	Electric demand savings (kW/yr)*	Natural gas savings (kCal/yr)	Other energy savings (kCal/yr)	Total energy savings (INR/yr)	Other energy-related O&M cost savings (INR/yr)	Total cost savings (INR/yr)	Guaranteed cost savings for year
Year 1 (Jan-Dec)		28,100	10,200	NA	NA	250,200	NA	250,200	248,000
Year 2 (Jan-June)		14,050	5,100	NA	NA	125,100	NA	125,100	124,000
Total savings								375,300	372,000

2. Details for ECM [name/#]

- Develop section for each ECM.

2.1 Overview of ECM, M&V Plan, and Savings Calculation for ECM

- Summarize the scope of work, location, and how cost savings are generated.
- Describe source of all savings including energy, O&M, and any other (if applicable).
- Discuss any changes in scope/results recorded in post-installation M&V report.
- State M&V guideline and option used[1].
- Provide an overview of M&V activities for ECM.
- Explain the intent of M&V plan, including what is being verified.
- Provide an overview of savings calculation methods for ECM.
- Provide a general description of analysis methods used for savings calculations.

2.2 M&V Activities Conducted During This Period

- Detail measurements, monitoring, and inspections conducted during this reporting period in accordance with M&V plan.
- Measurement equipment used.
- Equipment calibration documentation.
- Dates/times of data collection or inspections, names of personnel, and documentation of government witness.
- Details to confirm adherence to sampling plan (if applicable).
- Include all measured values for this period. Include periods of monitoring and durations and frequency of measurements. (Use appendix and electronic format as necessary). Include description of data format (headings, units, etc.).
- Describe how performance criteria have been met.
- Detail any performance deficiencies that need to be addressed by ESCO or host.
- Note impact of performance deficiencies or enhancements on generation of savings.

2.3 Verified Savings Calculations and Methodology

- Provide detailed description of analysis methodology used.
- Describe any data manipulation or analysis that was conducted prior to applying savings calculations.
- Detail all assumptions and sources of data, including all stipulated values used in calculations.
- Include equations and technical details of all calculations made. (Use appendix and electronic format as necessary.) Include description of data format (headings, units, etc.).
- Details of any baseline or savings adjustments made.
- Detail energy and fuel rates used to calculate cost savings.
  - Provide performance period energy & fuel rate adjustment factors, if used.
  - Report actual energy and fuel rates at site for same period (optional).
- Detail verified savings for this energy conservation measure for performance year.
- Please refer to Table 4 of the template.
- Details of O&M and Other Savings (if applicable)

2.4.1 Describe source of savings, if applicable.

- Describe verification activities.
- Provide performance period O&M savings adjustment factors, if applicable.

[1] M&V options include A, B, C & D. Guidelines include M&V Guidelines: Measurement & Verification for Federal Energy Projects, Version 2.2 (www.eere.energy.gov/femp/financing/superespcs_mvresources.cfm); and International Performance Measurement & Verification Protocol (IPMVP), Volume I, March 2002 (www.ipmvp.org) and CDM methodologies www.unfccc.int

Table 4: Verified Annual Savings for ECM for Performance Year

[Include all applicable fuels/commodities for project, e.g., electric energy, electric demand, natural gas, fuel oil, coal, etc.]

	Total energy use (kCal/yr)	Electric energy use (kWh/yr)	Electric energy cost, Year # (INR/yr)	Electric demand* (kW/yr)	Electric demand cost, Year # (INR/yr)	Natural gas (kCal/yr)*	Natural gas cost, Year # (INR/yr)	Other energy use (kCal/yr)	Other energy cost, Year # (INR/yr)	Other energy-related O&M costs, Year # (INR/yr)	Total costs, Year # ($/yr)
Baseline use		65,000	390,000	20,000	160,000						550,000
Performance Year # use		28,100	168,600	10,200	81,600						250,200
Savings											299,800

2.5 O&M and Other Activities

2.5.1 Operating requirements:

- State organization(s) responsible for equipment operations. If appropriate, detail how responsibilities are shared.
- Summarize key operating procedures and any related verification activities.
- Detail any deficiencies that need to be addressed by ESCO or host.
- Note impact of operating deficiencies or enhancements on generation of savings.

2.5.2 Preventive maintenance requirements:

- State organization(s) responsible for performing maintenance. If appropriate, detail how responsibilities are shared.
- Verification of scheduled maintenance items completed by ESCO or host.
- Detail any deficiencies that need to be addressed by ESCO or host.
- Note impact of maintenance deficiencies on generation of savings.

2.5.3 Repair and replacement requirements:

- State organization(s) responsible for repair and replacement. If appropriate, detail how responsibilities are shared.
- Summary of activities conducted this period by ESCO or host.
- Detail any deficiencies that need to be addressed by ESCO or host.
- Note impact of equipment deficiencies on generation of savings.

