Implementation of ISO 50001:2001 framework in a textile unit of Pakistan

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Abstract

The higher energy demand imposes burden on country's economy, specifically for the countries which are import dependent for energy supplies. Pakistan is an emerging economy which is going through an energy crisis due to sharp rise in demand-supply gap. Industry is the largest energy consumer of Pakistan including textile as the largest industry of the county in terms of exports and gross domestic product. ISO 50001:2001 energy management system was implemented in Shafi Texcel Ltd. to reduce the energy consumption of the textile unit. Energy performance indicators were identified (3 in the current study) and objectives were formulated to reduce the steam consumption in processes and reduce coal consumption or boiler efficiency enhancement. The targets were met with fairly small payback periods (less than 3 months), which means that it is convienent to implement energy management system in a short period of time without huge capital expenses. It also ensures that although the renewable energy systems are helpful and must be incorporated but management of already available sources is also essential for sustainable energy future. The savings of Rupees 15.6 Million will achievable annually after an investment cost of 2.2 Million Rupees.

Key Words: ISO50001; Textile, Energy sector, Pakistan; Energy Management System

Nomenclature

BOQ	Bill of Quantity
EnMS	Energy Management System
EnPI	Energy Performance Indicators
GCV	Gross Calorific Value
LPG	Liquid Petroleum Gas
MCU	Moisture Control Unit
MW	Mega Watt
STL	Shafi Texcel Ltd.
SFC	Specific Fuel Consumption
TWH	Tara Watt Hour

1. Introduction

The ever increasing population of the world demands continuous development of new energy sources and efficient utilization of already discovered energy sources. The increased awareness regarding the global warming has also effectively emphasized on efficient conservation of energy sources. The sustainable future energy solutions have bound the scientific society to look for efficient conversion, utilization and management of energy sources.

The energy conservation and management schemes depend on the national and international energy policies in general, however, in the modern world the paradigm has been observed and now the management schemes are practiced at institution or organizational levels in order to obtain monetary benefits and sustainability.

This work presents a case study of energy management system implementation in Pakistan. Pakistan is a country with emerging economy.The population boom resulted in 148 million in 2004 which was initially estimated to be 68 million in 1971. The urbanization of the country also increased from 25% to 37.2% [1]. Both these factors caused a rapid increase in energy demand of the country. The primary energy supply mix of

Pakistan is made of 72.2% oil & gas, 16.2% electricity, 10.4% coal and 1.2% LPG. Domestic oil fulfills only one sixth of country's demand, which force a huge expenditure on country's economy [2]. Renewable energy source development has a significant cost and the policies did not encourage the development of such sources till 2013 to meet the increasing requirements of energy. It was reported in [3] that the renewable energy mix was virtually negligible till 2012. The demand-supply gap of electricity was noted to be 31.6 TWh in 2010 which resulted in 2.5% loss in GDP of the country [4]. It was noted that if the energy mix and utilization levels remained unchecked, the global warming potential due to electricity generation will increase 22.2 million tons of CO_2 in 2012 to 55.2 million tons of CO_2 equivalent by 2030 [5]. Due to the energy lack of fossil fuel availability and import burdens there is a severe energy deficit specifically in the electric power supply. Urban areas are facing 10-12 hour of load shedding while rural areas have to bear 16-18 hours of power outage [6] with an electric demand supply difference of 6500MW in 2015 [7]. The current energy scenario in Pakistan requires drastic measures to meet its energy demands and ensure sustainable future. The measure includes development of renewable energy sources and implementation of energy management schemes to improve the energy conversion efficiency. The development of renewable energy sources require investment, time and technological capabilities at large scale, however, the energy management scheme implementation is less costly and relatively faster to implement.

The energy consumption of Pakistan is 39.4 Million TOE (tone of oil equivalent) in 2013 [8] and is presented in Fig 1. It can be seen that major consumer of energy is industrial sector. Effective energy management and conservation scheme in this sector will directly result in reduction of energy load of the country.

The industrial sector is the primary and main contributor in total energy consumption of Pakistan and biggest energy saving opportunities which are about 33% lies in this sector and also 38% carbon dioxide emissions can be reduced from this sector [9]. Center for Energy and Environment Management (CEEM) has been established by National Productivity Organization (NPO) & Ministry of Industries and Production Pakistan with an objective to attain highest efficiency in proper utilization of energy in industrial sector with the help of energy saving measures.

