

RELIANCE Energy

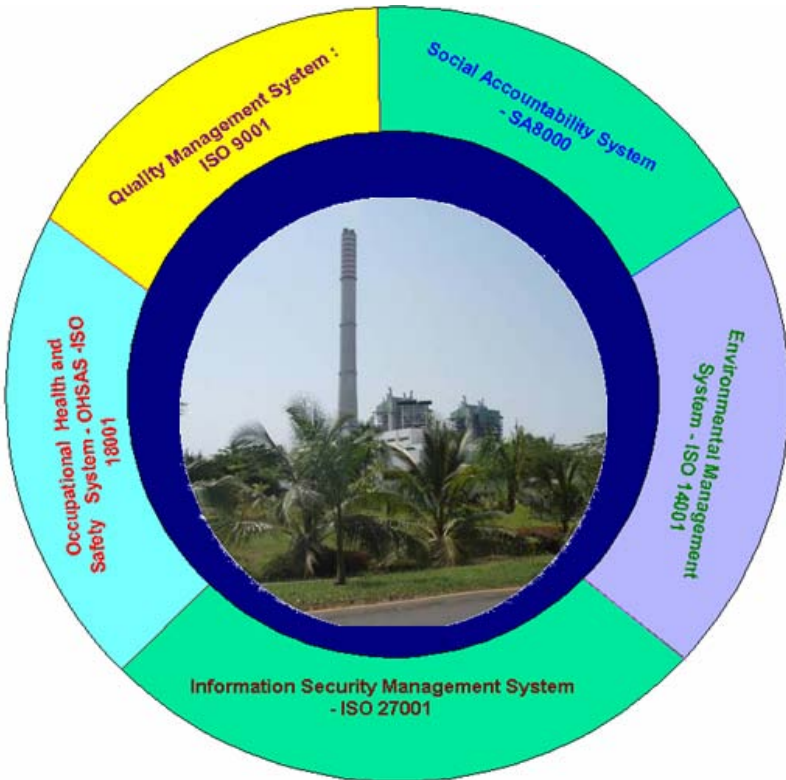
Anil Dhirubhai Ambani Group

Dahanu Thermal Power Station



Dahanu Thermal Power Station

Classified Energy saving projects



Annexure 'A'

National Energy Conservation Award 2008

Summary of classified energy saving measures implemented

(a) **Retrofitting/Minor Modifications of existing equipment – Low investment options.**

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Retrofitting of BFP by cartridge replacement	40.00	95.00
02	Optimizing supply voltage for the lighting system	0.0	6.0
03	Running of roll crusher with one drive unit.	0.0	35.00
04	Provision of water supply to refractory cooling header from service water header result in reduction in running hrs of seal water pump	0.0	2.0
05	Refurbishment of inner casing of ash disposal pump	0.0	1.0
06	To provide arrangement for isolation of individual coal mill for instrument air system,	0.0	0.5
07	Provision of emergency make up line for HP/LP sump from fire hydrant pump	10.00	5.0
Total		50.00	150

(b) Replacement/Installation/ Modernization of old and inefficient existing equipment and systems – High investment options.

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Installation of Variable Frequency Drive (VFD) in Condensate extraction pump	192	90
02	Installation of Variable Frequency Drive (VFD) in for dry Ash silo vent	6.5	4.5
03	Installation of Variable Frequency Drive (VFD) in for seal air fans in coal mills	45	88.2
04	Six sigma project reduction of tripping of CW pump	58.5	38
Total		302.00	220.7

(C) Energy substitution/switching measures.

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Solar Photovoltaic Lighting	10.00	2.2
02	Use of biomass in Canteen (sanjha chulha)	10	2.0
03	Installation of turbo ventilators in main plant and canteen	15.00	3.0
Total		35.00	7.2

(d) Combined heat and power systems-

Not Applicable.

(e) Waste Heat Recovery systems (Low Temperature - less than 350/400 C

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Condenser Tube cleaning by Bullet shot.	6.00	800.00
02	To detect air in leakages in condenser by use of Helium based air in leakage detector.	4.00	1500.00
Total		10.00	2300.00

(f) Process Monitoring and Controls

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Up gradation of ECW controls	05.00	2.00
02	Up gradation of compressor House controls	35.00	25.00
Total		45.00	27.00

(g) Reduction in usage of energy intensive raw materials

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Coal Mill ball loading pattern.	00.00	1000.00
Total		00.00	1000.00

(h) Reduction of rejects in the production process

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	NH3 injection in ESP	4.00	30.00
Total		4.00	30.00

(i) Reduction of water consumption in the plant

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	TO reduce Drinking water consumption in plant by installing water service devices. present water consumption 450 m3/dayv to be reduced 200 m3/day	20	02
02	TO reduces Domestic water consumption in plant by installing water service devices. present water consumption 700 m3/dayv to be reduces 420 m3/day	25	03
03	Installing rain guns in the coal handling plant	5.0	2.5
04	To reduce 65% of fire hydrant consumption	5.0	4.2
05	100% utilization of colony sewage water for horticulture	19.0	3.8
06	Recycling of hydrogen plants compressor and drier cooling water.	0.12	0.92
07	Plugging of leakages and installation of flow meter in spray water line to exercise monitoring for control.	0.12	0.58

08	6 no Development of ponds in colony and plant	124	62.0
09	Drip irrigation system provided in 260 Acres area	20.0	12.0
Total		218.24	91.00

(j) Recycling of material

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Recycling of water at various processes in plant and colony area.	00.00	20.00
Total		00.00	20.00

(k) Reduction of transport fuel

Sr. No.	Energy Saving Measures	Investment (Rs. Lakhs)	Money saving (Rs. Lakhs)
01	Reduction in transportation cost by using low ash content coal (Wash and imported coal) (i.e. Reduction in freight charge)	00.00	6000.00
Total		00.00	6000.00

(l) Human Resource Development for Energy Efficiency improvement

Sr. No.	Training	No. of Employees Trained	Money Invested (Rs. Lakhs)
01	Specific 'training need assessment study' carried out by internal team or external consultants for providing appropriate training to the employee	Training Need Identification exercise is being carried out on a daily basis, in which Training need on Energy efficiency	75.00



		improvement etc. are also identified.	
02	In-house training programmes conducted	225	3.95
03	Employees sent for training within India	55	5.5
04	Employees sent for training in abroad	01	-----
05	Study undertaken to assess the impact of training provided to employees	Yes, As a study undertaken to assess the impact and energy conservation awareness programme of 20 Engineers of DTPS has been qualified & certified as a Energy Auditors by BEE	-----
Total		281	9.0

Total Investment (Rs. Lakhs)	673.25
Total Savings (Rs. Lakhs)	9845



Energy Policy



The screenshot shows a web browser displaying the Energy Management Cell website. The address bar shows the URL: <http://embackup/EMCWeb/EMC/Energy/EMManagement%20Cell.htm>. The website has a navigation menu with links for "About us", "Energy Policy", "Awards", "EC Act 2001", "Energy Audit", "Slogans & Tips", and "Contact us". A main banner features the slogan "Save Energy, for yourself, your family future, organization, society, Nation and for World." Below this, there are sections for "Projects", "Electricity Act", "Study Material", "New Technologies", and "Links". A "You are Visitor No" counter is visible. The central content area is titled "Why Energy Management Cell ?" and lists 9 key activities: 1. Regular internal energy audits, 2. Documentation for energy management activities, 3. Regular energy audits through accredited energy auditing firms as per requirements by the EC Act, 2001, 4. Regular filing of energy returns to the state level designated agency as per the EC Act, 2001, 5. Enhancement of employees' knowledge about energy conservation and energy efficiency through internal training programmes, 6. Energy conservation projects - identification, evaluation and implementation, 7. Application of energy conservation techniques in the entire gamut of activities of O&M including purchase, training, O & M, inspection & testing, etc. 8. Establishing the efficiency test procedures and schedules for various equipments and system, 9. MIS accounting. There are also links for "National Certification Examination for Energy Managers and Energy Auditors" (May 2008) and "Celebration of Energy Conservation Week on 14th - 21st Dec 2007".



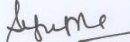
ENERGY MANAGEMENT POLICY

Reliance Infrastructure Ltd. is committed to be one of the most energy efficient utility. Our mission is to use all energy resources efficiently and thereby minimizing the impact of our operations on environment and conserving the scarce natural resources.

This we plan to achieve by,

- ❖ Adopting appropriate energy efficient and clean technologies in process design, procurement, implementation and also continually upgrade our performance.
- ❖ Managing efficient use of all forms of energy by adopting industry wide best practices.
- ❖ Continually benchmarking our energy performance and improving our competitiveness by capacity building measures.
- ❖ Creating awareness about efficient use of energy and conservation methods amongst all our stakeholders.
- ❖ Carrying out regular energy audits to identify areas for improvement.
- ❖ Complying with all relevant regulatory and statutory requirements on energy management.

Date: 29th September, 2008


S.C. Gupta
Director(Operation)

External Audit at DTPS



KIRLOSKAR CORROCOAT P. LTD.

CORROCOAT

***ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu***



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ENERGY CONSERVATION STUDY REPORT

AT

Reliance Energy Limited
DTPS, Dahanu Road,
Thane
Maharashtra

May 2008

***ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu***



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FOREWORD

The Energy Conservation Study was carried out at M/s **Reliance Energy Limited**, Dahanu, during the months of May 2008.

The basic objectives of energy audit studies are

- Identifying opportunities for energy saving in utility areas - pumps,.
- Estimate present efficiency of the pumps.
- Identify further potential areas for conservation of energy.
- Techno-economical assessment of various energy conservation measures.

KIRLOSKAR CORROCOAT P. LTD.

CORROCOAT

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ACKNOWLEDGEMENT

We are extremely thankful to M/s Reliance Energy Limited for having given us this opportunity to contribute in their endeavor of efficient energy management and for sincere efforts and interest in Conservation of Energy.

We are also grateful to the entire management & staff members for their cooperation in conducting the energy conservation study.

We hope the study will result in substantial conservation of energy; which shall be a true reward of joint efforts.

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



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**Opportunities
For
Conservation of Energy**

A. EXECUTIVE SUMMARY

SUMMARY OF ENERGY SAVING

Sr. No.	Scheme	No of Pumps	Max. Saving in kW / pump per annum	Total Power Saving per annum	Saving in Rupees per annum
1	ECW I Pumps 1A,1B & 1C (2)	3	102780	196057	588172
2	ECW II Pumps 2A,2B & 2C (2)	3	420554	891268	2673804
3	Sea Water Pumps 1,2,3 & 4 (3)	4	726145	2447206	7341619
4	H P Pumps A & C (2)	2	----	----	----
5	Raw Water Pumps 1,2 & 3 (2)	3	27307	52767	158303

Note: we have considered 24 hours x 365 days working with Rs. 2.90/kwH as energy charges & present flow & head has been assumed for calculation purpose.

No	Description	Annual Savings	Capital Investment	Payback Period
1	ECW I Pumps 1A,1B & 1C (2)	588172	7,50,000/-	10 Month
2	ECW II Pumps 2A,2B & 2C (2)	2673804	24,00,000/-(*)	7.8 Months
3	Sea Water Pumps 1,2,3 & 4 (3)	7341619	20,00,000/-	8.14Months
4	H P Pumps A & C (2)	----	/-	--Months
5	Raw Water Pumps 1,2 & 3 (2)	158303	7,50,000/-	36 Months

Energy Cost:

Description	Unit Rate
Electricity	Rs 3 per kWh



Chapter-I

Pump Performance Test

The performance of any system can be evaluated by calculating the efficiency of the system. The efficiency of the system can be calculated by ratio of output power to input power. Here the efficiency of pumps has been computed by hydraulic power generated by pump to shaft power to pump.

