MANUAL TO APPRAISE ENERGY EFFICIENCY PROJECTS

World Bank/UN Foundation-UNEP Technical Assistance Project

ICRA Advisory Services
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ABBREVIATIONS

BEE	Bureau of Energy Efficiency
CII	Confederation of Indian Industries
DSCR	Debt Service Coverage Ratio
ECA 2001	Energy Conservation Act 2001
EE	Energy Efficiency
EEM	Energy Efficiency Measure
ESA	Energy Savings Agreement
ESCO	Energy Services Company
FI	Financial Institution
HO	Head Office
HVAC	Heating, Ventilation, and Air Conditioning
ICRA	ICRA Advisory Services
IREDA	Indian Renewable Energy Development Agency
IRR	Internal Rate of Return
MOEF	Ministry of Environment and Forests
MOP	Ministry of Power
M&V	Monitoring and Verification
NPC	National Productivity Council
NPV	Net Present Value
OM&R	Operating, maintenance and repair
PC	Performance Contracting
RBI	Reserve Bank of India
ROCE	Return on Capital Employed
TA	Technical Assistance
VFD	Variable Frequency Drive
WB	World Bank

CONTENTS

1.0 Executive Summary

1.1 Background of the Study

World Bank has appointed ICRA Advisory Services (ICRA) to develop a credit appraisal manual for energy efficiency (EE) projects. The project is part of the World Bank's Technical Assistance (TA) project titled "Development of Financial Intermediation Mechanisms for Energy Efficiency Investments in Developing Countries". The World Bank is currently focussing on three countries, viz., Brazil, China and India. Indian Renewable Development Agency Limited (IREDA) is the Indian Project Secretariat for the same.

1.2 Brief Overview of the Manual

The manual is designed to facilitate banks and financial institutions to appraise energy efficiency projects/ESCOs. The manual respects the individuality of different participating banks and financial institutions and hence provides a general framework for appraisal of an EE project, which may be customised to a specific bank's internal credit policies and financing strategies.

The manual introduces the concept of Energy Efficiency and its importance in the Indian context by providing a possible list of areas or sectors where energy efficiency projects could be implemented. Existing and proposed regulatory framework for energy efficiency projects in India has also been covered in the manual.

The appraisal mechanism for EE projects has been divided in the following two parts in the manual:

1. Energy Efficiency Project Appraisal

   The appraisal process of an energy efficiency project covers a detailed appraisal of the following:

   i. Promoter Appraisal
   ii. Technical Appraisal
   iii. Financial Appraisal
   iv. Environmental Appraisal
   v. Legal Appraisal

2. Energy Service Company (ESCO) Appraisal

   A bank could provide financing to an ESCO in two ways:

   i. Credit Line to an ESCO
   ii. Energy Efficiency Project specific financing

   The appraisal process for both kinds of ESCO financing is covered in the manual.

The manual also includes few case studies (financing of energy efficiency projects) in the Indian context to further elucidate the appraisal process involved in financing of such projects.

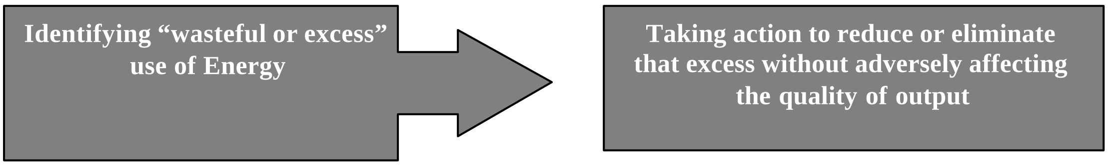
The manual is supplemented by an Evaluation Matrix (**Appendix –1**) and a Loan Application Form for energy efficiency project finance (**Appendix – 2**). The Evaluation Matrix provides a checklist of project-specific parameters to be assessed under technical, financial, environmental and legal appraisal of an energy efficiency project. The Loan Application form has been designed to capture all relevant information from the applicant that will help the institutions/lenders' to take a view on the project.

2.0 Energy Efficiency: Introduction

2.1 Energy Efficiency (EE)

Energy Efficiency (EE) by definition means using less energy to achieve same or better output compared to pre-implementation of the energy efficiency project (defined below in section 2.2).

Energy efficiency does not mean rationing or having to do without energy. Rather, energy efficiency means identifying wasteful energy, and taking steps to reduce or eliminate that waste without adversely affecting the production (if implemented in an industrial unit) and the quality of output. Illustratively, the energy efficiency process is depicted below as:



2.2 Energy Efficiency (EE) Project

Energy efficiency (EE) project refers to any process, technique or equipment that helps to achieve reduction in energy consumption to perform a designated operation to achieve same or better level of output while maintaining or improving processing time, quality, performance and safety with minimal environmental impact.

2.3 Advantages/Importance of Energy Efficiency

The following are some of the advantages of implementing EE projects:

- Reduction in energy consumption, thereby adding directly to the profits or bottom-line of the company
- Lowering the vulnerability to energy prices for unit/corporate that has implemented EE projects
- Reducing the need for investment in newer power plants and import of energy
- Reducing the dependence on conventional resources like oil and natural gas
- Reducing emissions of air pollutants in most cases

2.4 Some Areas where Energy Efficiency Projects can be implemented

In a recent study[1] conducted by Confederation of Indian Industries (CII) the potential from energy savings arising on account of implementation of EE Projects was estimated to be over US$ 730 million per year in India. Some possible areas where energy efficiency projects could be implemented in the industrial sector are:

[1] Investors Manual for Energy Efficiency, 2003, Confederation of Indian Industries (CII)

- Commercial buildings – e.g. replacing copper chokes with energy efficient electronic chokes in fluorescent lamps, installation of energy efficient lamps in place of low efficiency lamps, and installation of heat insulators
- Industrial facilities - a list of potential EE projects by industries/ sectors is provided in **Annexure-I**
- Municipal corporation/ bodies and local authorities – e.g. installing energy efficient street lighting, and waste heat recovery projects at the local authority level

2.5 What is an ESCO?

An energy service company (ESCO) is one that offers comprehensive, customised energy saving solutions to its customers. An ESCO is engaged in developing, installing and financing comprehensive, performance-based projects aimed at energy efficiency or load reduction of facilities owned/ operated by customers.

Typical services provided by most ESCOs include:

- Energy audit and formulation of detailed project reports
- Implementation of EE Projects (includes undertaking implementation and project monitoring)
- Procurement of equipments to be installed
- Arranging Finance (equity and debt) for the project in select cases
- Equipment maintenance and operations

2.6 Regulatory Perspective for Energy Efficiency

The Government of India enacted the Energy Conservation Act 2001 (ECA 2001) in September 2001 with an objective to promote and enforce the progressive regime of Energy Conservation. The act laid the foundation for establishment of Bureau of Energy Efficiency (BEE). BEE's objective was to facilitate the Central Government in formulation of a regulatory framework for energy efficiency and conservation in India, promote energy efficiency by increasing awareness via dissemination of information for efficient use of energy and its conservation, and develop promotional financing schemes[2].

Proposed Legislation for Energy Efficiency by Bureau of Energy Efficiency (BEE):

Since its incorporation in 2001, BEE has taken several initiatives to regulate the energy efficiency sector in India with the objective to enhance energy efficiency in specific industries/ sectors. Some of the recent initiatives or recommendations made by BEE to the Central Government are outlined below:

1. Programme for Accreditation of Energy Auditors:

   Currently, the accreditation programme for energy auditors is prevalent only in a few states in India like West Bengal, Delhi, Kerala, Tamil Nadu and Punjab, and is not standardised

[2] Source: Energy Conservation Act 2001, www.bee-india.com.

across the country, with each state (where such a programme exists) having its own individually designed programme.

Apart from the above state-specific accreditation programmes for energy auditors, some industry associations also offer such a programme, for example, Petroleum Conservation Research Association (PCRA) has its own industry-specific program to empanel energy auditors.

BEE has been working to develop a uniform nation-wide accreditation programme for energy auditors. In this regard, BEE had set up two committees, which have submitted recommendations to the Central Government for designing a national accreditation program for energy auditors. The Central Government is in the process of evaluating the recommendations for programme design and the notification from the Government is expected by end of 2004.

2. Energy Consumption Norms by Industry:

One of the roles envisaged for BEE by ECA 2001, was to facilitate the Central Government in setting norms for energy consumption by industry. ECA 2001 identified the following 15 energy intensive industries and other establishments specified as designated consumers:

1. Aluminium;
2. Fertilizers;
3. Iron and Steel;
4. Cement;
5. Pulp and paper;
6. Chlor Alkali;
7. Sugar;
8. Textile;
9. Chemicals;
10. Railways;
11. Port Trust;
12. Transport Sector (industries and services);
13. Petrochemicals, Gas Crackers, Naphtha Crackers and Petroleum Refineries;
14. Thermal Power Stations, hydel power stations, electricity transmission companies and distribution companies;
15. Commercial buildings or establishments;

BEE had recommended energy consumption norms to the Central Government for these above industries/ designated consumers. The Central Government is expected to release a notification for energy consumption norms for ‘7’ energy intensive industries by August-September 2004.

3.0 Energy Efficiency Project Appraisal

3.1 Loan Application for Assistance

The applicant seeking financial assistance for an EE project is required to furnish details as per prescribed EE loan application form (**Appendix –2**).

The Energy Audit Report and the Project Feasibility Report should be enclosed with the EE loan application.

3.2 EE Project Appraisal

Post submission of the application form, a bank would formally register the application and send a copy to the relevant credit department in the bank for a detailed project appraisal, which would entail the following:

1. Promoter Appraisal
2. Technical Appraisal
3. Financial Appraisal
4. Environmental Appraisal, and
5. Legal Appraisal

3.2.1 Promoter Appraisal (as applicable[3])

The promoter/ promoter company/ companies background, creditworthiness, track record and their past dealings with institutions/ banks should be ascertained. A proper evaluation of the promoter/ promoter company is an important part of the overall EE project appraisal

Also, since every bank has its own unique company appraisal mechanism, individual banks could use their respective company appraisal mechanism when appraising a new customer/ promoter. However, an indicative checklist to facilitate promoter appraisal is given below. An indicative framework for promoter information has also been included in the Loan Application Form (**Appendix-2**).

I. General

- Memorandum and Articles of Association (applicable for new customer)
- Promoters' agreement which is an agreement amongst the promoters
- Obtain and study the corporate plan of the company (for small projects, applicable only if corporate plan is available)
- Particulars of other projects promoted/ implemented by promoter in the particular industry (to understand the promoters' trackrecord in project execution)
- References from company's bankers/ other lenders (applicable for new customers)

[3] Applicable only for new customers of the bank. For existing customers, banks are advised to use their respective promoter/ customer assessment

- Information of bank limits utilised, future business plans and investments to be examined
- Group companies, their operations and the bank's exposure/ experience

II. Operational Results of Promoter Company/ Companies (for last 3 years)

- Profitability: Operating profit margin, Net Profit Margin, ROCE
- Liquidity: Current ratio
- Efficiency: Fixed assets turnover, Debtors Turnover, Inventory Turnover and Creditor Turnover
- Leverage: Debt/ Equity ratio
- Coverage: DSCR, Interest coverage,

ICRA recommends a list of financial indicators to assess the financial health of the promoter company. Refer to **Annexure II** for the list of financial indicators including definition and importance of each indicator.