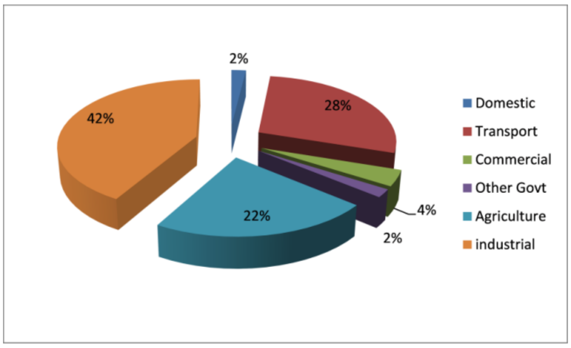

Fig. 1: Energy consumption of Pakistan

This will contribute a major portion towards economic growth of the country. The team of CEEM-NPO has conducted over 200 Energy audits in industrial sector of Pakistan and identified up to 15 % of energy savings potential [10].

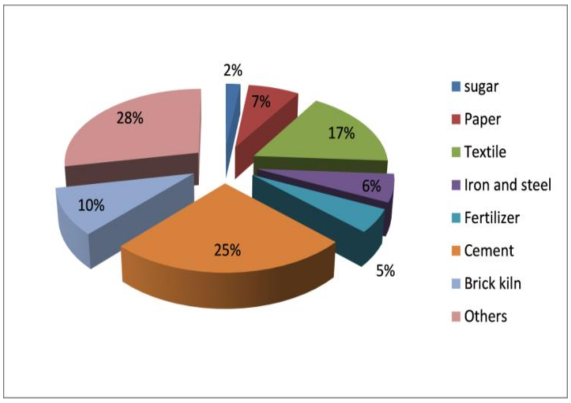

Fig. 2: Industrial Energy Consumption [8]

Textile sector consumes about 17% of total industrial energy, which is the second largest energy intensive industry after cement industries as presented in Fig 2. The Pakistan textile sector contributes to more than 60% of total exports and it is the largest manufacturing sector of Pakistan's industry but the power shortage has negatively affected the textile industry which was 8.5% of GDP [11]. In general the cost of energy is between 15 to 20% of the production cost in textile industry, the cost is as big as comparable to the costs of raw materials [12], therefore it is very important to ensure efficient utilization of energy sources and conserve as much as possible to improve the revenue of textile industry and reduction of energy import burdens on the country.

It was found that the energy-efficiency potential of small medium industries remains untapped mainly due to lack of technological improvements at operational level and lack of strategic approach. It was recommended that a Plan-Do-Check-Act based energy management scheme, energy efficiency and cleaner production should be adopted [13]. It is suggested that by implementation of energy management programs, the organizations can save upto 20% on their energy bills and can also achieve savings up to 5% to 10% with minimal investments, with effectively cutting operational costs [14]. Implementation of energy management schemes depend on the existing organizational structure, present knowledge, capacity and most importantly availability of human and financial resources. Several attempts have been made at national level to develop energy management systems but the general regulations, uniformity and conformance was missing at international level [15]. Previously ISO 14001 standard was introduced in 1996, as "the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy". However, it does not set any environmental goals or targets to be achieved (reduction in greenhouse emissions or recycling etc.) [16]. In general the environmental improvement also incorporated improved energy source utilization. In June 2011, ISO 50001 International standard was developed to provide a unified framework for energy management. According to ISO 50001, an energy management system (EnMS) is a set of interrelated or interacting elements to establish an energy policy and energy objectives, and procedures to achieve those objectives [17]. Therefore, the implementation of ISO 50001 will greatly influence energy savings and process streamlining. The advantages of ISO 50001- implementation include:

- Reduce the costs related to energy consumption
- Limit the effect of highly variable energy prices
- Assist operational cost savings
- Improved supply chain relationships
- Ability to meet any legal targets
- Improved profile and credibility
- Competitive advantage in the market place
- Reduce threat from the image of competitors
- Employee motivation and pride
- Valuable inputs from third party auditors

This paper presents the implementation of ISO 50001 in a textile unit of Pakistan. Although the regulations of ISO 50001, are well declared and documented in the standard itself and there are various research papers presenting energy policies in textile industry, this paper will identify the key performance indicators to work with, when implementing the ISO 50001 standard. The results will highlight the quantity of energy savings that can be performed in textile sector of Pakistan. It also highlights the challenges and limitations of implementation of the standard in Pakistan.

