

***Development of Financial Intermediation Mechanisms
for
Energy Efficiency Investments in Developing Countries***

Under World Bank/ UN Foundation–UNEP Technical Assistance Project

**Development of Energy Efficiency Projects in SME Paper Cluster
in the States of Punjab/Haryana/ Uttaranchal**

FINAL REPORT

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DSCL ENERGY SERVICES COMPANY LTD.

2nd Floor, Kanchenjunga, 18 Barakhamba Road, New Delhi 110001
Tel. 0091 11 23316801 Fax 0091 11 23319062 Email:dscpower@vsnl.com

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ABBREVIATIONS

ADB	Asian Development Bank
CMIE	Center for Monitoring of Indian Economy
DG	Diesel Generator
DPR	Detailed Project Report
DSCLES	DSCL Energy Services Company Ltd.
DSCR	Debt Service Coverage Ratio
ECO	Energy Conservation & Commercialization Project
EE	Energy Efficiency
EFS	Equipment Finance Scheme
ESP	Energy Saving Project
FD	Forced Draft
FY	Financial Year
IPPTA	Indian Pulp and Paper Technical Association
IPMVP	International Performance Measurement & Verification Protocol
IREDA	Indian Renewable Energy Development Agency Ltd.
IRR	Internal Rate of Return
M&V	Monitoring and Verification
MOU	Memorandum of Understanding
PMV	Performance Measurement and Verification
PSEB	Punjab State Electricity Board
ROI	Return on Investment
SBI	State Bank of India
SME	Small and Medium Enterprise
SSI	Small Scale Industry
TOR	Terms of Reference
UN	United Nations
UNEP	United Nations Environment Program
UPCL	Uttaranchal Power Corporation Ltd.
USAID	United States Agency for International Development
VFD	Variable Frequency Drive
W&P	Writing & Printing

UNITS AND WEIGHTS

kg	kilogram
kg/cm ²	kilo gram per square centimeter
kWh	Kilo-Watt hour
m ³	Cubic Meter
MT	Metric Tons
MW	Mega Watt
TPA	Tons Per Annum
TPD	Tons Per day

CURRENCY

Rs 1 Lakh = Rs 100,000
 Rs 1 Crore = Rs 10 Million

EXECUTIVE SUMMARY

Under the “Development of Financial Intermediation Mechanisms for Energy Efficiency Investments in Developing Countries – Brazil, India and China” (3-Country EE Project) supported by the World Bank/ UN Foundation/UN Environment Program (UNEP), DSCL Energy Services Co. Ltd, (DSCLES) was awarded a contract by the World Bank to develop at least 3 energy efficiency project proposals in the SME paper clusters in Punjab/Haryana/ Uttaranchal.

DSCLES selected the following three medium sized units for detailed study:

- Pragati Paper Industries, Punjab – producing newsprint from waste paper
- Banwari Paper Mills, Uttaranchal – producing writing and printing paper from agro residues and waste paper
- Shree Shyam Paper Mills, Uttaranchal – producing writing and printing paper and some grades of specialty paper from agro residues and waste paper

These 3 units are representative of the clusters and were willing to implement the identified energy saving projects (ESPs) and borrow term loan for the same. Except for Banwari Paper, which was marginally creditworthy (currently profit making but carrying forward accumulated losses) other units were complying with the eligibility criteria of the EE financing schemes available (viz Project UPTECH of State Bank of India, EE Financing Scheme of Canara Bank and Equipment Financing Scheme of Indian Renewable Energy Development Agency).

Energy audit was carried out in the above 3 units and findings are summarized in the following table.

(All units in Lakh Rs)

Unit	Generic EE Projects Proposed	Estimated Savings	Estimated Investment
Pragati Paper	Boiler – VFD for feed water pump, excess air control and heat recovery from flue gas; VFD on air compressor and VFD for hydra pulper.	62.00	41.00
Banwari	Digestor insulation, Flash steam recovery from paper machine, Blow tank heat recovery, Efficient fan pump for paper machine, raw water pump efficiency improvement, efficiency improvement in stock pumps, Boiler FD fan efficiency improvement	48.00	32.00
Shree Shyam	Replacement of inefficient process pumps and installation of VFDs in selected process pumps, Fan pump efficiency improvement and installation of VFD, installation of a separate vacuum pump for wire section and flash steam recovery.	44.00	40.00

As part of the deliverable detailed project reports including baseline and Performance Measurement and Verification (PMV) option and Measurement and Verification (M&V) plan for the project savings, project cost estimates for each energy saving project (ESP), estimation of savings (energy, operation & maintenance) and financial attractiveness of the investments proposed in each of the units have been prepared and submitted. Subsequently assistance was provided to all units in preparation of required documentation for availing term loan from IREDA in the case of Shree Shyam, Canara Bank in case of Pragati paper and Bank of Baroda in case of Banwari for implementation of the identified ESPs.

The progress of the project is summarized in the following table:

TOR Performance	Pragati	Banwari	Shree Shyam
Detailed audit	Yes	Yes	Yes
Project structuring including PMV methodology	Yes	Yes	Yes
Preparation of project report	Yes	Yes	Yes
Submission of loan application	Yes to Canara Bank	Yes to Bank of Baroda	Yes to IREDA
Appraisal by Banks	No Please refer to 5.3.3 for details	No – Please Refer to 6.3.3 for details	Yes- Please refer to 7.3.3 for details
Loan approval	No	No	Yes
Financial Closure	No	No	No
Project implementation	Yes – Technical and financial viability of implementing generic EE projects demonstrated	No	Yes– Technical and financial viability of implementing generic EE projects demonstrated
PMV	Yes – savings are comparable to the projections	No	Yes – savings are comparable to the projections

Key learning's are summarized as under:

1. EE projects and investment
 - a. The savings opportunities of 10 to 25% are in line with general projections made from time to time under various sponsored and commercial studies
 - b. The technical capacity for project implementation in two of the units has been observed to be quite high
 - c. Though there is awareness about energy efficiency potential, management attention still continues to be for increased production, more so due to buoyancy in the market
 - d. Major focus for reducing energy cost is in cogeneration.

- e. Cluster approach has its advantage of replication but some challenges have also been faced in getting mills together for sharing of technical information.
2. EE project implementation
- a. There is enough interest with varying degree of capability.
 - b. Most of the mills are continuously upgrading capacity and product mix and as such are cautious about investment in equipment retrofit. This also affects the Performance Measurement and Verification.
 - c. Two of the mills have been able to implement projects successfully. The speed of implementation noteworthy
 - d. PMV for projects would face hurdle. A non-intrusive PMV system has to be developed for such kinds of industries.
3. Financing
- a. A major barrier faced in the process of financial closure was due to reluctance of units to provide financial information required for the loan application.
 - b. Good creditworthy units do not want to go through the procedural hassle of loan sanction for smaller projects and generally have cash for investment in such projects evidenced by successful implementation of projects in two units.
 - c. Less creditworthy units would not be able to get loan sanctioned as per the present security norms of the banks and FIs.
 - d. High charges for bank guarantee (4%) required for security negates benefits of supposed to be concessional EE financing
 - e. The financing schemes launched by the commercial banks needs to be backed up by marketing and process innovation efforts
4. Financial Intermediation
- a. For smaller loans, present system of intermediation is unlikely to work.
 - b. Present system of transaction and security requirement may also pose challenge for ESCO system of financing to develop.

