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Energy audit report of M/s Kudale Iron Works Unit-2, Belgaum

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It is well worthy to mention that the efforts being taken and the enthusiasm shown by all the plant personnel towards energy conservation and sustainable growth was really admirable. We found all the personnel keen to implement the possible energy conservation aspects.

Last but not least, the interactions and deliberations with cluster coordinating agencies, industry associations, technology providers and who were directly or indirectly involved throughout the study were exemplary and the whole exercise was thoroughly a rewarding experience for TERI.

The Energy and Resources Institute (TERI)
New Delhi

Executive summary

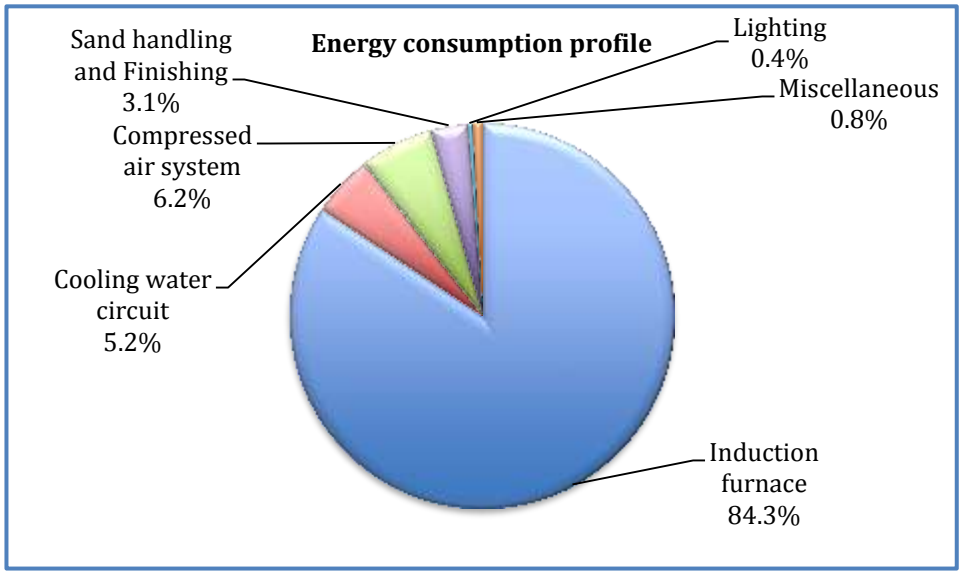
A detailed energy audit at M/s Kudale Iron Works Unit-2 was conducted to identify the potential of energy savings. This report provides details of energy audit such as areas covered under the study, performance assessment of different equipment, potential areas for energy saving and estimated energy and cost savings along with investment required and payback periods. It provides insights to the plant for proper planning of investments on energy conservation recommendations.

Brief Introduction of the foundry unit

Name of the Unit	M/s Kudale Iron Works Unit-2
No. of years in operation	06
Factory address	Machhe Industrial Estate, Machhe Belgaum – 590 014
Type of industry	Graded Cast Iron castings
Products Manufactured	Machine tools
Hours of operation per day	12
Number of days of operation per year	300
Energy used	Electricity

A detailed performance study was undertaken in the identified areas with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The total energy consumption of the unit during FY 2014 – 15 was 81.8 toe (951,000 kWh) which is equivalent to 65.2 lakh rupees. The total CO_2 emission during this period is estimated to be 932 tonnes. Electricity was considered for CO_2 emission estimation.

The main source of the energy consumption in the plant is electricity used in induction melting furnace and to drive the process equipment and other auxiliaries, various utilities.



The unit manufactures ductile iron and graded CI castings which include gears and machine tools and supplies to various industries. The unit uses green sand and CO_2 sand moulding process. The total liquid

melting production of the unit during 2014 – 15 was 1,451 tonnes and dispatched production was 921 tonnes. The plant has an installed capacity of 250 tonnes per month. With respect to production in financial year 2014 – 15 the capacity utilization factor for the unit is 48%. The net yield of unit is around 62%.

The energy consumption in the plant is mainly for following: induction furnace, cooling water circuit, compressed air system, sand handling and finishing, lighting and miscellaneous. A pie chart depicting share of each area/section is given in figure.

Summary of energy conservation measures identified in unit

Key recommendations made in this energy audit report are summarised below.

S. No	Energy conservation measures	Annual energy savings Electricity (kWh)	Investment (Rs Lakh)	Savings Rs. Lakh/ year	Simple payback year
1	Power factor improvement	510	0.44	0.43	1.0
2	Lid mechanism for induction furnace	14,437	2.00	0.88	2.3
3	Avoiding leakages in compressed air system and reducing pressure setting	3,842	-	0.23	-
4	Retrofit the air compressor with variable frequency drive	27,049	1.20	1.64	0.7
5	Replacement of coil cooling pump of induction furnace	2,382	0.55	0.14	3.8
6	Replacement of raw water pump of induction furnace	7,973	0.55	0.48	1.1
7	Installation of timer for shot blast machine	1,305	0.05	0.08	0.6
8	Replacement of existing lighting system with energy efficient lighting system	1,563	0.25	0.09	2.7
	Overall	**59,060**	**5.04**	**3.98**	**1.3**

Total nine energy conservation measures are identified. Implementing then would attract a one-time investment of Rs 5.04 lakh; it would lead to annual savings of Rs 3.98 lakh. This would result in reduction in energy consumption by 6.7%. The specific energy consumption of entire foundry would improve from 1,089 kWh per tonne to 1,016 kWh per tonne.

1.0 Production and energy consumption

1.1 Introduction

M/s Kudale Iron Works Unit 2 is a graded CI casting unit set up in 2010. The unit manufactures ductile iron and graded CI castings which include gears and machine tools and supplies to various Industries. The unit has an installed capacity of 200 tonnes per month. Brief summary of unit is given in table 1.1.

Table 1.1: Brief description of unit

Name of the Unit	M/s Kudale Iron Works Unit-2
No. of years in operation	06
Factory address	Machhe Industrial Estate, Machhe Belgaum – 590 014
Type of industry	Graded Cast Iron castings
Products Manufactured	Machine tools
Hours of operation per day	12
Number of days of operation per year	300
Energy used	Electricity

1.2 Process flow diagram

The major steps of process are mould sand preparation, charge preparation followed by melting, pouring, knockout and finishing. The unit uses green sand moulding process. The process flow diagram is shows in figure 1.2.

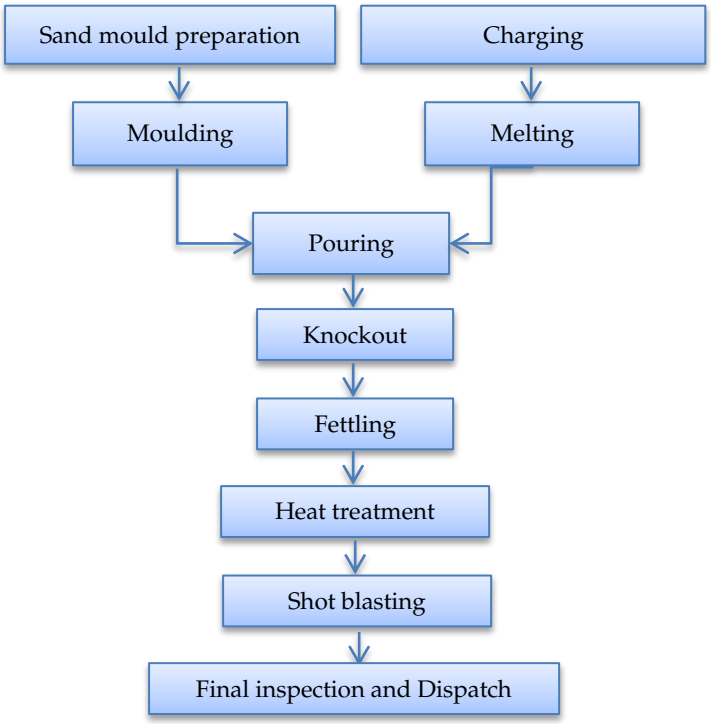


Figure 1.2: Process flow chart

1.3 Production and energy cost

The energy and production data for available period was taken from the unit for the analysis. The total liquid melting production of the unit during 2014–15 was 1,185 tonnes and dispatched production was 815 tonnes. The overall energy cost incurred for this production was 60.01 lakh rupees. Figure 1.3 refers the monthly production and energy cost profile of the unit.

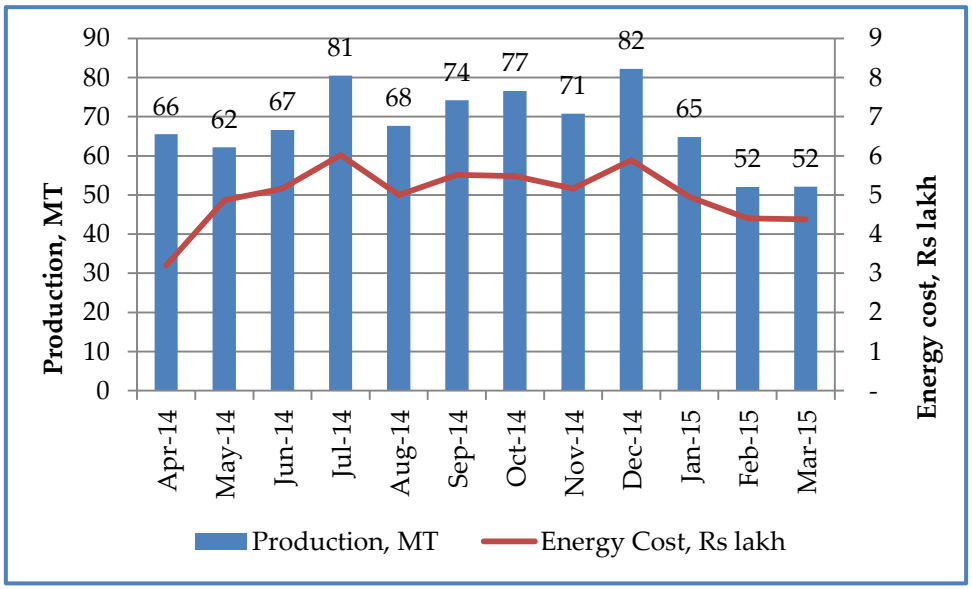


Figure 1.3: Production and energy cost profile

1.4 Energy sources availability and tariff details

Availability of listed energy types as above and their respective tariffs are given in table 1.4.

Table 1.4: Energy sources, availability and tariffs

S No	Energy source	Availability	Tariff details
1	Electricity	Supplied by HESCOM	Tariff category: HT-2(a) Voltage of supply: 11 kV Demand charges: Rs 170/kVA Energy charges: Rs 5.7/kWh (up-to 100,000 units) Rs 6.0/kWh (beyond 100,000 units) Time of day charges: 2200-0600: Rs -1.25/kWh 0600-1800: Rs 0.00/kWh 1800-2200: Rs +1.00/kWh PF penalty charges: For every 0.01 drop below 0.90, penalty Rs 0.03/kWh

1.5 Energy consumption

The total energy consumption of the unit during FY 2014 – 15 was 76.3 toe (887,576 kWh) which is equivalent to 60.01 lakh rupees. The total CO_2 emission during this period is estimated to be 870 tonnes. Electricity was considered for CO_2 emission estimation.

1.6 Performance indicators

1.6.1 Capacity utilization

The unit has an installed capacity of 200 MT per month. The actual monthly average melting is 98.8 MT. Thus, the capacity utilization (CU) of plant is 49%. The CU varies between 38 – 60%. The maximum CU was achieved in month of July in 2014 and minimum was in month of February in 2015. The CU is low due to lack of orders, thus the plant operates 12 hours per day only.

1.6.2 Net yield

The raw material consumption of foundry is around 102 tonnes per month and net casting sold is 67.9 tonnes per month. The net yield of foundry is 67.1%. The losses in metal occur at various stages, which includes, melting loss, pig and spillage, runner and risers, and rejection.

1.6.3 Specific energy consumption

The average specific energy consumption (SEC) of the plant for the year FY 2014 – 15 was estimated based on the monthly consumption of electricity and monthly production. The overall SEC is estimated to be 1,089 kWh per metric tonne of production. The SEC for induction furnace for melting is estimated to be 631 kWh per tonne of melting.

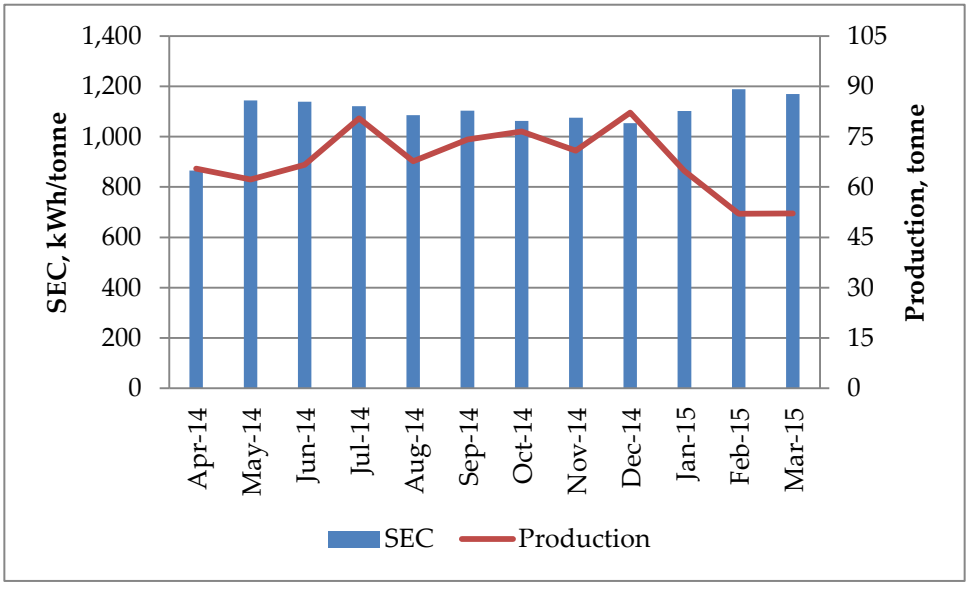


Figure 1.6.3: SEC and production profile

2.0 Electrical systems

2.1 Facility description

2.1.1 General

The main source of electricity for M/s Kudale Iron Works is from Hubli Electricity Supply Company Ltd (HESCOM) at 11 kV grid supply. The 11 kV Main Receiving Station (MRS) is located within the plant premises. The power supplied at 11 kV is step down to 433 V using 500 kVA transformer and is fed to the respective power distribution board (PDB) and light distribution board (LDB) at 415 V through the LT switchgear located at main substation. Table 2.1.1 shows the design specifications and no-load and full-load losses of installed transformer.

Table 2.1.1: Technical specifications of transformer

Parameters	Transformer-1
Rating (KVA)	500
Application	Induction furnace Auxiliary and Utility
Type	ONAN
Primary Voltage (V)	11,000
Primary Current (Amps)	26.25
Secondary Voltage (Volts)	433
Secondary Current (A)	233.3
Rated No Load Loss (kW)	1.1
Rated load loss (kW)	6.4

The rate of power failure in Belgaum, Karnataka is insignificant. However to cater the necessary power requirements during power outages, the plant installed diesel generators.

To maintain the power factor near to unity, plant has provided the power factor correction system at main incomer at power control centre (PCC) level.

2.1.2 Electricity consumption data

The power supply to the facility is from HESCOM grid under the tariff category HT-2(a), with 350 kVA contract demand. The minimum billing demand is 263 kVA (75% of the contract demand). The detail of electricity consumption is given in the table 2.1.2.

Table 2.1.2: Monthly electricity consumption details

Month & Year	Electricity consumption (kWh)	Contact demand (kVA)	Power factor	Billed demand (kVA)	Demand charges (Rs)	Energy charges (Rs)	P.F. rebate/ penalty (Rs)	Monthly electricity bill (Rs)
Apr-14	56,720	350	0.933	336	57120	303,452	-	319,861
May-14	71,156	350	0.939	334	56780	405,589	-	486,705
Jun-14	75,824	350	0.947	336	57120	432,197	-	516,052
Jul-14	90,244	350	0.952	327	55590	514,391	-	601,868
Aug-14	73,472	350	0.946	323	54910	418,790	-	499,706

Month & Year	Electricity consumption (kWh)	Contact demand (kVA)	Power factor	Billed demand (kVA)	Demand charges (Rs)	Energy charges (Rs)	P.F. rebate/ penalty (Rs)	Monthly electricity bill (Rs)
Sep-14	81,868	350	0.959	332	56440	466,648	-	551,253
Oct-14	81,396	350	0.951	331	56270	463,957	-	548,243
Nov-14	76,136	350	0.961	330	56100	433,975	-	516,480
Dec-14	86,580	350	0.948	367	62390	493,506	-	588,729
Jan-15	71,384	350	0.948	362	61540	406,889	-	494,882
Feb-15	61,828	350	0.924	371	63070	352,420	-	440,205
Mar-15	60,968	350	0.901	378	64260	347,518	-	437,389
Average	**73,965**	**350**	**0.942**	**344**	**58466**	**419944**	**-**	**500114**
Total	887,576				701590	5039331	-	6,001,373

Important parameters only are presented in above table, details such as time of day tariff, electricity duty and others are not presented. Figure 2.1.2 presents the contract demand, billed demand and the energy consumed for the year FY 2014 – 15.