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III. Promoter Background

- Family background, qualifications and previous industrial experience of the promoter
- Sources of income
- Income tax returns/certificates for the past three years
- Wealth tax returns for the past three years
- Details of personal properties/assets of promoters/guarantors to be obtained.

IV. Management and Organisational Set-up of Promoter Company/ Companies

- Details of Board of Directors
- Number of full-time directors and their responsibilities
- Qualification, experience of the Chief executive
- Qualification, experience and competence of the functional executives

3.2.2 Technical Feasibility of the Project

The technical appraisal of an EE project would primarily focus on three fundamental issues:

1. Are the projected energy savings realistic? Is the basis of calculation appropriate?
2. Which technology will be used for the EE project, and whether it fits with the existing technology/ processes at the facility?
3. Are there any drawbacks like impact on production or production schedules during implementation of the project?

The manual provides an exhaustive list of technical evaluation parameters to address the above mentioned questions. The evaluation parameters for technical appraisal of an EE project have been classified into three categories:

I. Estimating Energy Savings
II. Technology Evaluation, and
III. Proposed Project Implementation Plan

I. Estimating Energy Savings

Energy Savings from an EE project are calculated as difference between (i) current energy consumption or baseline consumption and (ii) the energy consumption after implementation of the EE project, such difference being multiplied by the prices[4] for the energy supplied. In general the formula for calculating energy savings is:

Energy Savings = Baseline Energy Consumption – Energy Consumption post EE Implementation ± Adjustments

Definitions

- *Baseline Energy Consumption* is the current energy consumption of the facility (before implementation of the EE project). Establishing baseline energy consumption is the first step towards identifying energy saving opportunities in a given facility. The baseline energy consumption forms an integral part of the energy audit report (refer to **Annexure IV** for the recommended energy audit report format)
- *Energy Consumption post EE Implementation* is estimated assuming that the energy efficiency opportunities identified in the energy audit report are implemented
- *Adjustments* can be of two different types:
  - i. Routine Adjustments are adjustments for changes in parameters that may occur during post retrofit period and for which a relationship with energy use/ demand is identified. These adjustments are often seasonal or cyclical, such as weather or occupancy variations, and can be predicted by extrapolating trends.
  - ii. Non-routine Adjustments are adjustments for changes in parameters expected to have a significant impact on the energy use or demand. These adjustments are based on known and agreed changes, which may affect the energy use at the facility. For Example: 1) Increase or decrease in the area being heated or air conditioned 2) Increase or decrease in any of the energy consuming equipment

(Adjustments if any, should be considered when computing the energy savings, and should form part of the energy audit report)

Checklist for assessing whether the estimated Energy Savings are realistic

In order to ascertain how realistic the energy savings are, the following would need to be reviewed:

1) What is the credibility of the energy auditor?
2) How the baseline energy consumption has been established?
3) What assumptions are made for estimating energy savings?

A checklist covering the three aspects mentioned above could be reviewed either by the credit officer or by the energy auditor, and forms part of the energy audit report (refer **to Annexure IV** for a recommended energy audit report format).

[4] for simplicity sake, one can take current prices

The checklist is given below:

1. Creditability of the energy auditor:

- Is the energy auditor accredited from Bureau of Energy Efficiency? Is he/ she empanelled with IREDA, PCRA, PFC, etc or the Bank?
- Track record of the energy auditor/ consultant based on factors like:
  a. What is the number of energy audits completed in the last 3 years?
  b. Whether the energy auditor has conducted any energy audit in the particular industry in question in the last 2 years? If yes, how many?
  c. In which five facilities/ companies has the energy auditor conducted audit in the last one year?

2. Establishing the Baseline Energy Consumption:

- What are the major utilities[5] being consumed currently?
- What are the quantities of consumption of each utility?
- How do the quantities of consumption of the utility per unit of output compare with industry standards, if available?
- The average price of each utility and the total energy costs for the company?

3. Estimating Energy Savings

- What do the energy savings consist of? Are these; savings in energy cost, fuel cost, labour cost, consumables and maintenance cost.
- Is the number of hours per year calculated as per the available working hours of the equipment?
- Are the savings resulting from higher capacity utilisation of the equipment or inefficiency of the existing equipment?
- What is the age of the unit/ plant, where the energy saving has been recommended? (if the plant/ equipment is too old, estimated energy savings may not be realisable?
- How does the energy consumption post EE project implementation compare with industry standards, if available?
- Does the implementation of the EE project result in higher manpower costs, or increased energy consumption in some other part of the facility, and has that been taken into account when computing the energy savings?
- Would the EE project implementation result in shut down of the facility? If yes, what would be the potential loss, and has that been taken into account when computing the energy savings?

Table A could be used as a template to summarise all energy saving opportunities in an identified facility.

[5] water, electricity, thermal, steam, fuel, etc.

Table A: Summary of Energy Saving Opportunities

S.No.	*Energy Saving Opportunity*	*Estimated Energy saving (% of current consumption)*	*Annual Estimated Energy Savings in (kWh or kl or Ton or MT)*	*Annual Savings (Rs.Lakh)*	*Capital Investment (Rs.Lakh)*
1	Energy Saving Opportunity 1				
2…	Energy Saving Opportunity 2…				
N	Energy Saving Opportunity n				
Total					

II. Technology Evaluation

Technology evaluation of an EE project should focus on the appropriate technology and compatibility of the technology with the existing technology or process in a given facility.

A checklist covering the three aspects mentioned above could be reviewed either by the credit officer or by the energy auditor, and forms part of the energy audit report (refer **to Annexure IV** for a recommended energy audit report format). The checklist is given below:

- Is the technology proven or tested? If not, whether successful anywhere else? and can that success be replicated in Indian context and conditions?
- Does the technology/ process/ equipment technically fit with the facility's existing technology/ process/ plant & machinery? If not, what aspects of the technology/ process do not fit, and what measures is the company planning to take in this regard?
- Is there any industry benchmark data available from a reliable source, on the level of energy consumption post deployment of this new technology/ process? (Check with BEE or industry-specific national or regional bodies)
- List of equipments and machinery to be installed, with cost and specifications of the equipments.
- Capacity of the equipment, and whether it is as per requirement?
- Cost comparison with similar new plant/ machinery (applicable for large EE projects and co-generation projects)
- List of recommended equipment suppliers?

Refer to **Annexure III** for a broad classification of EE projects based on technology deployed, and an indicative payback period for generic technologies used in EE projects.

III. Proposed Project Implementation Plan

An EE project could be implemented either by the host company or by a specialist like Engineering, Procurement & Contractor (EPC) or the Energy Service Company (ESCO).

A checklist evaluating the proposed implementation plan to assess whether the EE project can be implemented as per schedule and requirements should be reviewed by the credit officer, and should form part of the project report submitted to the bank by the borrower. The checklist for evaluation of the proposed implementation plan for the EE project is given below:

1. Skills and Experience of the Project Implementation Team:

- Who is implementing the project?
  - i. In-house: Company implementing the project
  - ii. Contracted to EPC or ESCO
- Whether the project implementation team has adequate skills and experience? (obtain information as per table B)
- Track record/ experience of the Company/EPC/ESCO depending upon whosoever is implementing the project. Provide a list of relevant projects completed in the last two years.

Table B: Key Personnel in the project

Names of Key People			
Position			
Total length of experience			
Number of years in current position			
Qualifications			
Training			
List of EE projects completed in last two years, including his/her role in project - *Designing & Constructing* - *Maintenance Experience* - *Skill Transfer*			
Availability for the project			

2. Selection of Suppliers:

- Have the suppliers been selected? If yes, provide list of selected suppliers, including equipments to be supplied by the supplier, price of the equipment and delivery schedule
- Reputation of the suppliers – Whether the supplier is a large national or regional distributor/ supplier or a local supplier?
- Terms for supply and installation of the equipment by the suppliers[6]?
- Is there any performance guarantees from the equipment suppliers?

3. Implementation Time Period

- Time period required to implement the EE project?
- Penalties in case project implementation is delayed?

Key Differences in Technical Appraisal (EE Project Vs. Conventional Project)

Technical Evaluation Parameter
Energy Savings Estimation Technical appraisal of an EE project reviews the process used to compute the energy savings, and assess how realistic the energy savings are?

3.2.3 Financial Appraisal of the Project

Financial appraisal of an EE project would review the estimated cost of the project, proposed means of financing, financial and cash flow projections, viability parameters and sensitivity analysis. The past record of the promoters should also be examined (covered in **section 4.3.1**) with reference to financial statements viz. Profit & Loss Account; Balance sheet and Cash flows for at least the past three years.

I. Project Cost

The various components of the project cost submitted by the borrower should be thoroughly examined as also the basis of the cost estimates. Realistic estimates should be used so as to prevent cost over-runs and/ or to avoid over-estimation of costs.

For small and medium sized EE projects, hardware costs, which comprises of the equipment, spares and tools typically constitute a majority (65-75%) of the total project cost. The remaining (25-35%) project costs are 'soft costs',[6] which include the energy audit charges, consultancy fees and project management charges (including charges for design & engineering). The main components of the project cost and key issues to be considered during appraisal are discussed below:

1. Pre-operative and Preliminary Expenses

The expenses incurred in the following should be examined:

(a) Cost of conducting energy audits, and
(b) Cost of preparing project feasibility reports.

The preliminary expenses (consisting of the above two components) should be capitalised and amortised over the tenor of the loan.

2. Equipment Cost

Estimates of equipment cost should be based on quotations/ purchase contracts entered into between the applicant and the suppliers. In cases where the EE project is executed by ESCO/ EPC the contract may be entered between the ESCO/ EPC and the supplier. These contracts should be finalised after obtaining competitive quotations from a few suppliers. The selection criteria should not solely focus on price, but also on appropriateness of the technology, reputation of suppliers, delivery periods, credit terms etc. The cost estimates should be scrutinised to ensure that taxes and duties, insurance, freight charges etc. are included and detailed break-up thereof has been provided. Provisions should be made for installation and spares.

3. Design and Engineering Fees, and Project Implementation Charges

[6] These are indicative numbers based on discussions with energy service companies and energy auditors after reviewing cost structures of some energy efficiency projects.

A break-up of design & engineering fees, and erection and commissioning charges should be obtained from the borrower, and should be enclosed with the project report.

4. Interest during Construction Period

Interest during construction refers to an amount equivalent to the interest and other charges payable by a borrower to the Bank at an agreed rate during the construction period of the project. The interest during construction period should be capitalised and included in the cost of the EE project.

5. Contingencies

There may be certain unforeseen expenses or losses that may increase the project cost estimates. For example, increase in duties, taxes, transportation charges, foreign exchange fluctuations, etc. Although proper estimation of cost of contingencies is difficult but generally it is prudent to keep 5-10% of the project cost as contingencies or such percentage in accordance with the internal guidelines of the bank.

Based on the above, a summary of the project cost could be prepared as per Table C.

Table C: Summary Form for Project Costs

Description	***Cost in Rs.***
Pre-operative and Preliminary Expenses	
Equipment Cost	
Design & Engineering Fees, and Project Implementation charges	
Interest during Construction Period	
Contingencies	
Total Project Cost	

Note: For large EE projects and co-generation projects, project cost components may also include the following cost heads, as applicable, over and above those components mentioned in Table E:

- Cost of land and building
- Plant & machinery cost
- Technical know-how expenses
- Miscellaneous Fixed Assets like furniture, office equipment, tools, vehicles, equipment for distribution of water, steam, power and lighting, laboratory and workshop equipment, fire fighting equipment etc.