2. Methodology

The textile energy consumption in various processes is presented in Fig 3 [8].

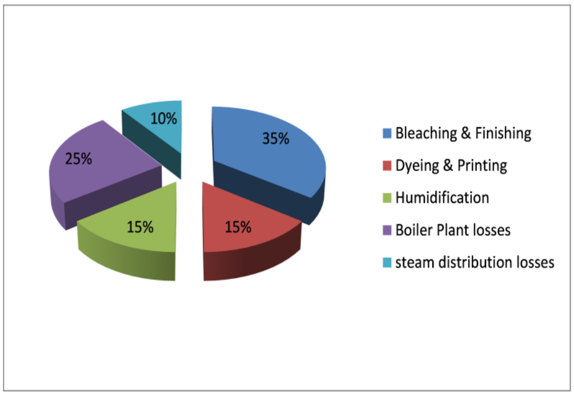

Fig. 3: Break-down of typical thermal energy usage in textile plant

Textile sector is a big consumer of energy & among in its sub sectors processing or finishing of fabric consumes more energy than other sectors so we choose thissector for the implementation of ISO 50001. Shafi Texcel Ltd. is situated near Sunder Industrial estate at Raiwind Manga Road. It is considered one of the major textiles in Punjab province of Pakistan, with a capacity of 200,000 meters fabric processing per month. Main fuels that are used include gas, coal, LPG & diesel while the main utilities include water, steam, electricity, thermal oil & compressed air.

There are three sub units in Shafi Texcel limited (STL) which are Yarn dyeing, Weaving and processing but processing was chosen as it is the bigger consumer of energy among all these. To provide utilities to all three units there is a separate utilities department which looks after for electricity, steam, water etc.

According to ISO 50001, the energy management system was established on the philosophy of quality management system that is PLAN, DO, CHECK & ACT, commonly known as PDCA cycle.

Fig 4 presents the general structure of energy planning process. The energy planning process require the identification of key performance indicators, method to measure the variable effecting them and then review of current energy consumption scenario.

The details of which can be presented as following:

✓ **Plan** ➢ Legal and other requirements ➢ Energy Review ➢ Energy Baseline ➢ Energy performance indicators ➢ Objectives, targets and energy management action plans	✓ **CHECK** ➢ Monitoring, measurement and analysis ➢ Evaluation of compliance with legal and other requirements ➢ Internal audit ➢ Non-conformities, correction, corrective and preventive actions ➢ Control of records
✓ **DO** ➢ Competence, training and awareness ➢ Communication ➢ Documentation ➢ Operational control ➢ Design ➢ Procurement	✓ **ACT** ➢ The organization puts into place correction and corrective actions to address any deficiencies in the system and introduces preventive actions to address any potential problem.