The pump performance test includes measurement of pump flow (M³/hr), head (M) generated by pump and motor power (kW).

The operating efficiency of the pumping system can be estimated by measuring

- Actual flow given by pumps with help of ultrasonic flow meter
- Actual power consumption of the pumping system by power analyzer.
- Suction & discharge pressure for pumps and calculating the differential head

The pump efficiency can be estimated as

Pump Efficiency = Flow (M³/hr) x Differential Pressure (M) / (367 x Motor power (kW) x Motor Efficiency)

These pumping systems are as follows.

- ECW I Pumps, 1A ,1B & 1C (Total Three no, Any two pumps in Operation)
- ECW II Pumps, 2A ,2B & 2C (Total Three no, Any two pumps in Operation)
- Sea Water Pumps, 1 , 2 , 3 & 4 (Total Four no, Any three pumps in Operation)
- H P I Pumps, A & C (Total Three no, Any two pumps in Operation)
- Raw Water Pump, 1, 2 & 3. (Total Three no, Any two pumps in Operation)

The performance of test has been carried out for each above running pumps. The detail analysis of each type pump has been given in the coming chapters.

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ENERGY LIMITED, DTPS, Dahanu**



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Data Collection

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER: -	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS: -	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti ltd, 129398
PUMP No.: -	ECW 1A	MOTOR Make & MODLE	
LOCATION: -	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1473.6	1634	19	75	56	6.39	30.60	0.90	306.0	50	81.44
2	1473.6	1639	19	75	56	6.4	30.60	0.90	305.0	50	81.95
3	1473.6	1687	19	75	56	6.4	30.50	0.90	305.0	50	84.35
4	1473.6	1723	19	75	56	6.39	30.60	0.90	306.0	50	85.87
5	1473.6	1738	19	75	56	6.4	30.60	0.90	305.0	50	86.90
AVG	1473.6	1684.2	19	75	56	6.40	30.58	0.90	305.4	50	84.10
SHUT OFF READING											
1			25	116	91	6.4	18.00	0.85	169.0	50	
2			25	116	91	6.39	17.90	0.85	168.0	50	
3			25	116	91	6.4	17.90	0.84	167.0	50	
4			25	116	91	6.39	18.00	0.85	169.0	50	
5			25	116	91	6.4	17.90	0.84	168.00	50	
AVG	#####		25	116	91	6.40	17.94	0.85	168.2	50.00	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



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MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti ltd, 129398
PUMP No.:-	ECW 1B	MOTOR Make & MODLE	
LOCATION:-	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1476	1653	21	75	54	6.4	31.10	0.90	311.0	49.4	78.16
2	1476	1673	21	75	54	6.4	31.20	0.90	311.0	49.9	79.11
3	1476	1637	21	75	54	6.4	31.20	0.90	311.0	49.9	77.41
4	1476	1567	21	75	54	6.4	31.20	0.90	311.0	49.4	74.10
5	1476	1616	21	75	54	6.4	31.10	0.90	311.0	49.9	76.41
AVG	1476	1629	21	75	54	6.40	31.16	0.9	311	49.7	77.038

SHUT OFF READING

1			25	110	85	6.4	18.00	0.84	167.0	50.1	
2			25	110	85	6.4	17.80	0.85	167.0	50.1	
3			25	110	85	6.31	18.00	0.85	169.0	50.1	
4			25	110	85	6.4	18.00	0.85	167.0	50.1	
5			25	110	85	6.4	17.80	0.84	167.00	50.1	
AVG	####		25	110	85	6.37	17.92	0.85	167.4	##	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



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MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER: -	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS: -	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti ltd, 129398
PUMP No.: -	ECW 1C	MOTOR Make & MODLE	
LOCATION: -	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1477.9	1415	20	85	65	6.55	30.40	0.90	310.0	49.9	80.80
2	1477.9	1437	20	85	65	6.56	30.40	0.90	310.0	49.9	82.06
3	1477.9	1410	20	85	65	6.57	30.40	0.90	309.0	49.9	80.77
4	1477.9	1440	20	85	65	6.55	30.40	0.90	310.0	49.9	82.23
5	1477.9	1450	20	85	65	6.56	30.40	0.90	310.0	49.9	82.80
AVG	1478	1430.4	20	85	65	6.56	30.4	0.9	309.8	49.9	81.73

SHUT OFF READING

1			25	110	85	6.57	17.60	0.84	168.0	49.9	
2			25	110	85	6.56	17.50	0.84	167.0	49.9	
3			25	110	85	6.56	17.40	0.84	167.0	49.9	
4			25	110	85	6.56	17.60	0.84	168.0	49.9	
5			25	110	85	6.56	17.40	0.84	167.00	49.9	
AVG	#####		25	110	85	6.56	17.5	0.84	167.4	49.90	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



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MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti Ltd, 129398
PUMP No.:-	ECW 2A	MOTOR Make & MODLE	
LOCATION:-	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1477.9	1681	25	72	47	6.4	34.80	0.89	345.0	50.2	62.37
2	1477.9	1666	25	72	47	6.4	35.00	0.89	346.0	50.2	61.63
3	1477.9	1645	25	72	47	6.4	35.00	0.89	347.0	50.2	60.68
4	1477.9	1622	25	72	47	6.4	34.80	0.89	345.0	50.2	60.18
5	1477.9	1608	25	72	47	6.4	35.00	0.89	346.0	50.2	59.48
AVG	1477.9	1644.4	25	72	47	6.4	34.92	0.89	345.8	50.2	60.867
SHUT OFF READING											
1			27.5	112	84.5	6.39	20.90	0.86	198.0	50.2	
2			27.5	112	84.5	6.39	21.10	0.86	199.0	50.3	
3			27.5	112	84.5	6.39	20.90	0.86	200.0	50.3	
4			27.5	112	84.5	6.39	20.90	0.86	198.0	50.2	
5			27.5	112	84.5	6.39	21.10	0.86	199.00	50.3	
AVG	#####		27.5	112	84.5	6.39	20.98	0.86	198.8	50.26	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
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MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti ltd, 129398
PUMP No.:-	ECW 2B	MOTOR Make & MODLE	
LOCATION:-	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1479.8	1501	25	72	47	6.39	32.50	0.90	324.0	49.7	59.30
2	1477.9	1522	25	72	47	6.39	32.50	0.90	324.0	49.7	60.13
3	1477.9	1528	25	72	47	6.39	32.40	0.90	324.0	49.7	60.36
4	1477.9	1531	25	72	47	6.39	32.50	0.90	324.0	49.7	60.48
5	1477.9	1529	25	72	47	6.39	32.50	0.90	324.0	49.7	60.40
AVG	1478.3	1522.2	25	72	47	6.39	32.48	0.9	324	49.7	60.1342

SHUT OFF READING

1			25	105	80	6.39	20.40	0.86	195.0	0.86	
2			25	105	80	6.39	19.20	0.85	181.0	0.85	
3			25	105	80	6.39	19.10	0.85	180.0	0.85	
4			25	105	80	6.39	20.40	0.86	195.0	0.86	
5			25	105	80	6.39	19.20	0.85	181.00	0.85	
AVG	#DIV/0!		25	105	80	6.39	19.66	0.85	186.4	0.85	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



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MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Jyoti ltd, 129398
PUMP No.:-	ECW 2C	MOTOR Make & MODLE	
LOCATION:-	Main Plant	Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	MOTOR EFFICIENCY
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1470	1300	65	6.6	35		300	50	77		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1479.1	1482	25	80	55	6.61	31.50	0.90	325.0	50	68.30
2	1479.1	1427	25	80	55	6.62	31.60	0.90	325.0	50	65.77
3	1479.1	1378	25	80	55	6.62	31.60	0.90	326.0	50.1	63.31
4	1479.1	1451	25	80	55	6.61	31.50	0.90	325.0	50	66.87
5	1479.1	1442	25	80	55	6.62	31.60	0.90	325.0	50	66.46
AVG	1479	1436	25	80	55	6.62	31.56	0.9	325.2	50.02	66.142
SHUT OFF READING											
1			27.5	112	84.5	6.39	20.90	0.86	198.0	50.2	
2			27.5	112	84.5	6.39	21.10	0.86	199.0	50.3	
3			27.5	112	84.5	6.39	20.90	0.86	200.0	50.3	
4			27.5	112	84.5	6.39	20.90	0.86	198.0	50.2	
5			27.5	112	84.5	6.39	21.10	0.86	199.00	50.3	
AVG	#####		27.5	112	84.5	6.39	20.98	0.86	198.8	50.26	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER: -	Reliance Energy Limited Dahanu	CONTACT PERSON: -	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS: -	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	KBL
PUMP No.:-	Sea Water Pump 1	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

PUMP DETAILS				MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
Sr. No.	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	991	5750	33.1	6.6	150		680	50	76		

MEASURED PARAMETERS

Date

23.05
.08

PUMP DETAILS						MOTOR DETAILS					
Sr. No.	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	990.5	7557	2.85	32	29.15	6.46	68.60	0.87	669.0	50.2	89.67
2	990.5	7481	2.85	32	29.15	6.46	68.60	0.87	670.0	50.2	88.64
3	990.5	7616	2.85	32	29.15	6.46	68.60	0.87	669.0	50.2	90.37
4	990.5	7462	2.85	32	29.15	6.46	68.60	0.87	669.0	50.2	88.55
5	990.5	7372	2.85	32	29.15	6.46	68.60	0.87	670.0	50.2	87.35
AVG	990.5	7498	2.85	32	29.15	6.46	68.6	0.87	669.4	50.2	88.92

SHUT OFF READING

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5											
AVG	####	####	####	####	####	####	#DIV/0!	#DIV/0!	#DIV/0!	####	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	KBL
PUMP No.:-	Sea Water Pump 2	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	991	5750	33.1	6.6	150		680	50	76		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	994.7	7657	2.85	29	26.15	6.46	69.70	0.87	679.0	50.3	80.31
2	994.7	7638	2.85	29	26.15	6.47	68.60	0.87	680.0	50.3	79.99
3	994.7	7610	2.85	29	26.15	6.47	68.50	0.87	679.0	50.3	79.81
4	994.7	7576	2.85	29	26.15	6.46	68.70	0.87	679.0	50.3	79.46
5	994.7	7372	2.85	29	26.15	6.47	68.60	0.87	680.0	50.3	77.21
AVG	994.7	7571	2.85	29	26.15	6.47	68.82	0.87	679.4	50.3	79.355
SHUT OFF READING											
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5											
AVG	####	#####	#####	#####	#####	#####	#DIV/O!	#DIV/O!	#####	####	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	KBL
PUMP No.:-	Sea Water Pump 3	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	991	5750	33.1	6.6	150		680	50	76		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	994.6	8172	2.85	30	27.15	6.47	70.90	0.87	692.0	50.3	87.32
2	994.6	8236	2.85	30	27.15	6.47	71.00	0.87	692.0	50.3	88.00
3	994.6	8264	2.85	30	27.15	6.47	71.10	0.87	693.0	50.3	88.17
4	994.6	8097	2.85	30	27.15	6.46	70.90	0.87	692.0	50.3	86.51
5	994.6	7979	2.85	30	27.15	6.47	71.00	0.87	692.0	50.3	85.25
AVG	994.6	8150	2.85	30	27.15	6.47	70.98	0.87	692.2	50.3	87.0503
SHUT OFF READING											
1											
2											
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5											
AVG	####		#####	#####	#####	#####	#DIV/0!	#DIV/0!	#####	####	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	KBL
PUMP No.:-	Sea Water Pump 4	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	991	5750	33.1	6.6	150		680	50	76		