II. Means of Financing

The proposed means of financing of an EE project should be reviewed so as to assess whether the project is funded adequately, and whether the proposed capital structure for funding the project is in line with the bank's credit guidelines and policies. Some of the important sources of finance for an EE project are defined below:

1. Promoters' Contribution

A certain percentage of the capital cost of the project should be met by promoters' contribution to ensure that they have a reasonable stake in and commitment to the project. Promoters' contribution could be in the form of:

a. Equity – share capital or unsecured loans from promoters/ associates
b. Internal Accruals from the existing company

Minimum promoters' contribution of 20% of the project cost is recommended. (Please note that is an indicative structure arrived after discussions with bankers, however a bank may use its own criteria and discretion as per the bank's internal credit policies.)

2. Term Loans

In cases where the project is to be funded by a consortium of lenders, it should be ensured that the other expected sources of loans are properly tied up, since any gap in the project funding would adversely affect the project.

The borrower should also provide details of the other potential banks/ institutions providing finance to the project as per **Section 2.1, Means of Financing, in Loan Application Form (Appendix II)**.

3. Others

Government subsidy/grants may be available for certain kinds of EE projects. Since these funds are normally realised only towards the end of the project or after commencement of operations, it is necessary to stipulate a condition that the promoters would bring in their own funds to bridge the gap until such time the government funds are received.

A summary of the means of financing of EE project could be prepared as per Table D.

Table D: Summary Form for Means of Financing

Description	***Cost in Rs.***
Promoters' Contribution	
Term Loans	
Others	
Total Project Cost	

III. Profitability Projections/ Project Cash flow

Profitability estimates, projected cash flow and balance sheet should be prepared for both the specific EE project(s) and the company as a whole. The projections should cover the entire duration of the loan. The bank should scrutinise the financial projections with reference to cost of the EE project, means of financing, and assumptions made in respect of schedule of implementation, capacity utilisation, energy savings and operating expenses.

The underlying assumptions for computing the profitability or cash flow projections of the project should be examined carefully to avoid any overstating or understating. The assumptions should be relevant to the industry. Some of the key assumptions of profitability projections of an EE project are briefly discussed below:

Key Assumptions:

1. Capacity Utilisation

For a retrofit EE project, the present/ immediate past level of capacity utilisation achieved by the company would be a good benchmark.

2. Estimated Energy Savings

Refer to section 3.2.2, section on 'Estimation of Energy Savings' of this manual for a checklist of items to be reviewed on the calculation on energy savings.

Average industry energy consumption per unit of output produced, if available, may be a good benchmark for projected average energy consumption per unit of output produced post-EE implementation at the plant/ facility. However, difference may still exist on account of plant/facility specific factors like age of the plant, the conditions prevailing in the facility, capacity utilisation, etc.

3. Operating, maintenance and repair (OM&R) expenses

OM&R expenses for an EE project may include the following:

- Equipment replacement costs
- Manpower costs
- Costs for spares and tools.

OM&R expenses vary from project to project as each project will have its own unique set of constraints, for example, number of working shifts, size of the EE project, industry etc. In cases, where the OM&R is greater than 10% of the estimated yearly savings for any year during the tenor of the loan, a detailed break-up of the OM&R expenses should be provided by the borrower.

Cash Flow projections for an EE project

After examing the above mentioned assumptions, cash flow projections (as per table E) should be prepared till the term of the proposed facility/ loan. Key financial parameters of the EE project should be calculated and sensitivity analysis of the base case performed (details on this provided in the next section, Financial Viability Parameters).

Table E: Cash Flow Projections for an EE Project

In Rs.lakh	*Year 0*	*Year1*		*Year2…*		*Year n*	
		*Case 1**	*Case 2***	*Case 1**	*Case 2***	*Case 1**	*Case 2***
Project Cost							
Promoters Contribution							
Loan Outstanding							
Cashflow Projections							
Gross Energy Saving							
(-) Depreciation							
(-) Interest							
(-) OM&R expenses							
Pre-tax Energy Savings							
(-) Tax							
Net Energy Savings							
(+)Depreciation							
Cash Inflow (simple)							
Principal Repayment							
IRR%							
DSCR							
Debt-equity ratio							
Payback period (in months)							

*As provided by the borrower

**Sensitised based on changes in various parameters (refer to section 3.2.3, section on 'Sensitivity Analysis' of this manual)

IV. Financial Viability Parameters

The viability parameters recommended for EE projects could be divided into:

1. Key financial parameters: include Internal Rate of Return (IRR), Debt Service Coverage Ratio (DSCR), Debt-equity Ratio, and Asset Coverage Ratio
2. Other financial parameters: Payback Period, Interest Coverage Ratio, and Net Cash Accrual Ratio.

Key Financial Appraisal Parameters for an EE project:

1. Internal Rate of Return (IRR): Based on discounted cash flow method, IRR is the rate of discount that equates the present value of the energy savings (cash inflow) to the present value of the cash outflows.

The methodology for computation of post-tax IRR is given below:

(i) Cash Outflows each year to include capital expenditure costs

(ii) Cash Inflows each year to include Net Energy Savings after tax plus interest and lease rentals, if any for equipments leased for the EE project, plus salvage value of the project plus depreciation plus any other non-cash charges related to the project computed at the end of the tenor of the loan. The salvage value of the project could be determined using the written down value (WDV) method or via an independent assessment carried out by a certified chartered engineer.

(iii) Cash flow projections till the tenor of the loan (includes moratorium period, if any)

To assess whether the project is financially viable or not, the bank could compare the IRR of the EE project with the Weighted Average Cost of Capital (WACC). For EE projects, post-tax IRR greater than or equal to the weighted average cost of capital (post-tax) of the project is recommended.

Computation of Weighted Average Cost of Capital (WACC)

WACC is to be calculated as post-tax weighted average cost of the mix of funds employed for the project (total investment in the project i.e. Capital cost of the EE project). The cost for different sources of funds is to be taken as follows:

a)	Equity share capital[7]	:	15-18%
b)	Cash accruals/ Retained Earnings[3]	:	15-18%
c)	Subsidy/ Incentive loans[3]	:	To be treated free of cost

d) Debt - The cost of long term loans from institutions/banks, non-convertible debentures, deferred credits is to be taken at the post-tax rate of interest i.e. at their respective effective cost to cost to be calculated as (interest rate x (1-tax rate)). The average applicable tax rate is to be taken for this purpose (not the notional prevailing tax rate). The prevailing notional tax rate may be 37.5% at a point of time but because of various tax benefits available (due to losses and incentives) the company's actual tax liability is generally lower than the prevailing tax rate.

2. Debt Service Coverage Ratio (DSCR)

DSCR = (Annual Net Energy Savings post-tax + Depreciation + Interest on term Debt + Lease Rentals)/ (Repayment of Term Debt + Interest on Term Debt + Lease Rentals)

Average DSCR should be computed by taking the total of all values of the numerator and denominator for the entire period of the proposed term loans commencing from the year in which commercial production starts, and not by taking an average of the DSCR for each year. An average DSCR greater than or equal to 1.75 times and a minimum DSCR in any year during the term of the loan of greater than or equal to 1.25 times is recommended.

3. Debt to Equity ratio

[7] In the absence of any other better benchmark the following benchmarks could be used

(Term Loans + Unsecured Loans and Deposits) / (Equity Share Capital + Reserves and Surplus + Subsidy + subordinated Loans from promoters + Portion of debentures to be compulsorily converted into equity shares-intangibles/ losses).
A debt to equity ratio of less than or equal to 4: 1 is recommended.

4. Asset Coverage Ratio
Asset Coverage ratio is defined as:
Written down value of the tangible asset provided as security / Secured Debt outstanding.
= (Net Fixed Asset value of the equipments or machinery installed as part of EE project)/ (Term Loan)

For existing companies, numerator is to be calculated as: Net Fixed Assets Add: Capital work-in-progress Less: Revaluation Amount less Net value of fixed assets hypothecated on specific/ first charge basis.
Asset Coverage ratio of greater than or equal to 1.0 is recommended for EE projects.

Other Financial Appraisal Parameters for an EE project:

1. Simple Payback Period
Simple payback of a project is defined as the length of time required for gross savings (before depreciation, interest and taxes) to equal the capital cost of the project or even more simply, it is the capital cost divided by the average annual savings. However, simple payback period as a method to assess project feasibility has certain advantages and disadvantages, as detailed below:

Advantages	**Disadvantages**
i. The method favours projects with short payback period, thus reducing uncertainty associated with calculation of savings over the long-term in the future.	i. The payback method does not consider savings produced after the payback time and therefore fails to assess the overall value of the project.
ii. Effects such as changing technology and fuel prices are reduced on account of the method favouring projects with short payback period.	ii. The payback period does not use discounted cash flow and therefore does not indicate a rate of return on the project.

2. Interest Coverage Ratio
Interest coverage ratio is an indicator of the ability to meet interest and rental commitments.

Interest Cover = (Annual Energy Savings post-tax + Depreciation + Interest on term Debt + Lease rentals)/ (Interest on Term Debt + Lease rentals)

3. Net Cash Accruals/ Total Debt (%)

$$= \frac{\text{Net Annual Savings after Tax + Depreciation – Dividends + Cash Adjustments}}{\text{Term Loan outstanding}} \times 100$$

Indicates what part of the term loan could be repaid from total cash accruals from the project in a given year.

Note: *The above recommended reference rates for key financial appraisal parameter have been arrived after discussion with bankers and may be used as indicative benchmarks, when assessing the financial viability of an EE project. However an individual bank is free to use its own discretion in setting these benchmarks when assessing the financial viability of an EE project.*

Sensitivity Analysis

A sensitivity analysis may to be performed to assess the impact of changes in key project parameters on the project's cash flows.

1. Base Case (Case 1):

Financial parameters like IRR, DSCR (average and minimum), debt-equity, payback period, interest coverage ratio are computed for the proposed EE project based on project cash flow, cost estimates provided by the borrower.

2. Worst Case (Case 2,…n):

The base case provided by the borrower is sensitised based on the following parameters to come up with various financial scenarios (case2,…n):

i) Delay in project implementation by one/ two quarters
ii) Increase in project cost estimates due to escalation in equipment prices (+5 to +10%)
iii) Reduce energy savings (-10% to –20%)
iv) Increase in OM&R expenses (+10% to +15%)

Note: The sensitivity bands mentioned above are indicative, with the individual bank free to use its own discretion to determine the extent of sensitivity required on a case-to-case basis.

Key Difference in Financial Appraisal (EE Project Vs. Conventional Project)

Basis of Project Cash flow: In an EE project cash flow is based on projected energy savings (improvement in bottom-line), unlike in a conventional project where cash flow is based on financial projections of top and bottom line.

3.2.4 Environmental Appraisal

The environmental appraisal assesses the pollution level of the given facility post EE project implementation, and compares the same with the level pre implementation of the EE project. In cases, where pollution level increases post-EE implementation requisite environmental clearances may be required.

I. Government Notification:

The Ministry of Environment & Forests is the apex body in the administrative structure of the Central Government, for the planning, promotion, co-ordination and overseeing of the implementation of environmental programmes.