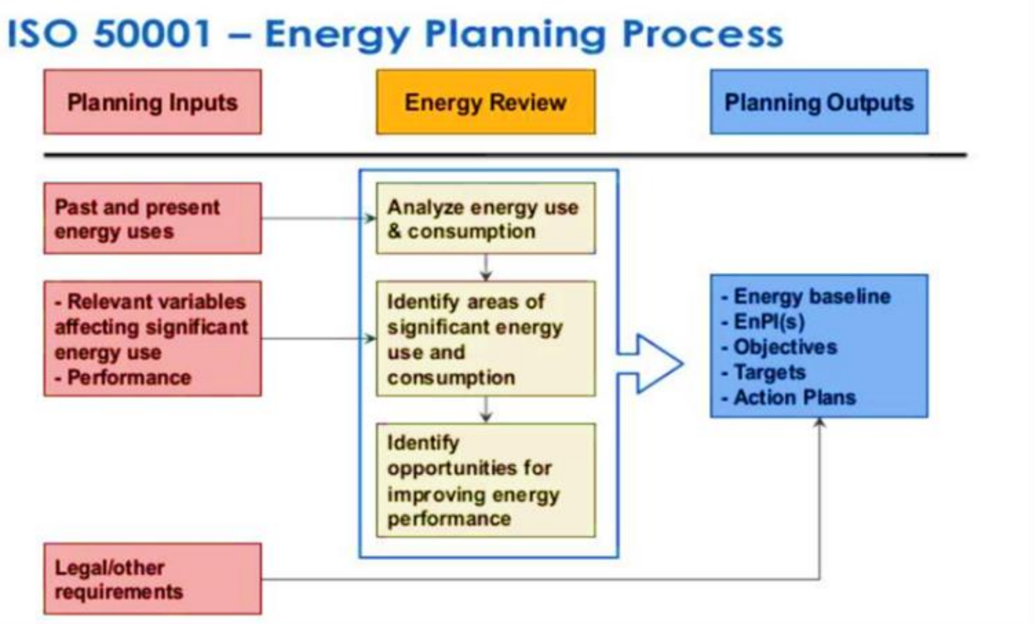

Fig. 4: Energy planning process

2.1 Data Collection

For the current case study, after careful examination of process energy flow, some key areas were identified where data collection was required. The equipment used to measure the variables affecting the key performance indicator are listed in table 1.

2.2 Energy Review

After the data collection, it was analyzed and reviewed for to establish and maintain an energy planning process, a system for identification and analysis of energy consumption and to identify significant energy uses, also to find out the opportunities for energy efficiency and reduction in energy. The procedure of energy review included the following:

➢ Energy consumption data recorded and maintained on daily basis.

➢ All members of energy management team, comprising Energy Manager and HOD's from theconcerned departments, conduct energy aspect identification and evaluation on yearly basis or whenever there is a major change in facilities, equipment's, systems or processes. During this process, followings are considered:

i. Past and present energy consumption and energy factors based on measurement and other data.
ii. Identification of areas of significant energy consumption particularly where significant energy changes occur during the last period.
iii. An estimate of the energy consumption in future.

2.3 Energy Performance Indicators (EnPI)

The energy review resulted in identification and implementation of EnPI's listed in table 2 in August 2015.

2.3.1 EnPI 01: Reduction in Coal Consumption for Steam Generation

Objective of EnPI 1: Reduction of coal consumption from 145kg/ton of steam to 125kg/ton of steam at 40-50% loading on boiler by proper burning of coal and maximum usage of energy in exhaust gases.

Target: April, 2016

Project 01: The flue gas analysis revealed that the temperature of exhaust gases is high, although economizer was installed at the outlet of boiler to extract heat from flue gases but it was observed that when water level is full in boiler, water is not flowing through economizer and flue gases are just passing carrying heat. So, it was recommended to install a three-way valve after economizer which will divert water after economizer to feedwater tank when water level is full in boiler so water circulation will not stop even when water level is full hence extracting complete energy from flue gases which will ultimately increase the efficiency of boiler and reduce the coal consumption for steam generation. The boiler efficiency was calculated by Eq. 1.

$$Boiler\ Efficiency\ (\eta) = \frac{Q(H-h)}{q(GCV)} * 100 \quad (1)$$

Table 1: Equipment for data collection for analysis

Measured Variable	Equipment	Location
Steam flow rate	Vortex type & orifice type	Waste heat boiler
Steam flow rate	Vortex type & orifice type	Gas boiler
Steam flow rate	Vortex type & orifice type	Coal boiler
Coal mass consumption	Weight scale	Coal fired boiler
Water flow rate	Electromagnetic flow rate meter	Feed water tank
Water flow rate	Turbine flow rate meter	All departments & Machines
Heat loss	Thermal cameras	All steam & oil lines
Light intensity	Lux meters	All departments
Combustion Gas composition	Flue Gas analyzer	Exhaust lines of boilers

Table 2: EnPI's to be expedited

EnPI #	EnPI Title	Area/Department	Base line value	Unit
EnPI 01	Specific coal consumption for steam generation	Utilities	125	kg of coal/Ton of steam
EnPI 02	Specific steam consumption	Processing	2.0	kg of steam/meter of Fabric
EnPI 03	Specific coal consumption for Oil Heating	Utilities	200	kg of coal/MkCal of heat transfer

Table 3: Action Plan for EnPI 01(Project 01)

Sr. No.	Activity	Time Frame	Responsibility
1.	Installation of steam flow meter at boiler for cross check of water flow meter	15th September 2015	Maintenance Manager
2.	Setting running frequencies at moderate level & educating operators to run boiler efficiently	30th October 2015	U.M & Boiler Engr.
3.	Cost benefit & pay back analysis to reduce exhaust temperature up to 150°C	25th October 2015	Utilities Manager
4.	Purchase & delivery of three-way water valve to install at exit of economizer to extract heat from exhaust gases	10th December 2015	Purchase Manager
5.	Installation of valve	30th December 2015	Maintenance Mgr.
6.	Results and comparisons	20th June 2016	Utilities Manager.