20.1 Case Study: Energy Efficiency Measures in Jayashree Textiles Division[14]

Project Activity

An energy efficiency program is an application of technology, and in this case, of a variable frequency drive (VFD) in the linen manufacturing process in Jayashree Textile Division (JST), a unit of Indian Rayon & Industries Limited (IR&IL). The purpose of the project activity is to improve the energy efficiency levels in the 'Humidification Towers' of the Worsted Mill and Flax Division of JST. These measures were devised to reduce electrical energy consumption of the 'electrical drives', which provide forced drafts in the Humidification Towers.

Technology Applied

- The VFD is installed to the rotor of the electric drives to operate them at variable speed. Since the rotor can operate at any speed below its maximum capacity, the output of the motor can be made to vary by controlling the rotor speed by a VFD installation (instead of the throttling or damper control).
- A variable frequency drive can control two main elements of a 3-phase induction motor: speed and torque. This is adjusted by changing the frequency applied to the motor. If the required output of the rotor is lower than the present output capacity, the frequency of the rotor may be regulated below full operational capacity by the variable frequency drive. With reduction in frequency of the rotor, the power input reduces proportionately

Table 17: Baseline and Post Implementation of Energy Efficiency measure in Jayashree Division

Time Period	Baseline	Post Implementation	Reduction
21/11/2000 to 31/03/2001	113,498.4 kWh	20,737.6 kWh	92,760.8 kWh – Electricity savings
21/11/2000 to 31/03/2001	50 Hz (Average)	25 Hz (Average)	Frequency reduction by 25 Hz
21/11/2000 to 31/03/2001	Average power 36.1 kW	Average power – 6.5 kW	Power reduction

Table 18: Monitoring Parameters of Energy Efficiency measure in Jayashree Division

S. No.	Parameters	Measured, Calculated (estimated)	Source of Data	Monitoring Equipment
1	Frequency	Measured	Humidity Record Book	VFD (ACS 400 Frequency Convertor) LCD Display
2	Power	Calculated	Record Book	Pre-calibrated Energy Meter
	Total electricity consumed at the various operating frequencies	Measured	Humidity Sample Record Book	Energy meter calibrated on annual basis

[14] http://cdm.unfccc.int/Projects/DB/SGS-UKL1137764792.88/view
UNFCCC project id : 0255
First monitoring report dated 01 Nov 2000- 31 March 2006 referred.

20.2 Case Study 2: Energy Efficiency in ITC Limited Paper Division[15]

Project Activity

Paperboards and Speciality Papers Division (PSPD) Bhadrachalam Unit, a part of ITC Limited, took voluntary initiatives to reduce their electrical energy consumption with an objective to contribute towards the reduction of greenhouse gases (GHG) in line with their corporate sustainable business approach.

Technology Applied

- Replacement of low efficient equipment (such as pumps, compressors, lamps) with energy efficient alternatives.

Table 19: Baseline and Project Information for PSPD, ITC Limited

Parameter	Baseline	Project
Specification	1,500 m^3/h at 65 m head	1,800 m^3/h at 35 m head
Power (kW)	304.60 kW	258.90 kW
Energy consumption	14,82,792.8 kWh	12,60,301.78 kWh (savings of about 2,22,491.02 kWh)

Table 20: Monitoring Parameters of PSPD, ITC Limited Project

S.No.	Parameters	Measured, Calculated (estimated)	Source of Data	Monitoring Equipment
1	Power (kW)	Measured	Record Book	Baseline and project energy consumption was recorded based on a month of observation on continuous basis through installed energy meters prior to project installation.
2	Electricity consumption (kWh)	Measured	Humidity Sample Record Book	Project energy consumption is measured through dedicated energy meters and monthly integrated consumption is recorded in IMIS Report.

[15] http://cdm.unfccc.int/Projects/DB/DNV-CUK1166082720.69/view
UNFCCC project id : 0806
Monitoring report referred: 01/09/2010 to 31/12/2011.