Ministry of Environment and Forests (MOEF) notification S.O.60(E), dated 27/01/1994 on Environment Impact Assessment and its subsequent amendments vide S.O. 356(E) dated 4/5/1994, S.O. 318(E) dated 10/4/1997, S.O. 319 dated 10/4/1997, S.O. 73(E) dated 27/1/2000, S.O. 1119(E) dated 13/12/2000, S.O. 737(E) dated 1/8/2001, S.O. 1148(E) dated 21/11/2001, S.O. 632(E) dated 13/06/2002 states[8]:

"*expansion or modernisation of any activity if pollution load is to exceed the existing one*, or new project listed in Schedule I to this notification, shall not be undertaken in any part of India unless it has been accorded environmental clearance by the Central Government in accordance with the procedure hereinafter specified in this notification"

Energy efficiency retrofit projects are modernisation projects as they modernise the existing facility by improving processes, installing energy efficiency equipments, converting wasted energy to useful energy, etc.

II. Recommended Process:

Based on the above MOEF notification, the following three-step process is recommended for assessing the environmental risks of an EE project:

Step 1 – Pollution Assessment Stage

The Energy Auditor should provide a declaration in the energy audit report on how the EE project would affect the pollution level at the facility. The declaration should clearly state whether the pollution level post EE project implementation is estimated to be higher or same or lower than the existing pollution level at the facility. Refer to recommended energy audit report format – **Annexure IV.**

Step 2 – Evaluating whether an Environmental Clearance is required

[8] Source: Ministry of Environment and Forests (MOEF), website: http://: envfor.nic.in/

In cases where pollution level post EE project implementation is expected to exceed the current level environmental clearances from the state and central government or MOEF may be required.

Step 3 – Process of obtaining Environmental Clearances

Environmental clearances for EE projects identified in Step2 may be required at two levels:

1. At State Level: The process of obtaining an environmental clearance from the State Pollution Control Board may be state specific.

2. At Central or MOEF Level: The process of obtaining environmental clearances from MOEF would involve the following:

(i) Conducting an Environmental Impact Analysis (EIA) - A broad framework of an EIA is included in Annexure IV(a),

(ii) Submission of application, along with a project report comprising of an Environmental Impact Assessment Report, Environment Management Plan and details of public hearing, if applicable, to the Secretary, Ministry of Environment and Forests, New Delhi.

(iii) The reports submitted with the application would be evaluated and assessed by the Impact Assessment Agency, which in this case, is the Union Ministry of Environment and Forests (MOEF) and/or a Committee of Experts appointed by MOEF. The assessment would be completed within a period of ninety days from receipt of the requisite documents, data from the project authorities, and completion of public hearing with the decision being conveyed within thirty days thereafter.

3.2.5 Legal Appraisal

Prior to disbursal of the loan the bank should ensure that all necessary legal documentation is completed. Since every bank has its own unique set of legal documentation requirements for loan disbursal, individual banks are free to use their respective legal documentation requirements for loan disbursal for an EE project too. However, an indicative checklist of statutory approvals and legal documentation required prior to loan disbursal for an EE project is given below:

(Please note that legal documentation requirements for a loan would also depend on the proposed financial structure for the project, which may be project specific and require consultation with the legal department in the bank).

1. Statutory Approvals
   - Environmental Clearance from the State Pollution Control Board, if applicable (refer to section 3.2.4 on environmental appraisal of an EE project)
   - Environmental Clearance from MOEF, if applicable (refer to section 3.2.4 on environmental appraisal of an EE project)

2. Legal Documentation
   - Sanction Letter or Letter of Intent (LOI):
     - The sanction letter or LOI sanctioning the loan to the borrower is issued by the bank. The letter should contain all the terms and conditions as per the bank's standard sanction letter format.
     - It should be ensured that the sanction letter is unconditionally accepted by the borrower company through a resolution of its Board of Directors under the Company's Act in the General Meeting of its shareholders.
     - The Memorandum of Association (MOA) of the company should be checked to ensure that company has necessary borrowing powers and an auditor's certificate should be obtained to that effect.

   - Loan Agreement - As per bank's standard loan agreement format covering the terms of the loan including loan amount, interest, repayment schedule and repayment mechanism, security offered, financial covenants, terms of termination of the agreement, penalties etc.

   - Due-diligence of security package
     i. In case where the loan is to be secured by mortgage of property, the title to the property should be examined.
     ii. In case where the loan is proposed to be secured by an unconditional and irrevocable Bank Guarantee a commitment from the concerned party that it is agreeable to furnish the guarantee is to be obtained.

iii. In case the ‘Personal Guarantee’ of the promoter director is insisted upon as a collateral security, it is to be ensured that the director has a sound financial background. This has to be done by analyzing the following information:
   - copies of Income Tax and Wealth Tax returns for the last 3 years
   - list of unencumbered immovable properties owned and their approximate market value
   - list of guarantees furnished jointly and severally in the past
   - details of the guarantee invoked
   - whether invoked guarantees were honoured
   - name and address of the bankers

iv. In case the ‘Corporate Guarantee’ of a sister concern is insisted upon as a collateral security the same due diligence, as mentioned above for a promoter, should be conducted. Also the Memorandum of Association of the sister concern should be examined to ensure that the company is authorised to issue such guarantees.

v. Form 8 & 13 relating to the deed of hypothecation should be registered with the Registrar of Companies within 30 days of date of execution of the deed.

vi. Valuations certificate of fixed assets should be obtained, wherever applicable

vii. Prima facie verification of title deed must be conducted by the Legal Department

viii. No objection certificate should be obtained from the existing charge holder for creation of final security

3. Due diligence of agreement with supplier
   - Examine the terms and conditions of the supplier agreement from the perspective of:
     i. Terms for supply of the equipment
     ii. Terms for Installation and commissioning of the equipment by the supplier (applicable only if the supplier is contracted to install and commission the equipment)
     iii. Terms of the performance guarantee, if any provided by the supplier
     iv. Penalties, if the equipment does not perform as per guaranteed performance

4. Due diligence of performance contract, if any provided by the ESCO in favour of the company/ facility where the EE project is to be implemented
   - Amount of Energy Savings guaranteed per year
   - Penalty/ incentive if guaranteed are not/ over achieved
   - Conditions under which savings are expected to be achieved

3.3 Loan Approval/ Sanctioning Process

Approval process for an EE project loan

Each bank has its own, unique loan approval system with designated officers appointed at the branch, zonal and head office level with loan approval discretionary powers. On account of the varying approval discretionary powers across different banks, a generic approval structure covering discretionary powers at the branch, zonal and head office of a bank for approving EE project finance proposal could not be suggested. It's recommended that the individual bank approve an EE project funding proposal as per its existing approval discretionary mechanism.

Technical Assistance

Given that some banks, currently may not possess adequate expertise at the branch level for technical appraisal for an EE project. It's recommended that for EE projects:

1. Using generic technologies as listed in **Annexure III** the technical appraisal could be handled at the branch level.
2. Using non-generic technologies the necessary expertise for conducting a technical appraisal may not be available at the branch level. In such cases, the branch could refer the proposal for technical assistance to the zonal/ head office for the initial few cases only, so as to enable a knowledge transfer at the branch level. Alternatively, the bank could also form a panel consisting of energy efficiency consultants to facilitate the bank in technical appraisal of EE projects.

3.4 Project Monitoring

Project Monitoring is an important tool for monitoring the progress in the implementation of the project, so as to take corrective steps or remedial measures at appropriate stages and thus to avoid any default in repayment of principal and interest. Project Monitoring also includes monitoring the energy savings achieved by the project by comparing it with energy savings estimated prior to EE project implementation, and taking corrective actions if achieved savings are lower than estimated. Tools used for monitoring an EE project can be divided into conventional monitoring tools (currently followed by banks) and EE project specific monitoring tools as detailed below:

3.4.1 Conventional Project Monitoring Tools

Each bank may formulate its own set of loan monitoring policies and tools. These could be:

1. Early Warning Reports

These reports are generated on a weekly, fortnightly or monthly basis depending on the individual bank's policy. These reports facilitate the bank in monitoring any default in repayment of principal or interest amounts due to the bank on a regular basis.

2. Periodic Reviews

This entails a detailed credit review of the customer's financial statements. These reviews are conducted periodically by the bank (generally yearly, however few banks have a policy of quarterly or half-yearly review).

3. Project Progress Reports

Periodic (time intervals agreed with the bank) progress reports provide information on production, sales, inventory, receivables, profitability, etc. of the project funded by the bank. Any undesirable features affecting/ expected to affect energy savings such as low capacity utilisation, decline in sales, accumulation of inventory, decrease in orders in hand or lower profits than anticipated should be taken up with the company.

4. Periodical Visits

Each assisted unit is generally visited once a year or as per the individual bank's policy on periodical project / company visits. Such a visit provides the bank with a first-hand view of the project progress to date. The visiting team may review energy consumption bills pre and post EE project implementation, examine the utilisation of funds, understand the company's operations, organisational set-up, provide a random check of the correctness of the progress report submitted by the company/ ESCO.

3.4.2 EE-Project Specific Monitoring Tool: (M&V) of energy savings

Over and above these conventional project monitoring tools, a bank may monitor and verify the energy savings at regular intervals of time.

It is recommended to conduct a Measurement and Verification (M&V) of energy savings post EE project implementation once every quarter or at least once every six months. The M&V of energy savings could be conducted by an energy auditor, accredited with the BEE, or empanelled with PCRA, IREDA or such reputed government body.

Table F below can be used to provide details of post-implementation M&V results and variation, if any with estimated energy savings:

Table F: Monitoring & Verification recommended format

Energy Saving Opportunities implemented at the facility	*Consumption per unit of output in (KL or kWh or tons or tps)*		*Energy Savings in (kWh or kl or tons or tps)**	*Price of input (Rupees).*	*Achieved Savings (Rupees).*	*Estimated Saving in (Rupees)*	*Savings – Baseline Vs M&V (Reason for variation, if any)*
	Pre-Implementat-ion	*Post-Implementat-ion*					
	1	*2*					
Energy saving Opportunity 1							
Energy saving Opportunity 2…							
Energy saving Opportunity n							
* Total savings =(Column 2- Column 1) X (Total production at pre-EE implementation stage)							

Corrective Steps

In cases, where actual energy saving is lower than estimates provided to the bank, and timely repayments of principal and interest is not being made to the bank, corrective steps would be required to be taken by the bank:

- The bank could have discussions with the company management and come up with a corrective action plan
- If the corrective action plan does not improve the energy savings by the next M&V, and the principal and interest due to the bank is not regularised, the bank may take necessary steps as per its internal credit policy and terms in the loan agreement

4.0 EE Project financing: ESCO Appraisal

4.1 What is an ESCO? What services does it offer?

An energy service company (ESCO) is a company that is engaged in developing, installing and financing performance-based projects, aimed at energy efficiency or load reduction of facilities owned/ operated by customers. It offers the customer a single window to address all areas of energy efficiency. Typically an ESCO offers the following services for an energy efficiency project:

1. Energy audit and formulation of detailed project reports
2. Implementation of EE Projects (includes undertaking implementation and project monitoring)
3. Procurement of equipments to be installed
4. Arranging Finance (equity and debt) for the project in select cases
5. Equipment maintenance and operations

4.2 Performance Contract

An ESCO may enter into a performance contract with the customer to guarantee a certain amount of energy savings from the project or a shared savings basis.