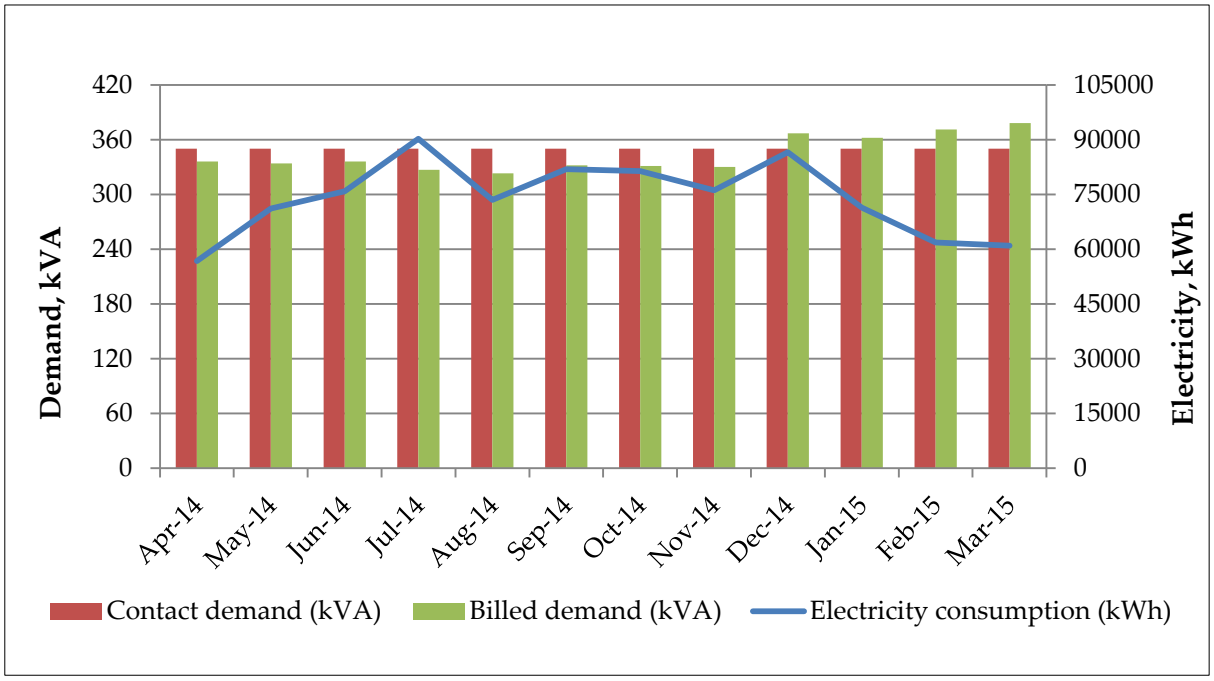


Figure 2.1.2: Demand and energy consumption pattern

As observed from above figure, plant has registered a maximum recorded demand of 378 kVA in the month of March 2015 whereas the minimum recorded demand of 323 kVA in the month of August 2014. The average recorded demand for the period was 344 kVA and it is 98% of the contract demand. Though, in past four months the average demand is 369 kVA which is higher than contract demand. The average electricity consumption of the plant from HESCOM grid was about 73,965 kWh per month.

2.2 Observation and analysis

2.2.1 Electrical power measurement

Electrical power data logging was carried out on the main power incomer at LT feeder panel using three-phase power quality analyser extensively. All electrical parameters have been recorded for identification and analysis of demand and power factor management of the plant. The operating power parameters of distribution transformer at LT side were measured evaluate the operational efficiency pattern. Some necessary data has been taken from the plant services department logbook for historical pattern better analysis.

2.2.2 Main system parameters

The electrical and power parameters of 500 kVA transformer are summarises in table 2.2.2.

Table 2.2.2: Summary of electrical and power parameters at main incomer

	Transformer 500kVA		
Parameters	**Minimum**	**Average**	**Maximum**
Voltage, Volt	406	414	437
Current, Amp	41	386	516
Active Power (kW)	3	241	375
Apparent Power (kVA)	29	277	390
Power Factor, pf	0.104	0.870	0.960
% THD (Voltage)	3.1	8.6	18.9
% THD (Current)	23.2	29.5	93.3

Observation:

- The load at transformer is variable and it follows the power curve of induction furnace.
- The average demand is found to be about 277 kVA for transformer during the measurement period however; the demand is fluctuating due to instantaneous loads of the utility system. The maximum demand was 390 kVA
- The total harmonic distortion in voltage and current is exceeding the permissible limit and this could be avoided by installation of harmonic filters.

2.2.3 Transformer

Plant is stepping down the electricity board power using the step down transformer of capacity 500. Summary of the loading pattern and respective operation efficiency of the transformer is given in table 2.2.3.

Table 2.2.3: Summary of the operational efficiency of transformer

			Calculated parameters	
Transformer	**Load Conditions**	**Rated capacity, kVA**	% Loading	% Efficiency
	Maximum		78.1	98.6
500 kVA	Minimum	500	5.7	72.6
	Average		55.4	98.7

The average operational loading of transformer is 55.4 % whereas the best efficiency point is 41.5% for given losses characteristics.

2.2.4 Power factor management

Plant has provided the power factor correction system at main incomer BUS at LT side as well as at PCC. The power factor pattern at main incomer and its variation with demand was analysed to understand the effect of the capacitor bank during the load changeability conditions. Power factor studied from past 12 months electricity bills and the measured power factor at transformer is given in figure 2.2.4a and 2.2.4b.

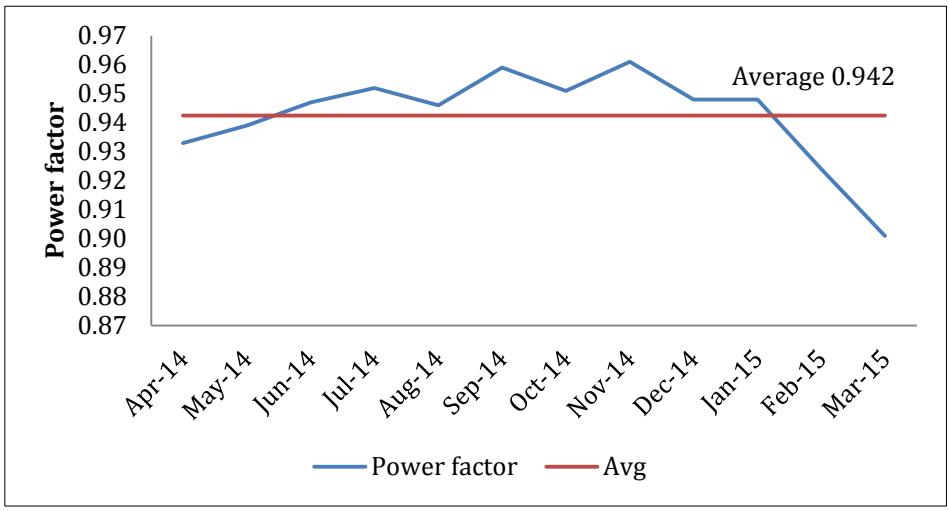


Figure 2.2.4a: Power factor variation during the year 2014-15

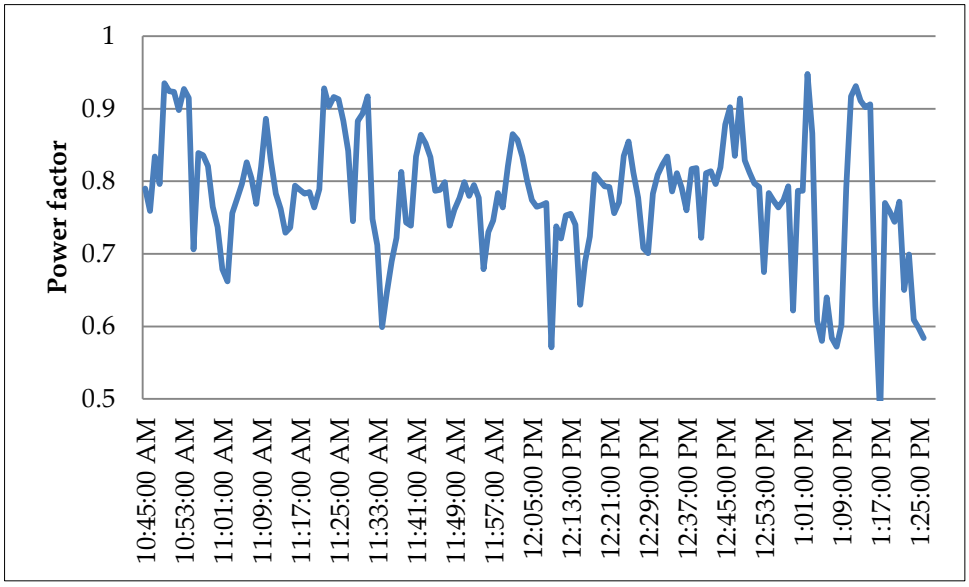


Figure 2.2.4b: Power factor at auxiliary panel

It has been observed that the average power factor of the plant at main incomer is around 0.873 during measurement and average for past one year is 0.942. It also has been observed that the power factor correction system required capacity augmentation to maintain the power factor unity.

2.2.5 Load factor of plant

The average monthly electricity consumption of plant is 73,965 kWh. The plant operates for 12 hours daily. The peak demand of plant is 344 kVA at power factor of 0.942 lag. This corresponds to a load factor of 76.3%. The high load factor is due to continuous running of induction furnace during operation period.

2.3 Energy conservation measures

2.3.1 Improving power factor and demand reduction

The average power factor recorded in foundry was 0.942. The average billed demand is 370 kVA and average maximum load is 348 kW (from December 2014 onwards). The power can be still improved near to unity by connecting capacitor bank. The power factor is quite low at the unit is at verge of paying penalty.

It was recommended to install capacitor bank of 90 kVAr capacity. Poor power factor does not only increase the penalty in billing but also increases demand charges and distribution losses. This will also reduce the demand by 20 kVA. The estimated annual energy savings by improving power factor is 510 kWh equivalents to a monetary saving of Rs 0.43 lakh. The investment requirement is Rs 0.44 lakh with a simple payback period of 1.0 year.

A detailed cost benefit analysis is been given in Table 2.3.1.

Table 2.3.1: Cost benefit analysis

Actual Parameters	Unit	Value
Contract demand	kVA	350
Minimum billing demand (@75%)	kVA	263
Average billed demand	kVA	370
Existing power factor	pf	0.942
Proposed power factor	pf	0.995
Existing real load	kW	348
New demand	kVA	350
Reduction in demand	kVA	20
Capacitor bank requirement	kVAr	89
Savings Estimation	**Unit**	**Value**
Annual energy saving	kWh	510
	toe/year	0.04
Energy cost saving	Rs lakh/year	0.03
Demand cost saving	Rs lakh/year	0.40
Monetary saving	Rs lakh/year	0.43
Investment cost for capacitor bank	Rs lakh	0.44
Simple payback period	years	1.0
CO_2 emission avoided	tCO_2/year	0.5

2.4 General recommendations

It was observed that current and voltage harmonics are crossing limits. In Karnataka as of now there is no penalty on harmonics but other states do have penalty. In future Karnataka may also introduce penalty on harmonics. The plant may consider installing harmonics filters. Table 2.4 gives details of harmonics. Harmonics from logged data is shown in figure 2.4a and 2.4b.

Table 2.4: Details of harmonics

Parameters	Permissible limit	Measure value
% THD Voltage	5.0%	8.6%
% THD Current	8.0%	29.5%
V 5th harmonics	3.0%	6.5%
V 7th harmonics	3.0%	3.4%

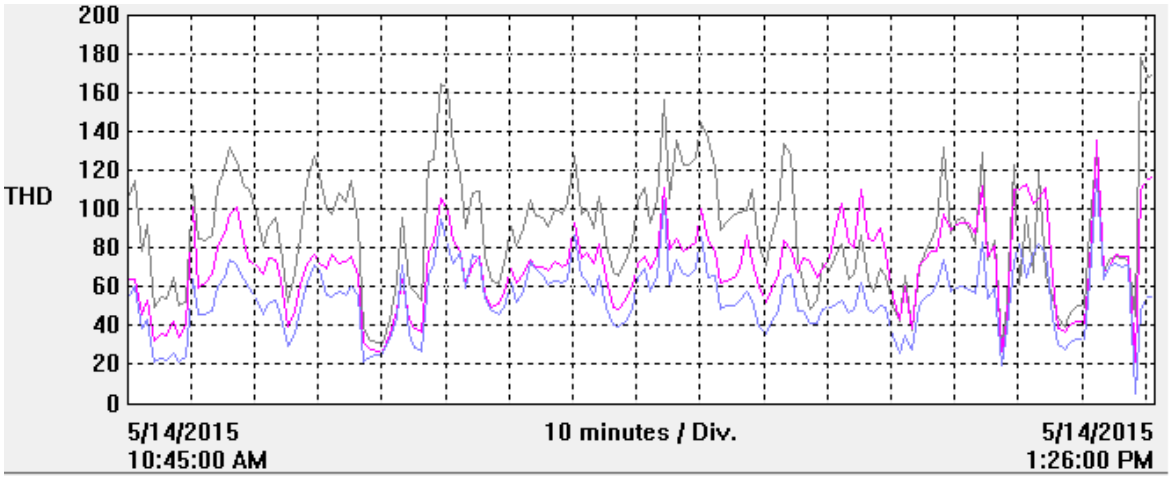


Figure 2.4a: Current harmonics

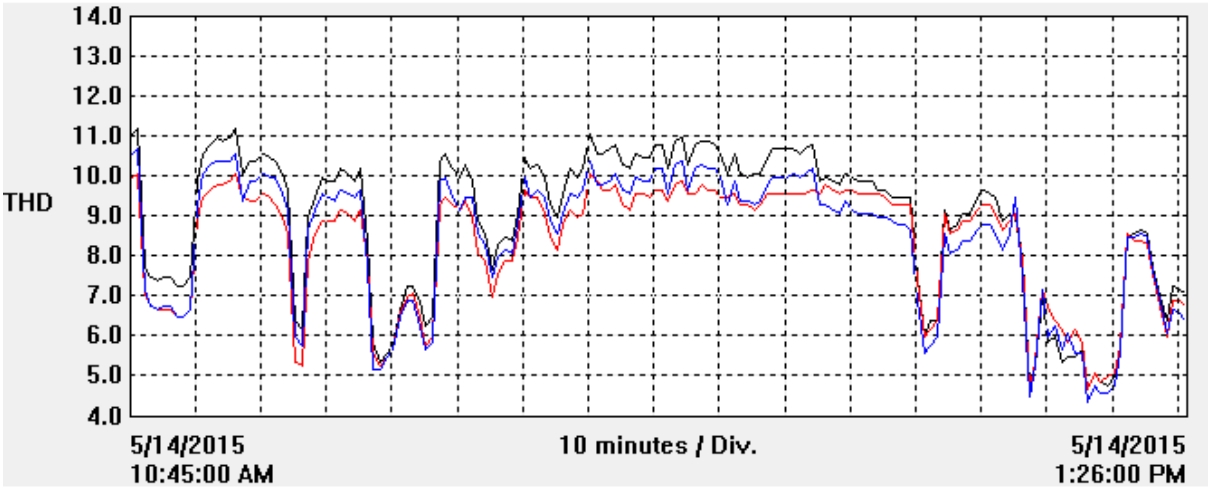


Figure 2.4b: Voltage harmonics

3.0 Furnace

3.1 Facility description

The plant is equipped with one induction melting furnace of rating 250 kW and it has a crucible of capacity 500 kg. The design parameters of the induction melting furnace are presented in Table 3.1.

Table 3.1: Induction melting furnace design parameters

Parameters/equipment ID	Furnace
Equipment	Induction furnace
Type/Year	SCR
Make/Type	Electrotherm/SCR
Voltage/Frequency, V/Hz	433/1000
Rating, kW	250
Crucible capacity, kg	500
Operating Temperature (°C)	1475
Mode of operation (batch/continuous)	Batch
Batch duration (minute)	98

3.2 Observation and analysis

The study was conducted on 500 kg crucible and four sample heats (batches) were studied to arrive at specific energy consumption of induction furnace. The details of observation are given in table 3.2. The power curves for the batches studied are shown in figure 3.2. Detailed furnace logging is given in annexure 3.2.