Most important learning is that creditworthy industries would avail benefit of separate EE financing scheme only with better and more flexible incentive scheme. For the rest, the efforts made by various institutions and consultants to innovate financing scheme within present guidelines of lending have not produced desired results and similar efforts in future should first look into possible solution for changing such guidelines.

1. PROJECT BACKGROUND

1.1. BACKGROUND

As part of the project “Development of Financial Intermediation Mechanisms for Energy Efficiency Investments in Developing Countries – Brazil, India and China” (3-Country EE Project) supported by the World Bank/ UN Foundation/UN Environment Program (UNEP), the World Bank awarded a contract to DSCL Energy Services Co. Ltd, (DSCLES) to develop at least 3 energy efficiency project proposals in the SME paper clusters in Punjab/Haryana/ Uttaranchal.

1.2. PROJECT RATIONALE & OBJECTIVE

The rationale for undertaking this study in paper mills in Punjab, Haryana & Uttaranchal under the 3 Country EE project is as follows:

“Small and medium enterprises (SME’s) in most industrial and other sectors form the backbone of the Indian economy. SME’s across-the-board suffer from serious technical and managerial resource constraints, and in many instances, also from financial constraints.

Paper units in the SME sector normally have out-dated technologies characterized by inefficient energy and water management systems. These mills are also characterized by wide diversity on raw material usage, finished products and capacity range. In terms of raw material usage, mills can be broadly put in two categories – waste paper based and agro-waste based. Similarly, for finished products too, though bulk of the mills produce only kraft paper, a number of them have started producing writing and printing papers today. These mills are quite closely networked and successful development in one mill is very rapidly replicated in large number of similar mills. This phenomenon has been recently demonstrated by quick adoption of cogeneration system in quite a few mills in Punjab, Uttar Pradesh and Gujarat. Some of the mills have now started looking into energy efficiency improvement opportunities too. Major opportunities exist for improving efficiency in the following generic areas, which can be quickly replicated in almost all the units:

- Water pumping
- Stock preparation and pumping
- Paper machine waste heat recovery
- Boilers and auxiliaries
- Steam distribution and condensate recovery
- Factory electrical distribution and lighting system
- Effluent treatment aerobic system
- Peak load management
- Process instrumentation

Between Punjab, Haryana and Uttaranchal, there are many such units where such EE projects can be implemented. Experience has shown that about 15 to 30% energy savings can be achieved by better operation and

maintenance and investment in better technology in the areas mentioned above. With adoption of cogeneration, further improvement in efficiency and cost reduction can be achieved.

Total investment potential in energy efficiency in these mills in just two state cluster of UP and Punjab would be around Rs. 1500 to 2000 million.”

With a view to enable large-scale replication of EE measures in the paper units located in clusters, this assignment aimed to develop bankable projects, which will be submitted to IREDA or other scheduled banks for their consideration for financing. It was expected that the implementation of these investments will demonstrate the technical viability and financial/economic benefits of EE measures in the cluster and also open up investment market for EE projects in the SME sector.

1.3. ORGANIZATION OF THIS REPORT

This report summarizes the results, key learnings of the consultants and recommends strategy for future implementation of EE Projects in SME units. The report is organized as follows:

Chapter 2 – Outlines terms of reference, approach by DSCLES and the deliverables as per the contract

Chapter 3 – Key findings and results from task 1 viz. selection of paper mills

Chapter 4 – Detailed Methodology of Energy Audit and Overall Progress and Status of the Project

Chapter 5, 6 and 7 – Discussion on findings and status in each unit

Chapter 8 –Barriers and Obstacles, Key learning’s and suggested strategy for the future

Chapter 9 – Conclusions

2. APPROACH & METHODOLOGY

2.1. SCOPE OF WORK

The scope of work of the consulting assignment was as follows:

- Assess the techno-economic feasibility of various technology options available for enhancing energy efficiency and reducing energy consumption through implementation of generic projects having wide replicability, which shall lead to at least three specific bankable project proposals from credit-worthy clients to be submitted for financing consideration to IREDA/Indian banks. Efforts shall be made to develop one proposal in each of the previously identified states.
- For the selected EE technology options in the units so identified, ascertain capital cost, energy savings and operating cost savings and overall financial attractiveness of the proposed investments.
- Finalizing suitable financial structures for the EE projects in the selected units, taking due consideration of lenders security requirements and incorporating innovative features as required so that units with marginal creditworthiness can still provide adequate security for financing of the identified projects.
- Preparing suitable baseline(s) and monitoring and verification (M&V) protocol(s) that are agreeable to both the borrower(s) and the lender (IREDA/other banks)

2.2. DSCLES APPROACH

The assignment was seen to comprise following four phases:

- Selection of Candidate Paper Mills
- Conducting investment grade energy study in the candidate mills
- Preparation of detailed project report and documentation required for seeking financial assistance
- Providing assistance for securing financial closure

2.3. DELIVERABLES

Contracted deliverables under the assignment were as follows, for each of the 3 paper mills studied:

- Detailed Project Report (DPR) with techno-economic analysis of EE technology, options for the selected units, the underlying rationale, financial/economic justification including cash flow projection etc.
- Draft baseline(s) and M&V protocol(s) that are acceptable to IREDA/other lenders and the borrowers.
- Details of the financial structure finalized, stating clearly the sources of funds for capital investment, equity contribution and securitization mechanism (including guarantee mechanism, if any)
- Loan application

3. SELECTION OF PAPER MILLS

The summary of the methodology adopted for the selection of paper mills and the findings are as follows:

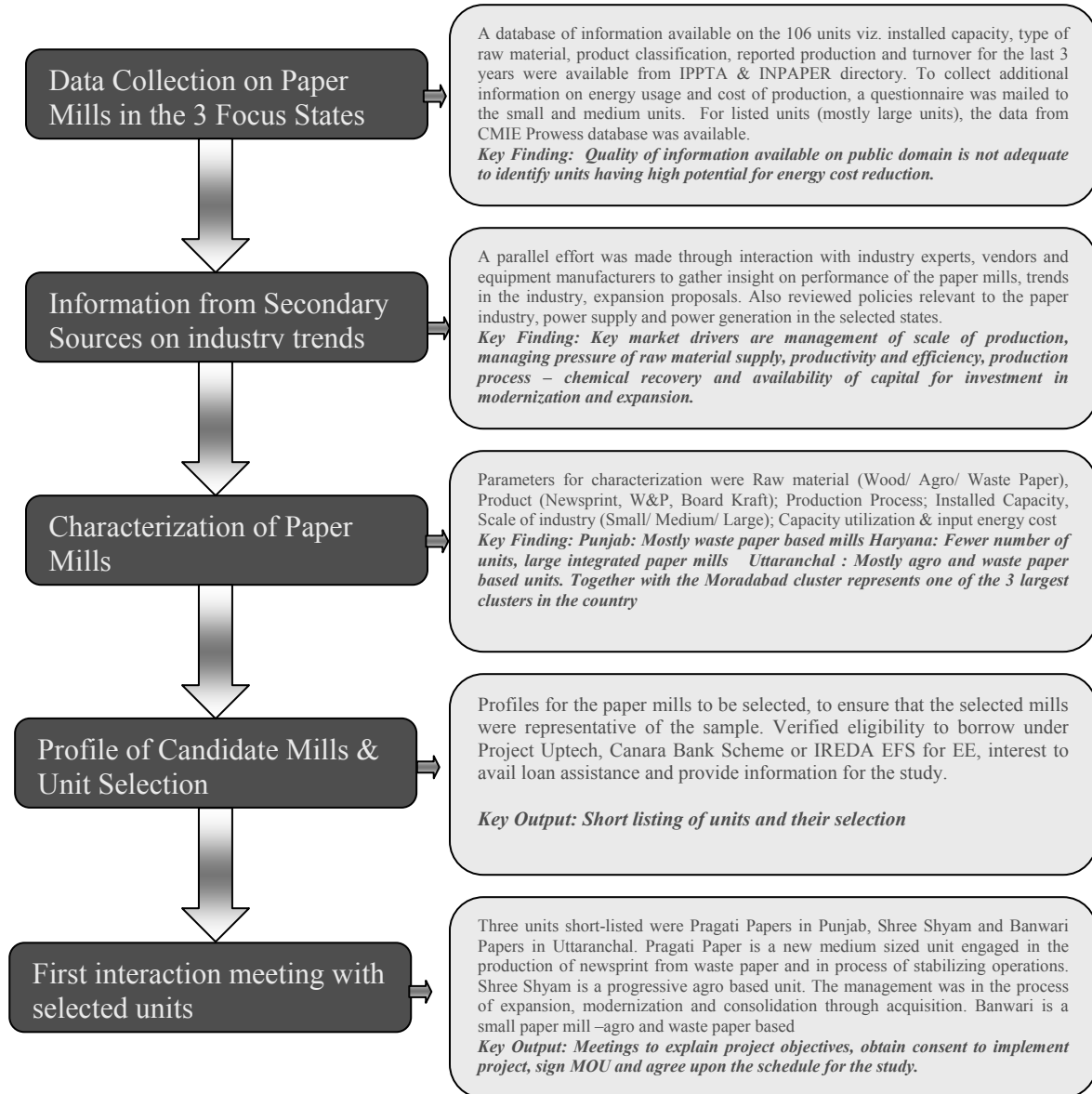


Figure 1 Methodology for Paper Mill Selection and Key Findings

4. ENERGY AUDIT IN SELECTED PAPER MILLS

4.1. METHODOLOGY ADOPTED

After signing of a memorandum of understanding with the 3 selected units, energy audit was carried out following DSCLES methodology for such projects. This involved:

4.1.1 Walk Through Audit

The walk through audit involved

- Assess the energy conservation potential
- Make an assessment of the measurement system and ensure completion of the following measurement requirements
 - Check all the existing measurement and analytical facilities and assess additional requirements for measurement and testing needed for detailed audit.
 - Make arrangements for making available additional instruments where portable instruments cannot be used
 - Make arrangements for providing tapping and connection points required for connecting portable instruments
 - Finalize the testing and measurement schedule
- Discuss and finalize the total project schedule.

4.1.2 Detailed audit

The activities to be carried out during the detailed audit included

- Study of the system & associated equipments.
- Data collection by conducting field testing & measurement using portable instruments
- Data analysis for preliminary estimation of saving potential at site
- Discussion with site personnel the findings and revalidation.
- Site trials for further validation
- Collection of data required for loan application
- Presentation on the summary of findings and measures identified, to site personnel.

4.1.3 Post audit off – site work

Post audit off-site work included the following

- Revalidation of all the calculations for arriving at the final savings potential, identify and articulate individual energy saving projects.
- Financial analysis of the various options to arrive at the best approach
- Vendor interaction

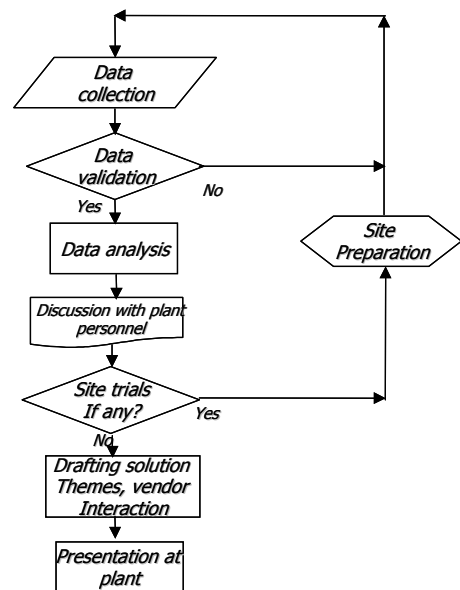


Figure 2 DSCLES EA Methodology

- Identifying baseline and measurement and verification approach for each energy saving project
- Draft report preparation/compilation and acquiring client’s acceptance.

4.1.4 Preparation of DPR and providing assistance for financial closure

This involved:

- Outlining procurement specifications for energy saving projects selected for implementation
- Finalize baseline and measurement and verification approach for each energy saving project
- Energy saving project costing, financial justification and cash flow projection.
- Finalize the means of financing for the project
- Preparation of detailed project report and documentation required for seeking financial assistance
- Providing assistance for securing financial closure

4.2. LEARNING’S FROM THE AUDIT PROCESS

DSCLES key learning’s/ barriers from the audit process is as follows:

- High level of awareness on generic ESPs. However, competition and to some extent polarization are barriers to sharing of results within a cluster.
- Availability of reliable quality of information is a barrier. Reasons are varied
 - Narrow focus of operations at shop floor level
 - Energy information system is minimal
 - Perceived threat particularly at mid-management level
- EE Value Proposition
 - Lower preference for high quality equipment due to cost.

4.3. OVERALL PROGRESS OF THE PROJECT AND STATUS

Table 1 Overall Status

Performance	Pragati	Banwari	Shree Shyam
Detailed audit	Yes	Yes	Yes
Project structuring including PMV methodology	Yes	Yes	Yes
Preparation of project report	Yes	Yes	Yes
Submission of loan application	Yes to Canara Bank	Yes to Bank of Baroda	Yes to IREDA
Appraisal by Banks	No Please refer to 5.3.3 for details	No – Please Refer to 6.3.3 for details	Yes- Please refer to 7.3.3 for details
Loan approval	No	No	Yes
Financial Closure	No	No	No
Project implementation	Yes – technical and	No	Yes– technical and

Performance	Pragati	Banwari	Shree Shyam
	financial viability of implementing generic EE projects demonstrated		financial viability of implementing generic EE projects demonstrated
PMV	Yes	No	Yes

A detailed report for each unit is given in subsequent sections (5, 6 & 7). The detailed project reports and Memorandum of Understandings are provided as separate Annexes to this report.

5. ENERGY AUDIT IN PRAGATI PAPER INDUSTRIES LTD.

5.1. BACKGROUND INFORMATION

Pragati Papers Industries Ltd. is a 100% waste paper based plant with a capacity of 144 TPD of newsprint. The plant is located at Handesra, Punjab. The plant was commissioned in February 2004. The company has a 6.5 MW cogeneration plant to meet its power & heat requirement, with a back up facility of DG power. Fuel used in the power plant is rice husk and the total energy bill estimated for six months (Feb 04 to Jul 04) is Rs. 290 Lakhs (32% towards process heat applications and 68% towards electricity cost). Specific energy consumption has come down from 750 kWh/ Ton of finished paper to 662 kWh/ ton since the plant came into commercial production.