4.2.1 What is a Performance Contract?

A performance contract guarantees that the cost savings from an energy efficiency improvement project will pay for the costs of the improvements at a facility.

4.2.2 Types of Performance Contracts

The contract may take many forms including guaranteed savings and shared savings.

I. Guaranteed Savings

Under a guaranteed savings contract the ESCO guarantees a given value of energy savings to be achieved from the executing the EE project. The customer makes periodic payments to the ESCO for developing, designing and installing the efficiency measures. If the guaranteed savings level is not achieved, the ESCO covers the difference between the guaranteed savings and the actual savings. However, the customer keeps any savings above and beyond the guaranteed savings level unless stated otherwise.

II. Shared Savings

Under a shared savings contract the customer commits to pay only a percentage of the realised savings to ESCO for cost of designing, implementing and monitoring the energy efficiency project. In this type of contract, the customer assumes no financial obligation other than to pay the ESCO a share of the savings that the project realises. The sharing of savings can take place as per the terms of the Energy Services Agreement (ESA). A typical ESA is structured as follows:

1. Basic Details of the project: Brief description of the project and the principle behind the energy savings.
2. Contract Details: Project cost including project cost funded, if any by the ESCO, the contract value, term of the contract, scope of work, equipment to be installed, installation and procurement schedules
3. Payment terms
4. Sharing of Energy Savings (in rupees) between the company and ESCO
5. Performance Measurement & Verification Protocol
6. Legal clauses specifying terms for termination of the contract.

4.3 ESCO Appraisal

An Energy Service Company (ESCO) could approach a bank for financing in the following two ways:

I. Credit Line to ESCO

An ESCO could seek a credit facility from the bank to finance its current operations, which may include financing ongoing or future projects. The credit facility may not be a project specific, and the ESCO may be allowed to draw down the facility whenever required until the expiry of the facility. The facility may be revolving or a terminating line.

Maximum eligible finance for this facility could be determined using the cash deficit-financing method. This is on account of the nature of the business that instead of assessing the requirement on the basis of the level of stocks/receivables, one may consider the financing based on the gap between the cash inflow and outflow as per three quarterly projections submitted by the ESCO. The bank may consider an upper limit of 2 month's requirement of funds of the ESCO. The margin requirement is to be met by the ESCO from own/ parent company sources. The maximum level of drawing could be limited to the peak net cash deficit arrived at on the basis of consolidated cash flow chart[9].

The above methodology for determining the maximum eligible finance for the credit facility is recommended. However, the individual bank is free to use any other appropriate method for determining the maximum eligibility finance for this credit line to be offered to ESCO.

The above mentioned credit facility to an ESCO could be secured either by having a recourse to the ESCO's balance sheet (if ESCO's balance sheet size is large enough for such a financing) or having recourse to its parent/promoter company's balance sheet. If such a financing is based on ESCO balance sheet strength the advances could be secured via having first charge over the ESCO's stocks and receivables, and fixed assets, if any. In the case, where the financing is secured by parent/ promoter company's balance sheet strength the

[9] As per recommended RBI guidelines to determine maximum eligible finance to a construction contractor. Source: http://www.obcindia.com/domestic/adv_loans_traders_constructionact.html

advance could be secured by first charge over ESCO's stocks, receivables and fixed assets, if any of the ESCO and appropriate security provided by the parent company.

The appraisal methodology to be used for such financing would be as follows:

1. In cases where the advance is based on only ESCO's balance sheet strength, an ESCO appraisal would be required. The appraisal methodology to be followed would be based on the promoter appraisal mechanism covered in section 3.2.1 of the manual or the individual bank's own company appraisal system
2. In cases where the advance is based on ESCO's parent company balance sheet strength, an ESCO appraisal as well an appraisal of the parent company would be required to be conducted. The appraisal methodology to be followed to appraise the ESCO and parent company would be based on the promoter appraisal mechanism covered in section 3.2.1 of the manual or the individual bank's own company appraisal system

The monitoring mechanism to be followed once the credit line is made available to the ESCO would include tools like excess or early warning reports, periodic reviews, quarterly or six monthly financial performance reports, periodic visits by the banker, and quarterly or six monthly monitoring of various projects being undertaken by the ESCO to assess whether the project work is as per schedule and energy savings achieved in completed projects is as per estimates.

II. Project-specific financing to ESCO

ESCO could seek financing from the bank for a specific energy efficiency project, which the ESCO is executing.

The primary risks associated with EE project specific financing include:

1. Performance risk i.e. ability of the ESCO to successfully execute and maintain the project
2. Project risk which includes:
   a) Promoter risk
   b) Technical risk emanating from the project
   c) Financial risk of the project emanating from the project
   d) Environmental emanating from the project, and
   e) Legal risk emanating from the project

The methodology/ framework to assess the above risks associated with EE project specific financing could be decomposed as:

1. Appraisal of the ESCO to assess its ability to successfully execute and maintain the EE project. This appraisal process can be divided into
   a) Basic ESCO Assessment
   b) Client references checks
2. Project appraisal - to assess promoter, technical, financial, environmental and legal risk (covered in detail in **Section 3.0**)

ESCO Appraisal – Project Specific Financing

I. Basic ESCO Information (Part I)

I. Track record		
1	*Is this a new or existing firm?*	*(new/ existing)*
a. *b.*	*<u>If Existing</u>* *Whether the ESCO has completed any energy efficiency project in the specific industry or sector? If yes, how many?* *List of EE projects completed in the last 2 years*	 *(yes/no; if yes: number)* *(as per below format)*

<u>List of key EE projects completed in the specific industry in the last 2 years</u>

I.	*Company/ Facility name where the project was executed*	
a.	*Date of project commencement/ completion*	
b.	*ESCO man-days*	
c.	*Industry*	
d.	*Brief description of energy saving project*	
e.	*Total Project Cost* - *Investment by facility owner* - *Investment by ESCO, if any* - *Loan (name of the bank or financial institution)*	
f	*Total Savings to the facility owner*	
g	*Terms of Payment to ESCO*	
h	*Project Results* *Key Performance indicators* • *Power & Fuel Bill – Pre & Post ESCO Project* • *Specific Energy Consumption – kWh or MT or KL or TPS per unit of output produced (Pre- & Post)* • *Cost of Implementation – Projected Vs Actual* • *Savings – Baseline Vs M&V Results*	

II. Firm Structure		
1.	*Names of the promoters of the ESCO?*	
2.	*Type of firm*	*(proprietorship, partnership, private limited or public limited)*
3.	*Number of Full Time Staff Numbers*	

Names of promoters

	Promoter Name	Equity Stake (%)
1		
2		

III. Qualifications & Experience		
1.	*Qualifications of key personnel assigned to the project (as per table below)*	

Key Personnel in the project

Names of Key People			
Position			
Total length of experience			
Number of years in current position			
Qualifications			
Training			
List of projects completed in the last two years, including his/her role in the project - *Designing & Constructing EE Projects* - *Maintenance Experience* - *Skill Transfer*			
Availability for the project			

IV. Financial Information		
1.	*Equity base and structure, Networth of ESCO/ Promoters*	
2.	*If existing firm, please provide last 3 years Profit & Loss and Balance Sheet.*	
2.	*Financial Projections (P&L and BS) till the term of the loan.*	
4.	*Current bankers to the firm:* - *Facility availed* - *Current outstandings* - *Security provided*	
5.	*Current order book*	

II. Client Reference Checks (Part II)

At least '3' client references preferably from that particular industry, for projects completed within the last two years are required. The client references would be in the following format:

<u>Feedback Form</u>

1. Client Name:
2. Industry:
3. Project completed by ESCO:
4. Date of project commencement:
5. Date of project completion:
6. Project Cost:
7. Services offered by the ESCO:

1.	How does the achieved energy savings compare with the estimated energy savings indicated in the energy audit report (pre-implementation)? a) Achieved savings higher than estimated b) Achieved savings as per expected/ estimated c) Achieved savings below than estimated <u>Comment:</u> *If 'c', please provide reason why the projected energy savings were not achieved.*
2.	Was there any cost escalation in the project? a) No cost escalation b) Project cost incurred were higher than projected on account of: i. Incorrect estimation of project cost by the ESCO? ii. External factors like increase in prices of equipment or any other costs? iii. Combined affect of the above two factors <u>Comment:</u> *If 'b', by how much were the project costs incurred higher than projected? Reason for higher projects costs. Specific areas where the project cost incurred was higher than estimated.*
3.	Was the project completed on schedule? a) Completed before schedule b) Completed as per schedule c) Delayed <u>Comment:</u> *If 'c', please provide reasons for delay, and by how much time the project was delayed.*

4.	Six months or one year post implementation, how does the energy saving achieved compare with the projected energy saving (prior implementation)? Response required, only if project was implemented six months or one year back, or earlier. a) Achieved savings higher than estimated b) Achieved savings as per expected/ estimated c) Achieved savings below than estimated <u>*Comment:*</u> *If 'c', please provide reason why the projected energy savings were not realised.*

<signature >
Name of the company official:
Company seal:
Date of signing:

Note: The duly completed feedback form is to be sealed in an envelope and directly sent to the bank

5.0 Annexures

5.1 Annexure I : Indicative List of possible energy efficient projects in Specific Industries

Aluminium Industry

- install variable frequency drive for spent liquor pump feeding to evaporator
- install thermo-compressor and recover flash steam from pure condensate tank in evaporator section
- install seal pot system for condensate recovery optimise excess o2% in kiln by continuous monitoring
- segregate pick-up and drying zone vacuums in red
- mud filters
- sweeten the digestion process by adding gibbsitic bauxite having higher solubility in downstream of higher temperature digestion circuit
- replace old horizontal stud soderberg (hss) cells with modern point feeder prebake cells

Caustic Chlorine Industry

- Installation of VFD (variable frequency drive) with Close Feedback Control in order to avoid Valve Throttling
- Replace Steam Ejector with Water Ring Vacuum Pump for Brine Dechlorination
- Installation of variable frequency drive for One Chlorine Compressor and Avoid Bypass Control during Load Variation
- Installation of Thermo compressor and Utilise Flash Steam in the I- Effect Heat Exchanger
- Install commercial Co-generation 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-lift with Bucket Elevator for Raw-meal Transport to the Silo
- Replacement of Existing Cyclones with Low Pressure Drop (LP) Cyclones
- Install a high level control system for kiln operation
- Usage of Cheaper Fuels for Calciner Firing
- Variable Speed Fluid Coupling for Cooler ID Fan and Replacement with Lower Capacity Motor
- Variable Frequency Drives for Cooler Fans
- Replacement of Existing Cooler I Grate with High Efficiency Cooler System
- Installation of Low Primary Air Burner in Place of Existing Conventional Burners
- Usage of High Efficiency Crusher as a Pre-grinder Before the Cement Mill
- Conversion of Open Circuit Cement Mills to Closed Circuit by Installing High Efficiency Separator
- Install A Co-Generation System For Recovering Heat From Kiln Pre heater And Cooler Exhaust

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 optimising 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
- Optimisation of pressure setting of air compressors
- Replacement of Aluminium blades with FRP blades in cooling tower fans
- Install temperature indicator controller (TIC) for optimising cooling tower fan operation, based on ambient conditions
- Install dual speed motors/ VSD for cooling tower fans
- Install hour meters on all material handling equipment, such, pulpers, beaters etc.