MEASURED PARAMETERS

Date 23.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	995	7820	2.85	28	25.15	6.43	71.80	0.87	696.0	50	76.95
2	995	7705	2.85	28	25.15	6.43	71.90	0.87	697.0	50.1	75.71
3	995	7803	2.85	28	25.15	6.42	71.80	0.87	695.0	50	76.90
4	995	7778	2.85	28	25.15	6.43	71.80	0.87	696.0	50	76.54
5	995	7915	2.85	28	25.15	6.43	71.90	0.87	697.0	50.1	77.78
AVG	995	7804	2.85	28	25.15	6.43	71.84	0.87	696.2	50.04	76.777
SHUT OFF READING											
1											
2											
3											
4											
5											
AVG	####		#####	####	#####	####	#DIV/O!	#DIV/O!	#DIV/O!	####	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Worthington
PUMP No.:-	H P 1A	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1		520	105	6.6	27.5		240	50	62		

MEASURED PARAMETERS

Date

28.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					Pump Efficiency in %
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	
1	1477	391.8	0	109	109	6.51	19.80	0.80	178.0	49.5	65.34
2	1477	387.8	0	109	109	6.51	19.80	0.80	178.0	49.5	64.67
3	1477	385.3	0	109	109	6.51	19.80	0.80	178.0	49.6	64.25
4	1477	383.3	0	109	109	6.51	19.80	0.80	178.0	49.5	63.92
5	1477	388.9	0	109	109	6.51	19.80	0.80	178.0	49.6	64.85
AVG	1477	387.4	0	109	109	6.51	19.8	0.8	178	49.54	64.608
SHUT OFF READING											
1											
2											
3											
4											
5											
AVG	####		#####	#####	#DIV/0!	#####	#DIV/0!	#DIV/0!	#####	#####	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Worthington
PUMP No.:-	H P 1C	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1		520	105	6.6	27.5		240	50	62		

MEASURED PARAMETERS

Date 28.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					Pump Efficiency in %
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in KVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	
1	1265.8	357.2	0	90	90	6.48	17.80	0.78	155.0	49.1	56.48
2	1265.8	356.8	0	90	90	6.49	17.90	0.78	158.0	49.1	55.35
3	1265.8	360.2	0	90	90	6.48	18.10	0.78	160.0	49.1	55.18
4	1265.8	363.5	0	90	90	6.48	17.80	0.78	155.0	49.1	57.48
5	1265.8	344.4	0	90	90	6.49	17.80	0.78	158.0	49.1	53.43
AVG	1265.8	356.42	0	90	90	6.48	17.88	0.78	157.2	49.1	55.583
SHUT OFF READING											
1											
2											
3											
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5											
AVG	#####		#DIV/0!	#####	#####	#####	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#####

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Kishor pump CVE/100-250
PUMP No.:-	RAW WATER PUMP-01	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1450	125	15				9.3	50	54		

MEASURED PARAMETERS

Date 27.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1438.9	203.2	0	3	3	422	17.80	0.76	9.61	49.7	17.28
2	1438.9	202.6	0	3	3	421	17.90	0.76	9.61	49.7	17.22
3	1438.9	202.2	0	3	3	422	18.10	0.76	9.61	49.7	17.19
4	1438.9	202.5	0	3	3	422	17.80	0.76	9.61	49.7	17.22
5	1438.9	202.1	0	3	3	421	17.80	0.76	9.61	49.7	17.18
AVG	1439	202.5	0	3	3	421.60	17.88	0.76	9.61	49.7	17.22

VALVE THROTTLED (MAINTAINED AT 10 MTR HEAD)

1	1438.9	147	0	10	10	422	18.30	0.78	10.4	49.8	38.49
2	1438.9	147.3	0	10	10	422	18.30	0.78	10.4	49.8	38.57
3	1438.9	147.5	0	10	10	422	18.30	0.78	10.4	49.8	38.62
4	1438.9	146.4	0	10	10	422	18.30	0.78	10.4	49.8	38.34
5	1438.9	146.2	0	10	10	422	18.30	0.78	10.4	49.8	38.28
AVG	1439	146.9	0	10	10	422	18.3	0.78	10.4	49.80	38.46

VALVE CLOSE

1	1438.9		0	20	20	421	15.80	0.74	8.7	49.5	
2	1438.9		0	20	20	421	16.30	0.72	8.6	49.5	
3	1438.9		0	20	20	421	15.50	0.72	8.2	49.5	
4	1438.9		0	20	20	421	15.80	0.74	8.7	49.5	
5	1438.9		0	20	20	421	16.30	0.72	8.6	49.5	
AVG	1439	#####	0	20	20	421	15.94	0.73	8.56	49.50	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER: -	Reliance Energy Limited Dahanu	CONTACT PERSON: -	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS: -	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Kishor pump CVE/100-250
PUMP No.: -	RAW WATER PUMP-02	MOTOR Make & MODLE	
LOCATION: -		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1450	125	15				9.3	50	54		

MEASURED PARAMETERS

Date 27.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1457.9	170.8	0	3	3	424	17.45	0.84	10.70	49.7	13.04
2	1457.9	170.2	0	3	3	424	17.40	0.84	10.70	49.7	13.00
3	1457.9	170.9	0	3	3	424	17.40	0.85	10.70	49.7	13.05
4	1457.9	170.1	0	3	3	424	17.45	0.84	10.70	49.7	12.99
5	1457.9	169.6	0	3	3	424	17.40	0.84	10.70	49.7	12.95
AVG	1458	170.3	0	3	3	424.00	17.42	0.842	10.70	49.7	13.00

VALVE THROTTLED (MAINTAINED AT 10 MTR HEAD)

1	1438.9	130.5	0	10	10	424	16.00	0.82	9.70	49.7	36.64
2	1438.9	131	0	10	10	424	16.10	0.82	9.71	49.7	36.74
3	1438.9	130.7	0	10	10	424	16.10	0.83	9.71	49.7	36.66
4	1438.9	131.7	0	10	10	424	16.00	0.82	9.70	49.7	36.98
5	1438.9	131.3	0	10	10	424	16.10	0.82	9.70	49.7	36.86
AVG	1439	131	0	10	10	424	16.06	0.82	9.70	49.70	36.77

VALVE CLOSE

1	1438.9		0	20	20	424	15.80	0.74	8.7	49.5	
2	1438.9		0	20	20	425	16.30	0.72	8.6	49.5	
3	1438.9		0	20	20	424	15.50	0.72	8.2	49.5	
4	1438.9		0	20	20	425	15.80	0.74	8.7	49.5	
5	1438.9		0	20	20	424	16.30	0.72	8.6	49.5	
AVG	1439	####	0	20	20	424.33	15.94	0.73	8.56	49.50	

**ENERGY CONSERVATION STUDY – M/s RELIANCE
ENERGY LIMITED, DTPS, Dahanu**



Enriching Lives

MEASUREMENT OF PERFORMANCE PARAMETERS OF PUMP

NAME OF CUSTOMER:-	Reliance Energy Limited Dahanu	CONTACT PERSON:-	Mr. P.S. Jalkote / D V Deshpande
WORKS ADDRESS:-	REL Dhanu Thermal Power Station	PHONE NO.	9325119746
		PUMP Make & MODLE	Kishor pump CVE/100-250
PUMP No.:-	RAW WATER PUMP-03	MOTOR Make & MODLE	
LOCATION:-		Cost of Energy in Rs.	

DESIGN PARAMETERS

Sr. No.	PUMP DETAILS			MOTOR DETAILS					Pump Efficiency in %	BKW	Motor Efficiency
	Speed in RPM	Flow in M3/Hr	Head In meters	Voltage in kVolts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz			
1	1450	125	15				9.3	50	54		

MEASURED PARAMETERS

Date 27.05.08

Sr. No.	PUMP DETAILS					MOTOR DETAILS					
	Speed in RPM	Flow in M3/Hr	Suction Head in m	Disch. Head in m	Head In meters	Voltage in Volts	Current in AMPS	Power Factor	Active power in kW	Freq. in Hz	Pump Efficiency in %
1	1456	176.2	0	4	4	425	18.50	0.81	11.10	50	17.29
2	1456	176.5	0	4	4	425	18.60	0.81	11.10	50.2	17.32
3	1456	177.2	0	4	4	426	18.60	0.81	11.10	50	17.39
4	1456	178.1	0	4	4	425	18.50	0.81	11.10	50	17.48
5	1456	178.6	0	4	4	425	18.60	0.81	11.10	50.2	17.53
AVG	1456	177.3	0	4	4	####	18.56	0.81	11.10	50.08	17.40

VALVE THROTTLED (MAINTAINED AT 10 MTR HEAD)

1	1456	140.3	0	10	10	427	17.60	0.80	10.50	50.2	36.39
2	1456	141	0	10	10	427	17.60	0.80	10.40	50.2	36.92
3	1456	141.5	0	10	10	427	17.60	0.80	10.40	50.2	37.05
4	1456	142.1	0	10	10	427	17.60	0.80	10.40	50.2	37.21
5	1456	140.6	0	10	10	427	17.60	0.80	10.40	50.2	36.82
AVG	1456	141.1	0	10	10	427	17.6	0.80	10.42	50.20	36.88

VALVE CLOSE

1	1456		0	17	17	426	12.40	0.67	6.16	50.1	
2	1456		0	17	17	426	12.40	0.67	6.17	50.1	
3	1456		0	17	17	426	12.40	0.67	6.16	50.1	
4	1456		0	17	17	426	12.40	0.67	6.17	50.1	
5	1456		0	17	17	426	12.40	0.67	6.16	50.1	
AVG	1456	#####	0	17	17	426	12.4	0.67	6.164	50.10	



OBSERVATIONS AT PUMPING STATION:

ECW I Pumps (1A, 1B & 1C)

1. The condition of pumps is good as far as operation is concerned. We observed smooth running for the pumps.
2. Pressure Gauges are properly working.
3. Delivery valve & NRV is working properly.
4. Pump delivering **more flow** at low head.
5. Active power consumption is more than design power.

ECW II Pumps (2A, 2B & 2C)

1. The condition of pumps is good as far as operation is concerned.
2. Pressure Gauges are properly working.
3. Pump delivering **more flow** at low head.
4. Active power consumption is more than design power.
6. Pumps operating in low efficiency zone may be reason, wear out internals of pump due to erosion & Corrosion.

Sea Water Pumps 1, 2, 3 & 4

1. The condition of pumps as well as pump house is good as far as operation is concerned. We observed smooth running for the pumps in pump house.
2. Pressure Gauges are properly working.
3. Pump operating on high **flow** & low head.



H P I Pumps, A & C

1. We observed delivery pipeline of pump is in very bad condition.
2. Celebrated Pressure Gauges is required.
3. Delivery valve was not working properly.
4. Pumps operating in low efficiency zone may be the reason, warn out internals of pump due to erosion & Corrosion.

Raw Water Pump 1, 2 & 3

1. The condition of pumps as well as pump house is good as far as operation is concerned. We observed smooth running for the pumps in pump house.
2. Pressure Gauges are properly working.
3. Design & Actual parameters are mismatching.
4. Pumps are operating at wrong duty point.

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SYSTEM ANALYSIS

All the systems goes under change due to aging, only the extent changes. We have tried to noted the system parameters to reasonable accuracy. In most of the cases as mentioned below head specified was more than the actual requirement hence the system is still developing near to required parameters. However henceforth below mentioned figures can be taken for the present head for designing / operating/changing the system accordingly.