Table 3.2: Observation and measurement of induction furnace

Type of Casting	Unit	Value
Raw material charge	kg	587
Units consumed	kWh	370.5
Cycle time (melting + pouring)	min	98
Specific Energy Consumption	kWh/MT	631
Tapping temperature	°C	1,475

- There was no lid cover on furnace crucible, thus leading to radiation and convection losses, around 5% of input energy
- Currently the furnace is operating in one shift (10-12 hours depending on demand) and is left for natural cooling at end of day, leading to bigger crakes in refractory lining and reducing lining life
- It was recommended to use a fan for forced cooling of crucible, this not only increase lining life but also reduce the hours of coil cooling requirement after furnace is switched off
- The rejection level was near to 7%, thus leading to a huge quantity of casting being re-melted
- The harmonics level is too high due to furnace operation. Current distortion is near 29.5% and voltage distortion is near 8.6%

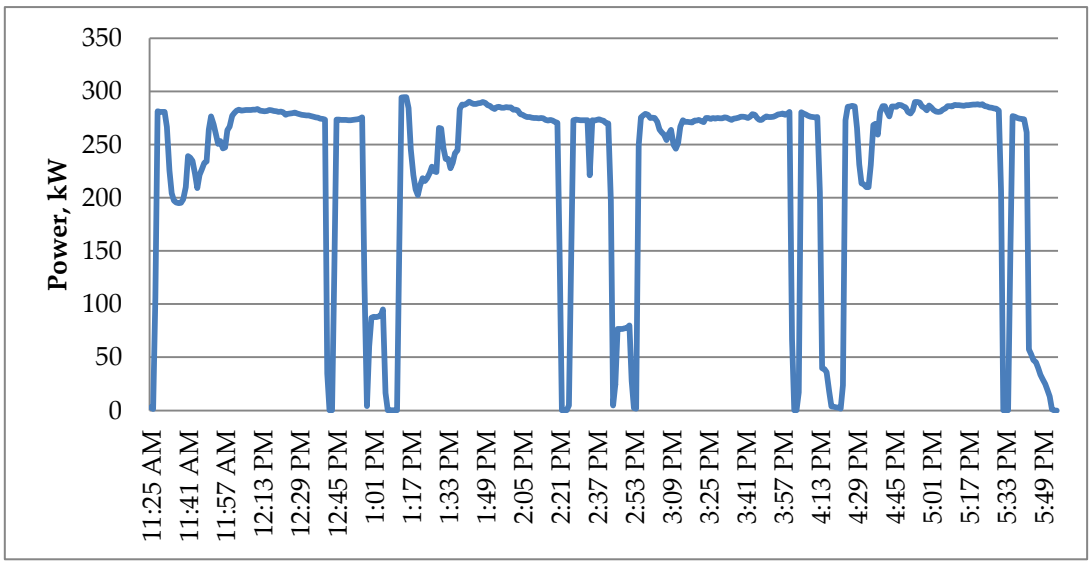


Figure 3.2: Power curve of induction furnace

3.3 Energy conservation measures

Based on the above analysis, identified energy efficiency measures in furnace are discussed in the following paragraphs.

3.3.1 Installation of lid mechanism for induction furnace

The operational parameters of the induction furnace including the electricity consumption and material charged were measured during the detailed energy audit and analysis of the past one year data. The specific energy consumption of the induction furnace was calculated to be 631 kWh per metric tonne of melting for CI melting. It was found that the opening of induction furnace is circular with 408 mm diameter. The opening heat losses for one batch (heat) were calculated to be 32 kWh per heat. The heat loss is due to radiation and convection loss.

It is recommended to install a hydraulically operated lid mechanism for induction furnace to avoid opening losses. It was estimated that around six units per heat can be saved.

Table 3.3.1: Installation of Lid mechanism for induction furnace

Particulars	Unit	Value
Average heats per day	heats	7
Saving potential in SGI heat	kWh/heat	6.87
Operational days per year	days	300
Annual saving potential	kWh/year	14,437
Energy cost per unit	Rs/kWh	6.06
Monetary saving	Rs lakh/year	0.88
Investment	Rs lakh	0.35
Simple payback period	years	0.4
CO_2 emission avoided	tCO_2/year	14.1

The estimated annual energy savings by using lid mechanism is 14,437 kWh equivalents to a monetary savings of Rs 0.88 lakh. The investment requirement is Rs 2.0 lakh with a simple payback period of 2.3 year. The annual reduction in CO_2 emission is estimated to be 14.1 tCO_2.

4.0 Compressed air system

4.1 Facility description

The plant has installed one screw type (air cooled) air compressor for meeting the compressed air requirement of instrumentation and service in the plant. The design parameters of the air compressor are presented in Table 4.1.

Table 4.1: Induction melting furnace design parameters

Particulars	Unit	Value
Make		Atlas Copco
Type		Screw (Air Cooled)
Model		GA 18 FMP
Serial Number		PNA 215313
Year		2012
Rated Capacity	m^3/min	3.15
	cfm	111
Pressure	bar	7.5
Power rating	kW	18.5

4.2 Observation and analysis

The air compressor is operating in load and unload mode. The compressors will be unloaded while reaching to the set pressure. This is analogous to start/stop control which controls the compressor functions, instead of the motor. When compressors in unload mode, the motor continues to operate however at much reduced load and no compressed air is delivered to the system. The compressed air pressure required at the end use point was observed to be about 6.5 – 7.5 kg/cm^2.

4.2.1 Performance assessment of air compressor

The details of FAD test conducted on the air compressor are given in table 4.2.1. The power curves for loading unloading of air compressor studied are shown in figure 4.2.1.

Table 4.2.1: Performance assessment of air compressor

Particulars	Unit	Value
Operating Pressure	bar	7.5
Initial Pressure	bar	0.7
Atmospheric pressure	bar	1.013
Capacity of Receiver	m^3	1.0
Additional holdup of volume	m^3	0.1
Pump up time	seconds	141
Inlet air temperature	^oC	32.0
FAD	m^3/min	3.00
	cfm	106
Isothermal power	kW	9.94
Motor power	kW	25.0

Particulars	Unit	Value
Motor efficiency	%	87.0%
Shaft power	kW	21.78
Isothermal efficiency	%	45.7%
Volumetric efficiency	%	95.2%
Loading power	kW	25.0
Specific power consumption	kW/cfm	0.236

- The FAD of air compressor was estimated to be 106 cfm and the specific power consumption of air compressor was 0.236 kW per cfm
- The volumetric efficiency and isothermal efficiency of air compressors were estimated to be 95.2% and 45.7% respectively
- The compressor follows load-unload pattern and switches OFF after every four cycles. The loading period is 35%, unload period is 52% and the OFF period is 13%.
- Considering only compressor ON time the load and unload period of air compressor are 40% and 60% respectively.

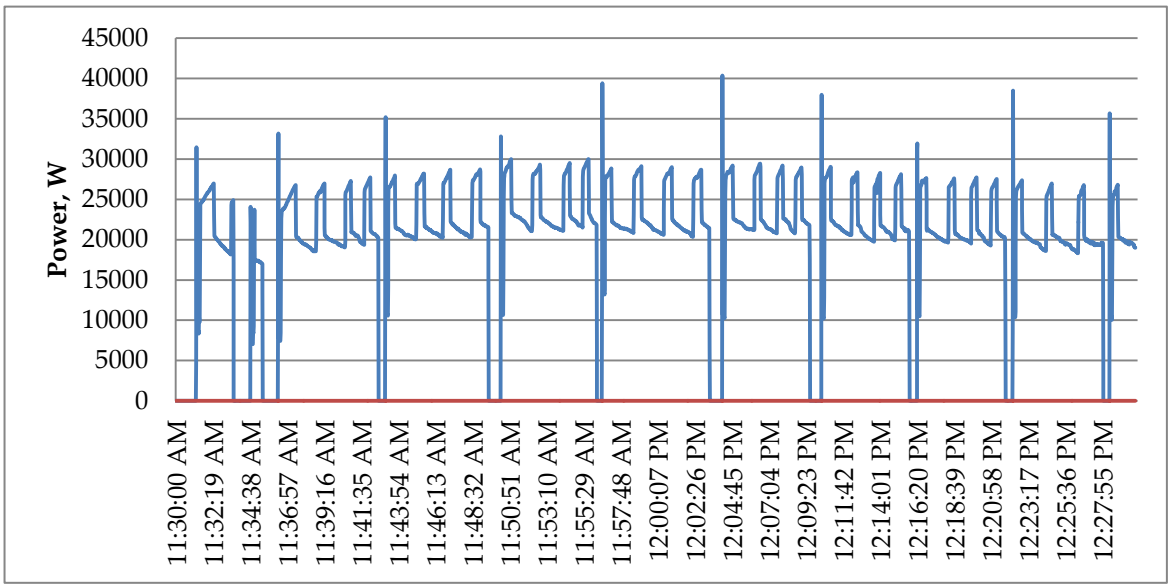


Figure 4.2.1: Power curve of air compressor

4.2.2 Leakage test

The leakage test of the compressed air distribution system was conducted during the field study. Under this test, all supply valves at utilization end were closed manually and compressor was operated for a period of 30 minutes. The loading and unloading time of the operating compressor during the leakage test is noted. The loading period is the generation of the compressed air, which is due to leakages in the distribution system. The estimated leakage in the compressed air distribution system is shown in table 4.2.2.

Table 4.2.2: Leakage assessment

Leakage Test	Unit	Value
Actual FAD	m^3/min	3.00
	cfm	106
Average ON time	sec	19

Leakage Test	Unit	Value
Average OFF time	sec	136
Leakage in plant	%	12%
	cfm	12.98

Leaks are a significant source of wasted energy in a compressed air system of plant, often wasting a portion of the compressor's output. Compressed air leaks can also contribute to problems with system operations, including:

- Fluctuating system pressure, which can cause air tool and other air-operated equipment to function less efficiently, which possibly affects the production.
- Excess compressor capacity, resulting in higher than necessary costs
- Decreased service life and increased maintenance of supply equipment (including the compressor package) due to unnecessary cycling and increased run time.

By installing suitable application specific nozzles, taking the necessary maintenance practices and periodic inspection of distribution network, it would be possible to reduce the air leakages significantly. Although leaks can occur in any part of the system, the most common problem areas are: couplings, hoses, tubes, fittings, pipe joints, quick disconnects, FRLs (filter, regulator, and lubricator), condensate traps, valves, thread sealants, and point of use devices. Leakage rates are a function of the supply pressure in an uncontrolled system and increase with higher system pressures.

The total leakage quantity in the system in plant is estimated to 12% of the supplied air which is equivalent to 13 cfm, which is significant. The permissible line losses in the industrial scenario are less than 5%.

4.3 Energy conservation measures

Based on the above analysis, identified energy efficiency measures in air compressor are discussed in the following paragraphs.

4.3.1 Avoiding leakages in compressed air system and reducing pressure setting

From preliminary assessment it was found that leakage in line is very high in both the pipe lines. Leakage test was performed during break time to estimate the amount of leakage. The on time and off time were measured for two air compressors. The leakage in existing compressed air piping system was measured and found to be 12%, which is high. Also, the pressure setting of air compressor for load and unload was 6.5 and 7.5 bar. The maximum pressure requirement in foundry operation is 6.1 bar.

It is recommended to reduce leakages in the compressed air piping system by periodically checking for air leaks and arresting them, and bring it down to about a nominal level of 5%. Once leakages are arrested the pressure setting can be reduce by 0.5 bar i.e. 6.3 – 7.0 bar.

Table 4.3.1: Leakage arresting and pressure reduction

Particulars	Unit	Value
Leakage in plant	%	12%
	cfm	12.98
Energy loss	kW/hour	1.2
Acceptable losses	%	5%
Energy Saving	kW	0.7
Operating hours	hour	3,000
Energy saving by leakage reduction	kWh/ year	2,190
Load pressure	bar	6.5
Unload pressure	bar	7.5
Recommended pressure		
Load pressure	bar	6.3
Unload pressure	bar	7.0
Energy Saving	%	3%
	kWh/ year	1,652
Energy saving by pressure reduction	kWh/ year	3,842
Monetary saving	Rs lakh/year	0.23
Investment	Rs lakh	-
CO_2 emission avoided	tCO_2/year	3.8

The estimated annual energy savings by arresting air leakage and reducing pressure setting is 3,842 kWh equivalents to a monetary savings of Rs 0.23 lakh. There is no investment requirement for this measure. The annual reduction in CO_2 emission is estimated to be 3.8 tCO_2.

4.3.2 Retrofit the air compressor with variable frequency drive (VFD)

The air compressor operates in load-unload mode. During study, it was operating at loading of 40% and unloading 60%. The screw air compressors are designed to give best efficiency/performance at loading over 80%. The loss of energy in unload period is quite substantial.

It is recommended to retrofit the air compressor with a variable frequency drive with pressure transducer. The compressor will follow the load variation and nullify the unload power wastage.

Table 4.3.1: VFD retrofitting of air compressor

Particular	Unit	Value
Unload loss	kW	18.30
	kWh/ year	28,701
VFD loss	%	3%
	kWh/year	1,652
Annual energy saving	kWh/year	27,049
	toe/year	2.33
Monetary saving	Rs lakh/year	1.6
Investment	Rs lakh	1.2
Simple payback period	years	0.7
CO_2 emission avoided	tCO_2/year	26.5

The estimated annual energy savings by retrofitting air compressor with VFD is 27,049 kWh equivalents to a monetary savings of Rs 1.6 lakh. The investment requirement is Rs 1.2 lakh with a simple payback period of 0.7 year. The annual reduction in CO_2 emission is estimated to be 26.5 tCO_2.

5.0 Pumping system and cooling towers

5.1 Facility description

Pumping systems and cooling towers were installed in the plant, mainly for supplying cooling water to induction furnace. The furnace panel has one (demineralised water) DM water pump for its cooling. Soft water is circulated for coil cooling using another pump. The soft water and DM water is cooling using heat exchanger, where raw water flows in secondary circuit. The rated parameters of the pumps have been given in table 5.1a.

Table 5.1a: Rated parameters of the pumps taken up for study

Design Parameters	Unit	Coil cooling pump	Raw water pump
Make		Kirloskar	Kirloskar
Type		Mono-Block	Mono-Block
Flow rate	m^3/hour	10.44	18.0
Head	m	46	30
Motor Power	kW	3.7	3.7
Overall Efficiency	%	34%	40%

The plant is equipped with one cooling tower (CT) to cater to the cooling water requirements of the induction furnace. The rated parameters of the cooling towers have been given in table 5.1b.

Table 5.1b: Rated parameters of the cooling tower taken up for study

Parameters	CT
Type	Induced draft
Make/year	NA
Purpose	Coil water cooling in induction melting furnace
Capacity (lpm)	300
Pump power (kW)	3.7
Fan power (kW)	0.75
Operating hours per day	12
Other Location of placement	Roof mounted

5.2 Observation and analysis

5.2.1 Pumps

The operating parameters, such as flow and head, were measured for all operating water pumps. Suction & discharge head of the pumps was measured by using standard pressure gauge from the plant. The flow rate of water delivered by the pumps was measured by using non-intrusive type flow meter. Simultaneously, operating electrical parameters of pump mainly voltage, current, power factor and kW were measured by using portable power analyser. The operating parameters and efficiency estimation is given in table 5.2.1.

Table 5.2.1: Estimation of efficiency of pump associated with induction furnace

Actual Parameters	Unit	Coil cooling pump	Raw water pump
Flow rate	m^3/hour	6.3	11.7
Suction Pressure	kg/cm^2		
Discharge Pressure	kg/cm^2	4.4	2.3
Differential Head	m	44	23
Power	kW	3.50	4.90
Overall efficiency	**%**	**21.6%**	**15.0%**

5.2.2 Cooling towers in the plant

Operating parameters of cooling towers such as cooling water temperature at inlet and outlet, water flow rates, air flow rates and power consumption of fan motor were monitored by using digital thermometer, non-intrusive type flow meter, anemometer and power analyser respectively. The operating parameters and the performance of the cooling tower are shown in table 5.2.2.

Table 5.2.2: Estimation of operating parameters and performance of cooling towers

Measured Parameters	Unit	Value
Water flow rate	m^3/hour	11.7
Ambient temperature	°C	30.1
RH	%	52.3
T inlet	°C	35.1
T outlet	°C	32.0
Calculations	**Unit**	
DBT	°C	30.1
WBT	°C	22.3
Approach	°C	9.7
Range	°C	3.1
Heat removed to atmosphere	kCal/hour	36,270
	TR	11.99
Effectiveness	%	24%
Fan power	kW	0.84

5.3 Energy conservation measures

There is a scope of considerable energy savings in the pumps and cooling tower area, as this is clear from the performance assessment that some of the pumps installed are of poor efficiency.

5.3.1 Replacement of existing coil cooling pump with energy efficient pump

The power consumption of furnace coil cooling pump was measured to be 3.5 kW. The water flow rate was measured to be 6.3 m^3/hr which is lower than the design flow of 10.44 m^3/hr. The overall efficiency of the pump is calculated to be 21.6% which is lower than design efficiency (34%).

The performance of an induction furnace is directly linked with the performance of its cooling water circuit. Therefore, it is recommended to replace the existing furnace coil cooling pump with an energy efficient pump. Details of pump are given in annexure 5.3.

Table 5.3.1: Replacement of existing coil cooling pump with energy efficient pumps

Recommended Pump Specification	Units	Coil cooling pump
Flow rate	m^3/hour	10.4
Differential Head	m	46.0
Efficiency	%	43.4%
Power	kW	3.00
Energy saving	kW	0.50
Operating period	hour	4,800
Annual Energy saving	kWh/year	2,382
	toe/year	0.20
Cost saving		
Energy cost per unit	Rs / kWh	6.06
Annual Monetary Saving	Rs lakh / year	0.14
Investment	Rs lakh	0.55
Simple Payback Period	years	3.8
CO_2 emission avoided	tCO_2/year	2.3

The estimated annual energy savings in coil cooling pump is 2,382 kWh equivalents to a monetary saving of Rs 0.14 lakh. The investment requirement is Rs 0.55 lakh with a simple payback period of 3.8 years. The annual reduction in CO_2 emission is estimated to be 2.3 tCO_2.