5.2. OBSERVATIONS ON EE PRACTICES

The awareness of energy conservation among plant management is quite high, manifested by the equipment installed in the plant. All the machinery are new with state-of-the-art technology employed, the pumps installed are of high efficiency, instrumentation and control is available wherever possible and VFD's are installed on major variable loads both in utility and process.

5.3. DSCLES STUDY

5.3.1 Project Identification

After selection of the unit, a memorandum of understanding was signed on 22 July 2004.

DSCLES carried out the walk through energy audit in the unit on 30 July 2004. The objective of the study was explained in detail and Pragati Paper showed their willingness to participate and implement the EE measures identified through the study. Pragati Paper was also apprised of the requirements of the project viz.- implementation of projects through debt financed by commercial banks/ IREDA and information regarding the terms of financing, security requirements and eligibility criteria was provided. Pragati Paper had expressed interest in availing loan from Canara Bank in view of ongoing relationship with them (working capital lenders and project financing for setting up the paper unit).

During the walk through audit it was agreed that the study would focus on the utility section including boiler and turbine, pulping & stock preparation section and the paper machine section.

The detailed study was carried out in August 2004. The projects identified were summarized in the following Table-2:

Table 2 Summary of ESPs Identified in Pragati Papers

SN	Particular	Saving, Rs lacs / annum	Investment* ' Rs lacs	ROI %
1	Boiler – Feed water pump	5.16	7.69	67.10%
2	Boiler – Excess air control	12.00	5.78	207.67%
3	Boiler – Heat recovery from exit flue gases	20.00	10.16	196.85%
4	Installation of VFD on Air Compressor	6.70	3.50	193.11%
5	Installation of VFD on Hydro Pulper	18.00	13.97	128.85%
	Total	61.86	41.10	150.66%

* *Excluding soft costs*

The basis for estimating savings: Cost of rice husk at Rs 1800/ T and power at Rs 3/kWh (applicable PSEB tariff).

5.3.2 Preparation of Documentation for Financial Closure

After the detailed audit, DSCLES and Pragati Paper, jointly met with the Canara Bank Branch to discuss the findings of the audit and the process for securing financing for the projects under the Canara Bank EE financing Scheme. The Bank confirmed that the Company qualified for financing under Canara Bank's Scheme for financing EE Projects. viz. the following eligibility criteria.

- Unit is SME
- Cost of energy for the unit should constitute not less than 20% of the total cost of production
- Satisfactory record of Borrowal a/cs-ASCC code S1 or S2 during previous review.
- Current account holders having dealings exclusively with the Bank satisfactorily for a period of last one year.
- Loan amount requested for was within Rs 1 Crore cap.

During the discussion the Bank also clarified the process for sanction of term loan assistance under the scheme viz.

- Submit the energy audit report with an application for term loan assistance from the company
- Application and the audit report would be forwarded to the Head Office for appraisal, since it was a new scheme
- Security requirement would be determined during the appraisal process
- Sanction of term loan

The company felt that the decision process for the sanction of term loan was too elaborate considering the loan assistance sought was less than Rs 1 Crore. However, they agreed to go ahead with the application as agreed in the MOU.

Accordingly, DSCLES submitted a DPR to the unit on 13 September 2004 (Annexure-1). The total project cost including soft costs was estimated as Rs 46 Lakhs and the means of

financing proposed were as per Canara Bank's Scheme (90% debt at 10% interest rate, 1% lesser than prevailing rate for loans of similar tenure, amortized over a 7 year period including a 6 month moratorium). Key financial indicators are as given in the following Table-3:

Table 3 Key Financial Indicators: Pragati Papers

SN	Key Financial Parameters	Value
1	Average Debt/Funded Equity	5.35
2	DSCR	4.57
3	Min DSCR	2.28
4	ROCE	46.86%
5	Project IRR (10 years)	124.43%
6	Equity IRR (10 years)	54%

5.3.3 Financial Closure

On request of the company, DSCLES provided assistance to draft vendor enquiry documents for each ESP (involving several interactions between October and December 2004). References of existing units (DSCLES Clients) where similar projects have been implemented were also provided to help them understand better the benefits of the ESPs proposed.

This process delayed the submission of loan application and the Company submitted term loan application to Canara Bank on 11 January 2005. As the loan amount was very small, the company was not keen to comply with additional requirements necessary to secure sanction under the EE Financing Scheme, and did not pursue the application.

5.3.4 Project Implementation

The projects were implemented by in-house team of Pragati Paper. Support was provided by DSCLES for equipment selection. Except for the boiler heat recovery project, the other energy cost reduction projects have been implemented.

5.3.5 Performance Measurement and Verification

The table below compares the savings achieved with targeted savings:

All figures in Rs lacs / year

Table 4 PMV Results: Overall -Pragati Paper

SN	Energy Saving Project	Projected Saving	Actual Saving
1	Boiler – Feed water pump	5.16	5.41
2	Boiler – Excess air control	12.00	12.95
3	Installation of VFD on Air Compressor	6.70	6.43
4	Installation of VFD on Hydro Pulper	18.00	16.91
Total		41.86	41.70

The PMV plan as agreed upon is given in the following Table-5:

Table 5 PMV Plan for Pragati Paper

<i>ECM</i>	<i>PMV Plan</i>	<i>Parameters to be measured for Baseline & Duration</i>	<i>Parameters to be measured after implementation</i>
Boiler feed water pump	Retrofit Isolation Plan B as per IPMVP	Measurement of flow, pressure and power Pressure drop across the control valve Production	3 hrs Measurement of flow, pressure and power Pressure drop across the control valve Production
Boiler excess air control	Partially Measured Retrofit Isolation Plan B along with Whole Facility Plan C as per IPMVP	Measurement of oxygen level Boiler load Production Rice husk consumption	3 hrs Measurement of oxygen level Boiler load Production Rice husk consumption
Installation of VFD on air compressor	Retrofit Isolation Plan B as per IPMVP	Measurement of power Production	3 hrs Measurement of power Production
Installation of VFD on hydro pulper	Retrofit Isolation Plan B as per IPMVP	Measurement of power Production	3 hrs Measurement of power Production

The procedures mentioned above were followed both during the baseline establishment and PMV, which was carried out in July 2005.