For all the saving & payback period calculations, we required exact duty points as per plant requirement.

Sr. No.	Pump house	Designed System Parameter		Actual Parameter		Required Parameters	
		Flow m3/hr	Head M	Flow m3/hr	Head M	Flow m3/hr	Head M
1	ECW I Pumps 1A ,1B & 1C (2)	2600	65	3313	55	3300	55
2	ECW II Pumps 2A ,2B & 2C F (2)	2600	65	3166	47	3300	55
3	Sea Water Pumps 1 , 2 , 3 & 4 (3)	17250	31	23219	27.3	18000	33
4	H P I Pumps, A & C (2)	1040	105	744	104	1040	105
5	Raw Water Pump 1, 2 & 3 (2)	250	15	372	3	250	15



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**Chapter-I
ECW I Pumps 1A, 1B & 1C**

These are ECW pumps; this needs about **3300 M³/hr** flow at **55 M** head. However, pumping system is over designed at 65 M head.

Therefore out of three, three pumps are operated to fulfill the plant requirements. In process of performance test the actual flow and differential pressure have been measured and efficiency has calculated. The detail of which is as follows.

Description	Units				
		1	2	3	4
Operations	Hrs/day	24			
	Days/Year	330			
Power Cost	Rs/kWh	3			
Design Parameters					
Make		JYOTI	JYOTI	JYOTI	
Model		HSC	HSC	HSC	
Head	M	65	65	65	
Flow rate	M ³ /hr	1300	1300	1300	
Efficiency Pump	%	77%	77%	77%	
Efficiency Motor	%	95%	95%	95%	
Power	bkW	300	300	300	
Actual Parameters					
	Pump no	1	2	3	
Velocity	M/sec				
Diameter	mm				
Flow rate	M ³ /hr	1684	1629	1430	
Suction Head	M	-			
Discharge Head	M	56	54	65	
Power	kW	305	311	309.8	
Differential Head at rated frequency	M	56	56	65	
Pump Efficiency	%	93.00%	85.00%	90.00%	
Recommended Parameters					
Head	M	55	55	55	
Flow rate	M ³ /hr	1650	1650	1650	
Efficiency	%	88%	88%	88%	
Motor Efficiency	%	95%	95%	95%	
Power Consumption	kW	295.62	295.62	295.62	
Saving	kW	9.38	15.38	14.18	
	kWh/day/Pump	225.06	369.06	340.26	



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	kWh/year/Pump	74268.73	121788.73	112284.73	
	Rs./year/pump	222806.19	365366.19	336854.19	
Cost of Implementation	Rs./pump	250000.00	250000.00	250000.00	
Pay Back Period	Months	13.46	8.21	8.91	

General Observation:

It has been observed that pump is shifted from its duty point & running with about 20 % higher flow at operating actual parameters. These pumps are operating about 55 meter head since actual requirement is 55 meter.

The following steps can be taken to enhance the pump efficiency.

- The impeller of the pump may be suitably trimmed, progressively or in consultation with the manufacturer, so as to totally eliminating the throttling. The savings would depend on the pump efficiency at the new operating point, and may not be very good considering vast difference between the design and actual pressure requirement. However, the investment would be marginal and savings up to **50%** of the projected values could be obtained. Blind trimming without studying pump thoroughly may not be correct.
- The individual pumps may be provided with a variable speed based controller to monitor the flow rate based on the cooling water pressure at the plant. This would provide maximum savings but involved additional investment as head is fluctuating and cost is higher.
- Coating of pumps will increase the efficiency by 6 to 7 points.

The maximum cost of implementation shall be around Rs. 7, 50,000/-.

The payback period shall maximum be around 8 to 9 months depending upon the combination.

It may be noted that the savings have been estimated based on the annual operating hours, as mentioned above; which would be greatly be influenced by the actual pump operations.

- **Additionally these will require honest assessment of the present operating parameter such as flow and head.**

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CALCULATION OF PAYBACK PERIOD AND EFFICIENCY IMPROVEMENT ANALYSIS

SCHEME: ECW I Pumps 1A, 1B & 1C

Sr. No.	Suggestions/ Recommendation	Present Efficiency & Power	Achievable Efficiency & Power	Saving in terms of Power & Rs. per Pump	Approx. investment per Pump	Payback Period per Pump
1	Trimming & Refurbishment of Pump using corrocoating (*)	86 % 305 kW	88 % 295.6 kW	12.97 kW 102780/-	2,50,000/-	8.9 Months

(*) At ASSUMED head and flow (1650 m³/hr 55 M Head)

Note: we have considered 24 hours x 365 days working with Rs. 3/kwH as energy charges & present flow & head has been assumed for calculation purpose.

Present average flow is 1581 kW and 58 M Head.



Chapter-II

ECW II Pumps 2A, 2B & 2C

The ECW II pumps. This needs about 1650 M³/hr flow at 50 M head. However, pumping system is over designed at 65 M head.

In process of performance test the actual flow and differential pressure have been measured and efficiency has calculated. The detail of which is as follows.

Description	Units				
		1	2	3	4
Operations	Hrs/day	24			
	Days/Year	330			
Power Cost	Rs/kWh	3			
Design Parameters					
Make		JYOTI	JYOTI	JYOTI	
Model		HSC	HSC	HSC	
Head	M	65	65	65	
Flow rate	M ³ /hr	1300	1300	1300	
Efficiency Pump	%	77%	77%	77%	
Efficiency Motor	%	95%	95%	95%	
Power	bkW	300	300	300	
Actual Parameters					
	Pump no	1	2	3	
Velocity	M/sec				
Diameter	mm				
Flow rate	M ³ /hr	1644	1522	1436	
Suction Head	M	-			
Discharge Head	M	47	47	55	
Throttling at Discharge	%	-			
Power	kW	345	324	325	
Differential Head at rated frequency	M	47	47	55	
Pump Efficiency	%	68.00%	68.00%	73.00%	
Recommended Parameters					
Head	M	50	50	50	
Flow rate	M ³ /hr	1650	1650	1650	
Efficiency	%	85%	85%	85%	



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Motor Efficiency	%	95%	95%	95%
Power Consumption	kW	278.23	278.23	278.23
Saving	kW	66.77	45.77	46.77
	kWh/day/Pump	1602.41	1098.41	1122.41
	kWh/year/Pump	528794.10	362474.10	370394.10
	Rs./year/pump	1586382.30	1087422.30	1111182.30
Cost of Implementation	Rs./pump	800000.00	800000.00	800000.00
Pay Back Period	Months	6.05	8.83	8.64

The head is down of the pump shows clear-cut mark of heavy erosion. In a longer process the efficiency will keep on dropping causing further worries. The savings has been worked out with higher

The following steps can be taken to enhance the pump efficiency.

- A set of new pumps, operating at 87% or better **site** efficiency at the **requisite parameters**, should be procured and installed.
- The individual pumps may be provided with a variable speed based controller to monitor the flow rate based on the cooling water pressure at the plant. This would provide maximum savings but involved additional investment.

The maximum cost of implementation shall be around Rs 24, 00,000/-.

The payback period shall maximum be around 7 to 8 months.

It may be noted that the savings have been estimated based on the annual operating hours, as mentioned above; which would be greatly be influenced by the actual pump operations.

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CALCULATION OF PAYBACK PERIOD AND EFFICIENCY IMPROVEMENT ANALYSIS

SCHEME: ECW II Pumps 2A, 2B & 2C

Sr. No.	Suggestions/ Recommendation	Present Efficiency & Power	Achievable Efficiency & Power	Saving in terms of Power & Rs. per Pump	Approx. investment per Pump	Payback Period per Pump
1	Replacement of pump assembly with corrocoating. . (*)	50 % 331 kW	85 % 278	53 kW 1261662/-	8,00,000/-	7.8 months

(*) At present head and flow (3300 m³/hr 50 M Head), any two pumps in operation.

Note: we have considered 24 hours x 365 days working with Rs. 3/kwH as energy charges & present flow & head has been assumed for calculation purpose.

Present average flow is 1428 kW and 56 M Head.



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Chapter-III

Sea Water Pumps (1, 2, 3, & 4)

The Sea water circulation pump. This needs about 6000 M³/hr flow at 33 M head. However, pumps operating to the right side.

In process of performance test the actual flow and differential pressure have been measured and efficiency has calculated. The detail of which is as follows.

Description	Units				
		1	2	3	4
Operations	Hrs/day	24			
	Days/Year	330			
Power Cost	Rs/kWh	3			
Design Parameters					
Make		KBL	KBL	KBL	KBL
Model		HSC	HSC	HSC	HSC
Head	M	33.1	33.1	33.1	33.1
Flow rate	M ³ /hr	5750	5750	5750	5750
Efficiency Pump	%	76%	76%	76%	76%
Efficiency Motor	%	95%	95%	95%	95%
RPM		991	991	991	991
Power	bkW	680	680	680	680
Actual Parameters					
Pump no		1	2	3	4
Velocity	M/sec				
Diameter	mm				
Flow rate	M ³ /hr	7498	7571	8150	7804
Suction Head	M	-			
Discharge Head	M	29.15	26.15	27.15	25.15
Throttling at Discharge	%	-			
Power	kW	669.4	679.4	692.2	696.2
Differential Head at rated frequency	M	29.15	26.15	27.15	25.15
Pump Efficiency	%	98.00%	88.00%	96.00%	85.00%
Recommended Parameters					
Head	M	30	30	30	30
Flow rate	M ³ /hr	6000	6000	6000	6000
Efficiency	%	94%	84%	92%	81%
Motor Efficiency	%	95%	95%	95%	95%
Power Consumption	kW	551.28	617.66	563.07	638.45
Saving	kW	118.12	61.74	129.13	57.75
	kWh/day/Pump	2834.94	1481.68	3099.16	1385.98



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	kWh/year/Pump	935529.08	488955.13	1022722.36	457374.30
	Rs./year/pump	2806587.25	1466865.38	3068167.07	1372122.89
Cost of Implementation	Rs./pump	500000.00	500000.00	500000.00	500000.00
Pay Back Period	Months	2.14	4.09	1.96	4.37

The erosion of efficiency can be seen. Pumps are operating at wrong duty point

The following steps can be taken to enhance the pump efficiency.

- By corrocoating will retain same efficiency with optimization of duty points.
- The individual pumps may be provided with a variable speed based controller to monitor the flow rate based on the cooling water pressure at the plant. This would provide maximum savings but involved additional investment.

The maximum cost of implementation shall be around Rs. 20, 00,000/-.

The payback period shall maximum be around 2 to 2.5 months.

It may be noted that the savings have been estimated based on the annual operating hours, as mentioned above; which would be greatly be influenced by the actual pump operations.

CALCULATION OF PAYBACK PERIOD AND EFFICIENCY IMPROVEMENT ANALYSIS

SCHEME: Sea Water Pumps 1, 2, 3 & 4

Sr. No.	Suggestions/ Recommendation	Present Efficiency & Power	Achievable Efficiency & Power	Saving in terms of Power & Rs. per Pump	Approx. investment per Pump	Payback Period per Pump
1	Corrocoating of Pump(*)	67 % 510 kW	67 % 433 kW	77 kW 611801 /-	5,00,000/-	2 Months

(*) At present head and flow (6000m³/hr 33 M Head) any three pumps in operation.

Note: we have considered 24 hours x 365 days working with Rs. 3/kWh as energy charges & present flow & head has been assumed for calculation purpose.