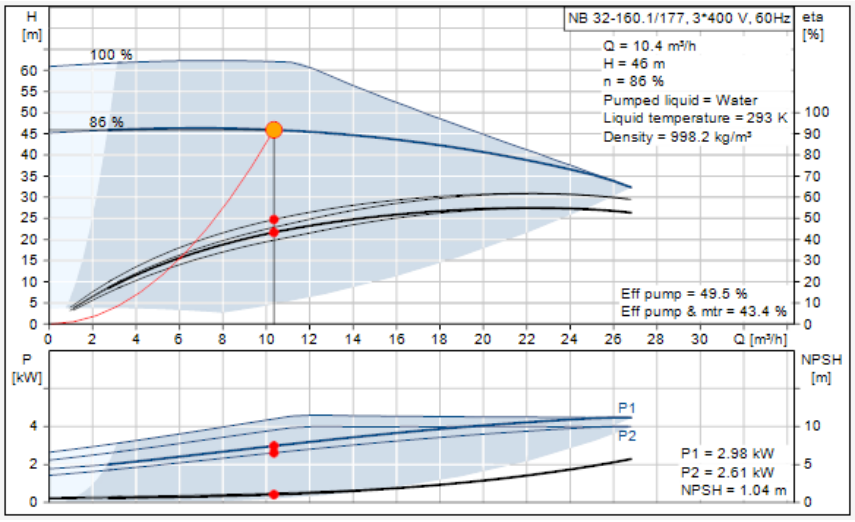


Figure 5.3.1: Proposed coil cooling pump

5.3.2 Replacement of existing raw water pump with energy efficient pump

The power consumption of raw water pump was measured to be 4.9 kW which is higher than its rating (3.7 kW). The water flow rate was measured to be 11.7 m^3/hr which is lower than the design flow of 18 m^3/hr. The overall efficiency of the pump is calculated to be 15% which is lower than design efficiency (40%).

The performance of an induction furnace is directly linked with the performance of its cooling water circuit. Therefore, it is recommended to replace the existing raw water pump with an energy efficient pump. Details of pump are given in annexure 5.3

Table 5.3.2: Replacement of existing raw water pump with energy efficient pumps

Recommended Pump Specification	Units	Raw water pump
Flow rate	m^3/hour	18.0
Differential Head	m	30.0
Efficiency	%	54.8%
Power	kW	2.69
Energy saving	kW	2.21
Operating period	hour	3,600
Annual Energy saving	kWh/year	7,973
	toe/year	0.69
Cost saving		
Energy cost per unit	Rs / kWh	6.06
Annual Monetary Saving	Rs lakh / year	0.48
Investment	Rs lakh	0.55
Simple Payback Period	years	1.1
CO_2 emission avoided	tCO_2/year	7.8

The estimated annual energy savings in raw water pump is 7,973 kWh equivalents to a monetary saving of Rs 0.48 lakh. The investment requirement is Rs 0.55 lakh with a simple payback period of 1.1 years. The annual reduction in CO_2 emission is estimated to be 7.8 tCO_2.

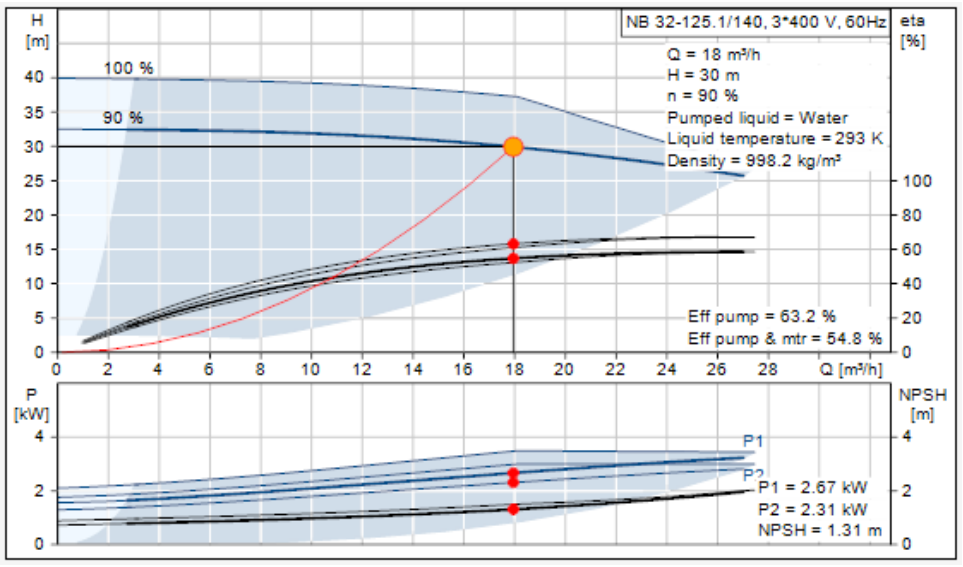


Figure 5.3.2: Proposed raw water pump

6.0 Motors

6.1 Facility description

The energy audit of electrical motors associated with utility and process equipment was carried out to assess the performance and identify potential for energy savings. The study included motors installed in the utility (water pumping, utilities, shot blasting, fettling) process machinery and other associated systems. The study focussed broadly on the following aspects with a view to assess the performance of motors:

- Loading of motors
- Nature of load (fixed or variable)

The details of measurements and observation on each of these three aspects are detailed in the following sections.

6.2 Observations and analysis

Different sections of the plant include pumping and sand handling. The operating parameters of motors were measured using portable instruments to observe load profile and power consumption. The range of motor loadings in different sections was evaluated. To evaluate the operating performance of motors and study the loading pattern, load tests were carried out for about 15 electrical motors in the plant covering utility and process areas.

6.2.1 On -load motor test

The operational loading of the electrical motors is calculated using the measured electrical parameters from the unit. The details are given in table 6.2.1.

Table 6.2.1: Motor power parameter and loading

	Motor Rating		Motor Operating Parameters									
Motor Description	Rated power (kW)	Efficiency (%)	V	V_{thd} (%)	A	A_{thd} (%)	kW	kVA	PF	kVAr	Hz	% Loading
CO_2 Sand mixer blender	5.5	86.0%	424	7.9	9.4	12.2	4.0	6.9	0.58	5.6	50.1	63%
Sand muller old	7.5	86.0%	420	9.6	9.7	19.5	5.4	7.1	0.76	4.2	50.1	62%
Sand muller bucket	2.2	85.0%	432	4.5	2.1	5.8	0.8	1.6	0.50	1.4	50.1	31%
Sand muller main motor	9.3	87.0%	439	9.4	10.6	21.4	6.0	8.0	0.75	5.3	50.1	56%
Sand muller blender	5.5	86.0%	431	5.6	7.7	8.0	2.1	5.7	0.36	5.1	50.1	33%
DM panel pump	3.0	86.0%	418	9.7	3.8	12.4	2.3	2.7	0.86	1.4	50.1	66%
Cooling tower fan	1.1	85.0%	417	9.2	1.2	6.1	0.8	0.9	0.98	0.2	50.1	65%
Coil cooling pump	3.7	87.0%	424	7.7	5.7	7.4	3.5	4.2	0.82	2.3	50.1	82%
Raw water pump	3.7	87.0%	419	7.3	7.7	7.6	4.9	5.6	0.87	2.8	50.1	115%
Shot blast main	11.2	87.0%	423	8.8	8.0	10.9	5.6	6.8	0.83	3.8	50.1	44%

Motor Description	Motor Rating		Motor Operating Parameters									%
motor												
Shot blast table	0.8	80.0%	416	8.8	1.2	12.2	0.2	0.8	0.27	0.8	50.1	25%
Shot blast bucket elevator	2.2	83.0%	425	8.5	3.4	14.1	1.6	2.5	0.66	1.9	50.1	62%
Shot blast dust collector	2.2	83.0%	415	9.4	2.2	15.4	1.2	1.6	0.8	0.9	50.1	46%

The performances of the all-operating motors were assessed to understand the operational loading. The loading of the major motors was found under the normal performance range.

6.3 Energy conservation measures

There is a scope of considerable energy savings in the motors, this section details on it.

6.3.1 Installation of timer for shot blast machine

The plant has installed a table type shot blast machine to meet shot blasting needs. The machine operates in batch mode and each cycle is of five minutes. The timer in shot blast is not operating and the operator switch off the machine based on judgement and most of time they end up over shooting the time limit.

It is recommended to install a new timer for the shot blast machine. The machine operates for seven hours in a day. It has been estimated that its operation can be brought down by as much as half hour after installing timer.

Table 6.3.1: Installation of timer for shot blast machine

Particular	Unit	Value
Shot blast average power consumption	kW	8.7
Operating hours per day	hour/day	7
Operating hours with timer	hour/day	6.5
Annual energy saving	kWh/year	1,305
Monetary saving	Rs lakh/year	0.08
Investment	Rs lakh	0.05
Simple Payback Period	year	0.6
CO_2 emission avoided	tCO_2/year	1.3

The estimated annual energy savings in timer for shot blast machine is 1,305 kWh equivalents to a monetary saving of Rs 0.08 lakh. The investment requirement is Rs 0.05 lakh with a simple payback period of 0.6 years. The annual reduction in CO_2 emission is estimated to be 1.3 tCO_2.

6.4 General observations and recommendations

- The under loaded condition of motors in the plant are mainly because of its operating pattern.

- Inspecting motors regularly for wear in bearings and housings (to reduce frictional losses) and for dirt/dust in motor ventilating ducts (to ensure proper heat dissipation).
- Checking load conditions to ensure that the motor is not over or under loaded. A change in motor load from the last test indicates a change in the driven load, the cause of which should be understood.
- Lubricating appropriately. Manufacturers generally give recommendations for how and when to lubricate their motors. Inadequate lubrication can cause problems, as noted above. Over lubrication can also create problems, e.g. excess oil or grease from the motor bearings can enter the motor and saturate the motor insulation, causing premature failure or creating a fire risk.
- Checking periodically for proper alignment of the motor and the driven equipment. Improper alignment can cause shafts and bearings to wear quickly, resulting in damage to both the motor and the driven equipment.
- Ensuring that supply wiring and terminal box are properly sized and installed. Inspect regularly the connections at the motor and starter to be sure that they are clean and tight.
- Ambient conditions can also have a detrimental effect on motor performance. For example, excessively high temperatures, high dust loading, corrosive atmosphere, and humidity can impair insulation properties; mechanical stresses due to load cycling can lead to misalignment. However, with adequate care, motor performance can be maintained.
- Rewinding can affect a number of factors that contribute to deteriorated motor efficiency.

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7.0 Lighting system

7.1 Facility description

The total connected lighting load of the plant, as per the inventory collected during the detailed assessment study, was estimated to be 2.9 kW (including ballast losses). The different types of lamps operating in the plant are Fluorescent Tube Light (T-8, T-12), Compact Fluorescent Light (CFL) and incandescent lamp (for inspection). Table 7.1 gives the type of lamps used in different areas of the plant.

Table 7.1: Details of the lighting system

S. No	Location in the plant	Type of lamps & ballast	No. of lamps	Rated wattage, watt (including ballast)	Connected load, kW	Average operating hours
1	Office and Plant	FTL T12	39	52	2.0	5
2	Office	FTL T8	4	48	0.2	10
3	Plant	CFL	6	85	0.5	5
4	Plant	GLS	4	40	0.2	5

7.2 Energy conservation measures

7.2.1 Replacement of existing lighting system with efficient lighting system in phase manner

The foundry is using mixed lighting, including FTL T12 and HPMV. Fluorescent tube lights of 40W FTLs with conventional copper ballasts consume more energy. About 39 T12 and four T8 were found in different locations of the unit. It is proposed to replace all 40W copper ballast FTLs with 28W FTLs having electronic ballasts. Electronic ballasts help in instantaneous starting of lamps and have improved regulation for varying input voltage. Major benefits of T5 fixtures over conventional T12 FTL are as follows:

- Uniform light output for wide range of supply voltages.
- Instant start and flicker free operation.
- Improves the power factor almost close to unity.
- Less heat generation, hence load on ACs reduces.
- Increased lamp life around 15000 hrs.
- Higher lumen output per watt (around 105 lumens per watt)

Table 7.2.1: Replacement of existing lighting system with efficient lighting system

Particulars	Unit	Existing	Proposed	Existing	Proposed
Type of lamp	-	T-12	T-5	T-8	T-5
Wattage of lamps	W	40	28	36	28
Design Lumen (Approx.)	Lumen	3200	2900	3200	2900
Watt loss per ballast	W	12	2	15	0
No. of lamps to be replaced	No.	39	39	4	4

Particulars	Unit	Existing	Proposed	Existing	Proposed
Average Operating Hours per day	Hours/Days	5.0	5.0	10.0	10.0
Operating day /year	No.	300	300	300	300
Energy consumption	kWh/year	3042	1755	612	336
Energy savings	kWh/year		1287		276
Energy Cost	Rs/kWh		6.06		6.06
Energy cost savings	Rs/ year		7805		1674
Initial retrofitting cost / lamps	Rs		585		585
Initial investment cost	Rs		22815		2340
Payback period	Years		2.9		1.4
GHG emission factor	tCO_2/MWh		0.98		0.98
CO_2 avoided	t CO_2/year		1.3		0.3
Energy savings	toe/year		0.111		0.02

The envisaged annual energy saving potential in lighting is 1,563 kWh per year equivalent to a monetary saving of Rs 0.09 lakh per year. The investment requirement is Rs 0.25 lakh with a simple payback period of 2.7 years. The annual reduction in CO_2 emission is estimated to be 1.5 tCO_2.

[1] The photograph in cover page was taken during energy audit

8.0 Summary of potential savings

8.1 Summary of recommendations

The proposed energy conservation measures (ECMs) for various facilities of Kudale Iron Works is categorized as no investment, short term investment and medium term investment based recommendations as per the following criteria:

- The energy savings measures, which are having immediate returns, are considered to be no investment recommendations.
- The energy saving measures, which are having a simple payback period of less than a year, are considered to be short term measures.
- The energy saving measures, which are having a simple payback period of 1 to 2 year, are considered to be medium term measures.
- The energy saving measures, which are having a simple payback period greater than 2 years, are considered to be long term measures.

The number of energy conservation measures under the above categories as given table 8.1:

Table 8.1: Categorization of energy conservation measures

Sr. No	Type of recommendation	ECMs	Energy cost saving potential (Rs lakh)	Investment required (Rs lakh)	Simple payback (years)
1	No investment based	1	0.23	-	-
2	Short term return based (< 1 year)	3	2.59	3.25	1.3
3	Medium term return based (1-2 year)	2	0.91	0.99	1.1
4	Long term return based (> 2 year)	2	0.24	0.80	3.4
	Total	**8**	**3.98**	**5.04**	**1.3**

8.2 Recommended energy conservation measures

The recommended measures considered for energy audit report after discussion with unit representative is given in table 8.2

Table 8.2: Recommended energy conservation measures for implementation

S. No	Energy conservation measures	Annual energy savings Electricity (kWh)	Investment (Rs Lakh)	Savings Rs. Lakh/ year	Simple payback year
1	Power factor improvement	510	0.44	0.43	1.0
2	Lid mechanism for induction furnace	14,437	2.00	0.88	2.3
3	Avoiding leakages in compressed air system and reducing pressure setting	3,842	-	0.23	-
4	Retrofit the air compressor with variable frequency drive	27,049	1.20	1.64	0.7
5	Replacement of coil cooling pump	2,382	0.55	0.14	3.8

S. No	Energy conservation measures	Annual energy savings	Investment	Savings	Simple payback
	of induction furnace				
6	Replacement of raw water pump of induction furnace	7,973	0.55	0.48	1.1
7	Installation of timer for shot blast machine	1,305	0.05	0.08	0.6
8	Replacement of existing lighting system with energy efficient lighting system	1,563	0.25	0.09	2.7
	Overall	**59,060**	**5.04**	**3.98**	**1.3**

Total eight energy conservation measures are identified. Implementing then would attract a one-time investment of Rs 8.8 lakh; it would lead to annual savings of Rs 5.21 lakh. This would result in reduction in energy consumption by 7.7%. The specific energy consumption of entire foundry would improve from 1,033 kWh per tonne to 953 kWh per tonne.

8.3 Lifetime energy and CO_2 savings

Implementation of the energy conservation measures in the unit may result in reduction in CO_2 emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 57.9 tonne of CO_2 per year. The life time CO_2 emission reduction in estimated to be 868 tonne. The lifetime energy and CO_2 saving are given in table 8.3

Table 8.3: Lifetime CO_2 savings

Sr. No.	Energy conservation measures	Life time energy saving (toe)	Life time CO_2 reduction (tonne)
1	Power factor improvement	0.66	7.49
2	Lid mechanism for induction furnace	18.62	212.22
3	Arresting leakages and reducing pressure setting of compressor	4.96	56.75
4	Retrofit the air compressor with variable frequency drive	34.89	397.61
5	Replacement of coil cooling pump of induction furnace	3.07	35.01
6	Replacement of raw water pump of induction furnace	10.29	117.21
7	Installation of timer for shot blast machine	1.68	19.18
8	Replacement of existing lighting system with energy efficient lighting system	2.02	22.98
	Overall	**76.2**	**868.2**

8.4 Renewable energy recommendation

The use of renewable energy technologies is not techno-economically feasible for melting, which is the most energy-intensive area in foundry application. Moreover, some of these

technologies are not fully commercially mature and hence was not recommended for implementation.