5.3.5.1 Project 1: Boiler feed water pump

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-6:

Table 6 Boiler Feed Water Pump: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Boiler feed water flow	m ³ /hr	27.30	26.85
2	Pressure at pump discharge	kg/cm ²	90.00	75.50
3	Power consumption	kW	131.70	108.50
4	Pressure drop across control valve	kg/cm ²	15.00	0.00

* Average value of 3 hr measurement

The table-7 below provides the details of the savings achieved in the project

Table 7 Boiler Feed Water Pump - Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	171, 850	180,227
2	Monetary savings	Rs lacs/yr	5.16	5.41

5.3.5.2 Project 2: Boiler Excess Air Control

As per method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-8:

Table 8 Boiler Excess Air Control: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Oxygen level in exit flue gas	%	8.00	5.10
2	Boiler load	TPH	23.00	23.00
3	Rice husk consumption	TPD	150.18	147.30

* Average value of 3 hr measurement

The table-9 below provides the details of the savings achieved in the project

Table 9 Boiler Excess Air Control - Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Fuel savings	T/yr	667	719.70
2	Monetary savings	Rs lacs/yr	12.00	12.95

5.3.5.3 Project 4: Installation of VFD on Air Compressor

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-10:

Table 10 VFD for Air Compressor: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Power consumption	kW	47.63	20.85

* Average value of 3 hr measurement

The table-11 below provides the details of the savings achieved in the project

Table 11 VFD for Air Compressor - Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	224,800	214,200
2	Monetary savings	Rs lacs/yr	6.70	6.43

5.3.5.4 Project 5: Installation of VFD on Hydrapulper

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-12:

Table 12 VFD for Hydra Pulper: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Power consumption	kW	151.43	70.46

The table-13 below provides the details of the savings achieved in the project

Table 13 VFD for Hydra Pulper - Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	600000	563,667
2	Monetary savings	Rs lacs/yr	18	16.91

The actual figures are lower because the baseline for pulp density could not be established as the operation is manual.

5.4. OBSTACLES FACED

The main obstacles faced during the various stages of the study are given in the following Table-14:

Table 14 Barriers & Efforts Made to Overcome Barriers

Activity	Barrier/ Obstacle Encountered	Efforts made to overcome Barriers
Detailed audit	Inadequate energy information system	Collection of information from multiple sources and confirmation of assumptions with plant personnel.
Establishing PMV Methodology	Several parameters for which adjustments could not be defined due to nature of operations	The retrofit isolation PMV plan was selected even though this does not provide the impact on the overall energy consumption.
Preparation of Project Report and documentation for loan application	Decision process: The unit wanted the costs to be firmed up before applying for term loan assistance, requiring more time	Provided assistance – vendor specifications, and facility references where similar projects are operating.
	Preparation of loan application as per Bank norms: Reluctance to comply with stipulated requirements under the scheme.	-
Financial Closure	Magnitude of financing available from existing schemes for EE financing	Several meetings were held and benefit of EE financing explained. However, benefit

Activity	Barrier/ Obstacle Encountered	Efforts made to overcome Barriers
	as compared to the transaction need was not attractive to the client	was not considered attractive enough.
	Appraisal by Banks – same as above	-
	Security Requirements – was not an issue.	-
Project Implementation	Selection of Projects for implementation – None – the company was keen to implement all the projects identified.	-
PMV	None	-

6. ENERGY AUDIT IN BANWARI PAPER MILLS LTD.

6.1. BACKGROUND INFORMATION

Banwari Paper Mills Ltd. is an agro-based plant with a capacity of 35 TPD. The plant is located at Kashipur, Uttaranchal. A mix of raw materials (bagasse, wheat straw, elephant grass –*sarkhanda* and waste paper) is used which include agro waste, waste paper and pulp. Banwari produces different grades of Writing & Printing (W&P) paper, through the chemical soda process (batch operation).

Power requirement for paper manufacturing is met from the state grid and DG sets. The paper mill utilizes the grid power sourced from Uttaranchal Power Corporation Ltd. (UPCL). Though power tariff at Uttaranchal is among the lowest compared to many other states (Rs.2.63/kWh), the mill has to run their diesel generator as their contracted demand was lower than the requirement. The main energy inputs are rice husk as fuel for the boiler. The specific power consumption in Banwari Paper Mills Ltd. (992 kWh/MT of paper) compares well with benchmark data, whereas the specific fuel consumption is nearly 25% higher.

This mill was selected, as it was a marginally credit worthy unit and typical of medium paper mills in the cluster. It was expected that this would provide an opportunity to design financial structure for financing EE projects in such units.

6.2. OBSERVATIONS ON EE PRACTICES

The management was keen and showed interest to carry out the study. The plant has been effectively utilizing the in-house capability in their production process. The plant has initiated a few energy efficiency projects as part of their energy conservation efforts.

6.3. DSCLES STUDY

6.3.1 Project Identification

MOU with Banwari Paper Mills was signed on 08 July 2004.

Walk through audit was carried out in July 2004. The objective of the study was explained in detail and the mill showed their willingness to participate and implement the energy conservation measures. The management was apprised of the requirements of the project viz. - implementation of projects through debt financed by commercial banks/ IREDA. Information regarding the terms of IREDA financing, security requirements and eligibility criteria was provided.

The scope for the detailed energy audit was finalized during the walk through audit. The existing measurement and analytical facilities were assessed and requirements for providing tapping for portable instruments were identified.

The detailed study was carried out in August 2004. The following generic EE projects listed in the following Table-15 were identified during the study:

Table 15 Summary of ESPs Identified in Banwari Papers

Particular	Saving, Rs lacs / annum	Investment, Rs lacs*	ROI %
Insulation of digesters	6.6	2.64	250%
Flash steam recovery from paper machine	7.4	2.9	255%
Blow tank heat recovery	20	11.2	179%
Installation of efficient fan pump for paper machine	3	3.96	76%
Raw water pump efficiency improvement	1.25	1	125%
Efficiency improvement of stock pumps	7.3	7.92	92%
Thermax boiler FD fan efficiency improvement	2	2.64	76%
Total	47.55	32.22	148%

* Excluding soft costs

The savings were estimated based on rice-husk cost of Rs 1700/Ton and power cost of Rs.2.63/kWh. The UPCL power tariff was used, since future power requirements were expected to be met from the grid.

6.3.2 Preparation of Documentation for Loan Application

Banwari Papers indicated interest to avail IREDA loan under the EFS, in view of the attractive rates of interest and repayment terms. However they did not comply with the following eligibility criteria.

- The company should not have accumulated losses (without taking into account revaluation of assets) as per audited annual accounts in the immediate preceding financial year. (2003-04)
- No default of payment due to FI's Banks, NBFCs

IREDA was invited to the presentation made by DSCLES to Banwari Paper in September 2005 for finalization of ESPs. The objective of IREDA's participation in the meeting was to help the unit understand the requirements of IREDA (loan application process, security and disbursement). The company also wanted to explore and discuss the possibility of relaxations available for EE projects in view of their financial attractiveness. However as per IREDA's norms, projects from such companies can be financed only against security of bank guarantee.

Since the cost of providing a bank guarantee is very high (4% p.a for Banwari Paper against 100% margin), and the company was expecting to wipe off losses by March 2005, it was proposed to seek the term loan assistance in the FY 2005-06.

Accordingly, the means of financing proposed were as per IREDA’s equipment financing scheme for the total estimated project cost of Rs 37 Lakhs. Key financial indicators were as per the following Table-16.:

Table 16 Key Financial Indicators - Banwari Papers

SN	Key Financial Parameters	Value
1	Current ratio	1.33
2	DSCR	5.2
3	Min DSCR	3.28
4	ROCE	60%
5	Project IRR (10 years)	103%

Detailed Project Report including the MOU, description of ESP’s, PMV methodology, project cost estimation, means of financing, financial analysis and risk analysis is enclosed as Annexure – 2.

6.3.3 Financial Closure

The company could not wipe off accumulated losses during FY 2004-05.