Copper Smelter

- Reduction of Idle Running hours of Feed Conveyors by Automation
- Installation of correct size pump for Slag Granulation pump / cooling tower pump
- Utilise the heat of smelter furnace exhaust gases to preheat the blower air
- Install waste heat recovery system for Anode furnace exhaust and Utilise to preheat combustion air
- Installation of Variable Speed Drive for smelting furnace Induced Draught Fan
- Installation of Variable Fluid Coupling For Converter plant ID Fan
- Installation of Auto Inlet Guide Vane (IGV) operation for Converter Blower.
- Installation of Variable Frequency Drive for lime recirculation at scrubber exhaust system of Anode furnace
- Replacing old fan with an energy efficient fan for direct exhaust fan at Anode furnace
- Replace existing main firing burner with high efficiency burners in the Anode Furnaces
- Avoid radiation losses through feed door by covering the openings in the Anode Furnaces
- Effective Utilisation of Acid Coolers in Sulphuric Acid Plant to Reduce Cooling tower Pumps Load
- Replacing existing pump with correct size pump in Sulphuric Acid Plant Cooling water pump and matching with the requirement
- Improvement Of Boiler Efficiency in Phosphoric Acid Plant
- Installation of Variable Speed Drive for Gypsum Slurry Pump in Phosphoric Acid Plant
- Installation of Variable Speed Drive for return Acid Pumps, HH Cloth Wash Pump and dilute cake wash pump in Phosphoric Acid Plant
- Reduction of compressed air usage in the plant
- Installation of guide vane control system to control the blower capacity
- Segregating cooling water requirements of compressors & smelter plant
- Utilisation Of Vent Compressed Air In Oxygen Plant
- Replace old inefficient compressors with energy efficient compressors

- Installation of variable frequency drives for screw compressor
- Installation of Variable speed drives for cooling tower fans
- Conversion of V-belt drives to flat belt drives in compressors and blowers

Fertilisers

- Installation of High Efficiency Turbine for Air Blower in the Plant
- Installation of Variable Frequency Drive (VFD) for required Pump
- Installation of Right Size Hot Sump Pump
- Optimisation of Vacuum Pump Operation
- Installation of a Pipe Reactor in Complex Plant
- Installation of Right Size High Efficiency Sea Water Pumps
- Installation of Vapour Absorption System
- Replacement of Old PRDS Valves with Superior Design Valves
- Replacing Reformer Tubes with Tubes of HPNb Material Stabilised with Micro-Alloys
- Modernisation of the Ammonia Converter Basket
- Installation of Waste Heat Boiler (WHB) at the Inlet of LTS Converter in Ammonia Plant
- Replacement of Air Inter-coolers in the Ammonia Plant
- Routing of Ammonia Vapours from Urea Plant to Complex Plant
- Replacement of Pellet Type Catalyst with Ring Shaped Catalyst in a acid Plant
- Installation of a Waste Heat Recovery Boiler for Generating Set Exhaust
- Installation of more than one Turbo Alternator in a acid Plant
- Installation of Hydraulic Turbine in the CO2 Removal Section
- Installation of Plate heat exchangers for drying tower cooler in a acid plant
- Installation of mechanical conveying system in place of pneumatic conveying system for rock phosphate conveying in a acid plant
- Replacement of steam ejectors with vacuum pumps

Foundry Industry

- Minimising the heat loss during metal transfer
- Provide insulated lid for the holding furnace to avoid heat loss due to radiation
- Reduce the tap to tap time in the furnace
- Energy saving by optimal scheduling of pouring molten metal in the furnace
- Optimise the operating pressure of the compressor to match with the requirement
- Improve combustion efficiency of cupola furnace
- Optimise the size of the coke fed into cupola furnace
- Practice oxygen enrichment in cupola furnace
- Optimise combustion air supply to the oil fired heat treatment furnaces
- Install blower air for sand cooling and avoid compressed air supply
- 8. Segregate thick and thin section molten metal requirement and operate furnace at different
- temperatures
- Bundle and improve the bulk density of the input material
- Provide closed hood for the furnace and minimise the loss due to radiation and convection
- Control of sintering cycle through automatic sintering cycle time

- Optimise cooling water supply to the induction furnace
- Install kWh indicator cum integrator for induction furnace
- Install medium frequency induction furnace of main frequency furnace
- Install spectro meter for analyzing the molten metal
- Install online shot blasting machine for cleaning the returns

Glass Industry

- Installation of Variable Frequency Drive (VFD) for Combustion Air Blower
- Installation of Variable Fluid Coupling for cooling blowers in furnace
- Installation of Variable Frequency drives to screw compressor catering to process air requirements
- Replacement of inefficient cooling blowers with energy efficient blowers
- Replacement of inefficient reciprocating compressors with high efficiency compressors
- Segregate low pressure and high pressure compressor air systems and operate LP air system catering to instrumentation systems at lower pressure
- Optimisation of the combustion air supply to the furnace and maintaining the O2 level in the flue gas
- Reduce the conveying length of product from the furnace to the lehr and reduce temperature drop
- Replace existing V-belt drives with flat belt drives for identified equipment
- Balance system voltage to avoid unbalance in motor load
- Replace faulty capacitors
- Replace old motors with energy efficient motors
- Replacement of Aluminium blades with FRP blades in cooling tower fans
- Install dual speed motors/ Variable speed drive for cooling tower fans

Power Industry (mainly for IPPs and CPP)

- Install VFD for boiler ID/FD fans, Boiler feed water pump
- Install circulating fluidised bed boilers for efficient combustion
- Install high efficiency turbines
- Install vapour absorption system to Utilise LP steam for air-conditioning
- Convert spreader stoker boilers to fluidised bed boilers
- Install steam drives to prevent HP steam flow through pressure reducing valves
- Install vapour absorption heat pump in place of vapour compression system
- Install capacitor banks to improve power factor
- Replace rewound motors with energy efficient motors
- Replace old and inefficient compressors with screw or centrifugal compressors
- Convert medium pressure steam users to LP steam users to increase co-generation
- Install condensate recovery systems in air heaters
- Utilise waste condensate for de-superheating the process steam
- Install Variable Fluid Coupling or variable frequency drive for condensate extraction pump
- Utilise flash steam from boiler blow down for deaerator heating

5.2 Annexure II – Recommended Financial Indicators for Promoter Appraisal

	Financial Indicator	*Definition*
1	Sales Growth	(Net Sales CY)/ (Net Sales PY) -1
2	Net Profit Growth	(Net Profit CY)/ (Net Profit PY) -1
3	Operating Profit Margin	(Profit before Interest, Extraordinary Items, and Depreciation)/ (Net Sales + Operational Income) X 100
4	Net Profit Margin	(Net Profit after tax)/ (Net Sales + Operational Income) X 100
5	ROCE	[(Profit Before Tax and Interest Extraordinary Items)] / [Total Debt[10]+Tangible Networth-Capital WIP-Preoperative expenses not allocated]
6	ROE	[(Net Profit)/ (Avg[11].Net worth)] (Avg Net worth = Avg. (Equity capital + Reserves - Intangible assets)
7	Current Ratio	[Debtors+Inventory+Cash+Other current assets]/[Current Portion LTD+Interest accrued and due+Creditors+Provisions+Other current liabilities]
8	Fixed Assets Turnover	(Net Sales)/ (Net Fixed Assets)
9	Debtors Turnover	(Gross Sales)/ (Receivables+Bills discounted)
10	Inventory Turnover	(Cost of Goods Sold)/ (Raw material+WIP+Finished Goods)
11	Creditor Turnover	(Purchases)/ (Sundry Creditors)
12	Debt/Equity	[Long term debt includes secured and unsecured] / [Equity share capital+preference share capital+general reserve+share premium+other reserves-Accumulated losses-Misc Exp. Not w/off]
13	TOL/ TNW	[Long term debt+Working capital loan+other short-term borrowings+current maturity to long term debt] / [Equity share capital+preference share capital+general reserve+share premium+other reserves-Accumulated losses-Misc Exp. Not w/off]
14	DSCR	[(Net Profit + Depreciation + Interest on Term Debt+Other non-cash expenses)/ (Repayment of Term Debt + Interest on Term Debt)
15	Interest Coverage	(Net Profit + Depreciation + Interest on Term Debt)/ (Interest on Term Debt)

Note: Current Year (CY), Previous Year (PY)

[10] Includes short-term and long-term debt
[11] Average of last two years

	Financial Indicator	*Importance of the Indicator*
1	Sales Growth	Sales growth is an indicator of the company's sales performance compared with performance in previous year's/ years. A positive growth indicates an increase in sales, while a zero growth or negative growth indicates a stagnation or reduction in sales in the current year compared to previous year.
2	Net Profit Growth	Net profit growth is an indicator of the company's profitability in the current year compared to that in the previous year/ years. A positive growth indicates an increase in profits, while a zero growth or negative growth indicates a stagnation or reduction in profits in the current year compared to previous year.
3	Operating Profit Margin	Operating profit margin is an indicator of management's ability to produce goods efficiently. It simply describes the raw profit and is used as an important measure for peer comparison. A change in GPM over a period of time reflects relationship in three factors: 1)Manufacturing costs, 2)Volume of sales and, 3)product prices
4	Net Profit Margin	Net profit margin is an indicator of net profit available for shareholders after meeting administrative & selling overheads, financial costs and Taxes.
5	ROCE	This ratio is a measure of business performance, which is not affected by interest and tax. It abstracts away the effect of financial structure and tax rate and focuses on operating performance.
6.	ROE	This ratio is a measure of business performance in terms of income generated in relation to the funds provided by the shareholders of the company.
7	Current Ratio	This ratio is an indicator of the ability of a borrower to meet its obligations in the short run, usually one year. Theoretically, higher the current ratio, the greater is the short-term solvency.
8	Fixed Assets Turnover	
9	Debtors Turnover	This ratio indicates the average length of time between credit sales and cash collection.
10	Inventory Turnover	This ratio indicates the average length of time for which the stock is stored before it is sold.
11	Creditor Turnover	This ratio indicates the average length of time between credit purchases and cash payment. The degree that a firm uses trade creditors to finance operations is illustrated by this ratio
12	Debt/Equity	This ratio expresses the relationship between capital contributed by creditors and that by owners. It expresses the degree of protection provided by the owners for the creditors. This ratio is

		an indicator of capital structure of a company. Higher the ratio, greater the risk being assumed by creditors and more vulnerable the company is to business downturns. A lower ratio generally indicates greater long-term financial safety.
13	TOL/TNW	This ratio is an indicator of financial risk of a company Lower the ratio the better is the long term solvency of the company
13	DSCR	This ratio is an indicator of debt servicing ability of a company Higher the ratio, the greater is the solvency of the company A low ratio indicates higher dependence on external sources of fund or lower profitability
14	Interest Coverage	This ratio is an indicator of interest servicing ability of a company A low ratio indicates higher dependence of the company on the external sources of funds or lower profitability

Note: Current Year (CY), Previous Year (PY)

It's recommended that the individual bank use its own benchmarks for the above financial parameters when assessing the promoter/ promoter company financial strength

5.3 Annexure III – Broad Classification of EE Projects by technology

Energy Efficiency or Energy Cost reduction activities can be broadly classified under 2 heads –

1. Generic type: Generic type will be common across the vertical industry segment. Typically these would include improvements in utilities, pumping, generation of power etc.
2. Process type: Process type will be specific to a given industry segment. Typically these would include process changes, waste heat recovery heat exchanger networking etc.