Annexures

Annexure: 3.2 Logging of induction furnace

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	Sum		Sum	Sum	L1	L2	L3	
14/05/15	11:25 AM	241.3	241.6	242.1	6.0	6.2	5.8	21	21	21	91.0	92.6	92.2	2.9	0.0	14.8	15.1	0.20	0.19	0.19	49.97
14/05/15	11:26 AM	241.2	241.4	242.0	5.7	5.8	5.5	10	11	10	93.0	95.1	93.1	1.4	0.1	7.2	7.4	0.21	0.18	0.19	49.96
14/05/15	11:27 AM	240.1	240.3	241.0	7.1	7.0	6.8	237	245	244	63.3	65.4	63.9	105.8	1.8	42.0	117.5	0.51	0.51	0.50	49.96
14/05/15	11:28 AM	237.9	238.2	238.8	9.7	9.4	9.2	406	419	417	24.3	24.3	24.2	281.2	6.5	91.2	295.7	0.95	0.95	0.95	49.95
14/05/15	11:29 AM	237.4	237.7	238.1	9.8	9.5	9.3	406	419	417	24.2	24.1	24.1	280.8	11.2	90.9	295.2	0.95	0.95	0.95	49.94
14/05/15	11:30 AM	237.2	237.5	237.8	9.3	9.2	8.9	406	417	418	24.3	24.1	23.8	280.8	15.9	89.5	294.7	0.95	0.96	0.95	49.95
14/05/15	11:31 AM	237.7	238.0	238.1	9.5	9.4	9.1	405	417	417	24.2	24.0	23.7	280.6	20.6	90.0	294.7	0.95	0.95	0.95	49.96
14/05/15	11:32 AM	237.6	238.0	238.0	9.6	9.4	9.2	386	397	397	24.3	24.1	23.8	266.6	25.0	86.8	280.4	0.95	0.95	0.95	50.00
14/05/15	11:33 AM	238.5	238.8	238.8	8.9	8.5	8.5	326	337	335	26.0	25.9	25.5	225.5	28.8	75.9	237.9	0.95	0.95	0.95	50.05
14/05/15	11:34 AM	238.7	239.0	239.0	8.2	7.8	7.9	295	305	303	26.8	26.8	26.3	204.2	32.2	69.3	215.7	0.94	0.95	0.95	50.06
14/05/15	11:35 AM	238.8	239.1	239.2	7.6	7.3	7.3	285	294	293	27.2	27.2	26.7	197.4	35.5	66.7	208.4	0.95	0.95	0.95	50.04
14/05/15	11:36 AM	238.7	239.0	239.2	7.2	6.8	6.8	282	291	290	27.2	27.3	26.9	195.6	38.7	65.3	206.2	0.95	0.95	0.95	50.03
14/05/15	11:37 AM	237.4	237.7	237.8	8.0	7.7	7.7	284	293	291	27.3	27.3	26.8	194.9	42.0	67.2	206.2	0.94	0.95	0.95	50.03
14/05/15	11:38 AM	236.6	236.9	237.1	8.0	7.7	7.7	285	294	293	27.2	27.3	26.8	195.3	45.2	67.3	206.6	0.94	0.95	0.95	49.98
14/05/15	11:39 AM	236.8	237.1	237.4	8.2	7.9	7.9	290	299	298	27.1	27.2	26.7	198.5	48.5	68.4	210.0	0.94	0.95	0.95	49.98
14/05/15	11:40 AM	235.0	235.3	235.5	9.1	8.9	8.8	310	320	318	26.5	26.5	26.0	210.0	52.0	73.0	222.3	0.94	0.95	0.95	50.01
14/05/15	11:41 AM	234.7	234.8	235.0	10.0	9.8	9.6	352	364	362	25.4	25.2	24.9	239.3	56.0	82.2	253.1	0.94	0.95	0.95	50.02
14/05/15	11:42 AM	234.3	234.5	234.7	9.5	9.5	9.3	350	362	359	25.0	24.7	24.6	237.8	60.0	80.3	251.1	0.95	0.95	0.95	50.01
14/05/15	11:43 AM	235.5	235.6	235.7	9.5	9.3	9.2	344	355	353	25.4	25.3	25.0	234.7	63.9	79.9	247.9	0.94	0.95	0.95	50.02
14/05/15	11:44 AM	238.1	238.3	238.4	9.0	8.8	8.7	322	333	331	26.1	25.9	25.6	222.2	67.6	75.7	234.8	0.94	0.95	0.95	50.00
14/05/15	11:45 AM	239.7	239.9	239.9	8.3	8.0	8.0	301	311	309	26.6	26.6	26.2	209.0	71.1	71.0	220.7	0.95	0.95	0.95	50.00
14/05/15	11:46 AM	240.4	240.6	240.6	8.5	8.2	8.1	318	328	326	26.4	26.5	26.1	221.4	74.8	74.5	233.6	0.95	0.95	0.95	49.99
14/05/15	11:47 AM	239.3	239.6	239.5	9.2	9.0	8.9	326	337	335	25.8	25.6	25.4	226.4	78.5	76.0	238.8	0.95	0.95	0.95	49.96
14/05/15	11:48 AM	238.0	238.3	238.2	9.3	9.0	8.9	337	348	346	25.7	25.6	25.3	232.8	82.4	78.0	245.6	0.95	0.95	0.95	49.96
14/05/15	11:49 AM	238.0	238.5	238.3	9.2	8.9	8.7	338	350	348	25.7	25.6	25.3	234.2	86.3	77.8	246.8	0.95	0.95	0.95	49.96
14/05/15	11:50 AM	237.3	237.8	237.6	9.6	9.3	9.2	383	396	394	24.6	24.4	24.3	264.2	90.7	86.1	277.9	0.95	0.95	0.95	49.96

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	11:51 AM	237.6	238.0	237.7	10.2	10.1	9.9	399	414	410	24.1	23.7	23.8	276.4	95.3	90.7	290.9	0.95	0.95	0.95	49.96
14/05/15	11:52 AM	237.4	237.8	237.5	9.8	9.9	9.6	390	403	400	24.3	23.9	24.0	269.1	99.8	88.2	283.2	0.95	0.95	0.95	49.98
14/05/15	11:53 AM	238.2	238.2	238.0	9.6	9.6	9.3	376	388	386	24.5	24.1	24.2	260.1	104.2	85.5	273.8	0.95	0.95	0.95	49.98
14/05/15	11:54 AM	238.8	237.8	237.9	9.9	9.8	9.4	362	375	372	24.8	24.5	24.4	250.6	108.3	83.7	264.2	0.95	0.95	0.95	49.97
14/05/15	11:55 AM	238.4	237.5	237.5	9.9	9.8	9.4	367	379	377	25.0	24.8	24.7	253.2	112.5	84.5	267.0	0.95	0.95	0.95	49.95
14/05/15	11:56 AM	238.5	237.5	237.4	9.5	9.3	9.0	357	369	367	25.3	25.2	25.0	246.5	116.7	82.1	259.8	0.95	0.95	0.95	49.98
14/05/15	11:57 AM	237.9	236.8	236.7	9.6	9.5	9.2	359	372	369	25.2	25.0	24.7	247.3	120.8	82.9	260.8	0.95	0.95	0.95	49.98
14/05/15	11:58 AM	237.7	236.7	236.6	9.9	9.8	9.4	383	396	393	24.6	24.4	24.2	263.5	125.2	88.2	277.9	0.95	0.95	0.95	49.96
14/05/15	11:59 AM	238.0	237.1	236.9	9.9	9.7	9.4	388	400	398	24.5	24.4	24.2	266.9	129.6	89.3	281.5	0.95	0.95	0.95	49.96
14/05/15	12:00 PM	239.0	237.9	237.6	9.8	9.6	9.3	400	414	411	24.3	24.2	24.1	277.0	134.2	91.7	291.8	0.95	0.95	0.95	49.98
14/05/15	12:01 PM	239.0	238.0	237.5	10.0	9.8	9.5	404	418	415	24.4	24.3	24.3	279.8	138.9	91.8	294.5	0.95	0.95	0.95	50.00
14/05/15	12:02 PM	240.1	239.0	238.5	9.9	9.7	9.4	405	419	416	24.5	24.3	24.3	281.9	143.6	92.0	296.5	0.95	0.95	0.95	50.00
14/05/15	12:03 PM	240.4	239.4	238.8	9.5	9.5	9.2	406	419	416	24.3	24.0	24.1	282.7	148.3	91.7	297.2	0.95	0.95	0.95	50.00
14/05/15	12:04 PM	239.8	238.8	238.1	10.0	9.8	9.5	406	420	416	24.2	24.0	23.9	281.9	153.0	92.2	296.6	0.95	0.95	0.95	50.01
14/05/15	12:05 PM	239.8	238.8	238.0	9.9	9.8	9.5	406	420	417	24.3	24.0	24.0	282.2	157.7	92.4	297.0	0.95	0.95	0.95	50.02
14/05/15	12:06 PM	239.5	238.5	237.7	9.7	9.6	9.3	407	420	417	24.5	24.2	24.3	282.4	162.4	91.5	296.9	0.95	0.95	0.95	50.02
14/05/15	12:07 PM	240.0	238.9	238.1	10.0	9.7	9.4	406	420	417	24.4	24.3	24.2	282.5	167.1	92.1	297.1	0.95	0.95	0.95	50.03
14/05/15	12:08 PM	240.1	239.0	238.2	10.1	9.9	9.5	406	420	417	24.4	24.2	24.2	282.5	171.8	92.5	297.3	0.95	0.95	0.95	50.06
14/05/15	12:09 PM	240.3	239.2	238.3	10.0	9.8	9.4	406	420	417	24.5	24.3	24.2	282.7	176.5	92.5	297.4	0.95	0.95	0.95	50.06
14/05/15	12:10 PM	240.3	239.2	238.4	10.0	9.7	9.4	406	420	417	24.5	24.3	24.2	282.7	181.3	92.3	297.4	0.95	0.95	0.95	50.05
14/05/15	12:11 PM	240.7	239.6	238.7	9.5	9.5	9.1	406	420	417	24.3	24.0	24.1	283.4	186.0	91.7	297.9	0.95	0.95	0.95	49.99
14/05/15	12:12 PM	239.8	238.8	237.9	9.7	9.7	9.3	406	419	417	24.3	24.0	24.0	282.0	190.7	92.0	296.6	0.95	0.95	0.95	49.97
14/05/15	12:13 PM	239.5	238.6	237.6	9.8	9.7	9.2	406	418	417	24.1	23.8	23.7	281.6	195.4	91.7	296.1	0.95	0.95	0.95	49.98
14/05/15	12:14 PM	239.5	238.5	237.5	9.7	9.6	9.2	406	418	417	24.0	23.8	23.6	281.4	200.1	91.6	295.9	0.95	0.95	0.95	49.97
14/05/15	12:15 PM	239.7	238.7	237.8	9.7	9.5	9.2	406	417	417	24.0	23.8	23.6	281.6	204.8	91.5	296.1	0.95	0.95	0.95	49.94
14/05/15	12:16 PM	240.5	239.4	238.7	9.6	9.6	9.1	406	417	417	24.2	24.0	23.7	282.6	209.5	91.7	297.1	0.95	0.95	0.95	49.94
14/05/15	12:17 PM	240.2	239.1	238.4	9.8	9.7	9.3	406	417	417	24.3	24.1	23.8	282.2	214.2	91.5	296.7	0.95	0.95	0.95	49.94
14/05/15	12:18 PM	239.8	238.8	238.0	10.0	9.8	9.4	405	419	417	24.5	24.3	24.1	281.6	218.9	92.3	296.4	0.95	0.95	0.95	49.93
14/05/15	12:19 PM	239.7	238.7	237.8	10.0	9.8	9.4	405	419	417	24.5	24.4	24.2	281.4	223.6	92.4	296.2	0.95	0.95	0.95	49.93
14/05/15	12:20 PM	239.2	238.3	237.4	10.0	9.8	9.4	405	419	416	24.4	24.3	24.1	280.7	228.2	92.3	295.5	0.95	0.95	0.95	49.95
14/05/15	12:21 PM	239.4	238.3	237.4	10.0	9.8	9.5	406	419	417	24.1	24.0	23.8	281.0	232.9	92.2	295.8	0.95	0.95	0.95	50.00

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	12:22 PM	239.1	238.0	237.1	10.1	9.8	9.5	405	418	416	24.0	24.0	23.8	280.3	237.6	92.3	295.1	0.95	0.95	0.95	49.98
14/05/15	12:23 PM	239.8	238.7	237.8	10.0	9.7	9.4	401	414	412	24.2	24.1	23.9	278.1	242.2	91.8	292.8	0.95	0.95	0.95	49.97
14/05/15	12:24 PM	240.5	239.5	238.5	9.9	9.7	9.3	401	413	412	24.1	24.1	23.9	279.0	246.9	91.3	293.5	0.95	0.95	0.95	49.98
14/05/15	12:25 PM	241.5	240.4	239.6	9.9	9.8	9.5	399	412	410	24.2	23.9	23.9	279.2	251.5	91.7	293.9	0.95	0.95	0.95	49.95
14/05/15	12:26 PM	241.2	240.4	239.4	9.4	9.7	9.2	401	411	411	24.0	24.1	23.7	279.6	256.2	90.6	293.9	0.95	0.95	0.95	49.92
14/05/15	12:27 PM	240.8	240.2	239.3	9.5	9.8	9.2	402	412	412	23.9	24.1	23.6	280.2	260.9	90.6	294.4	0.95	0.95	0.95	49.91
14/05/15	12:28 PM	239.7	239.1	238.1	9.4	9.7	9.2	403	413	413	23.9	24.1	23.6	279.3	265.5	90.2	293.5	0.95	0.95	0.95	49.90
14/05/15	12:29 PM	240.5	239.6	238.6	9.4	9.6	9.1	400	411	411	24.0	24.2	23.7	278.6	270.2	89.7	292.7	0.95	0.95	0.95	49.89
14/05/15	12:30 PM	239.7	239.0	238.1	9.4	9.8	9.2	401	411	411	24.0	24.1	23.6	278.0	274.8	89.6	292.1	0.95	0.95	0.95	49.88
14/05/15	12:31 PM	240.3	239.5	238.5	9.4	9.8	9.2	400	409	410	24.2	24.4	23.9	277.8	279.4	89.5	291.9	0.95	0.95	0.95	49.86
14/05/15	12:32 PM	240.8	240.2	239.2	9.3	9.6	9.0	398	407	408	24.3	24.5	23.9	277.4	284.0	88.7	291.2	0.95	0.95	0.95	49.86
14/05/15	12:33 PM	241.1	240.4	239.4	9.3	9.7	9.1	397	407	408	24.2	24.4	23.9	277.3	288.7	89.1	291.3	0.95	0.95	0.95	49.87
14/05/15	12:34 PM	240.9	240.2	239.3	9.3	9.7	9.1	397	407	407	24.3	24.4	23.9	276.7	293.3	89.1	290.7	0.95	0.95	0.95	49.88
14/05/15	12:35 PM	241.1	240.4	239.5	9.1	9.5	9.0	396	406	406	24.4	24.5	24.0	276.3	297.9	88.4	290.1	0.95	0.95	0.95	49.90
14/05/15	12:36 PM	242.0	241.3	240.2	9.0	9.4	8.8	393	403	403	24.4	24.6	24.0	275.7	302.5	87.7	289.3	0.95	0.95	0.95	49.90
14/05/15	12:37 PM	240.7	239.9	238.7	9.0	9.3	8.7	395	405	405	24.4	24.6	24.1	275.3	307.1	87.7	288.9	0.95	0.95	0.95	49.90
14/05/15	12:38 PM	240.1	239.4	238.2	9.0	9.3	8.7	395	404	405	24.4	24.6	24.1	274.4	311.6	87.4	288.0	0.95	0.95	0.95	49.91
14/05/15	12:39 PM	240.6	239.8	238.7	8.8	9.2	8.6	393	403	403	24.5	24.7	24.1	274.2	316.2	86.8	287.6	0.95	0.95	0.95	49.93
14/05/15	12:40 PM	240.1	239.2	238.1	8.9	9.3	8.8	394	403	404	24.5	24.6	24.1	273.6	320.8	87.2	287.2	0.95	0.95	0.95	49.94
14/05/15	12:41 PM	243.9	242.9	241.8	5.8	6.1	5.7	139	142	142	37.8	73.9	34.8	34.7	321.3	12.3	37.4	0.95	0.95	0.95	49.96
14/05/15	12:42 PM	244.8	243.7	242.9	5.7	6.1	5.6	1	1	1	37.7	82.3	34.7	0.1	321.3	0.7	0.7	0.95	0.95	0.95	49.98
14/05/15	12:43 PM	244.2	243.0	242.7	5.7	6.1	5.6	1	1	1	38.0	82.5	37.3	0.1	321.3	0.8	0.8	0.95	0.95	0.95	49.99
14/05/15	12:44 PM	242.1	240.9	240.8	7.1	7.5	7.0	269	276	276	32.8	54.5	32.1	130.1	323.5	43.1	137.6	0.91	0.92	0.92	49.99
14/05/15	12:45 PM	241.5	240.5	240.2	8.3	8.7	8.1	390	400	400	24.8	25.0	24.4	273.4	328.1	86.4	286.7	0.95	0.95	0.95	49.97
14/05/15	12:46 PM	242.1	241.0	240.7	8.2	8.5	8.0	389	399	399	25.0	25.2	24.5	273.4	332.6	86.2	286.6	0.95	0.95	0.95	49.95
14/05/15	12:47 PM	242.9	241.8	241.2	8.3	8.6	8.0	388	398	398	24.9	25.1	24.5	273.3	337.2	86.2	286.6	0.95	0.95	0.95	49.94
14/05/15	12:48 PM	243.3	242.1	241.5	8.5	8.8	8.3	388	397	398	24.8	25.0	24.4	273.3	341.7	86.7	286.7	0.95	0.95	0.95	49.95
14/05/15	12:49 PM	243.7	242.5	241.8	8.5	8.8	8.2	387	396	397	24.7	24.9	24.3	273.1	346.3	86.2	286.4	0.95	0.95	0.95	49.95
14/05/15	12:50 PM	242.5	241.4	240.7	9.0	9.3	8.6	389	398	399	24.5	24.7	24.1	273.0	350.8	87.0	286.5	0.95	0.95	0.95	49.93
14/05/15	12:51 PM	243.2	242.1	241.2	8.9	9.3	8.6	388	397	398	24.5	24.6	24.1	273.0	355.4	86.9	286.5	0.95	0.95	0.95	49.94
14/05/15	12:52 PM	242.6	241.6	240.6	9.0	9.4	8.7	389	399	399	24.4	24.6	24.1	273.2	359.9	87.1	286.8	0.95	0.95	0.95	49.93