Banwari Paper and DSCLES explored other options for obtaining financing and the company has submitted a loan application to Bank of Baroda (working capital Bankers) in May, 2005. *(The credit guarantee fund scheme is applicable only for SSI units seeking term loan assistance upto Rs 25 Lakhs.)*

However, Banwari Paper Mills Ltd., felt that the loan amount was too small as compared to the effort required to pursue a sanction.

6.3.4 Project Implementation

The company has not implemented any of the projects identified as they could not qualify to obtain financing from IREDA. Further, the importance of energy in managing the cost of production is not as magnified in view of the low cost of power purchased from UPCL and the operating practices which focuses on maximizing production. The quantum of savings that would accrue as a result of the implementation of the ESPs was also a reason for not implementing the projects .

6.4. OBSTACLES FACED

The main obstacles faced during the various stages of the study at this unit are given in the following Table-17:

Table 17 Summary of Barriers

Activity	Barrier/ Obstacle Encountered	Efforts made to overcome Barriers
Financial Closure	Absence of flexibility in financing norms and	Facilitated meeting of the Unit with IREDA to explore

Activity	Barrier/ Obstacle Encountered	Efforts made to overcome Barriers
	security requirements	possibility of alternative financial structures. Explored other sources of financing viz. Bank of Baroda.

7. ENERGY AUDIT IN SHREE SHYAM PULP & BOARD MILLS LTD.

7.1. BACKGROUND INFORMATION

Shree Shyam Pulp & Board Mills Ltd. located at Kashipur, Uttaranchal is a 26000 TPA, publicly owned company. The company was set up in 1995 to manufacture Kraft paper and was amongst the first in the cluster to have successfully converted to writing and printing paper in the year 2000. The unit is also the only paper mill in the cluster manufacturing specialty paper. After conversion the manufacturing capacity was 40 TPD and in the year 2001 the capacity was enhanced to 75 TPD. A mix of raw materials is used which include rice & wheat straw, bagasse, white cutting and waste paper.

The company utilizes grid power and during the period when the grid power is not available, the plant utilizes its resources (DG sets) to generate power. Biomass (rice husk) is used for catering to heat energy requirement. The total electrical energy consumption for the year 2002-03 was 156.1 lac kWh of which 79% is sourced from grid. The total energy bill reported for the year 2002-03 was Rs. 7.06 Cr. Cost of generated power was 48% of the total power bill. Even though the power tariff is low, the quality of grid power is poor -with incoming voltage varying between 350-450 V, leading to break down, motor burn out, cable over heating and affects the quality of paper production. To tackle this problem, the plant is setting up a 6 MW power plant.

7.2. OBSERVATIONS ON EE PRACTICES

During the walk through audit it was observed that the plant has given adequate attention to good housekeeping and maintenance. Also, the plant has been effectively utilizing the in-house capability for expansion work. Systems like evaporator and paper machine are built with considerable amount of in-house engineering and knowledge inputs. The plant has initiated several EE projects as part of their energy conservation efforts. Some of the noteworthy projects under implementation are;

1. Installation of one additional paper machine of 75 TPD capacity.- various new technologies that would help in energy conservation are being considered for design stage incorporation in their expansion process
2. Replacement of existing batch digester (spherical) with continuous digester.
3. Installation of bio mass based power plant - 6 MW double extractions cum condensing turbine.
4. Installation of chemical recovery boiler i.e evaporator and causticizing plant .

7.3. DSCLES STUDY

7.3.1 *Project Identification*

Memorandum of understanding was signed on 08th July 2004.

Walk through audit was carried out in July 2004 and was useful in understanding the system from energy conservation point of view as well as to understand the management's willingness to participate till the implementation of the energy saving measures. The management was apprised of the requirements of the project viz. - implementation of projects through debt financed by commercial banks/ IREDA. Information regarding the terms of IREDA financing, security requirements and eligibility criteria has been provided to the management. The company is profit making and satisfies the eligibility criteria for IREDA financing.

The scope for the detailed energy audit was finalized during the walk through audit. In view of the 2 new projects planned, cogeneration and paper mill expansion, it was decided to carry out an in-depth study of the bleaching section and the paper machine section only for conceptualizing energy saving projects. The existing measurement and analytical facilities were assessed and requirements for providing tapping for portable instruments were identified. The detailed study was carried out in August 2004. The following projects listed in Table-18 were identified during the study:

Table 18 Summary of ESPs Identified - Shree Shyam Papers

#	Particular	Saving, Rs lacs	Investment * Rs lacs	ROI %
1	Replacement of inefficient process pumps	4.00	8.35	48%
2	Installation of VFD on process pumps	3.00	4.93	61%
3	PM # 1 fan pump efficiency improvement & installation of VFD	10.80	8.25	131%
4	PM # 2 installation of VFD on fan pump	2.20	4.61	48%
5	PM # 1 & 2 separate vacuum pump for wire section	6.80	9.72	70%
6	PM # 1 & 2 flash steam recovery	17.30	4.55	380%
TOTAL		44.10	40.41	109%

* *excluding soft cost*

The savings were estimated based on rice-husk cost of Rs 1700/Ton and power cost of Rs.2.50/kWh (energy cost from new cogeneration plant). A detailed project report including baseline and PMV methods for each of the projects identified was prepared (enclosed as Annexure-3).

7.3.2 Preparation of Documentation for Loan Application

A presentation to finalize and select projects for implementation was made to the management in September 2005. IREDA was invited to the presentation to explain to the company IREDA's terms for financing EE Projects.

Shree Shyam Papers were keen to approach IREDA for financing for large projects since they had enough internal accruals to finance the identified EE projects. Two meetings were held with IREDA, to discuss the possibility of packaging the EE projects identified with the Recovery Plant Project in a single loan application. It emerged from the

discussions that for the project financing scheme, time required for appraisal would be longer, due to more rigid procedural compliance requirements.

Further the interest rates applicable were not competitive as compared to commercial banks. The company agreed to avail loan for the EE projects under the EFS (as part of the 3-country project) and follow up for a larger loan under the project-financing scheme.

The total project cost including soft costs was estimated as Rs 48 Lakhs and the means of financing proposed were as per IREDA's equipment financing scheme. Key financial indicators are as in the following Table-19:

Table 19 Key Financial Indicators – Shree Shyam Papers

SN	Key Financial Parameters	Value
1	Current Ratio	1.33
2	DSCR	3.58
3	Min DSCR	2.26
4	ROCE	39%
5	Project IRR (10 years)	64%

7.3.3 Financial Closure

Shree Shyam Papers completed the documentation required for loan application and submitted the loan application to IREDA in January, 2005. They were sanctioned a term loan under IREDA's equipment financing scheme in February 2005.

The unit however could not complete the documentation required (no-objection letter from the bank agreeing to provide *pari-passu* charge to IREDA) to sign the loan agreement within the time provided by IREDA.

DSCLES facilitated four discussions between IREDA, Shree Shyam and State Bank of Indore (the units Banker) to resolve this (between March and May'2005). The company requested IREDA to accept earmarking of cash credit account for one installment of IREDA loan in lieu of *pari passu* letter. IREDA did not have the flexibility to accept this request.

The projects have been financed from internal accruals.