ACRONYMS

Acronym	Definition
AEEE	Alliance for an Energy Efficient Economy
AFD	Agence Française de Développement
AHU	air handling unit
AIIMS	All India Institute of Medical Sciences
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
CII	Confederation of Indian Industry
DCs	designated consumers
DM	demineralization
DPR	detailed project report
DPT	differential pressure transmitter
DRCs	Default Review Committees
DSCR	debt service coverage ratio
ECM	energy conservation measures
EEFP	Energy Efficiency Financing Platform
EESL	Energy Efficiency Services Limited
EEMs	energy efficiency measures
ESA	energy savings agreement
ESCO's	energy service companies
ESIC	Employees' State Insurance Corporation
ESPC	Energy Savings Performance Contracting
ESPA	Energy Services Performance Agreement
ESP	energy savings performance
FEEED	Framework for Energy Efficiency Economic Development
FIs	financial institutions
FEMP	Federal Energy Management Program
GHG	greenhouse gas(es)
GPM	Gross Profit Margin
HVAC	heating, ventilation and air-conditioning
ID	induced draft
ICICI Bank	Industrial Credit and Investment Corporation of India Bank
INR	Indian Rupee
IPMVP	International Performance Measurement and Verification Protocol
IRR	internal rate of return
IREDA	Indian Renewable Energy Development Agency Limited

IR&IL	Indian Rayon and Industries Limited
JICA	Japan International Cooperation Agency
JST	Jayashree Textile
KfW	Kreditanstalt Für Wiederaufbau
kWh	kilo watt hour
M&V	measurement and verification
MFI	microfinance organization
MOP	Ministry of Power
MOU	Memorandum of Understanding
MOEF	Ministry of Environment and Forests
MSME	Micro Small and Medium Enterprise
MTEE	Market Transformation for Energy Efficiency
MTPA	million tonnes per annum
MVA	Mega Volt Ampere
NAPCC	National Action Plan for Climate Change
NMEEE	National Mission for Enhanced Energy Efficiency
NPC	National Productivity Council
NPV	net present value
O&M	operation and maintenance
OM&R	operation, maintenance and repair
PAT	Perform, Achieve and Trade
PRGFEE	Partial Risk Guarantee Fund for Energy Efficiency
PSPD	Paperboards and Speciality Papers Division
PV	photovoltaic
RO	reverse osmosis
ROE	return on equity
SBI	State Bank of India
SEC	specific energy consumption
SECI	Solar Energy Corporation of India
SIDBI	Small Industries Development Bank of India
SMEs	small and medium enterprises
TRA	trust and retention account
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VFD	variable frequency drive
VCFEE	Venture Capital Fund for Energy Efficiency
VSK	vertical shaft kiln

Notes

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ENERGY EFFICIENCY FINANCING PLATFORM (EEFP)

Training of all Scheduled Commercial Banks (except cooperative Banks)

- Training of master trainers (2015-16) - 4 to 5 workshops in nos.
  - Training of 25 Master Trainers in each training programme
  - Training of at-least 10 officials by each master trainer
- Training of bank officials where no training colleges exist (2016-19)
  - Training of 10 officials in each back
  - Each Training programme shall have 25-30 participants

Benefits of Training Programme For Financial Institutions

- Capacity building of loan/risk managers in assessing Energy Efficiency projects
- ESCOs and other end-users will have easy access to financial institutions for implementing EE projects.
- Energy efficiency will lead to decline in greenhouse gas emission and help us to achieve energy security.
- Banks will be in a better position to support energy efficiency project

For more information write to us at eefp@beenet.in or visit our website www.beeindia.in

FRAMEWORK FOR ENERGY EFFICIENCY ECONOMIC DEVELOPMENT

PRGFEE

The Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) is a risk sharing mechanism to provide commercial banks with a partial coverage of risk involved in extending loans for energy efficiency project. The Government of India has approved around INR 312 crores.

ELIGIBLE PROJECTS

- 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 empanelled ESCO on performance contracting mode

BENEFITS TO PFIs

- PFIs shall be empanelled for a long time with BEE i.e. for 5 years.
- PFIs shall be eligible to seek guarantee under PRGFEE, however, non-empanelled FIs shall not be eligible to seek guarantee.
- Advantage of participating in training/awareness programmes that will be organised by BEE.
- Information regarding empanelled PFIs shall be kept on BEE's website.

VCFEE

The Venture Capital Fund for Energy Efficiency (VCFEE) provides risk capital support to EE investments in new technologies, good and services. The Government of India has approved about INR 210 crores for the VCFEE.

ELIGIBLE PROJECTS

- Seek to achieve demonstrable energy savings and mitigate in emissions of greenhouse gases and project sponsors/participants must offer a viable method to monitor and verity the same.
- Be a new project, not takeover of an existing project.
- Use viable technologies and be developed after energy audit/feasiblity studies.

BENEFITS TO INVESTORS

- The projects under VCFEE will be recognized the Government of India.
- As compared to high return on investment required by typical Venture Capital Funding, VCFEE will provide seed capital at nominal Return on Investment (RoI).
- Advantage of participating in training/ awareness programmes that will be organised by BEE/VCFEE Trust.
- Information regarding investment in projects under VCFEE shall be kept on BEE's website.

For more information write to us at prgfee@beenet.in/vcfee@beenet.in or visit our website www.beeindia.in

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