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Chapter IV

H P (1A & 1C)

The H P water pumps. This needs about 520 M³/hr flow at 105 M head. However, pumping system is working on lower flow. In process of performance test the actual flow and differential pressure have been measured and efficiency has calculated.

The detail of which is as follows.

Description	Units				
		1	2	3	4
Operations	Hrs/day	24			
	Days/Year	330			
Power Cost	Rs/kWh	3			
Design Parameters					
Make		Worthington	Worthington		
Model		HSC	HSC		
Head	M	105	105		
Flow rate	M ³ /hr	520	520		
Efficiency Pump	%	62%	62%		
Efficiency Motor	%	95%	95%		
Power	bkW	240	240		
Actual Parameters					
Pump no		1A	1C		
Velocity	M/sec				
Diameter	mm				
Flow rate	M ³ /hr	387.4	356.4		
Suction Head	M	-			
Discharge Head	M	109	90		
Throttling at Discharge	%	-			
Power	kW	178	157.2		
Differential Head at rated frequency	M	109	90		
Pump Efficiency	%	71.00%	62.00%		
Recommended Parameters					
Head	M	105	105		
Flow rate	M ³ /hr	520	520		
Efficiency	%	80%	80%		
Motor Efficiency	%	95%	95%		
Power Consumption	kW	195.65	195.65		
Saving	kW	-17.65	-38.45		
	kWh/day/Pump	-139775.60	-304511.60		
	Rs./year/pump	-419326.81	-913534.81		



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Cost of Implementation	Rs./pump	800000.00	800000.00		
Pay Back Period	Months	-22.89	-10.51		

The erosion of efficiency can be seen. Pumps are operating at different duty point

The following steps can be taken to enhance the pump efficiency.

- A set of new pumps, operating at 80% or better **site** efficiency at the **requisite parameters**, should be procured and installed. Savings may not be there as the required parameters are more.
- The individual pumps may be provided with a variable speed based controller to monitor the flow rate based on the cooling water pressure at the plant. This would provide maximum savings but involved additional investment.

The maximum cost of implementation shall be around Rs. 8, 00,000/-.

The payback period shall maximum be around 16 months.

It may be noted that the savings have been estimated based on the annual operating hours, as mentioned above; which would be greatly be influenced by the actual pump operations.

CALCULATION OF PAYBACK PERIOD AND EFFICIENCY IMPROVEMENT ANALYSIS

SCHEME: H P 1A & 1C

Sr. No.	Suggestions/ Recommendation	Present Efficiency & Power	Achievable Efficiency & Power	Saving in terms of Power & Rs. per Pump	Approx. investment per Pump	Payback Period per Pump
1	Replacement of Pump with coating(**)	63 % 167 kW	80 % 195.	(**)		

(*) At present head and flow (387m³/hr 109 M Head)

Note: we have considered 24 hours x 365 days working with Rs. 3/kwH as energy charges & present flow & head has been assumed for calculation purpose.

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(**)At higher flow and head (520 m³/hr 15 M Head)

Note: we have considered 24 hours x 365 days working with Rs. 3.4/kWh as energy charges & present flow & head has been assumed for calculation purpose.

(**) Saving may not take place since different duty pump is selected.

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Chapter-V

Raw Water Pumps (1, 2 & 3)

The Raw water pumps. This needs about 250 M³/hr flow at 15 M head.

In process of performance test the actual flow and differential pressure have been measured and efficiency has calculated. The detail of which is as follows.

Description	Units			
		1	2	3
Operations	Hrs/day	24		
	Days/Year	330		
Power Cost	Rs/kWh	3		
Design Parameters				
Make		Kishor	Kishor	Kishor
Model		CVE/100-250	CVE/100-250	CVE/100-250
Head	M	15	15	15
Flow rate	M ³ /hr	125	125	125
Efficiency Pump	%	54%	54%	54%
Efficiency Motor	%	95%	95%	95%
Power	bkW	9.3	9.3	9.3
Actual Parameters				
	Pump no	1	2	3
Velocity	M/sec			
Diameter	mm			
Flow rate	M ³ /hr	146.9	131	141
Suction Head	M	-		
Discharge Head	M	10	10	10
Throttling at Discharge	%	-		
Power	kW	10.4	9.7	10.4
Differential Head at rated frequency	M	10	10	10
Pump Efficiency	%	44.99%	43.02%	43.18%
Recommended Parameters				
Head	M	15	15	15
Flow rate	M ³ /hr	125	125	125
Efficiency	%	80%	80%	80%
Motor Efficiency	%	95%	95%	95%
Power Consumption	kW	6.72	6.72	6.72
Saving	kW	3.68	2.98	3.68



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	kWh/day/Pump	88.35	71.55	88.35	
	kWh/year/Pump	29155.93	23611.93	29155.93	
	Rs./year/pump	87467.78	70835.78	87467.78	
Cost of Implementation	Rs./pump	250000.00	250000.00	250000.00	
Pay Back Period	Months	34.30	42.35	34.30	

The head is down of the pump shows clear-cut mark of heavy erosion. In a longer process the efficiency will keep on dropping causing further worries. The savings has been worked out with higher

The following steps can be taken to enhance the pump efficiency.

- A set of new pumps, operating at 80% or better *site* efficiency at the *requisite parameters*, should be procured and installed.
- The individual pumps may be provided with a variable speed based controller to monitor the flow rate based on the cooling water pressure at the plant. This would provide maximum savings but involved additional investment.

The maximum cost of implementation shall be around Rs 7, 50,000/-.

The payback period shall maximum be around 36 months.

It may be noted that the savings have been estimated based on the annual operating hours, as mentioned above; which would be greatly be influenced by the actual pump operations.

CALCULATION OF PAYBACK PERIOD AND EFFICIENCY IMPROVEMENT ANALYSIS

SCHEME: Raw Water Pumps 1,2 & 3

Sr. No.	Suggestions/ Recommendation	Present Efficiency & Power	Achievable Efficiency & Power	Saving in terms of Power & Rs. per Pump	Approx. investment per Pump	Payback Period per Pump
1	Replacement of pump assembly with corrocoating. . (*)	39 % 10 kW	80 % 6.71kW	3.44 kW 27307/-	2,50,000/-	36 months

(*) At present head and flow (139 m3/hr 10 M Head), any two pumps in operation.



Note: we have considered 24 hours x 365 days working with Rs. 3/kwH as energy charges & present flow & head has been assumed for calculation purpose.

Additional Potential Saving Areas

The following potential saving areas have been identified for further exploration.

- Optimizing the system pressure requirements.
- Complete heat recovery from flue gases.
- Minimizing idle running of the furnaces.
- Replacing steam jet vacuum system with mechanical vacuum system.



CONCLUSION

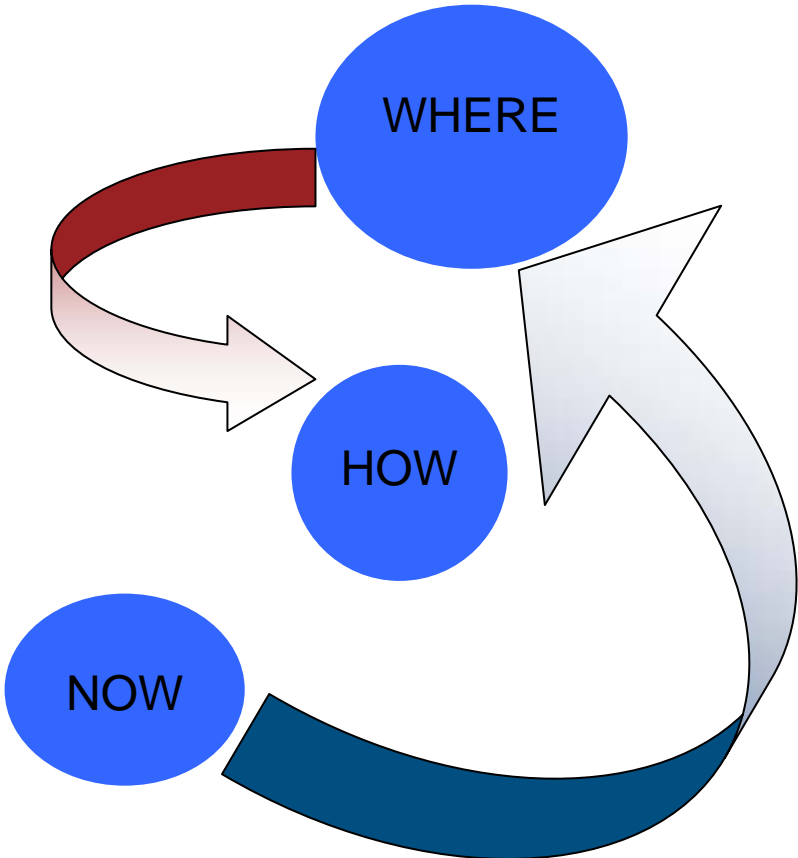
The work of carrying out above changes will require technical input of great extent to arrive at the desired energy saving. Since numbers of pumps are running in parallel, a change in one pumps affect the total system. Additionally the mere component replacement may not help as a system requirement has gone lot of change than the original designed one.

Again the results arrived above are based on the measured parameters and honest assessment of data which may change depending upon the condition of the components / material. For eg. During assembly and dismantling of the pump many a times we are required to replace bearing which becomes additional activity.

As cleared above at all the places earlier designed head and present head is different. Hence replacement of recommended part supported by refurbishment of tongue portion or altogether a different pump assembly closely resembling to match the present duty parameters will be very much essential.

Head and Power of the system has been worst affected. This is mainly due to wear / tear of the parts hence it is strongly recommended to provide effective protection against these.

Trend setting project



Annexure- E

1. Installation of Variable frequency Drive for Condensate Extraction Pump

Background

The condensate extraction pump (CEP) is the one of the major energy utilizing equipment in the thermal power plant. The CEP is the multistage pump delivering water from the hot well to the dearator through the various heaters and coolers. A three element control station is in operation for controlling the quantity of condensate flow.

Observation

During energy audit it was observed that the control valve is severely throttled and open for around 67-68% only. This valve throttling leads to pressure loss and energy loss.

Technical and Financial analysis

As almost 6-7 kg/cm² pressure is drop across the control valve, it offers good scope for the application of variable frequency drive for the pump. However, due to Medium voltage high power motor, it was a challenging task to retrofit the suitable VFD.

Impact of implementation

After installing the MV VFD, the cost-benefit analysis was as below.

Energy saving of CEP-2A with 100% Valve open position when VFD in service.

- Without VFD application : **590 KW**
- With VFD application : **440 KW**
- Net energy saving due to VFD application: **150 KW**
- Energy savings per year : 3600 units X 350 days = **1260000 units**
- Estimated energy savings per year : 1260000Units X Rs.2 per unit = **Rs4410000/-**
- Cost of VFD : **Rs.75.00 Lakhs / unit**
- Payback period = **21 months**



2. Installation of Variable frequency Drive for Seal air fan

Background

The Seal air fan is used for providing sealing of Mills, classifier gates and feeders. There are six mill and each mill have two seal air fan out of which one fan remains in service and other remains as hot standby. One running seal air fan motor draws approximately 120 KW power.

Observation

The existing control used for the matching of fan requirement with the system requirement is by damper control. Generally the header pressure requirement is 800-1000mmWC and the fans generate 1350mmWC of pressure. The loss taking place across the damper is major source of energy wastage.

Technical and Financial analysis

It was concluded that the loss taking place across the damper is the major source of energy wastage. Hence decision was taken to install the variable frequency drive for the fan.