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	12:53 PM	244.6	243.5	242.5	8.5	8.8	8.2	386	395	396	24.7	24.9	24.3	273.4	364.5	86.0	286.6	0.95	0.95	0.95	49.96
14/05/15	12:54 PM	245.4	244.2	243.3	8.2	8.5	8.0	385	394	395	25.0	25.1	24.4	273.7	369.1	85.9	286.8	0.95	0.95	0.95	49.97
14/05/15	12:55 PM	245.6	244.2	243.5	8.8	8.6	8.8	386	395	396	25.1	25.1	24.6	274.3	373.6	86.2	287.6	0.95	0.95	0.95	49.97
14/05/15	12:56 PM	245.4	244.1	243.2	8.5	8.8	8.4	388	398	398	24.9	24.9	24.3	275.5	378.2	87.0	288.9	0.95	0.95	0.95	49.99
14/05/15	12:57 PM	247.6	246.1	245.2	6.2	6.5	6.1	256	262	262	58.4	59.5	57.7	122.8	380.3	54.0	141.3	0.54	0.54	0.54	50.01
14/05/15	12:58 PM	250.1	248.6	248.0	4.5	4.8	4.5	28	29	29	87.6	89.3	87.2	4.2	380.3	20.6	21.0	0.20	0.20	0.20	50.04
14/05/15	12:59 PM	249.5	248.0	247.7	5.6	5.8	5.8	113	116	116	47.2	47.7	47.3	60.4	381.3	44.2	76.6	0.64	0.65	0.64	50.08
14/05/15	1:00 PM	248.9	247.5	247.3	6.3	6.4	6.4	136	139	139	29.9	29.8	29.8	87.1	382.8	54.8	102.9	0.84	0.85	0.84	50.09
14/05/15	1:01 PM	250.7	249.3	249.4	5.2	6.0	5.8	138	141	141	29.9	29.8	29.7	88.0	384.3	56.7	104.7	0.84	0.85	0.84	50.12
14/05/15	1:02 PM	252.0	250.5	250.7	5.3	5.4	5.5	137	141	140	30.0	29.8	29.8	87.8	385.7	57.7	105.0	0.83	0.84	0.83	50.12
14/05/15	1:03 PM	252.0	250.5	250.8	5.1	5.6	5.5	138	142	142	29.9	29.8	29.7	88.5	387.2	58.1	105.9	0.83	0.84	0.83	50.12
14/05/15	1:04 PM	252.7	251.3	251.7	5.0	4.9	5.1	140	143	143	30.0	29.8	29.8	89.0	388.7	59.6	107.1	0.83	0.84	0.83	50.09
14/05/15	1:05 PM	251.7	250.3	250.8	5.0	5.8	5.6	149	152	152	29.8	29.7	29.7	94.9	390.3	62.2	113.6	0.83	0.84	0.83	50.06
14/05/15	1:06 PM	253.2	251.7	252.0	4.7	4.9	4.6	62	64	63	37.2	74.6	38.7	16.5	390.5	10.9	20.1	0.85	0.86	0.85	50.02
14/05/15	1:07 PM	253.2	251.8	252.1	4.4	4.7	4.4	1	1	1	38.4	82.4	47.4	0.1	390.5	0.8	0.8	0.10	0.86	0.85	49.99
14/05/15	1:08 PM	252.6	251.2	251.5	4.8	5.0	4.8	1	1	1	38.1	81.2	58.4	0.1	390.5	0.8	0.8	0.20	0.86	0.02	49.97
14/05/15	1:09 PM	253.2	251.8	252.2	4.3	4.7	4.4	1	1	1	38.5	81.6	59.7	0.1	390.6	0.8	0.8	0.20	0.02	(0.01)	49.98
14/05/15	1:10 PM	252.8	251.4	251.9	4.5	4.9	4.6	1	1	1	38.3	80.4	57.9	0.1	390.6	0.8	0.8	0.14	0.02	(0.01)	49.96
14/05/15	1:11 PM	252.4	251.0	251.4	4.7	4.9	4.7	1	1	1	38.0	79.6	54.7	0.1	390.6	0.8	0.8	0.14	0.01	(0.01)	49.96
14/05/15	1:12 PM	251.7	250.4	250.8	6.5	6.7	6.4	274	282	282	30.8	47.5	33.3	152.6	393.1	48.9	160.6	0.94	0.94	0.93	49.97
14/05/15	1:13 PM	249.5	248.1	248.8	8.3	8.3	8.3	406	417	417	24.4	24.5	24.1	294.4	398.0	92.2	308.5	0.95	0.96	0.95	49.93
14/05/15	1:14 PM	249.3	247.8	248.3	8.5	8.5	8.4	407	418	417	24.4	24.5	24.2	294.7	402.9	92.3	308.8	0.95	0.96	0.95	49.93
14/05/15	1:15 PM	249.5	248.0	248.3	8.5	8.5	8.3	407	418	417	24.4	24.5	24.3	294.7	407.8	91.9	308.7	0.95	0.96	0.95	49.94
14/05/15	1:16 PM	249.4	247.8	248.0	8.3	8.2	8.1	393	403	403	24.4	24.5	24.2	284.3	412.6	88.4	297.8	0.95	0.96	0.95	49.94
14/05/15	1:17 PM	250.8	249.2	249.3	7.3	7.3	7.2	337	346	345	25.2	25.2	25.0	245.5	416.7	75.0	256.7	0.96	0.96	0.96	49.94
14/05/15	1:18 PM	250.4	248.8	248.9	6.8	6.7	6.6	305	313	312	25.9	26.0	25.8	221.5	420.3	68.2	231.7	0.95	0.96	0.96	49.93
14/05/15	1:19 PM	249.6	248.0	248.0	6.9	7.0	6.6	287	295	294	26.2	26.1	26.1	207.8	423.8	65.1	217.7	0.95	0.96	0.95	49.94
14/05/15	1:20 PM	250.4	248.8	248.7	7.1	7.1	7.1	279	287	286	26.2	25.9	25.8	202.6	427.2	63.2	212.2	0.95	0.96	0.96	49.93
14/05/15	1:21 PM	250.7	249.1	249.0	6.7	7.0	6.6	291	299	298	25.9	25.6	25.5	211.6	430.7	65.5	221.5	0.95	0.96	0.96	49.91
14/05/15	1:22 PM	250.8	249.2	249.2	6.6	6.9	6.4	300	308	308	25.9	25.6	25.5	218.3	434.4	67.4	228.5	0.95	0.96	0.96	49.93
14/05/15	1:23 PM	250.8	249.2	249.2	6.6	6.9	6.4	296	304	303	25.8	25.6	25.5	215.6	437.9	66.1	225.5	0.95	0.96	0.96	49.93

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	1:24 PM	250.3	248.7	248.7	6.9	7.2	6.6	301	309	309	25.7	25.5	25.4	218.5	441.6	67.9	228.8	0.95	0.96	0.96	49.92
14/05/15	1:25 PM	250.3	248.6	248.7	6.8	7.1	6.6	307	316	315	25.8	25.6	25.5	223.2	445.3	69.7	233.9	0.95	0.96	0.95	49.91
14/05/15	1:26 PM	250.6	248.9	248.9	6.7	7.0	6.5	315	323	323	25.8	25.6	25.4	229.2	449.1	70.7	239.8	0.95	0.96	0.96	49.93
14/05/15	1:27 PM	251.0	249.3	249.2	6.6	6.9	6.4	309	317	317	25.8	25.6	25.5	225.1	452.9	69.3	235.5	0.95	0.96	0.96	49.98
14/05/15	1:28 PM	250.6	248.9	248.8	6.7	7.0	6.5	308	317	317	25.9	25.7	25.5	224.2	456.6	69.5	234.7	0.95	0.96	0.96	50.00
14/05/15	1:29 PM	249.4	247.7	247.6	7.8	7.8	7.7	368	378	377	25.4	25.3	25.1	265.7	461.0	82.9	278.3	0.95	0.96	0.95	50.01
14/05/15	1:30 PM	248.7	246.9	246.7	8.0	8.2	7.8	368	378	378	25.0	24.8	24.7	265.1	465.5	83.8	278.1	0.95	0.95	0.95	50.03
14/05/15	1:31 PM	248.6	246.8	246.5	7.8	8.0	7.6	343	352	352	25.1	24.9	24.8	246.8	469.6	77.8	258.8	0.95	0.95	0.95	50.00
14/05/15	1:32 PM	247.0	245.2	245.0	8.1	8.4	7.9	331	340	340	25.1	24.8	24.8	236.6	473.5	75.9	248.5	0.95	0.95	0.95	49.97
14/05/15	1:33 PM	246.1	244.4	244.1	8.2	8.4	7.9	332	341	341	25.0	24.8	24.7	236.6	477.5	75.9	248.5	0.95	0.95	0.95	49.94
14/05/15	1:34 PM	246.0	244.3	244.0	8.5	8.4	8.4	320	329	329	25.4	25.1	25.0	227.8	481.3	73.1	239.3	0.95	0.95	0.95	49.93
14/05/15	1:35 PM	246.3	244.6	244.3	8.5	8.4	8.3	328	337	336	25.2	25.0	24.9	232.9	485.1	74.8	244.7	0.95	0.95	0.95	49.95
14/05/15	1:36 PM	245.3	243.5	243.3	8.5	8.7	8.3	341	350	350	24.8	24.6	24.5	241.9	489.2	77.8	254.2	0.95	0.95	0.95	49.94
14/05/15	1:37 PM	245.6	243.8	243.6	8.6	8.7	8.4	345	354	354	25.0	24.7	24.6	244.5	493.2	78.2	256.7	0.95	0.95	0.95	49.94
14/05/15	1:38 PM	244.8	243.1	242.8	9.6	9.6	9.5	401	411	411	24.4	24.2	24.1	283.5	498.0	91.6	297.9	0.95	0.95	0.95	49.97
14/05/15	1:39 PM	245.2	243.7	243.0	9.5	9.8	9.1	406	415	417	23.7	23.9	23.4	287.6	502.8	92.0	302.0	0.95	0.95	0.95	49.98
14/05/15	1:40 PM	244.3	242.6	242.2	9.3	9.4	9.3	407	417	417	24.0	24.1	23.7	287.4	507.6	91.9	301.7	0.95	0.95	0.95	49.96
14/05/15	1:41 PM	244.5	242.8	242.3	8.7	9.5	9.2	409	419	418	24.7	24.8	24.5	288.5	512.4	92.5	302.9	0.95	0.95	0.95	49.96
14/05/15	1:42 PM	245.7	244.5	243.8	7.9	8.7	8.4	409	419	419	24.8	24.9	24.5	290.3	517.2	93.5	305.0	0.95	0.95	0.95	49.95
14/05/15	1:43 PM	245.1	243.7	243.1	8.5	9.9	9.6	409	419	419	25.0	25.0	24.7	289.1	522.0	93.8	303.9	0.95	0.95	0.95	49.94
14/05/15	1:44 PM	244.6	243.2	242.5	8.3	9.0	8.7	409	419	418	24.8	24.8	24.5	288.2	526.8	94.1	303.2	0.95	0.95	0.95	49.95
14/05/15	1:45 PM	245.1	243.7	243.0	8.2	8.8	8.6	408	418	418	24.8	24.8	24.4	288.4	531.6	94.1	303.4	0.95	0.95	0.95	49.95
14/05/15	1:46 PM	245.3	244.0	243.1	8.3	9.0	8.8	408	418	418	24.9	24.9	24.5	288.8	536.4	94.1	303.8	0.95	0.95	0.95	49.99
14/05/15	1:47 PM	245.5	244.2	243.3	8.1	8.7	8.5	408	418	418	24.8	24.9	24.5	289.2	541.3	94.1	304.1	0.95	0.95	0.95	50.02
14/05/15	1:48 PM	246.1	244.7	243.8	8.0	8.5	8.3	409	419	419	24.9	24.9	24.5	290.2	546.1	93.9	305.0	0.95	0.95	0.95	50.02
14/05/15	1:49 PM	245.4	244.0	243.0	8.3	8.8	8.7	409	419	419	24.7	24.8	24.4	289.2	550.9	93.9	304.1	0.95	0.95	0.95	50.01
14/05/15	1:50 PM	243.9	242.6	241.6	9.0	9.8	9.6	408	418	418	24.6	24.6	24.2	287.1	555.7	93.8	302.1	0.95	0.95	0.95	50.01
14/05/15	1:51 PM	243.4	241.9	240.9	9.4	9.9	9.8	408	418	418	24.7	24.8	24.4	286.4	560.5	92.9	301.1	0.95	0.95	0.95	49.99
14/05/15	1:52 PM	243.2	241.5	240.5	9.6	9.7	9.5	406	416	416	24.1	24.3	24.0	284.6	565.2	92.1	299.2	0.95	0.95	0.95	49.98
14/05/15	1:53 PM	242.8	241.3	240.2	9.5	9.5	9.3	404	415	414	24.4	24.5	24.2	283.3	569.9	91.5	297.7	0.95	0.95	0.95	49.97
14/05/15	1:54 PM	242.8	241.1	240.0	9.3	9.3	9.0	407	418	417	24.2	24.2	24.0	285.3	574.7	91.8	299.7	0.95	0.95	0.95	49.96