7.3.4 Project Implementation

The project was implemented by in-house team. Except for the vacuum pump project, the other energy cost reduction projects have been implemented.

7.3.5 PMV Results

The actual savings achieved are Rs. 33.03 lacs per annum. The PMV results are provided in the following Table-20.

Table 20 PMV Results: Overall –Shree Shyam

SN	Particular	Targeted Saving	Actual Saving
1	Replacement of inefficient process pumps	4.00	3.38
2	Installation of VFD on process pumps	3.00	3.12
3	PM # 1 fan pump efficiency improvement & installation of VFD	10.80	9.43
4	PM # 2 installation of VFD on fan pump	2.20	2.44
5	PM # 1 & 2 flash steam recovery	17.30	17.81
	Total	37.30	36.18

The PMV plan for the energy cost reduction projects proposed was as per the following Table-21:

Table 21 PMV Plan for Shree Shyam Paper

<i>ECM</i>	<i>PMV Plan</i>	<i>Parameters to be measured for Baseline & Duration</i>	<i>Parameters to be measured after implementation</i>
Replacement of inefficient process pumps	Retrofit Isolation Plan B as per IPMVP	Measurement of flow, pressure and power Production Consistency check	3 hrs Measurement of flow, pressure and power Production Consistency check
Installation of VFD on process pumps	Retrofit Isolation Plan B as per IPMVP	Measurement of flow, pressure and power Production Consistency check Pressure drop across the flow regulating valve	3 hrs Measurement of flow, pressure and power Production Consistency check Pressure drop across the flow regulating valve
PM # 1 fan pump efficiency improvement and installation of VFD	Retrofit Isolation Plan B as per IPMVP	Measurement of flow, pressure and power Pressure across the regulating valve Production Consistency check Head box level maintenance GSM of the paper being manufactured	3 hrs Measurement of flow, pressure and power Pressure across the regulating valve Production Consistency check Head box level maintenance GSM of the paper being manufactured
PM # 2 installation	Retrofit Isolation	Measurement of flow, pressure and	3 hrs Measurement of flow, pressure and power

<i>ECM</i>	<i>PMV Plan</i>	<i>Parameters to be measured for Baseline & Duration</i>		<i>Parameters to be measured after implementation</i>	
of VFD on fan pump	Plan B as per IPMVP	power		Pressure across the regulating valve	
		Pressure across the regulating valve		Production	
		Consistency check		Consistency check	
		Head box level maintenance		Head box level maintenance	
		GSM of the paper being manufactured		GSM of the paper being manufactured	
PM # 1 & 2 flash steam recovery	Retrofit Isolation Plan B as per IPMVP	Steam usage	3 hrs	Steam usage	3 hrs
		Production		Production	
		Condensate temperature		Condensate temperature	

The procedures mentioned above were followed both during the baseline establishment and PMV.

7.3.5.1 Project 1: Replacement of Inefficient Process Pumps

The following process pumps were recommended for replacement

- Pump 1 - Low consistency pump
- Pump 2 - ClO₂ tower pump
- Pump 3 - Alkali tower pump
- Pump 4 - Cl₂ tower pump
- Pump 5 - Bleached tower pump

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-22:

Table 22 Pump Replacement: Measurements as Per PMV Plan

Pump/ Parameter	Flow in m ³ /hr		Pressure at Pump discharge kg/cm ²		Power consumption kW	
	Baseline	PMV	Baseline	PMV	Baseline	PMV
Pump 1-Low consistency pump	243	250	1.6	1.6	17.6	11.1
Pump 2-ClO ₂ tower pump	232	244	2.2	2.2	18.0	16.7
Pump 3-Alkali tower pump	220	232	2.1	2.1	15.5	14.0
Pump 4-Cl ₂ tower pump	220	232	2.1	2.1	17.3	14.0
Pump 5-Bleached tower pump	205	211	2.4	2.4	18.0	13.6

The table-23 below provides the details of the savings achieved in the project

Table 23 Pump Replacement- Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	159058	135,270
2	Monetary savings	Rs lacs/yr	4.00	3.38

7.3.5.2 Project 2: VFD's for Process Pumps

The following process pumps were recommended for installation of VFD

- Pump 1 - Low consistency pump
- Pump 2 - ClO₂ tower pump
- Pump 3 - Alkali tower pump
- Pump 4 - Cl₂ tower pump

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-24:

Table 24 VFD for Process Pumps: Measurements as Per PMV Plan

Pump/ Parameter	Flow in m ³ /hr		Pressure at Pump discharge kg/cm ²		Power consumption kW		Pressure drop across CV kg/cm ²	
	Baseline	PMV [#]	Baseline	PMV [#]	Baseline	PMV [#]	Baseline	PMV [#]
Pump 1-Low consistency pump	243	250	1.6	1.2	17.6	7.3	0.4	Nil
Pump 2-ClO ₂ tower pump	232	244	2.2	1.7	18.0	12.1	0.5	Nil
Pump 3- Alkali tower pump	220	232	2.1	1.7	15.5	10.5	0.4	Nil
Pump 4-Cl ₂ tower pump	220	232	2.1	1.7	17.3	10.5	0.4	Nil

* Average value of 3 hr measurement

These values include the benefit of the higher efficiency pumps also

The table-25 below provides the details of the savings achieved in the project

Table 25 VFD For Process Pumps- Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	119338	124,980
2	Monetary savings	Rs lacs/yr	3.00	3.12

7.3.5.3 Project 3: Paper Machine 1- Fan Pump Replacement and Installation of VFD

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-26:

Table 26 PM# 1 Fan Pump: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Flow	m ³ /hr	444.0	431.7
2	Pressure at pump discharge	kg/cm ²	4.1	3.2
3	Power consumption	kW	110.6	63.5
4	Pressure drop across regulating valve	kg/cm ²	0.9	Nil

* Average value of 3 hr measurement

The table-27 below provides the details of the savings achieved in the project

Table 27 PM # 1 Fan Pump- Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	432300	377,095
2	Monetary savings	Rs lacs/yr	10.80	9.43

7.3.5.4 Project 4: Paper Machine 2- Installation of VFD for Fan Pump

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-28:

Table 28 PM# 2 Fan Pump: Measurements as Per PMV Plan

SN	Parameters*	Units	Baseline	PMV
1	Flow	m ³ /hr	488.8	479.2
2	Pressure at pump discharge	kg/cm ²	4.0	3.2
3	Power consumption	kW	67.2	54.9
4	Pressure drop across regulating valve	kg/cm ²	0.8	Nil

* Average value of 3 hr measurement

The table-29 below provides the details of the savings achieved in the project

Table 29 PM # 2 Fan Pump- Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Electrical savings	kWh/yr	88.690	97,540
2	Monetary savings	Rs lacs/yr	2.20	2.44

7.3.5.5 Project 6: Condensate Flash Steam Recovery

As per the method proposed in the PMV Plan measurements were made for the following parameters during the PMV. The baseline parameters and the measured parameters are given in the following table-30:

Table 30 Flash Steam Recovery: Measurements as Per PMV Plan

SN	Parameters*	Units	PM# 1 Baseline	PM# 2 Baseline	PM# 1 PMV	PM# 2 PMV
1	Steam usage	TPH	4.20	3.80	3.88	3.52
2	Condensate temp.	deg C	99.0	99.0	99.0	99.0