Q= Steam generated (kg/hr)

H = Enthalpy of steam at generated pressure (kJ/kg. K)

h = Enthalpy of water feed to boiler (kJ/kg. K)

q = Heat input OR coal consumed (kg/hr)

GCV= Gross Calorific Value of coal

Action Plan for project 01 is presented in table 3.

Project 02: During the flue gas analysis, it was also observed that CO percentage is high in exhaust gases which mean unburned fuel. Upon investigation it was found that coal size should be even for proper burning and furnace doors should be kept close. Also frequencies of induced and forced draft fans were adjusted to reduce the unburned coal and hence minimizing the coal consumption for oil heating.

Action Plan for project 02 is presented in table 4.

2.4 EnPI02: Reduction in steam consumption for processing of Fabric

Objective of EnPI 02: Reduction of steam consumption from 2.7 kg of steam/meter of fabric to 2.0 kg of steam/meter of fabric.

Target: December, 2016

Project 01: It was observed that steam line losses are about 10%. Line losses were reduced to 5% through thermal graphic analysis of lines, valves and traps. Proper insulation was done and faulty traps were replaced with new ones.

Action Plan for project 01 is showed in table 5.

Project 02: Steam was used to increase the feed water temperature of boiler and it was allocated to fabric processed. Self consumption of steam was reduced by 2% through proper condensate recovery from processing unit. Hence it reduces the specific consumption of steam to process fabric. Action Plan for project 02 is presented in table 6.

Table 4: Action Plan for EnPI 01(Project 02)

Sr. No.	Activity	Time Frame	Responsibility
1.	Selection of Flue gas analyzer	15th August 2015	Maintenance Manager
2.	Purchase request and delivery of equipment	30th September 2015	Purchase Manager
3.	Monitoring of Flue gases of Boiler	25th October 2015	Utilities Manager
4.	Setting of Frequencies of Draft fans	30th October 2015	Boiler Engineer
5.	Feeding of Coal after grading	30th November 2015	Boiler Engineer
6.	Results and comparisons	30th April 2016	Utilities Manager

Table 5: Action Plan for EnPI 02 (Project 01)

Sr.NO.	Activity	Time Frame	Responsibility
1.	Selection of proper steam traps	10th March. 2016	Maintenance Manager
2.	Making BOQ of project	20th March. 2016	Maintenance Manager
3.	Cost benefit and pay back analysis	25th March 2016	Maintenance Manager
4.	Raising capital approval request	28th March 2016	Maintenance Manager
5.	Purchase & delivery of Traps	30th April 2016	Purchase Manager
6.	Installation & commissioning	30th May 2016	Maintenance Manager
7.	Thermal Graphic of lines, valves etc.	10th June 2016	Maintenance & Utilities Manager
8.	Insulation at lines and jackets on valves	30th June 2016	Maintenance Engineer
9.	Results & comparison	30th October 2016	Utilities Manager

Table 6: Action Plan for EnPI 02 (Project 02)

Sr. No.	Activity	Time Frame	Responsibility
1.	Selection of proper steam traps	1st April 2016	Maintenance Manager
2.	Making BOQ of project	20th April 2016	Maintenance Manager
3.	Raising capital approval request	25th April 2016	Maintenance Manager
4.	Purchase & delivery of items	20th May 2016	Purchase Manager
5.	Installation & Fabrication work phase #01	15th June 2016	Maintenance Manager
6.	Installation & Fabrication work phase #02	15th July 2016	Maintenance Manager
7.	Insulation work at lines	10th August 2016	Maintenance Manager
8.	Thermal graphy after insulation work	20th August 2016	A.M Utilities
9.	Results Comparison	30th December 2016	Maintenance & Utilities Manager

Project 03: In a processing unit, most of the steam is used in washing the fabric and then drying the fabric. If water extraction efficiency can be improved before drying then a huge quantity of steam can be saved. High pressure squeezing padders were used for this purpose.

Also to monitor the drying process, mostly no device is used and operator is doing this by feeling the moisture by hand, it was decided to install the moisture control units at the exit of dryers to check and control the moisture of fabric hence controlling the steam.

Action Plan for project 03 is presented in table 7.