Impact of implementation

- Energy saving of SAF with 100% Damper open position when VFD in service.
- Without VFD application : **122 KW**
- With VFD application : **58 KW**
- Net energy saving due to VFD application: **64 KW**
- Energy savings per year : **6144 units X 350 days = 2150400 units**
- Estimated energy savings per year : **2150400Units X Rs.2 per unit = Rs4300800/-**
- Cost of VFD : **Rs.30.5 Lakhs /- per unit**
- Payback period = **10 months**



3. Installation of Variable frequency drive for Dry ash silo vent fan

Background

The ash collected in the ESP is stored in a buffer silo and then passes through a classifier where the coarse material is separated and stored in a coarse ash fly ash silo. The fine ash passes through the bag filter and it is collected in the fine fly ash silo. Air is vented through the vent fan.

Observation

A damper provided at the suction side of one fan controls the flow of air through the mill. The damper is about 20-25% open. The present head requirement from the fan is 380mmwc as compared to the design head rating of 510mmwc. This indicates a significant amount of pressure drop across the damper.

Technical and Financial analysis

The damper control in fan is a very inefficient method of capacity control as a part of energy supply to the fan is lost across the damper and the most efficient method is to change the speed of the fan according to the requirement of capacity through the variable frequency drive.

Impact of implementation

- Energy saving of Vent air fan with 100% Damper open position when VFD in service.
- Without VFD application : **69 KW**
- With VFD application : **42 KW**
- Net energy saving due to VFD application: **27 KW**
- Energy savings per year : **648 units X 350 days = 226800 units**
- Estimated energy savings per year : **226800 Units X Rs.2 per unit = Rs453600/-**
- Cost of VFD : **Rs.6.5 Lakhs /- per unit**
- Payback period = **18 months**



4. Six sigma project on the reduction of tripping of CW pump

Background

One of the major auxiliary of the DTPS is the Circulating water pump located at around 1.8 Km from the turbine buildings. There are four CWPP pumps which cater the cooling water demand for the entire station. Any tripping of this may directly lead to generation loss

Observation

It has been observed that whenever any CW pump trips, the vacuum level drops and it is required to back down the generation. At the same loss of supply to all pumps simultaneous will leads to total loss of 500MW. Hence it is of paramount important to have a reliable supply system for the CW pumps. A six sigma project was undertaken to enhance the availability and reliability of CWPP supply system.

Technical and Financial analysis

After detail study of the CW Pump supply system. a bus transfer system is install to provide the uninterrupted supply to the CW Pump even if one of the supply fails. With the help of this automatic bus transfer system the power is extended automatically in case of one source tripping and hence the loss of generation is avoided.

Impact of implementation

- Cost of Bus transfer system =37 lakhs
- Revenue loss due to one tripping of station = Rs.58.5 lakhs

Recently at two occasions, in case of failure CWPP supply source, the successful operation of the Bus transfer system has prevented the tripping of CW Pump and in turns prevents the revenue loss.



5. Optimizing the supply voltage for the lighting system

Background

In large thermal power plant, considerable amount of electrical energy is utilized by the lighting system. The optimization of the voltage for the lighting system not only will reduce the energy saving but also reduces the failure rate of lamps and luminaries.

Observation

During the lighting audit of entire electrical system the voltage profile of each switchgear was measured and recorded. It was quite evident that the lighting voltage is as high as 250V in some of the substation and offer good scope for energy saving.

Technical and Financial analysis

M/S ERDA suggested lowering down lighting system voltage close to 230 V and indicated saving of Rs 5.98 lakh .This was achieved this by reducing the tap of the unit and service auxiliary transformers. The lighting system voltage reduces to 220V to 230V.While doing this it was also keep track of required illumination for different locations as per IS 6665.

Impact of implementation

With the reduction in lighting voltage by changing the tap of the lighting transformer, annual saving of Rs.5.98 lakh has been achieved.

6. Provision of redundant arrangement for water supply to refractory cooling header

Background

At DTPS, Bottom Ash Hopper below the boiler is lined with Castable Monolithic Refractory Fire Crete IS 8:1984. Presently the sea water for refractory lining cooling/maintaining bottom ash overflow is pumped by 2 out of 3(per unit one) low pressure pumps at AHP pump house.

Observation

There was no provision of water supply to refractory cooling header in case of non availability of all LP pumps during desilting of LP sump or due to unplanned maintenance. Non availability of water supply causes damage to refractory lining of bottom ash hopper due to zero flow of water.

Technical & Financial analysis

For redundant supply, a tapping was provided to the refractory cooling header along with an isolating valve / reducer & provision was made for a flexible hose with adaptor for hydrant nozzle.

This ensures continuous supply of water for refractory cooling & to maintain Bottom ash hopper overflow in all conditions.

Consequently system reliability/availability is enhanced.

Impact of Implementation

Alternate arrangement for refractory cooling available in all conditions.

Consequently system reliability/availability is enhanced.

Savings of @1.5 lacs will be achieved as refractory lining life expectancy increases.

7. Provision of emergency make up line for HP/LP sump from fire hydrant header.

Background

At DTPS, sea water coming from tapping taken from condenser outlet line is used for ash disposal system. This sea water is pumped by High pressure pumps from HP/LP sump.

Observation

This sea water intake line is rerouted as it was fouling the FGD structure. In the process it was elevated at two locations than the original line causing air trapping. This led to no supply of water for ash disposal. Hence system was frequently started & stopped. This hampered the deashing cycle.

Technical & Financial analysis

An emergency water supply line from fire hydrant line header was provided to HP/LP sump with proper isolation.

In case of no water supply from main intake line, emergency supply line is to be opened to make up the HP/LP sump level & thus pump will be in running condition.

Impact of Implementation

Provision of redundant supply of water for sump will ensure continuous running of HP pumps avoiding frequent start /stop.

The deashing cycle will not be hampered due to unavailability of supply of water for deashing.

Reliability & availability increased due to redundant supply of water.

Savings of @2.0 lacs will be achieved as frequent start/stop cycles of HP pumps will be reduced. Also mechanical failures will be reduced.

8. Refurbishment of inner casing of Ash disposal pump

Background

Ash disposal pumps for wet ash handling system centrifugal pumps with Ni-hard impeller and inner casing with cast iron outer shell. Due to highly erosive nature of ash & corrosiveness of sea water, heavy erosion of pump internals is observed.

Observation

It was observed that the inner casing and impeller made of special alloy steel are to be scraped as this causes frequent leakages. Major areas of erosion were mating face of inner casing, impeller vanes, etc.

Technical & Financial analysis

Inner Casing mating faces damaged area was initially welded with special alloy electrode & then coated with hard facing electrodes. Same mating face was grinded to have better surface finishing.

This spare which otherwise would have been scraped was reconditioned & reused.

Impact of Implementation

Cost savings @1.0 Lacs per casing due to salvaging/reconditioning.

Resource conservation as used spare is reconditioned for reuse.

9. Running of Double Roll crusher with one drive unit

Background

The Double roll crusher is used in coal handling plant to crush the big size coal into small size in order to facilitate the transportation of coal. The coal is then passes through conveyer to the bunker and feed to the boiler.

Observation

There are two double roll crushers available in the Coal handling plant and depending upon the incoming feeding of raw coal the DRC is running however it was observed that in case of good quality crushed coal, there is idle running of the DRC which is loss of energy.

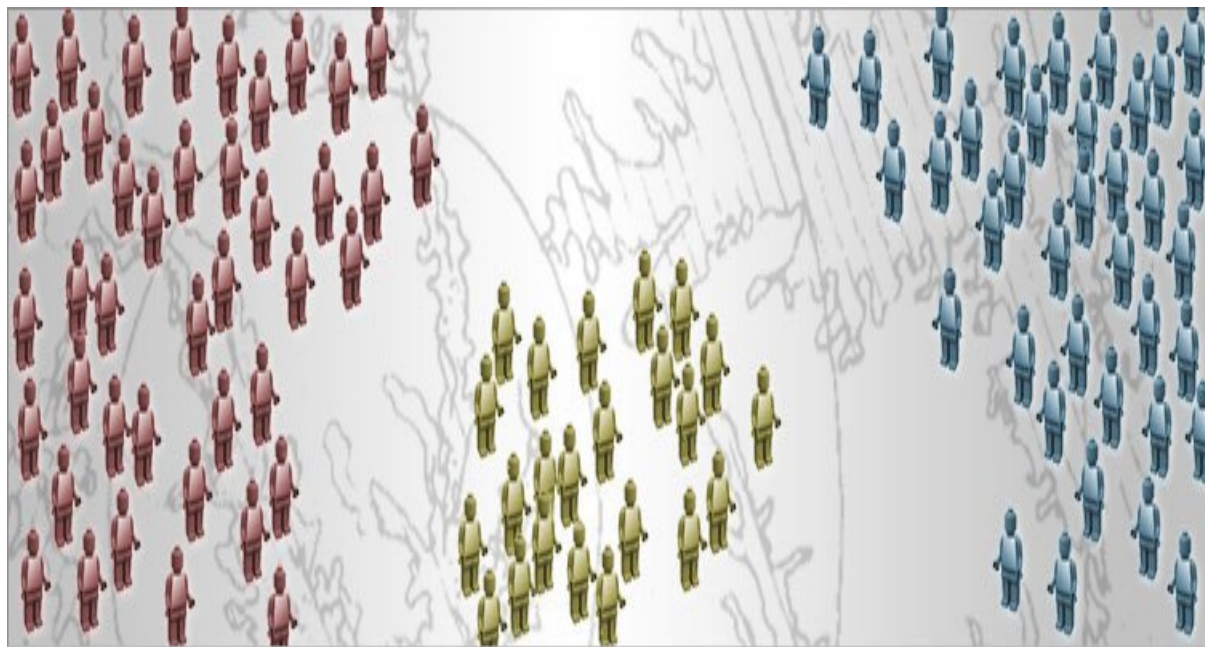
Technical & Financial analysis

After detail study, it was decided to run the DRC only with one drive and keep the other drive as standby and regular changeover schedule is made to maintain the healthiness of the drive. This optimization has lead to saving in auxiliary [power consumption.

Impact of Implementation

The energy consumed with one drive is 30.55 KW
Energy saving /year =Rs.3.464 Lakhs without any investment.

Major innovation project



Section: F - Innovative Project

Reduction in cycle time for shutdown and Start-up operations of unit

1. Introduction

Reliance Energy is India's largest integrated private sector power utility company. The company is into generation, transmission, distribution and trading of power. It distributes over 5,000 MW of power - the largest in the country. Reliance Energy has a consumer base of 25 millions in Mumbai, Delhi and Orissa. It generates 941 MW of electricity, through its power stations located in Maharashtra, Andhra Pradesh, Kerala, Karnataka and Goa.

Dahanu TPS is Reliance Energy Ltd's single largest power generating facility. It is a 500 MW (2 X 250 MW) coal based thermal power station situated approximately 120 kms, from Mumbai on the western seacoast. The power generated at Dahanu TPS is fully absorbed by Mumbai against the demand of 2000 MW; else power is purchased at higher price. To provide economical and uninterrupted power to customers the reliability of power generation at Dahanu is highly critical.

DTPS is the first utility to be certified as ISO 9001 for its Quality Management System and ISO 14001 for its Environment Management System. The plant is also accredited with OHSAS - 18001 certification for its Occupational Health and Safety management & SA – 8000 certificate for Social Accountability & also implemented Integrated Management System in 2007-2008

These practices have resulted in present level of performance, which has been benchmark for others; appreciated and awarded by national and international agencies like CEA, CII, MEDA,

2. Process Overview

Today electricity is one of the most basic needs. And consumers demand that electricity must be available 24 X 7. The scenario in power sector is changing day by day. Competition is being introduced in monopolistic environment. Consumers will become more and more demanding and also they will have a choice to select a supplier. Hence, Innovation requires to improve availability / reliability of power station.