* Average value of 3 hr measurement

The table-31 below provides the details of the savings achieved in the project

Table 31 Flash Steam Recovery- Projected Vs Actual Savings

SN	Description	Units	Projected	Actual
1	Fuel savings	T/yr	1015.80	1047.81
2	Monetary savings	Rs lacs/yr	17.30	17.81

7.4. OBSTACLES FACED

The main obstacles faced during the various stages of the study at this unit are given in the following Table-32:

Table 32 : Summary of Barriers

TOR	Barriers/ Obstacles Encountered	Efforts made to overcome barriers
Establishment of PMV Methodology	Several parameters for which adjustments could not be defined due to nature of operations	The retrofit isolation PMV plan was selected even though this does not provide the impact on the overall energy consumption.
Preparation of Project Report and documentation of loan application	Magnitude of financing available from existing schemes for EE financing as compared to the transaction need was not attractive to the client - the estimated transaction cost for this project is 7.5-10% of the loan value	Provided assistance to client for meeting documentation requirements
Financial Closure	Appraisal by Banks: None Security Requirements: The requirement of <i>pari-passu</i> letter from Bank and inability to accept alternative security.	- Facilitated meetings between lenders, bank to resolve issues.
Project Implementation	None	-
PMV	None	-

8. KEY LEARNINGS

8.1. BARRIERS AND KEY LEARNING'S

Summary of the barriers identified and key learning's are given in the following table-33. These barriers have been drawn based on the experience of the consultants, project hosts and banks involved throughout the entire process of interactions, (captured from service reports of meetings), and reflects the views of all the stakeholders. They also represent barriers identified through live cases as against perceived cases and conclusions drawn from previous such studies.

Table-33: Summary of the barriers identified and key learnings

Phase	Obstacle/ Barrier	Key Learning
Project Identification	SME industry characteristic- information asymmetry - Availability of reliable information.	Units in the small and medium sector (particularly paper mills) have been operating in a largely unregulated and unorganized environment and have a large volume of cash based transactions due to dependence on smaller business organizations and individuals to meet supply and purchase requirements. Picture projected on the potential for energy cost reduction is distorted due to this. Scope to design and standardize user/ operation- friendly energy information systems for different types of units (raw material/ product/ process based)
Developing a PMV Methodology	Several parameters for which adjustments could not be defined due to nature of operations.	Scope to design and standardize continuous monitoring systems for different types of units (raw material/ product/ process based)
Preparation of documentation for loan	Magnitude of financing available from existing schemes for EE financing as compared with transaction need was not attractive to the end users. (includes documentation requirement,	SME's have been identified as an important market segment for commercial banks. The spectrum of products available to SMEs and the cost of financing are very competitive. Need to design products around

Phase	Obstacle/ Barrier	Key Learning
	competitiveness of interest rates, simplified process banking transactions)	such financing facilities.
Financial Closure	The ceiling applicable for EE Projects - Rs 80 Lakhs to Rs 100 Lakhs.	Investment scale ranges from small to medium to large. Small ESPs are normally implemented from operating budget by SMEs having good credit standing with Banks. Medium and large projects are packaged with major projects and financed from capital budget.
	Availability of cost-effective financing	Time required for financial closure (particularly when a new institution other than the existing banker is involved), documentation requirement – loan and security, locational proximity and level of effort is very significant. For schemes where the ceiling for a term loan is specified, the costs are further magnified. Passive response to the needs for finance of the small and medium sector (particularly the marginally credit worthy units) is a systemic barrier. Cost of internal financing is not a consideration despite the fact that internal financing attracts the highest hurdle rate. The financial attractiveness of the projects and the option of cash based transaction outweigh the disadvantage.
	Nature of relationship with bank	Small and Medium industries are characterized by high trust banking relationships, due to combination of personal and business banking

Phase	Obstacle/ Barrier	Key Learning
Project Appraisal	Lender: From the point of view of securing financing for a project, merits and financial returns of the project are not considered.	Loan review and servicing process are not consistent and scaleable (different types of EE projects in different industries – makes parameterization of appraisal process difficult). The emphasis on project performance and technology risk assessment during the appraisal process is lesser.
Project Implementation	Borrower: EE Value Proposition	In units where maximizing production is the priority, focus on cost reduction is not very high. Energy cost reduction is on the back-burner.

8.2. RECOMMENDED STRATEGY FOR THE FUTURE

- Unit Selection Process
 - It would be better to prepare a complete dossier on participation requirement and share the same candidly with the prospective clients before starting similar work in future. Despite the fact that DSCLES had very good relation with at least two of the clients and had been having excellent cooperation during the study phase, the clients finally got exasperated with the transaction process.
- Project identification, implementation and PMV
 - Design and standardize energy information systems and continuous monitoring systems
 - Innovative non-intrusive PMV system has to be developed for most of the industries in the SME sector.
- Improving access to financing to SMEs
 - In the recent past considerable efforts have been made for innovating financing mechanisms for EE projects:
 - US AID ECO-Municipal EE project
 - ADB EE PPTA-Industrial and Government sector projects
 - Present project.

None of these projects have been able to successfully address to the key barriers faced in financing. It would be good to capture the learning from all these projects and explore newer program designs.

- Appraisal Process
 - Simplify process and empower the local offices for sanctioning such small loans or empanel certified energy auditors/ audit firms for the process.

9. CONCLUSIONS

The project has helped in getting newer insights into the working of the SME industries

- EE Potential and project implementation in Paper Mills
 - Contrary to previous belief, there is lot more awareness and capability in the SME sector on EE projects and benefits.
 - Though savings are financially attractive, project and investment sizes are not attractive enough for the entrepreneurs and also the banks.
 - Till such time taxation system in the country has been simplified and better governed, cash transaction would remain and this is likely to be the biggest barriers against undertaking systematic improvement work requiring verification.
- Advantages of Cluster Based Operations
 - The cluster system did provide some advantage in carrying out the communication process. But at the same time it was observed that there is some kind of Turf war and the desired results of replication may or may not be met.
 - Cluster forums deal more with Governmental and administrative issues and are not enthusiastic in sharing technological and financial information.
 - However, there is some kind of intelligence networking and if any of the company succeeds in a new process, others do try to find out informally and to that extent benefit can be expected.
- Financing projects
 - Financing of major projects do not seem to pose any problem-all the three factories had been relentlessly and aggressively investing in capacity expansion and modernization
 - For smaller projects, new products, process and intermediation mechanism have to be developed. The products and processes developed from the 3-country projects would not be able to overcome the transactional barriers under the existing system.

At least three assisted programs have addressed the issue of financing EE projects in India in the recent past. The programs had different objectives viz USAID ECO aimed at increasing the number of EE projects that achieve financial closure and ADB EEE TA aimed at identifying barriers to establishing an EE investment market and designing financial products which would overcome barriers faced by project hosts, ESCOs and financial institutions and the current project aimed at EE financing in SME sector. The barriers identified and the conclusions drawn from the 3 Country Program are the only ones based on live cases.

A comprehensive summary of barriers and risks specific to different sectors can be prepared based on the recommendations and learning's of the three programs which can help provide direction to future strategy for program design for EE financing.