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	1:55 PM	243.2	241.5	240.2	9.7	9.7	9.4	407	417	417	23.8	23.8	23.6	285.4	579.5	91.7	299.8	0.95	0.95	0.95	49.98
14/05/15	1:56 PM	242.1	240.5	239.0	9.2	9.3	8.8	407	419	417	24.3	24.1	24.1	284.7	584.2	91.0	298.9	0.95	0.95	0.95	49.99
14/05/15	1:57 PM	242.2	240.6	239.0	9.5	9.7	9.1	407	418	417	24.3	24.0	24.0	284.7	588.9	90.7	298.8	0.95	0.95	0.95	50.00
14/05/15	1:58 PM	242.3	240.7	239.1	9.1	9.3	8.8	407	419	417	24.6	24.2	24.3	285.1	593.7	90.5	299.1	0.95	0.95	0.95	50.00
14/05/15	1:59 PM	242.7	241.0	239.5	9.1	9.3	8.7	406	418	416	24.6	24.2	24.2	284.8	598.4	90.8	298.9	0.95	0.95	0.95	50.03
14/05/15	2:00 PM	242.6	241.0	239.5	9.6	9.7	9.1	407	418	417	24.3	24.0	23.9	285.0	603.2	91.1	299.2	0.95	0.95	0.95	50.08
14/05/15	2:01 PM	242.9	241.3	239.8	9.4	9.5	8.9	403	414	413	24.4	24.1	24.0	282.9	607.9	90.0	296.9	0.95	0.95	0.95	50.12
14/05/15	2:02 PM	242.7	241.0	239.6	9.7	9.8	9.2	404	414	414	24.1	23.9	23.7	282.7	612.6	91.1	297.0	0.95	0.95	0.95	50.13
14/05/15	2:03 PM	242.5	240.8	239.4	9.9	9.9	9.3	403	414	414	23.9	23.7	23.5	282.3	617.3	91.0	296.6	0.95	0.95	0.95	50.12
14/05/15	2:04 PM	242.4	240.7	239.5	9.1	9.2	8.8	398	408	407	24.0	24.0	23.8	278.6	622.0	87.8	292.1	0.95	0.95	0.95	50.10
14/05/15	2:05 PM	242.0	240.3	239.0	8.8	8.8	8.3	397	408	407	24.5	24.4	24.3	278.0	626.6	88.0	291.6	0.95	0.95	0.95	50.05
14/05/15	2:06 PM	241.3	239.6	238.5	8.6	8.6	8.5	398	407	407	24.4	24.6	24.3	276.9	631.2	87.8	290.5	0.95	0.95	0.95	50.00
14/05/15	2:07 PM	239.7	238.1	237.0	8.7	8.8	8.6	399	409	408	24.2	24.4	24.1	276.0	635.8	87.4	289.5	0.95	0.95	0.95	49.99
14/05/15	2:08 PM	238.7	237.2	236.0	8.9	9.0	8.8	400	410	409	24.1	24.2	24.0	275.8	640.4	87.8	289.5	0.95	0.95	0.95	49.97
14/05/15	2:09 PM	237.4	235.8	234.8	8.9	9.0	8.8	402	412	411	24.1	24.3	24.0	275.4	645.0	87.9	289.1	0.95	0.95	0.95	49.95
14/05/15	2:10 PM	237.1	235.6	234.6	8.9	8.9	8.7	402	412	411	24.3	24.4	24.1	275.0	649.6	87.8	288.7	0.95	0.95	0.95	49.94
14/05/15	2:11 PM	237.5	235.9	234.7	9.1	9.2	8.7	401	412	411	24.4	24.2	24.2	274.9	654.2	88.0	288.7	0.95	0.95	0.95	49.94
14/05/15	2:12 PM	237.3	235.7	234.4	9.2	9.3	8.6	401	412	411	24.6	24.3	24.3	274.7	658.7	88.1	288.5	0.95	0.95	0.95	49.93
14/05/15	2:13 PM	236.9	235.4	234.2	9.2	9.3	8.6	402	413	412	24.6	24.3	24.3	275.0	663.3	88.4	288.9	0.95	0.95	0.95	49.92
14/05/15	2:14 PM	236.2	234.6	233.4	10.3	10.3	9.7	404	415	415	24.1	23.9	23.9	274.6	667.9	91.2	289.4	0.95	0.95	0.95	49.92
14/05/15	2:15 PM	235.1	233.5	232.2	10.6	10.7	10.0	404	415	415	23.9	23.7	23.7	273.2	672.5	91.8	288.2	0.95	0.95	0.95	49.91
14/05/15	2:16 PM	234.5	232.9	231.6	10.7	10.8	10.2	405	416	415	23.9	23.7	23.7	272.6	677.0	92.2	287.8	0.95	0.95	0.95	49.88
14/05/15	2:17 PM	234.5	232.9	231.6	10.7	10.8	10.2	405	416	416	23.7	23.5	23.5	273.2	681.6	91.8	288.2	0.95	0.95	0.95	49.87
14/05/15	2:18 PM	233.5	232.0	230.6	10.9	11.0	10.3	406	417	417	23.6	23.4	23.4	272.7	686.1	91.1	287.5	0.95	0.95	0.95	49.85
14/05/15	2:19 PM	232.1	230.6	229.2	10.7	10.9	10.3	406	417	417	23.7	23.5	23.5	271.3	690.6	90.6	286.0	0.95	0.95	0.95	49.82
14/05/15	2:20 PM	230.9	229.4	228.1	10.3	10.4	9.9	406	418	417	23.9	23.6	23.6	270.4	695.1	89.4	284.8	0.95	0.95	0.95	49.85
14/05/15	2:21 PM	232.9	231.3	230.0	8.7	8.9	8.4	297	306	305	32.2	54.1	30.6	145.5	697.6	49.0	153.9	0.95	0.95	0.95	49.86
14/05/15	2:22 PM	236.0	234.3	233.3	6.7	6.9	6.4	1	1	1	39.0	85.4	35.5	0.1	697.6	0.7	0.7	0.95	0.04	0.95	49.83
14/05/15	2:23 PM	236.5	234.8	234.2	6.8	6.9	6.4	1	1	1	39.0	86.1	37.1	0.1	697.6	0.7	0.7	0.95	0.04	(0.01)	49.80
14/05/15	2:24 PM	236.5	234.7	234.4	6.9	7.0	6.4	1	1	1	39.6	89.0	39.9	0.1	697.6	0.8	0.8	0.95	0.04	0.01	49.79
14/05/15	2:25 PM	236.5	234.6	234.6	7.0	7.4	6.8	33	34	34	86.3	88.6	86.5	4.6	697.6	22.6	23.0	0.20	0.21	0.19	49.79

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	2:26 PM	234.2	232.5	232.5	9.1	9.3	8.7	291	299	299	54.9	54.6	54.2	142.9	700.0	58.4	159.8	0.59	0.60	0.59	49.81
14/05/15	2:27 PM	232.7	231.3	231.2	10.6	10.7	10.0	406	417	417	23.6	23.4	23.5	272.8	704.6	90.2	287.3	0.95	0.95	0.95	49.83
14/05/15	2:28 PM	233.5	232.1	231.8	10.5	10.7	10.0	406	417	417	23.7	23.5	23.5	273.5	709.1	90.7	288.2	0.95	0.95	0.95	49.85
14/05/15	2:29 PM	234.1	232.6	232.1	10.4	10.5	9.9	405	416	415	23.7	23.5	23.5	273.1	713.7	91.0	287.8	0.95	0.95	0.95	49.85
14/05/15	2:30 PM	234.6	233.0	232.4	10.4	10.5	9.9	403	414	414	23.7	23.5	23.5	272.9	718.2	90.2	287.4	0.95	0.95	0.95	49.86
14/05/15	2:31 PM	235.1	233.5	232.9	10.2	10.3	9.7	402	413	413	23.8	23.5	23.5	272.9	722.8	89.2	287.1	0.95	0.95	0.95	49.85
14/05/15	2:32 PM	235.1	233.6	232.9	10.3	10.4	9.8	402	413	413	23.7	23.5	23.5	272.8	727.3	89.1	287.0	0.95	0.95	0.95	49.86
14/05/15	2:33 PM	234.6	233.0	232.1	10.3	10.5	9.8	403	415	414	23.7	23.4	23.5	272.8	731.9	90.1	287.3	0.95	0.95	0.95	49.83
14/05/15	2:34 PM	235.1	233.5	232.6	9.2	9.4	8.8	332	342	341	24.7	24.3	24.2	221.2	735.6	72.9	233.0	0.95	0.95	0.95	49.82
14/05/15	2:35 PM	234.0	232.5	231.6	10.6	10.8	10.1	405	416	415	23.6	23.4	23.4	272.8	740.1	90.7	287.5	0.95	0.95	0.95	49.84
14/05/15	2:36 PM	233.5	232.0	230.9	10.8	11.0	10.3	406	416	416	23.5	23.4	23.3	272.7	744.6	90.4	287.3	0.95	0.95	0.95	49.82
14/05/15	2:37 PM	233.6	232.1	231.0	10.5	10.7	10.0	406	416	416	23.6	23.4	23.4	273.1	749.2	89.9	287.5	0.95	0.95	0.95	49.80
14/05/15	2:38 PM	234.2	232.6	231.6	10.2	10.4	9.7	405	416	416	23.8	23.5	23.5	273.9	753.8	89.7	288.2	0.95	0.95	0.95	49.78
14/05/15	2:39 PM	232.7	231.0	230.1	10.4	10.5	9.8	406	417	417	23.7	23.5	23.5	272.8	758.3	89.1	287.0	0.95	0.95	0.95	49.76
14/05/15	2:40 PM	232.3	230.6	229.7	10.6	10.7	10.0	406	417	417	23.7	23.4	23.4	272.3	762.8	89.2	286.5	0.95	0.95	0.95	49.75
14/05/15	2:41 PM	230.9	229.1	228.1	11.1	11.1	10.5	406	417	417	23.5	23.3	23.3	270.2	767.4	89.5	284.6	0.95	0.95	0.95	49.77
14/05/15	2:42 PM	230.6	228.8	227.8	10.9	11.0	10.4	406	417	417	23.5	23.4	23.3	269.9	771.8	89.3	284.3	0.95	0.95	0.95	49.79
14/05/15	2:43 PM	232.3	230.4	229.5	8.8	8.9	8.4	337	346	346	30.6	30.4	30.5	197.1	775.1	80.9	217.3	0.81	0.82	0.81	49.82
14/05/15	2:44 PM	236.9	234.9	234.2	5.5	5.7	5.3	33	34	34	87.0	87.0	87.1	4.8	775.2	23.3	23.8	0.21	0.21	0.20	49.85
14/05/15	2:45 PM	236.8	234.9	234.5	5.7	6.0	5.5	78	79	79	70.6	70.9	71.4	24.6	775.6	31.6	42.2	0.37	0.37	0.36	49.89
14/05/15	2:46 PM	235.3	233.5	233.3	6.2	6.7	6.1	139	142	142	30.1	29.9	29.8	76.7	776.9	62.5	99.0	0.77	0.78	0.77	49.93
14/05/15	2:47 PM	235.2	233.4	233.4	6.3	6.8	6.1	139	142	142	30.0	29.8	29.8	76.7	778.2	62.4	98.9	0.77	0.78	0.77	49.97
14/05/15	2:48 PM	235.4	233.6	233.8	6.0	6.5	5.9	139	142	142	30.0	29.8	29.8	76.7	779.5	62.7	99.0	0.77	0.78	0.77	49.97
14/05/15	2:49 PM	237.1	235.3	235.6	5.1	5.4	5.0	140	143	143	30.0	29.8	29.8	77.3	780.7	64.4	100.6	0.76	0.78	0.76	49.98
14/05/15	2:50 PM	235.0	233.2	233.6	6.1	6.5	5.9	140	143	143	30.0	29.8	29.8	77.4	782.0	62.9	99.7	0.77	0.79	0.77	49.98
14/05/15	2:51 PM	233.7	232.0	232.4	6.9	7.3	6.7	154	157	157	36.6	36.6	36.4	79.9	783.4	56.6	99.7	0.72	0.73	0.72	49.98
14/05/15	2:52 PM	235.6	233.8	234.4	6.4	6.6	6.0	85	87	87	75.0	74.9	75.1	27.9	783.8	25.1	41.5	0.36	0.37	0.36	50.01
14/05/15	2:53 PM	237.6	235.7	236.4	5.5	5.6	5.1	16	17	16	90.0	90.3	90.5	2.3	783.9	11.1	11.3	0.22	0.20	0.20	50.00
14/05/15	2:54 PM	237.9	236.0	236.7	5.9	6.0	5.4	13	13	13	91.2	93.3	93.2	1.8	783.9	8.6	8.8	0.22	0.19	0.19	49.96
14/05/15	2:55 PM	234.2	232.6	233.2	9.2	9.4	8.7	373	384	383	24.8	24.5	24.5	249.5	788.1	81.6	262.6	0.94	0.95	0.94	49.93
14/05/15	2:56 PM	233.7	232.1	232.6	9.4	9.7	9.0	407	419	418	24.1	23.8	23.9	275.5	792.7	88.9	289.5	0.95	0.95	0.95	49.91

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	2:57 PM	235.2	233.5	233.8	9.5	9.7	9.0	408	419	418	24.1	23.8	23.9	277.4	797.3	89.6	291.5	0.95	0.95	0.95	49.93
14/05/15	2:58 PM	236.1	234.5	234.6	9.5	9.7	9.1	408	420	418	24.2	23.8	24.0	278.8	801.9	89.8	292.9	0.95	0.95	0.95	49.92
14/05/15	2:59 PM	235.7	234.2	234.1	9.9	10.1	9.5	408	419	418	24.0	23.7	23.7	278.0	806.6	90.0	292.2	0.95	0.95	0.95	49.84
14/05/15	3:00 PM	233.9	232.3	232.1	10.0	10.1	9.6	407	418	417	24.0	23.7	23.7	274.9	811.1	89.4	289.1	0.95	0.95	0.95	49.82
14/05/15	3:01 PM	234.8	233.3	232.9	10.0	10.1	9.6	406	417	416	24.0	23.7	23.7	275.4	815.7	89.8	289.6	0.95	0.95	0.95	49.84
14/05/15	3:02 PM	234.6	233.3	232.7	10.0	10.1	9.6	405	417	416	23.9	23.6	23.7	274.9	820.3	89.8	289.2	0.95	0.95	0.95	49.85
14/05/15	3:03 PM	234.7	233.3	232.7	10.0	10.2	9.6	401	412	411	23.9	23.6	23.7	271.5	824.8	89.2	285.8	0.95	0.95	0.95	49.84
14/05/15	3:04 PM	233.4	231.9	231.3	10.3	10.5	10.0	392	404	403	23.9	23.5	23.6	264.1	829.2	87.7	278.3	0.95	0.95	0.95	49.85
14/05/15	3:05 PM	231.7	230.3	229.5	10.6	10.7	10.2	392	403	402	23.8	23.5	23.5	261.6	833.6	87.4	275.8	0.95	0.95	0.95	49.83
14/05/15	3:06 PM	231.4	230.0	229.1	10.8	10.8	10.3	389	400	399	23.7	23.4	23.5	259.4	837.9	87.3	273.7	0.95	0.95	0.95	49.82
14/05/15	3:07 PM	231.2	229.8	229.0	10.4	10.6	10.1	382	393	391	23.9	23.5	23.7	254.3	842.2	85.2	268.2	0.95	0.95	0.95	49.85
14/05/15	3:08 PM	231.1	229.7	228.9	10.3	10.5	10.0	391	402	401	24.1	23.7	23.8	260.2	846.5	87.0	274.4	0.95	0.95	0.95	49.88
14/05/15	3:09 PM	230.8	229.4	228.5	10.3	10.5	10.0	397	409	407	23.9	23.6	23.7	264.0	850.9	88.2	278.3	0.95	0.95	0.95	49.87
14/05/15	3:10 PM	230.9	229.4	228.6	10.3	10.5	10.0	375	387	385	23.9	23.5	23.7	249.8	855.1	83.4	263.3	0.95	0.95	0.95	49.90
14/05/15	3:11 PM	232.5	230.9	230.2	10.2	10.4	9.9	367	378	377	23.9	23.6	23.7	246.0	859.2	81.9	259.3	0.95	0.95	0.95	49.93
14/05/15	3:12 PM	232.3	230.9	230.0	10.5	10.6	10.1	375	386	385	24.0	23.6	23.7	251.1	863.3	83.7	264.7	0.95	0.95	0.95	49.97
14/05/15	3:13 PM	232.1	230.6	229.8	10.8	11.0	10.5	399	410	410	23.6	23.4	23.4	267.0	867.8	88.6	281.3	0.95	0.95	0.95	49.97
14/05/15	3:14 PM	232.6	231.1	230.3	10.8	11.0	10.5	407	418	418	23.8	23.5	23.5	273.0	872.3	90.1	287.5	0.95	0.95	0.95	50.03
14/05/15	3:15 PM	231.4	229.9	229.1	10.8	11.0	10.5	407	418	418	23.7	23.5	23.5	271.4	876.9	90.3	286.0	0.95	0.95	0.95	50.06
14/05/15	3:16 PM	231.5	230.0	229.2	10.8	11.0	10.5	407	418	417	23.8	23.5	23.6	271.3	881.4	90.4	285.9	0.95	0.95	0.95	50.06
14/05/15	3:17 PM	231.7	230.2	229.3	10.9	11.1	10.6	406	418	417	23.9	23.6	23.7	271.2	885.9	90.7	285.9	0.95	0.95	0.95	50.06
14/05/15	3:18 PM	231.4	229.9	228.9	11.0	11.1	10.6	406	418	417	23.6	23.4	23.4	270.8	890.4	90.6	285.5	0.95	0.95	0.95	50.05
14/05/15	3:19 PM	233.0	231.5	230.5	11.1	11.2	10.7	406	417	417	23.5	23.3	23.2	272.5	895.0	91.0	287.3	0.95	0.95	0.95	50.02
14/05/15	3:20 PM	232.9	231.5	230.5	11.1	11.1	10.7	406	417	417	23.7	23.5	23.5	272.5	899.5	91.0	287.3	0.95	0.95	0.95	50.02
14/05/15	3:21 PM	233.1	231.7	230.6	10.5	10.6	10.1	406	417	417	24.0	23.7	23.7	273.2	904.1	89.6	287.5	0.95	0.95	0.95	50.02
14/05/15	3:22 PM	232.0	230.5	229.5	10.5	10.5	10.0	406	418	417	23.7	23.5	23.4	272.0	908.6	89.3	286.3	0.95	0.95	0.95	49.98
14/05/15	3:23 PM	231.2	229.8	228.9	10.4	10.4	10.0	406	418	417	23.8	23.5	23.5	271.2	913.1	89.0	285.4	0.95	0.95	0.95	49.96
14/05/15	3:24 PM	233.9	232.5	231.4	9.9	10.1	9.6	406	418	417	23.9	23.5	23.6	274.9	917.7	88.5	288.8	0.95	0.95	0.95	49.96
14/05/15	3:25 PM	233.8	232.5	231.4	9.9	10.1	9.5	406	418	417	23.9	23.6	23.6	274.9	922.3	88.4	288.7	0.95	0.95	0.95	49.94
14/05/15	3:26 PM	233.4	232.0	231.0	10.1	10.2	9.7	406	418	417	23.9	23.6	23.6	274.1	926.8	88.8	288.1	0.95	0.95	0.95	49.92
14/05/15	3:27 PM	234.1	232.7	231.6	10.2	10.2	9.7	406	418	417	24.1	23.8	23.7	274.9	931.4	89.0	288.9	0.95	0.95	0.95	49.91