Table 7: Action Plan for EnPI 02 (Project 03)

S. No.	Activity	Time Frame	Responsibility
1.	Comparison of different padders	15th January 2017	Maintenance Mgr.
2.	Cost benefit analysis of replacing padder	25th January 2017	Maintenance Mgr.
3.	Raising capital request for padder	30th January 2017	Maintenance Mgr.
4.	Placing the order	15th February 2017	Maintenance Mgr.
5.	Confirmation of drawings	15th March 2017	supplier
6.	Padder arrival	15th June 2017	Import department
7.	Installation of Padder	10th July 2017	Maintenance Engr.
8.	Comparison of different MCU’s	20th January 2017	Maintenance Mgr.
9.	Cost benefit analysis of installing MCU	25th January 2017	Maintenance Mgr.
10.	Raising capital request for MCU	30th January 2017	Maintenance Mgr.
11.	Purchasing & getting supply of MCU	30th March 2017	Purchase Mgr.
12.	Installation of MCU	30th April 2017	Maintenance Mgr.
13.	Steam Data comparison after installations	30th November 2017	Maintenance Mgr.
14.	Comparison of estimated savings and payback with actual savings & payback	15th December 2017	G.M Engineering

2.4.1 EnPI03: Reduction in coal consumption for Oil Heating

Objective of EnPI 03: Reduction of coal consumption from 210 kg of coal/MKCal to 200 kg of coal/MKCal of heat transfer.

Target: December, 2016

Project: During the flue gas analysis, it was observed that CO percentage is high in exhaust gases which mean unburned fuel. Upon investigation it was found that coal size should be even for proper burning and furnace doors should be kept close. Also frequencies of induced and forced draft fans were adjusted to reduce the unburned coal and hence minimizing the coal consumption for oil heating.

Action Plan for EnPI 03 is presented in table 8. The action plans to achieve the objectives were implemented and the results are presented in next section and discussed if objectives have been achieved or not.

3. Results & Discussion

EnPI 01: Table 9 presents the data collected from steam flow meters and the consumption of coal. It can be seen that the effect of action plans of EnPI 01 is visible as the efficiency of boiler has increased. Fuel consumption of boiler decreased and efficiency increased from June-15 to June-16. SFC decreased from 145 kg of coal/ton of steam to 125 kg of coal/ton of steam and efficiency increased from 64.8 % to 75.6% which can be found in Fig 5.

Figure 5 represents the efficiency of boiler which was calculated using Eq. 1.

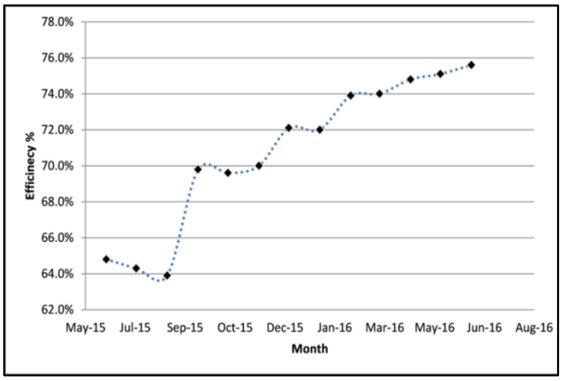

Fig. 5: Month wise efficiency of steam boiler

EnPI 02: Table 11 presents the data collected from steam flow meters of processing unit and fabric production of processing unit. It can be seen that the effect of action plans of EnPI 02 is visible as the steam SFC (kg/m) has decreased by an average of 10-13% after the month of April-16.

Table 8: Action Plan for EnPI 03

Sr. No.	Activity	Time Frame	Responsibility
1.	Selection of Flue gas analyzer	15th August 2015	Maintenance Manager
2.	Purchase request and delivery of equipment	30th September 2015	Purchase Manager
3.	Monitoring of Flue gases of oil Heater	25th December 2015	Utilities Manager
4.	Setting of Frequencies of Draft fans	15th January 2016	Boiler Engineer
5.	Feeding of Coal after grading	25th January 2016	Boiler Engineer
6.	Results and comparisons	30th December 2016	Utilities Manager

Table 9: Coal Consumption & Efficiency of coal boiler

Month	Coal Consumption	Steam Generated	SFC
	(kg)	Tons	kg of coal/ton of steam
Jun-15	340,754	2345	145
Jul-15	287,990	1967	146
Aug-15	321,930	2184	147
Sep-15	317,576	2352	135
Oct-15	328,005	2425	135
Nov-15	411,060	3055	135
Dec-15	517,820	3962	131
Jan-16	477,493	3649	131
Feb-16	396,575	3109	128
Mar-16	278,747	2191	127
Apr-16	274,423	2180	126
May-16	215,413	1718	125
Jun-16	193,820	1555	125