However there are instances when a power unit becomes unavailable for supplying the consumers. Such instances cannot be forecasted. Present technology in Indian Power sector is not capable of eliminating this type of outages. If such an outage happens during high demand period, it may even affect the stability of regional power system also. Hence the aim of O & M section of power station is to reduce percentage share of unplanned non-availability to the extent possible.

To minimize such events DTSPS has initiated projects to improve reliability and availability of units one of the project is Reduction in cycle time of Start up and Shutdown operations of Units.

Shut down cycle: When this type of outage happens, the maintenance section has to repaired this fault as quickly as possible for which the boiler, which produces steam at 1000oc needs to be cooled quickly .In fact till boiler is cooled maintenance work can not be started, so this ideal period in which there is no generation as well as no maintenance. This is shut down process; hence longer the shutdown process longer is non-availability of units.

Start up cycle: After rectifying the fault by maintenance Department. unit Startup process starts in sequential manner in which there are many activities like startup of equipments, achieving steam parameter admission of steam in turbine raising of Generator speed, and synchronization of Unit (Generation starts) & achieving 100% capacity. This whole process is called as Startup process.

Both these process involves lot of manual operation in control room as well as equipment locations. Layout of typical power station has equipments spread over large area like up to 3KM away and at 56Meter heights. The operations are carried out in coordination by the local operators, helpers, plant control room engineers, shift in charge engineer and support maintenance staff.

This requires a concentrated and co-coordinated effort from the O & M section.

In last eight years of operation DTSPS has concentrated on reducing the downtime of Units in case of forced withdrawal of Units. By deploying best practices in the power industry it could achieve Start-up & Shutdown time which has become a benchmark for others. In its journey towards excellence, DTSPS decided to further improve its performance by taking this project.

3. Objectives

Cycle time for shutdown process varies from 11 hours to 19 hours with average of 15 hours and for start-up process it is between 7 to 13 hours with average of 10 hours.

In case of forced outages startup & shutdown cycle time was 34% to 84% (Average 52%) of total down time. This variation leads to unpredictability in availability of Unit and thereby generation loss with mismatch between demand and supply of electricity. The mismatch between the demand and supply has to be filled with purchase of electricity at higher tariff from external source.

Thus the main objective of the project is to provide economical and reliable power to the costumers as long as possible.

4. Approach

A cross functional team is formed and Systematic, robust and structural approach of Six sigma - DMAIC is used for implementing this project.

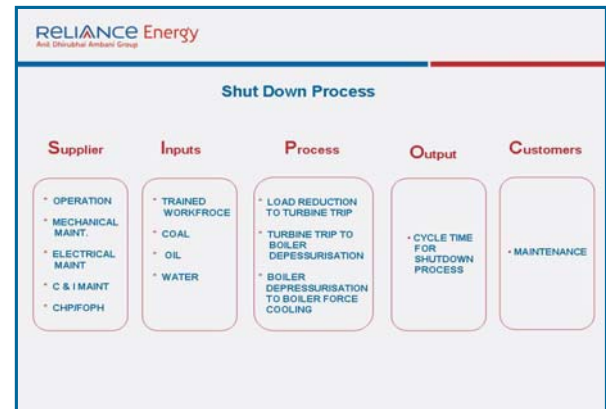
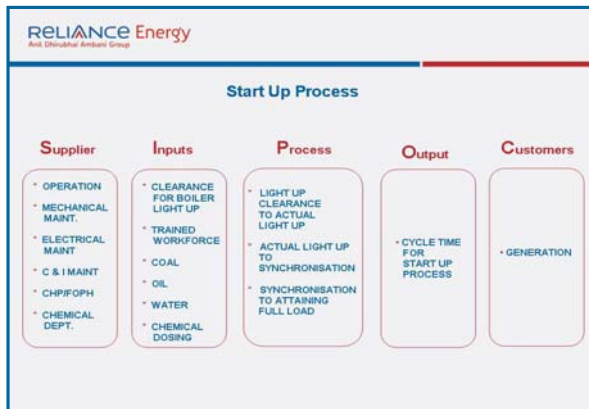
DMAIC	Define	28-10-2005 to 27-11-2005
	Measure	28-11-2005 to 27-12-2005
	Analyze	28-12-2005 to 30-01-2006
	Improve	31-01-2006 to 27-02-2006
	Control	28-02-2006 to 30-04-2006

Brainstorming sessions with all levels of process operators / engineers are conducted for identification of process pain, problems / root causes, probable solutions and comfort / training need for implementation of the solutions finalized.

4.1 Define

In define phase pain and problem statement is prepared, high level process map laid down separately for Start up and Shutdown process. Data is collected from ISO documents to find out critical to Quality characteristics (CTQ) i.e. Startup and Shutdown time.

High Level Mapping Of Process



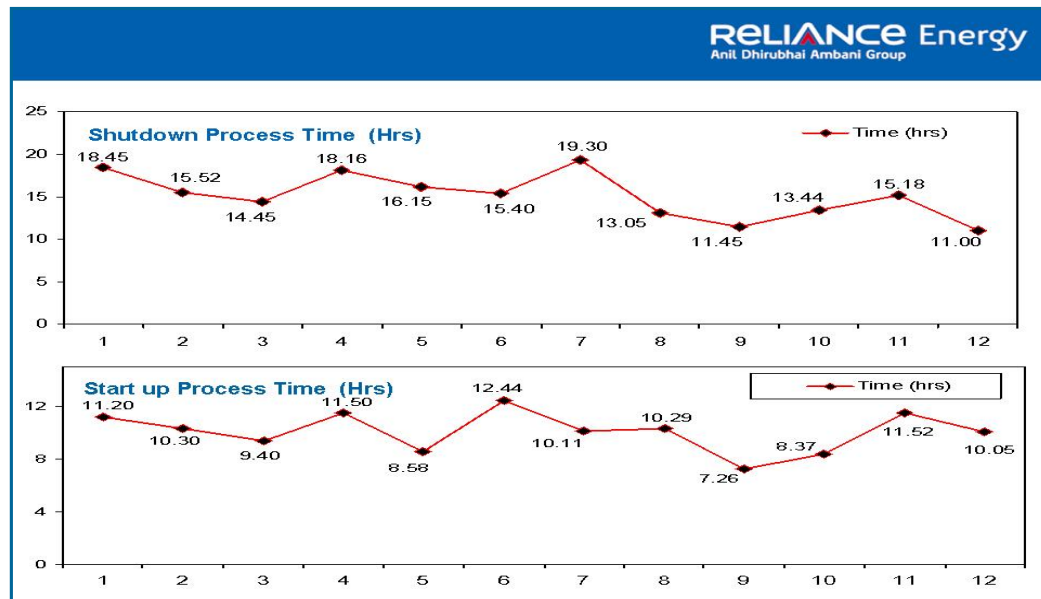
The project objective and is finalized with measurables

Project Objective

To reduce cycle time by 30 % for shutdown & start-up process in case of forced outage of unit.

Cycle time for Shutdown process is to be reduced to average 11 hours from 15 hrs

Cycle time for Start-up process is to be reduced to average 7 hours from 10 hrs



4.2 Measure

In measure phase detail AS IS process map is prepared, present process capability and Cost of Poor Quality calculated and target is set.

AS IS process map is prepared with the process operators involved and the team

The process is divided into five sub process for further analysis

- Load reduction to Turbine trip.
- Turbine trip to Boiler de-pressurization.
- Boiler de pressurisation to boiler force cooling.
- Maintenance clearance to unit synchronization.
- Unit synchronization to full load 250 MW.

The validated data for each startup and shutdown time is collected from ISO Documents and the ERP packages to calculate the present process capability and to set target for the project.

Measurement of Process Capability

Startup time

Current average cycle time	– 10 hours
Best cycle time so far	– 7 hours
Target is to bring average cycle time to best	– 7 hours
Current sigma level =0,	Target sigma level= 3 sigma

Shut down time

Current Average cycle time	– 15 hours
Best cycle time so far	– 11 hours
Target is to bring average cycle time to best	– 11 hours
Current sigma level =0,	Target sigma level= 3 sigma

Calculation of Cost of Poor Quality

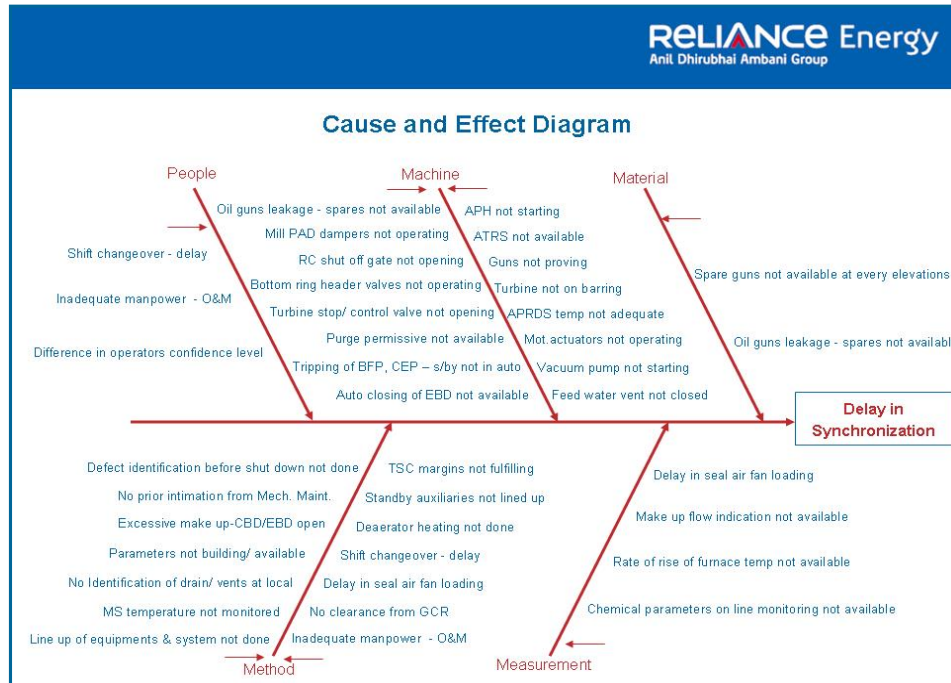
- Reduction in cycle time will improve, Station availability by **16 hours**, Effective generation by **8 Mu's** & Revenue by 28 Million rupees
- In addition to above there will be saving in oil consumption by 60 KL and reduction in aux. power and DM water consumption.

4.3 Analyze

In analyze phase the potential causes for the delay in the Startup and Shutdown operations has be identified from the ISO documents, Plant Management System, Digitally Generated reports from year 2002.

To identify further potential causes of the delay in the process, Brainstorming session with all levels of process people conducted, possible causes identified, similar causes grouped together and Cause and Effect Diagram prepared.

Cause & Effect Diagram



Total 107 potential causes are identified.

The potential causes are grouped in three categories –

- Direct improvement causes
- Controllable Causes
- Non controllable causes

Failure Mode and Effect Analysis (FMEA) carried out for all Controllable & Direct Improvement causes and causes with high risk priority numbers are identified for further improvement.

Prioritized Root causes for the delay in Startup & Shutdown operations are

- HEA not proving
- IFM not proving
- Gun not proving
- Purge permissive not available
- Silica restriction

- Manual valves not operating
- Motorized valves not operating

4.4 Improve

In improve phase the probable solutions for the potential causes are identified.