The table below lists various types of generic energy efficiency projects, along with an indicative payback period:

	Generic Type EE Projects	Simple Payback	Example
		Years	
1	Waste Heat Recovery (Generic)	0.5 - 1.5	Heat Recovery in boilers and gensets
2	Fuel Shift or change of energy source	0.5 - 1.5	Fuel Shift from coal to biomass; change from electric heating to thermal
3	Cogeneration	0.5-3	Higher the % of back pressure steam; lower is the payback
4	Electrical Distribution	0.5-1.5	Power factor improvement; transformer loss reduction
5	Pumping	0.5-1.5	Proper selection of pumps and better system design
6	Automation	2-Jan	VFD installation; O2 analyser in boiler
7	Steam Distribution	0-1	Condensate/ Flash steam recovery;
8	Compressors	0.5-2	Change from reciprocating to screw or centrifugal chiller; matching of demand and generation parameters
9	Energy Efficient Motors	0.25-1	
10	Lighting	0.5-2	

Note: *The above list of generic type EE projects is not a comprehensive list. Also, the payback periods mentioned above are indicative, and should not be used as benchmarks for energy efficiency, as payback period for an EE project is also dependent on project-specific factors like vintage of the current technology, conditions in the plant etc.*

5.4 Annexure IV – Recommended Energy Audit Format

TABLE OF CONTENTS

i. Acknowledgement

ii. Executive Summary (a brief on the facility and promoters, energy saving opportunities at a glance & recommendations)

1.0 Introduction

1.1 Is the energy auditor accredited from Bureau of Energy Efficiency? Is he/ she empanelled with IREDA, PCRA, PFC, etc or the Bank?

1.1.1 Track record of the energy auditor/ consultant based on factors like:

- What is the number of energy audits completed in the last 3 years?
- Whether the energy auditor has conducted any energy audit in the particular industry in question in the last 2 years? If yes, how many?
- In which five facilities/ companies has the energy auditor conducted audit in the last one year?

1.2 General Plant details and descriptions (Plant capacity, products produced, date when production commenced, whether the plant is breaking even or having profits, number of employees, the technology used in the plant, etc)

1.3 Component of production cost (Raw materials, energy, chemicals, manpower and other overhead costs)

2.0 Production Process Description

2.1 Brief description of manufacturing process

2.2 Process flow diagram and Major Unit operations

3.0 Details of Baseline Energy Consumption

3.1 Brief description of the existing unit including utility of the unit for the entire plant, inputs consumed by the unit, output produced by the unit, process/ technology used in the unit, as per the below table:

Baseline consumption details:

		<latest financial year>		
		Total Consumption per unit of output produced (specify unit)*	*Average Price of utility* (rupees)*	*Total Cost of utility (rupees)*
a.	Fuel Consumption	*<if applicable>*		
b.	Electrical energy consumption	*<if applicable>*		
c.	Steam consumption	*<if applicable>*		
d.	Other inputs such as compressed air, cooling water etc	*<if applicable>*		

*in cases, where total consumption per unit of output produced or average price of utility is not available for the last FY, the energy auditor could provide an estimate of the same, detailing the methodology and assumptions

3.2 How does the consumption of the utility per unit of output compare with industry standards, if available?

4.0 Details of Energy Saving Opportunities

4.1 Estimating Energy Savings

- What do the energy savings consist of? Are these; savings in energy cost, fuel cost, labour cost, consumables and maintenance cost.
- Are the savings resulting from higher capacity utilisation of the equipment or inefficiency of the existing equipment?
- What is the age of the unit/ plant, where the energy saving has been recommended? (if the plant/ equipment is too old, estimated energy savings may not be realisable?
- How does the energy consumption post EE project implementation compare with industry standards, if available?
- Does the implementation of the EE project result in higher manpower costs, or increased energy consumption in some other part of the facility, and has that been taken into account when computing the energy savings?
- Would the EE project implementation result in shut down of the facility? If yes, what would be the potential loss, and has that been taken into account when computing the energy savings?

4.2 Identifying Energy Saving Opportunities

S.No.	*Energy Saving Opportunity*	*Estimated Energy saving (% of current consumption)*	*Annual Estimated Energy Savings in (kWh or kl or Ton or MT)*	*Annual Savings (Rs.Lakh)*	*Capital Investment (Rs.Lakh)*	*Payback period (years)*
1	Energy Saving Opportunity 1					
2…	Energy Saving Opportunity 2…					
N	Energy Saving Opportunity n					
Total						

4.2.1 Evaluation of Technology to be deployed for Energy Saving Opportunity 1

- Is the technology proven or tested? If not, whether successful anywhere else? and can that success be replicated in Indian context and conditions?
- Does the technology/ process/ equipment technically fit with the facility's existing technology/ process/ plant & machinery? If not, what aspects of the technology/ process do not fit, and what measures is the company planning to take in this regard?

- Is there any industry benchmark data available from a reliable source, on the level of energy consumption post deployment of this new technology/ process? (Check with BEE or industry-specific national or regional bodies)

4.2.2 Evaluation of Technology to be deployed for Energy Saving Opportunity 2

- Is the technology to be deployed for the EE project proven or tested? If not, why is it recommended?
- Does the technology/ process/ equipment technically fit with the facility's existing technology/ process/ plant & machinery? If not, what aspects of the technology/ process do not fit, and what measures is the company planning to take in this regard?
- Is there any industry benchmark data available from a reliable source, on the level of energy consumption post deployment of this new technology/ process? (Check with BEE or industry-specific national or regional bodies)

4.2.n Evaluation of Technology to be deployed for Energy Saving Opportunity n

- Is the technology to be deployed for the EE project proven or tested? If not, why is it recommended?
- Does the technology/ process/ equipment technically fit with the facility's existing technology/ process/ plant & machinery? If not, what aspects of the technology/ process do not fit, and what measures is the company planning to take in this regard?
- Is there any industry benchmark data available from a reliable source, on the level of energy consumption post deployment of this new technology/ process? (Check with BEE or industry-specific national or regional bodies)

4.3 Prioritising Energy Savings Opportunities in terms of No cost/ Low Cost, Medium cost and high investment Cost (as per table below)

Types and Priority of Energy Saving Measures				
S.No.	*Type of Energy Savings Options*	*Annual Fuel/ Electricity Savings*	*Annual Savings*	*Priority*
		(kWh or kl or Ton or MT)	*(Rs.Lakh)*	
A	No/ Low Cost - Operational Improvement/ Housekeeping			
B	Medium Cost - Controls/ Equipment Modification /Process change			

C	High Cost - Energy efficient Devices/ Product modification/ Technology Change			

5.0 Annexures to the Audit report

5.1 Pollution Declaration

- Clearly state whether the pollution level post EE project implementation is estimated to be higher or same or lower than the existing pollution level at the facility

5.2 List, along with specifications of equipment to be installed and recommended vendors

- List of equipments and machinery to be installed with cost and manufacturing specifications.
- Capacity of the equipment, and whether it as per requirement?
- List of recommended equipment suppliers/ vendors

5.5 Annexure V - Guidelines for an Environmental Impact Assessment

Environmental Impact Assessment (EIA) is a comprehensive assessment tool to analyse environmental issues concerning planning, implementation, operation and maintenance stages of a project.

Objectives of EIA

Providing possible quantitative environmental information so that potential impacts can be avoided in project and project design; providing a basis of development of management measures to avoid or reduce negative impacts; and providing an Environmental Management Plan (EMP) for the project that will help promote sustainable development.

The basic information taken from the project-sponsor is to furnish details on the nature of the atmospheric, soil and water pollution likely to be created by the project

Components of EIA

1. Description of the project: Parameters that need to be considered are project type, location, area and layout of the project, climate, physiography, landform and soil type of the location.

2. Environmental baseline description: Following information is needed,
   - Environmental baseline map
   - Natural physical resources
   - Natural biological resources
   - Economic/development resources and
   - Socio-economic feature.

3. Scoping: Scoping may be obtained through published information, expert opinion, people's opinion and identification of environmental issues.

4. Bounding: Bounding of a project must be clear. They may be physical, political and administrative, social and ecological.

5. Field investigation: Following information are needed through field investigation: Survey, computation and analysis, risk assessment, climate, land use, soils, ground and surface water, natural biological resources, endangered species, agriculture, fisheries, forest and socio-economic condition.

6. People's participation: It is needed all through the project. Participation of local people can help in grading and identifying issues. It is obtained through public meeting/hearing, scoping, local Government views, seminar or workshop, comments from concerned agency and comments from well-informed persons/experts.

Steps in environmental impact assessment:

1. Prediction: Prediction of impacts can be done by modelling (physical, conceptual and mathematical models), correlation with key variables, trend analysis and comparison and projection.

2. Classification: Impacts are classified in the following ways: Short or long term impacts, frequency of impacts, reversible or irreversible impacts, cumulative or non-cumulative impacts, direct or indirect impacts, synergistic impacts and positive or negative impacts.

3. Evaluation: Evaluation is important to clarify impacts as it measures impacts as perfect as possible. It is done through economic terms where costing is possible and acceptably accurate, quantitative or numeric terms where costing is not feasible and descriptive term where neither of the above is feasible

5.6 Annexure VI – Non-Sugar Co-Generation Project

Co-generation (Combined Heat and Power or CHP) is the simultaneous production of electricity and heat, both of which are used. The central and most fundamental principle of co-generation is that, in order to maximise the many benefits that arise from it, systems should be based according to the heat demand of the application.

Co-generation optimises the energy supply to all t3ypes of consumers with the following benefits to both users and society at large:

- Increased efficiency of energy conversion and use. Co-generation is the most effective and efficient form of power generation
- Lower emissions to the environment, in particular of CO2, the main greenhouse gases. Co-generation is the single biggest solution to the Kyoto targets
- Large cost savings, providing additional competitiveness for industrial and commercial users, and offering affordable heat for domestic users

Example of a non-sugar co-generation project

Background

Huge amount of heat is wasted in a sponge iron plant emanating from the kilns. This waste heat can be recovered using a waste heat recovery system to produce electricity. The recovery and processing of heat emanating from the kilns is done before it enters into the boilers. This is an example of a sponge iron plant that presently meets its entire electricity requirement from the Grid.

Previous Status

The sponge iron plant has an annual electricity consumption of about 60 million units per annum. It currently purchases electricity from the grid at Rs.4 per unit.

Co-generation/ Energy Saving Project

It plans to set up a 10 MW co-generation plant to meet its entire requirement from the plant and to use the grid power as a backup support. This way it would be able to save the entire amount from the electricity charges whereas it will also incur some cost for producing the electricity in the co-generation plant. The incremental benefit in the cost will result in substantial saving for the plant.