Table 10: Saving and payback by implementation of EnPI 01 objectives

Previous Coal Consumption	145	kg/Ton of steam
Current Coal consumption	125	kg/Ton of steam
Avg. steam generated from coal in one month	2500	Tons
Savings of Coal	50,000	kg's/Month
Avg. Price coal (imported)	15	Rs.
Total savings	750,000	Rs./Month
Implementation cost	800,000	Rs.
Pay Back Period	1.07	Months

Table 10 shows the savings by implementing the two projects under EnPI 01. It can be seen that 20kg of coal were saved for every ton of steam and pay back is just one month.

EnPI 03: Table 13 presents the data collected from steam flow meters of processing unit and fabric production of processing unit. It can be seen that the effect of action plans of EnPI 02 is visible as the steam SFC (kg/meter) has decreased by an average of 10-13% after the month of April-16.

4. Conclusion

It can be concluded from the work that implementation of ISO 50001, introduces a structure and basic framework for the implementation of energy policy and energy management systems. It provides measureable

Table 11: Fabric Production & SFC of Steam

Month	Production	Steam consumption	steam SFC
	m	Tons	kg/m
Jan-16	685,423	1617	2.36
Feb-16	501,504	1382	2.76
Mar-16	540,652	1427	2.64
Apr-16	656,980	1620	2.47
May-16	545,698	1202	2.20
Aug-16	538,418	1206	2.24
Sep-16	542,658	1260	2.32
Oct-16	1,018,563	2370	2.33
Nov-16	1,045,855	2418	2.31
Dec-16	1,065,236	2373	2.23

The savings of EnPI 02 action plan is presented in table 12.

Table 12: Saving and payback by implementation of EnPI 02 objectives

Month	Steam saved	steam cost	Total savings
	Tons	Rs.	Rs.
May-16	227.73	1591	362,318
Aug-16	160.5	1925	308,963
Sep-16	159	1960	311,640
Oct-16	298.64	1732	517,244
Nov-16	322.14	1919	618,187
Dec-16	417.92	1950	814,944
Total			2,933,296
Savings Avg./Month (Rs)			488,914
Implementation cost (Rs)			1,300,000
Payback period (Months)			2.66

Table 13: Coal consumption & efficiency of coal powered oil heater

Month	Coal Consumption	Running Hours	SFC	Flow Rate	Temperature difference	SFC
	(kg)	Hrs.	(kg of coal/ hour)	m3/hr.	◦C	(kg of Coal/MkCal)
Jan-16	105,841	443	239	178	14	211
Feb-16	890,59	409	218	179	13	206
Mar-16	807,12	404	200	181	12	204
Apr-16	829,89	428	194	179	11	203
May-16	736,12	386	191	168	12	201
Jun-16	644,21	339	190	174	12	198
Jul-16	828,81	401	207	175	13	196
Aug-16	888,63	490	181	176	11	194

Sep-16	728,51	450	162	174	10	192
Oct-16	120,918	642	188	176	11	202
Nov-16	125,152	609	206	169	13	196

Table 14 presents the payback and savings in rupees by the implementation of EnPI 03 objectives.

Table 14: Saving and payback by implementation of EnPI 03 objectives

Month	Coal saved/MKCal	Total Heat Transfer	Total savings
	Kg's	MkCal/Month	Rs./Month
Feb-16	4	433	25,980
Mar-16	6	396	35,640
Apr-16	7	430	45,150
May-16	9	366	49,410
Jun-16	12	336	60,480
Jul-16	14	404	84,840
Aug-16	16	458	109,920
Sep-16	18	400	108,000
Oct-16	8	598	71,760
Nov-16	14	639	134,190
Total			725,370
	Savings avg./month (Rs)	61,860	
	Implementation cost (Rs)	100,000	
	Payback period (Months)	1.62	

efficiency improvements and can also help in calculation of cost savings. The system also supports to distribute the energy system implementation plan at individual level in an organization and takes responsibilities are well defined. The implementation cost of the projects mentioned had a fairly small payback period (Under 3 months) and a total sum of Rs.13,00,000 could be saved per months which is approximately a savings of 15.6 million rupees with an investment of Rs. 2.2 Million.

5. Acknowledgement

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