To prepare counteractions for the prioritized potential causes Brainstorming sessions with the Operation and Maintenance people from all level conducted. Techno – commercial feasibility of the solutions studied and the counteractions for the Prioritized Root causes finalized

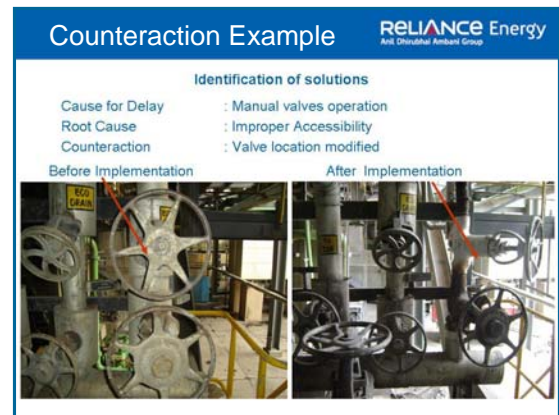
The Counteraction/ Solutions identified are implemented through the work request through ERP package, the responsibility assigned to the respective process owners and time frame is finalized.

To validate the counteractions prepared Failure Mode and Effect Analysis carried out for each identified counteractions after the solutions implemented.

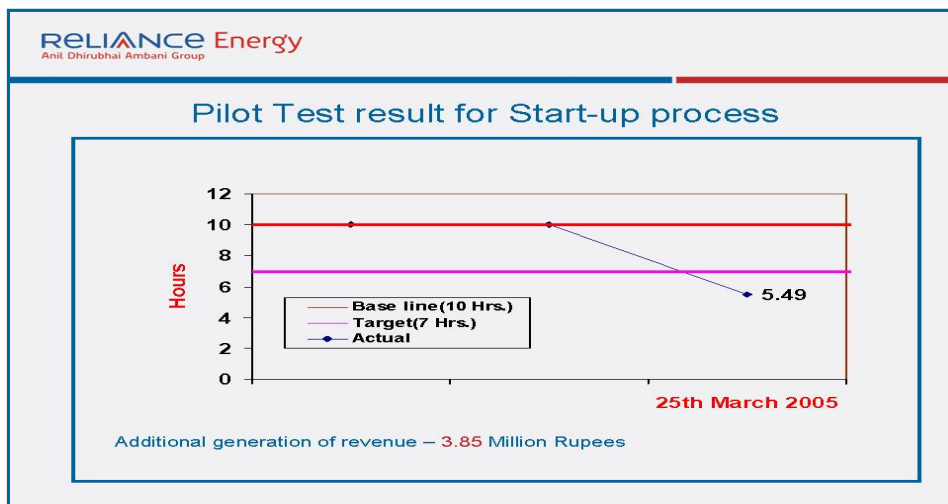
Counteraction implemented for the pilot test is

- Use of New checklist
- Use of RIM
- Modification for purge cycle
- Change in operation philosophy of CPU

With no major investment



The Pilot test is conducted after implementation of the solutions and the results are as below



4.5 Control

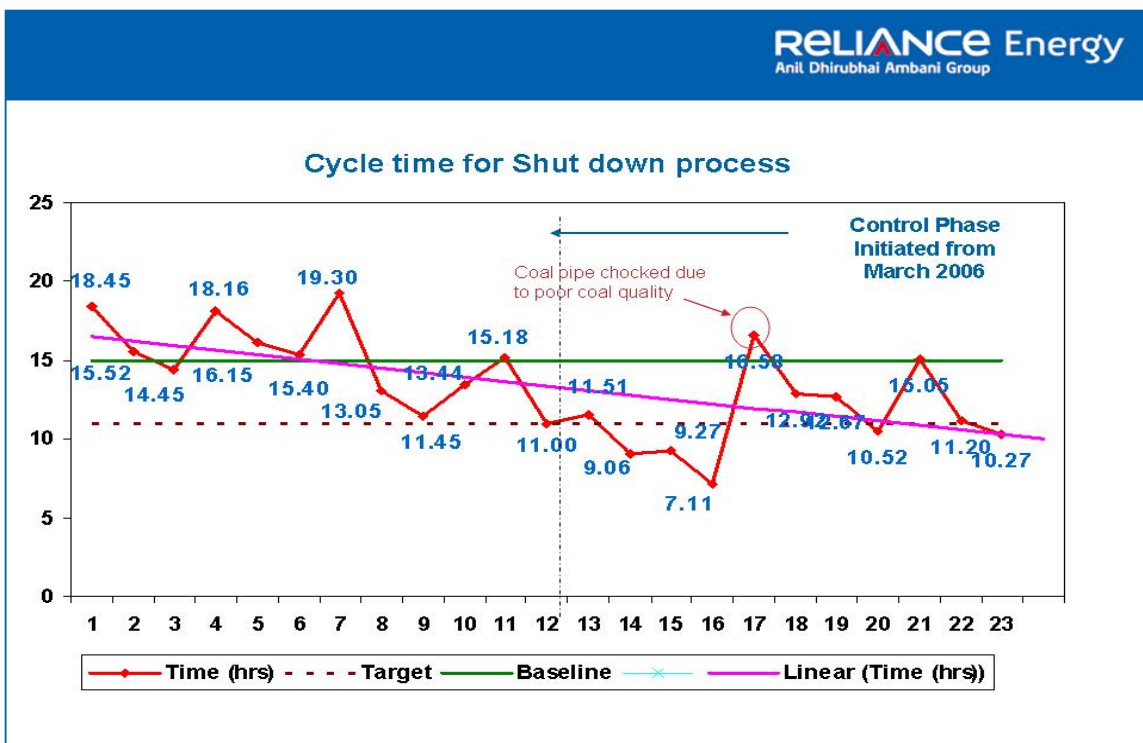
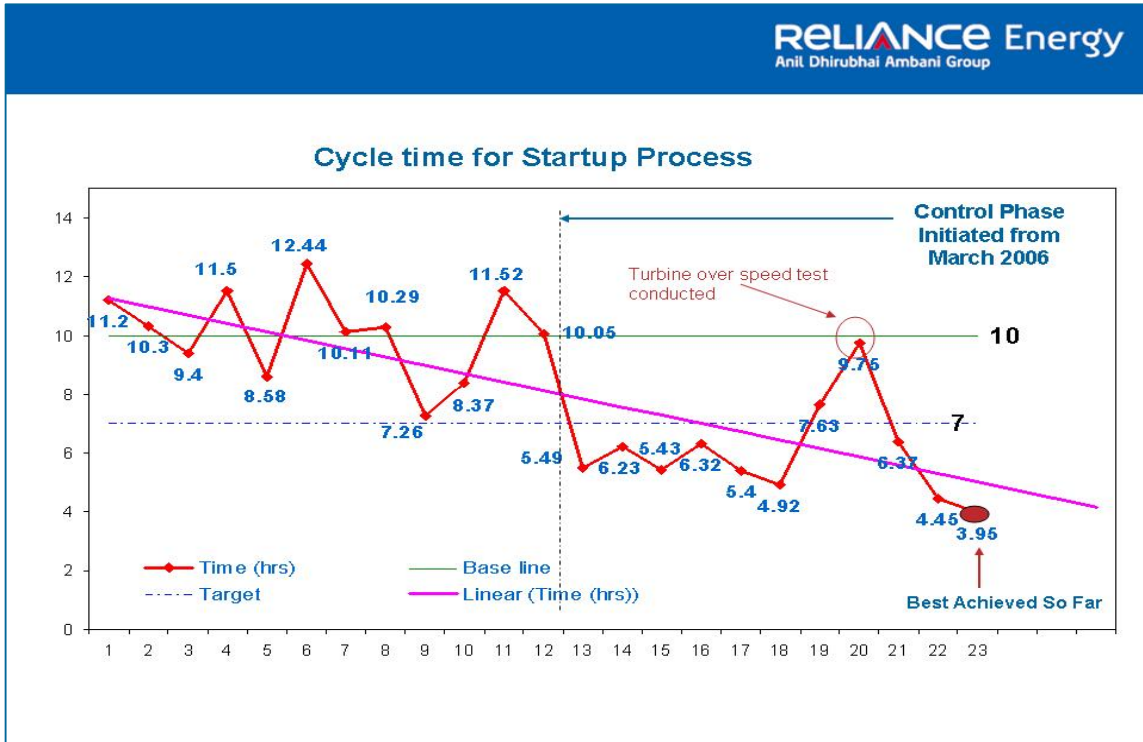
Based on the results of the pilot test to make the gain irreversible the solutions are implemented through the Quality Management System

- Quality Improvement plans – 09 nos
- Standard operation procedure record format - check list 07 nos

Sr No	Counteraction	Responsibility	Plan
1	Replacement of IFM by HEA	Manager (C&I)	Quality Improvement plan
2	Provision of IA instead of SA for oil atomization	Manager (Mechanical)	Quality Improvement plan
3	Two second time delay to be added in purge permissive during purging for flame/no flame status	Manager (C&I)	Quality Improvement plan
4	Parallel operation of Fill pump	Manager (Mechanical)	Quality Improvement plan
5	Relocation of some of the valves	Manager (Mechanical)	Quality Improvement plan
6	Provision of Seal Air Fan current in PMS	Manager (Electrical)	Quality Improvement plan
7	Limit switch & F/B of BD isolating valve	Manager (C&I)	Quality Improvement plan
8	Existing lighting at MAL floor to be replaced by better quality lighting	Manager (Electrical)	Quality Improvement plan
9	Improved communication through RIM	Manager (C&I)	Implemented
10	Checklists for Mechanical / C&I / Operation department - 07	Manager (Mechanical ,C&I, Operation)	ISO 9001

Quality Improvement Plans and Record Format in form of Check List are standard procedures followed by REL – DTSP under ISO system.

5. Results



6. Benefits

There are total 11 incidents of the Startup time less than 10 hours of the average which increase the availability of generating unit by 44.06 hours

Considering one hour average generation = 0.25 Million units

Total increase in generation = $44.06 * 0.25 = 11.05$ Million units
Increase in revenue collection = $11.05 * 3.5 \text{ Rs/unit} * 10^6$
= Rs 38.6 Millions (cumulative)

There are total 09 incidents of the Shutdown time less than 15 hours of the average which increase the availability of generating unit by 40.98 hours

Total increase in generation = $40.98 * 0.25 = 10.24$ Million units
Increase in revenue collection = $10.24 * 3.5 \text{ Rs/unit} * 10^6$
= Rs 35.8 Millions (cumulative)

With above benefits there is reduction in oil consumption required for startup and shutdown process by 4 kL/hour which will save oil required by = $85 * 4 = 340$ kL
Revenue saved is $340 * 28000 = \text{Rs } 9.52$ Millions

The Tangible benefits of the Project are increase in Availability of the units by 85 hours which will able to generate 21.29 Million units of electricity with the same capacity of Unit.

In addition to above benefits there are other benefits like

- Reduction in Auxiliary power consumption
- Reduction in DM water makeup requirement
- Reduction in noise level

7. Conclusion

- The improvements can be easily implemented in all over power industries.
- This will result in reduction of down time of approximately six hours for coal based thermal units.
- Considering around 400 units; the total improvement in availability of electricity by 340000 hrs without any capacity addition and conservation of the Oil required for Startup and Shutdown of the Coal based thermal units.
- Considering present scenario of power sector, this is huge benefit.
- The approach adopted by DTSPS can be easily emulated by other power plants and customized solutions can be identified.