Financial Analysis

Particulars		**Yr 0**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Yr 6**	**Yr 7**
Capacity of Plant	MW		10	10	10	10	10	10	10
Load factor of the system	%		0.8	0.8	0.8	0.8	0.8	0.8	0.8
Annual Energy Generated	*million kWh*		*58*	*58*	*58*	*58*	*58*	*58*	*58*
Transfer Pricing Methodology									

Cost of Electricity	Rs/kWh		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Cost of production of electricity	Rs/kWh		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Estimated Energy saving	Rs/kWh		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Gross Estimated Energy saving	*Rs mn*		*115.2*	*115.2*	*115.2*	*115.2*	*115.2*	*115.2*	*115.2*
Investment	Rs mn	320.0							
Promoters Investment (30%)	Rs mn	9.6							
Loan (70%)	Rs mn	22.4	19.2	16.0	12.8	9.6	6.4	3.2	0.0
Gross Estimated Energy saving	Rs mn		115.2	115.2	115.2	115.2	115.2	115.2	115.2
Depreciation @5%	Rs mn		16.0	16.0	16.0	16.0	16.0	16.0	16.0
Interest	Rs mn		2.7	2.3	1.9	1.5	1.0	0.6	0.2
Pre Tax Net Savings	Rs mn		96.5	96.9	97.3	97.7	98.2	98.6	99.0
Post Tax Net Savings (tax @36.75%)	Rs mn		61.0	61.3	61.6	61.8	62.1	62.3	62.6
Depreciation	Rs mn		16.0	16.0	16.0	16.0	16.0	16.0	16.0
Net Cash Inflow	Rs mn	*-320.0*	*77.0*	*77.3*	*77.6*	*77.8*	*78.1*	*78.3*	*78.6*
Principal Repayment	Rs mn		3.2	3.2	3.2	3.2	3.2	3.2	3.2
Interest	Rs mn		2.7	2.3	1.9	1.5	1.0	0.6	0.2
DSCR			13.5	14.5	15.7	17.0	18.7	20.7	23.1
Leverage		2.3	2.0	1.7	1.3	1.0	0.7	0.3	0.0
Payback period (years)		**2.8**							
IRR		**15%**							

Cost-Benefit Analysis

Average Annual Savings	=	Rs. 115 million
Investment	=	Rs. 320 million
IRR	=	15%
Payback	=	2.8 years

5.7 Annexure VII (a) – Case Study 1 – Simple Retrofit – Company Implements the Project

Replacing conventional tube lights (using copper choke) with high lumen tube lights (using electronic choke).

Background

Adequate lighting system in a place results in high productivity and better working environment. Lux Level, Lamp Efficacy (Lumens/Watt), Lighting System Design (Power Consumption) indicates the performance of the lighting system. The quality of lighting design depends upon its ability to provide the required illumination level at minimum energy consumption.

Commercial building, large establishments and Industry require vary high quality of lighting arrangements and number of lamps/tube lights used at these places are large in numbers. In such buildings/places electricity consumption contributable to lighting system is generally very high. Earlier all these establishments were relaying on incandescent bulbs and Fluorescent Tube lights for the lighting system. Many buildings in India are still continuing with the system. Incandescent bulbs can be replaced by Compact Fluorescent Lamps (CFL) who consumes vary less. The conventional choke consumes about 50 W of power whereas tube light fitted with electronic choke or high lumen tube lights with electronic choke consumes hardly about 30 W.

Replacement of conventional lighting system with modern advanced system will result in saving of energy however pay back period will vary for every building/establishment depending on the existing lighting arrangement.

Energy Saving Project

The following case study, which was conducted in a Building where large number of tube lights was continuously used and the consumption from the electricity, was very high. Study considered the various characteristic of lighting system and proper replacement was suggested without compromising the quality of light. In this process some of the tube lights were delamped.

Previous Status

Particular	Number of Tubelights	Wattage	Cost
Existing Lighting System	No.	Watt	Rs.
Tube lights in Building	3000	46.4	40
Tubelight in staircase	34	46.4	40

Energy Efficiency Project

Replaced Lighting System			
Replacing tubelight in building and staircase with high lumen TL & Electronic ballast**	3034	30	600

** on account of Delamping of 19 single FTL which illuminates the ceiling

Assumptions

Operating hours for the tube lights in the rooms	Hrs	3000
Operating hours of the tubelights in the staircase	Hrs	8760
Present Energy Charges	Rs./unit	6.7
Depreciation		30%
Tax		36.75%
Loan repayment period		43years
OMR Expenses		5%
Interests		11%

Saving in Energy after Implementation

Total Energy Consumption of Existing System	kWh	431,420
Total Energy Consumption of Proposed System	kWh	273,060
Total Energy Saving	kWh	158,360

Replacing each FTL with high lumen TL & Electronic ballast	Rs. '000	1,820
Cost of Labour for replacement	Rs. '000	100
Any other cost (ex. A&G)	Rs. '000	50
Total Investment Required	*Rs. '000*	*1,970*
Total Saving from Energy	*Rs. '000*	*1,061*

Financial Analysis

			Year 1	Year 2	Year 3
Investment	Rs. '000	1,970			
Promoters Investment (40%)	Rs. '000	985			
Loan (60%)	Rs. '000	985			

Estimated energy saving	Rs. '000		1,061	1,061	1,061
Depreciation @ 30%	Rs. '000		546	546	546
Interest	Rs. '000		90	18	-
Operating Expenses @ 5% of project cost	Rs. '000		99	99	99
Total Expenses	Rs. '000		735	663	645

Pre Tax Net Savings	Rs. '000		326	398	416
Tax @ 36.75 %	Rs. '000		120	146	153
Post Tax Net Savings (tax @36.75%)	Rs. '000		206	252	263
Depreciation	Rs. '000		546	546	546
Cash Inflow	Rs. '000		752	798	809
Amount of Principal Repayment	Rs. '000		328	328	328
Interest	Rs. '000		90	18	-
Loan Outstanding			657	328	-
DSCR			2.01	2.36	2.46
Leverage		1.0	0.7	0.3	0.0
Payback period (in Years)	**1.9**				

Cost-Benefit Analysis

Average Annual Savings (‘000)	=	Rs. 1,061
Investment (‘000)	=	Rs. 1,970
Payback	=	1.9 years

Annexure VII (b) - Case Study 2 - ESCO Involved

Replacing two 12.5 MVA transformer with single 25 MVA transformer with on load tap changing facility

Background

Company: ABC Limited, a leading ESCO is executing an energy efficiency project at mini Steel plant. The project is designed to reduce energy costs, and increase plant productivity. The company's energy costs have increased due to power shortages and low voltage levels causing inefficient operation of its melting and casting operations. The project involves the installation of a highly efficient 25 MVA transformer to replace two older and smaller transformers.

With 1,000,000 tons of ingot production capacity and 75,000 tons of rolling mill capacity, the company manufactures a range of high carbon and alloy steels. The steel plant is part of a large Group of Companies and has been in production for the last 25 years. The mill melts scrap metal in an electric arc furnace and uses continuous casting technology to produce steel.

ESCO: An internationally reputed energy services company with a strong track record and having successfully executed some similar energy efficiency projects.

Previous Status

Earlier to the implementation of the project company used to receive the power at 66 kV which was transformed at 11 kV by two 12.5 MVA transformers. Energy use at the plant is comprised of consumption at the steel melting shop, the wire rod mill, and inherent transformer losses. The steel melting shop has a 30-ton GEC electric arc furnace. The wire rod mill produces wire rods from 5 mm to 16 mm in diameter.

Due to the poor quality of supply and frequent poor voltage at incoming point, company suffered from frequent tripping of Arc furnace, which increases the amount of time needed for heating and melting the scrap. This has not only affected the production quality but also increased the cost of production. Also the production of the company has fallen because of the ban on production during evening peak hours. Power consumption increased because the electric arc furnace at the plant takes more time to complete the melting process. This resulted in increase of electricity charges. Falling production levels, increasing power and fuel costs are adversely affecting plant profitability.

Energy Saving Project

II. As a part of the project company decided to replace the two 12.5 MVA transformer by single 25 MVA transformer with on load tap changing facility. This on load tap changing facility reduced the frequency of trappings resulting in better production quality and saving in the consumption of electricity. As the drive systems at the mill already have in-built automatic voltage regulators, there was not expected to be any substantial reduction in energy usage as a result of the project. When power quality is good, specific energy consumption averages between 550 kWh and 650 kWh per ton. With poor power quality, consumption can increase up to 700 kWh for the same product mix. Transformer loss has also come down due to replacement.

Energy use at the plant is comprised of consumption at the steel melting shop, the wire rod mill, and inherent transformer losses.

Summary of Energy Saving Recommendations

Particular	Unit	Quantum
Production	Ton	37500
Current Specific Energy Consumption in Steel Melting Shop	(kWh/ ton)	600
Current Specific Energy Consumption Wire Rod Mills	(kWh/ ton)	200
New Consumption in Steel Melting Shop	(kWh/ ton)	570
New Consumption in Wire Rod Mills	(kWh/ ton)	200
Total Loss in old transformers	(kWh/ ton)	20
Total loss in New transformers	(kWh/ ton)	10
Energy Charges	Rs/unit	3.5

Particular	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Production (ton)	37.5	37.5	37.5	37.5	37.5	37.5
Pre Implementation						
Consumption in Steel Melting Shop (kWh)	22500	22500	22500	22500	22500	22500
Consumption in Wire Rod Mills (kWh)	7500	7500	7500	7500	7500	7500
Losses in Transformer (kWh)	750	750	750	750	750	750
Total Baseline Consumption (kWh)	30750	30750	30750	30750	30750	30750
Post Implementation						
Consumption in Steel Melting Shop (kWh)	21375	21375	21375	21375	21375	21375
Consumption in Wire Rod Mills (kWh)	7500	7500	7500	7500	7500	7500
Losses in Transformer (kWh)	375	375	375	375	375	375
Total Consumption (kWh)	29250	29250	29250	29250	29250	29250
Net Saving after Implementation (kWh)	1500	1500	1500	1500	1500	1500
Total Saving in Rs.	**5250**	**5250**	**5250**	**5250**	**5250**	**5250**

Financial Analysis

Particulars	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of Equipment	8,000					

Cost of Labour	1,500					
Any other charges (exp A&G)	500					
Total Investment	**10,000**					
Promoters Investment (25%)	2,500					
Loan (75%)	7,500					
Estimated energy saving		5,250	5,250	5,250	5,250	5,250
Depreciation @ 8% as per MoP		627	627	627	627	627
Interest @ 11%		743	578	413	248	83
Operating Expenses (OM&R)		-	-	-	-	-
Pre Tax Net Savings		3,880	4,045	4,210	4,375	4,540
Post Tax Net Savings @36.75%		2,454	2,559	2,663	2,767	2,872
Depreciation		627	627	627	627	627
Cash Inflow	(10,000)	3,081	3,186	3,290	3,395	3,499
Principal Repayment to the Bank		1,500	1,500	1,500	1,500	1,500
Remaining Cashflow after bank payment		1,581	1,686	1,790	1,895	1,999
Share of ESCO (50% of Net Savings)		791	843	895	947	999
Net Cash Inflow to Company (50% of Net Savings)		791	843	895	947	999
Principal Repayment		6,000	4,500	3,000	1,500	-
DSCR		2.05	2.12	2.19	2.26	2.33
Leverage	3.00	2.40	1.80	1.20	0.60	0.00
Payback period (years)	**1.90**					
IRR	**19%**					

Cost-Benefit Analysis

Average Annual Savings ('000)	=	Rs 5,250
Investment ('000)	=	Rs.10,000
IRR	=	19%
Payback	=	1.9 years

Financing Mechanism: The achieved energy savings were accrued to an escrow account. The lending financial institution had a 1st lien on the account for repayment of its principal and interest due on the loan. The energy savings remaining after repaying the bank were equally shared between the ESCO and the company.