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	3:28 PM	233.7	232.2	231.2	10.0	10.1	9.6	406	418	417	24.3	24.0	23.9	274.4	936.0	88.6	288.4	0.95	0.95	0.95	49.90
14/05/15	3:29 PM	234.0	232.5	231.5	9.8	9.9	9.5	406	418	417	24.4	24.0	24.0	274.9	940.6	88.7	288.9	0.95	0.95	0.95	49.87
14/05/15	3:30 PM	233.8	232.2	231.3	10.1	10.1	9.7	406	418	418	24.2	23.9	23.8	274.6	945.2	88.8	288.6	0.95	0.95	0.95	49.89
14/05/15	3:31 PM	233.8	232.3	231.3	10.0	10.0	9.6	407	418	418	24.0	23.7	23.6	274.7	949.7	88.8	288.7	0.95	0.95	0.95	49.92
14/05/15	3:32 PM	234.5	232.9	231.9	9.9	10.0	9.5	407	418	418	23.9	23.7	23.6	275.5	954.3	88.8	289.4	0.95	0.95	0.95	49.91
14/05/15	3:33 PM	234.5	233.0	232.0	10.2	10.2	9.6	406	417	418	23.8	23.6	23.4	275.4	958.9	89.2	289.5	0.95	0.95	0.95	49.95
14/05/15	3:34 PM	233.4	231.9	230.9	10.1	10.1	9.6	407	418	418	23.9	23.6	23.5	274.1	963.5	89.2	288.3	0.95	0.95	0.95	49.93
14/05/15	3:35 PM	232.5	231.1	230.0	10.0	10.1	9.6	407	418	418	23.9	23.6	23.6	273.1	968.0	89.0	287.2	0.95	0.95	0.95	49.90
14/05/15	3:36 PM	233.5	232.2	231.1	10.2	10.3	9.7	406	418	418	23.8	23.5	23.4	274.3	972.6	89.0	288.4	0.95	0.95	0.95	49.89
14/05/15	3:37 PM	233.8	232.5	231.4	10.0	10.1	9.5	407	418	418	23.9	23.6	23.5	274.7	977.2	89.2	288.8	0.95	0.95	0.95	49.87
14/05/15	3:38 PM	234.2	232.9	231.8	9.9	10.1	9.5	407	418	418	23.9	23.6	23.6	275.3	981.8	89.3	289.4	0.95	0.95	0.95	49.87
14/05/15	3:39 PM	235.1	233.8	232.6	10.3	10.4	9.8	407	418	417	23.7	23.5	23.4	276.1	986.4	89.7	290.3	0.95	0.95	0.95	49.86
14/05/15	3:40 PM	235.2	233.9	232.8	10.5	10.5	9.9	407	417	418	23.7	23.6	23.4	276.2	991.0	89.9	290.4	0.95	0.95	0.95	49.84
14/05/15	3:41 PM	234.8	233.5	232.5	10.3	10.4	9.8	407	418	418	24.1	23.8	23.7	275.9	995.6	89.6	290.1	0.95	0.95	0.95	49.83
14/05/15	3:42 PM	234.1	232.7	231.7	10.3	10.3	9.8	407	418	418	24.0	23.8	23.7	274.9	1,000.2	89.5	289.1	0.95	0.95	0.95	49.80
14/05/15	3:43 PM	234.9	233.5	232.4	9.9	9.9	9.4	407	418	418	24.3	24.0	23.9	276.3	1,004.8	88.8	290.2	0.95	0.95	0.95	49.79
14/05/15	3:44 PM	236.5	235.1	234.0	9.2	9.3	8.8	407	419	418	24.5	24.2	24.2	278.7	1,009.4	88.5	292.4	0.95	0.95	0.95	49.79
14/05/15	3:45 PM	236.1	234.6	233.6	9.5	9.6	9.1	407	419	418	24.4	24.1	24.1	277.9	1,014.0	89.0	291.8	0.95	0.95	0.95	49.79
14/05/15	3:46 PM	233.9	232.3	231.4	9.7	9.7	9.2	407	419	418	24.4	24.1	24.1	274.9	1,018.6	89.3	289.1	0.95	0.95	0.95	49.79
14/05/15	3:47 PM	232.8	231.3	230.3	10.3	10.3	9.8	407	418	418	24.1	23.9	23.8	273.2	1,023.2	89.7	287.5	0.95	0.95	0.95	49.82
14/05/15	3:48 PM	232.8	231.3	230.3	10.1	10.2	9.7	407	418	418	24.2	23.9	23.9	273.3	1,027.7	89.5	287.6	0.95	0.95	0.95	49.83
14/05/15	3:49 PM	233.9	232.5	231.4	9.5	9.6	9.1	407	419	417	24.3	23.9	24.0	275.2	1,032.3	88.9	289.2	0.95	0.95	0.95	49.81
14/05/15	3:50 PM	234.8	233.4	232.3	9.4	9.5	9.0	407	419	417	24.2	23.8	24.0	276.4	1,036.9	88.8	290.3	0.95	0.95	0.95	49.82
14/05/15	3:51 PM	234.2	232.9	231.8	9.2	9.4	8.9	407	419	417	24.2	23.8	24.0	275.9	1,041.5	88.4	289.7	0.95	0.95	0.95	49.81
14/05/15	3:52 PM	234.2	233.0	231.8	9.2	9.3	8.8	407	419	418	24.3	23.9	24.0	276.0	1,046.1	88.4	289.8	0.95	0.95	0.95	49.84
14/05/15	3:53 PM	234.4	233.2	232.0	9.1	9.2	8.7	407	419	418	24.4	24.0	24.1	276.3	1,050.7	88.6	290.1	0.95	0.95	0.95	49.86
14/05/15	3:54 PM	235.3	233.9	232.9	9.4	9.4	8.9	407	419	418	24.3	24.0	24.1	277.0	1,055.3	89.3	291.0	0.95	0.95	0.95	49.87
14/05/15	3:55 PM	236.0	234.8	233.8	9.1	9.3	8.8	407	419	418	24.6	24.2	24.3	278.3	1,060.0	88.6	292.1	0.95	0.95	0.95	49.89
14/05/15	3:56 PM	236.2	234.9	233.9	9.1	9.3	8.7	407	419	417	24.4	24.0	24.2	278.5	1,064.6	88.6	292.3	0.95	0.95	0.95	49.87
14/05/15	3:57 PM	237.0	235.6	234.6	9.2	9.4	8.8	407	419	417	24.5	24.1	24.2	279.3	1,069.3	89.2	293.2	0.95	0.95	0.95	49.89
14/05/15	3:58 PM	236.3	234.8	233.8	9.7	9.9	9.3	407	418	417	24.3	24.0	24.0	277.9	1,073.9	89.5	292.0	0.95	0.95	0.95	49.92

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	3:59 PM	237.0	235.7	234.7	9.8	9.9	9.4	407	418	417	24.3	23.9	23.9	278.8	1,078.6	89.8	292.9	0.95	0.95	0.95	49.96
14/05/15	4:00 PM	238.6	237.3	236.2	9.6	9.8	9.2	407	418	417	24.4	24.0	24.0	280.8	1,083.2	90.0	294.8	0.95	0.95	0.95	49.98
14/05/15	4:01 PM	243.2	241.8	240.8	6.5	6.6	6.1	196	202	202	35.4	68.9	31.5	66.6	1,084.3	22.5	70.9	0.95	0.95	0.95	50.01
14/05/15	4:02 PM	245.1	243.6	242.8	5.4	5.6	5.2	1	1	1	37.6	87.5	33.8	0.1	1,084.3	0.8	0.8	0.95	0.04	0.95	50.05
14/05/15	4:03 PM	245.7	244.3	243.8	5.3	5.4	5.0	1	1	1	37.8	86.0	37.0	0.1	1,084.4	0.8	0.8	0.95	0.05	0.01	50.04
14/05/15	4:04 PM	245.8	244.5	244.3	5.7	5.9	5.4	94	97	97	38.0	79.4	38.1	17.0	1,084.6	7.7	19.6	0.71	0.70	0.63	50.03
14/05/15	4:05 PM	241.2	240.0	239.8	9.6	9.7	9.2	401	413	412	24.4	24.0	24.1	280.3	1,089.3	91.0	294.7	0.95	0.95	0.95	50.04
14/05/15	4:06 PM	241.5	240.1	239.8	9.8	9.8	9.3	399	411	410	24.4	24.0	24.1	279.2	1,094.0	90.7	293.5	0.95	0.95	0.95	50.04
14/05/15	4:07 PM	241.4	240.1	239.7	9.7	9.7	9.3	398	410	409	24.4	24.0	24.0	278.2	1,098.6	90.2	292.5	0.95	0.95	0.95	50.03
14/05/15	4:08 PM	241.6	240.4	239.8	9.6	9.7	9.2	396	408	407	24.4	24.0	24.1	277.2	1,103.2	89.7	291.4	0.95	0.95	0.95	50.02
14/05/15	4:09 PM	241.5	240.2	239.6	9.6	9.7	9.3	395	407	405	24.4	24.0	24.0	276.2	1,107.8	89.5	290.4	0.95	0.95	0.95	50.02
14/05/15	4:10 PM	242.4	241.2	240.3	9.6	9.8	9.3	393	405	403	24.4	24.0	24.0	275.8	1,112.4	88.6	289.7	0.95	0.95	0.95	50.01
14/05/15	4:11 PM	242.6	241.3	240.4	9.3	9.5	9.1	392	404	402	24.5	24.0	24.1	275.6	1,117.0	88.2	289.4	0.95	0.95	0.95	49.99
14/05/15	4:12 PM	243.4	242.0	241.1	9.2	9.4	8.9	391	403	401	24.5	24.1	24.1	275.8	1,121.6	88.0	289.5	0.95	0.95	0.95	50.01
14/05/15	4:13 PM	243.8	242.4	241.5	7.7	7.9	7.5	332	342	341	26.4	26.2	26.2	204.8	1,125.0	83.9	227.7	0.81	0.82	0.81	50.00
14/05/15	4:14 PM	244.5	243.1	242.3	5.0	5.5	5.1	115	117	117	30.8	30.9	30.9	39.7	1,125.7	75.1	85.0	0.46	0.48	0.46	49.99
14/05/15	4:15 PM	243.8	242.3	241.9	5.2	5.7	5.2	112	115	115	30.8	30.8	31.0	38.9	1,126.3	73.2	82.9	0.46	0.48	0.46	49.96
14/05/15	4:16 PM	243.8	242.3	242.1	5.4	5.9	5.4	104	106	106	30.8	30.7	30.9	36.1	1,126.9	67.6	76.6	0.46	0.48	0.47	49.96
14/05/15	4:17 PM	243.9	242.2	242.3	6.1	6.4	6.0	69	70	70	61.2	61.5	61.2	17.8	1,127.2	39.8	44.0	0.33	0.34	0.32	49.97
14/05/15	4:18 PM	245.8	244.2	244.4	5.9	6.1	5.7	26	26	26	88.0	88.6	89.1	3.8	1,127.3	18.7	19.1	0.20	0.20	0.20	50.03
14/05/15	4:19 PM	246.2	244.5	244.9	5.8	6.0	5.7	24	24	24	88.0	88.5	88.8	3.6	1,127.4	17.3	17.7	0.21	0.20	0.20	50.02
14/05/15	4:20 PM	246.5	244.8	245.2	5.6	5.8	5.4	20	21	21	87.7	88.8	89.2	3.0	1,127.4	14.7	15.0	0.21	0.20	0.20	50.02
14/05/15	4:21 PM	246.6	244.9	245.4	5.6	5.8	5.4	16	17	17	87.6	89.0	89.9	2.5	1,127.4	11.9	12.1	0.21	0.20	0.20	50.03
14/05/15	4:22 PM	246.6	245.0	245.5	5.7	5.9	5.5	12	12	12	90.1	90.5	91.1	1.8	1,127.5	8.7	8.9	0.22	0.19	0.20	50.01
14/05/15	4:23 PM	246.6	244.9	245.5	6.0	6.2	5.8	93	96	95	83.7	83.6	82.8	23.7	1,127.9	15.2	31.3	0.30	0.28	0.28	50.00
14/05/15	4:24 PM	242.9	241.4	242.0	9.3	9.4	8.9	389	401	400	24.5	24.1	24.2	272.9	1,132.4	89.0	287.1	0.95	0.95	0.95	49.99
14/05/15	4:25 PM	242.7	241.2	241.5	9.7	9.8	9.3	407	418	418	24.2	23.8	23.8	285.5	1,137.2	93.3	300.4	0.95	0.95	0.95	50.00
14/05/15	4:26 PM	242.6	241.1	241.2	9.6	9.7	9.3	407	419	418	24.3	23.9	23.9	285.9	1,141.9	93.1	300.6	0.95	0.95	0.95	50.01
14/05/15	4:27 PM	243.1	241.7	241.5	9.5	9.6	9.1	407	419	418	24.3	23.9	24.0	286.5	1,146.7	92.9	301.2	0.95	0.95	0.95	50.02
14/05/15	4:28 PM	243.2	241.8	241.5	9.4	9.5	9.0	406	418	416	24.4	24.0	24.1	285.7	1,151.5	92.7	300.3	0.95	0.95	0.95	50.01
14/05/15	4:29 PM	243.7	242.2	241.8	8.7	8.9	8.4	376	388	386	24.9	24.4	24.5	265.3	1,155.9	85.6	278.7	0.95	0.95	0.95	50.03

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	4:30 PM	244.5	243.0	242.5	8.4	8.6	8.1	328	338	335	25.1	24.5	24.5	231.5	1,159.8	74.9	243.3	0.95	0.95	0.95	50.06
14/05/15	4:31 PM	245.1	243.5	243.2	8.3	8.5	8.0	302	311	309	25.4	24.8	24.7	213.7	1,163.3	69.9	224.8	0.95	0.95	0.95	50.06
14/05/15	4:32 PM	245.9	244.2	244.0	8.5	8.6	8.1	299	308	306	25.3	24.7	24.6	212.3	1,166.9	69.5	223.3	0.95	0.95	0.95	50.03
14/05/15	4:33 PM	246.9	245.2	245.0	8.3	8.4	8.0	294	303	301	25.4	24.8	24.7	209.9	1,170.4	68.5	220.8	0.95	0.95	0.95	50.02
14/05/15	4:34 PM	247.3	245.6	245.5	8.1	8.3	7.8	294	303	301	25.6	25.0	24.8	210.1	1,173.9	68.5	221.0	0.95	0.95	0.95	50.00
14/05/15	4:35 PM	247.1	245.5	245.4	8.4	8.6	8.1	323	333	330	25.1	24.5	24.5	230.7	1,177.7	74.5	242.4	0.95	0.95	0.95	50.00
14/05/15	4:36 PM	247.0	245.4	245.2	8.7	8.9	8.5	375	387	385	24.7	24.1	24.3	268.5	1,182.2	86.0	281.9	0.95	0.95	0.95	50.00
14/05/15	4:37 PM	247.1	245.4	245.2	8.7	9.0	8.5	377	389	386	24.7	24.1	24.3	269.6	1,186.7	86.4	283.1	0.95	0.95	0.95	50.00
14/05/15	4:38 PM	247.0	245.3	245.0	9.1	9.3	8.8	363	374	372	24.8	24.2	24.3	259.5	1,191.0	84.1	272.8	0.95	0.95	0.95	50.00
14/05/15	4:39 PM	245.0	243.4	243.0	9.8	10.0	9.5	396	408	407	24.2	23.8	23.9	280.4	1,195.7	91.5	295.0	0.95	0.95	0.95	49.97
14/05/15	4:40 PM	243.9	242.3	241.8	9.8	9.9	9.4	406	418	416	24.1	23.7	23.7	286.2	1,200.4	92.8	300.8	0.95	0.95	0.95	49.95
14/05/15	4:41 PM	244.1	242.5	241.9	9.8	9.9	9.4	405	418	416	24.1	23.7	23.8	286.2	1,205.2	93.0	300.9	0.95	0.95	0.95	49.95
14/05/15	4:42 PM	245.0	243.3	242.6	9.2	9.4	9.0	396	408	406	24.7	24.2	24.4	280.8	1,209.9	90.4	295.0	0.95	0.95	0.95	49.99
14/05/15	4:43 PM	243.2	241.4	240.8	8.9	9.1	8.7	393	406	403	24.7	24.2	24.3	276.4	1,214.5	89.5	290.5	0.95	0.95	0.95	49.98
14/05/15	4:44 PM	243.1	241.4	240.8	9.4	9.5	9.1	406	419	417	24.3	23.8	23.9	285.7	1,219.3	92.8	300.4	0.95	0.95	0.95	49.94
14/05/15	4:45 PM	243.2	241.5	240.8	9.4	9.5	9.1	406	419	417	24.3	23.8	23.9	285.7	1,224.0	92.6	300.3	0.95	0.95	0.95	49.93
14/05/15	4:46 PM	243.1	241.4	240.7	9.3	9.4	8.9	406	419	417	24.3	23.9	24.0	285.6	1,228.8	92.3	300.2	0.95	0.95	0.95	49.92
14/05/15	4:47 PM	244.4	242.7	241.8	9.1	9.2	8.7	406	419	417	24.7	24.3	24.3	287.5	1,233.6	91.6	301.8	0.95	0.95	0.95	49.91
14/05/15	4:48 PM	244.0	242.4	241.5	9.1	9.2	8.7	407	419	417	24.4	24.0	24.1	287.1	1,238.4	91.7	301.4	0.95	0.95	0.95	49.91
14/05/15	4:49 PM	243.1	241.4	240.6	9.3	9.3	8.9	406	419	417	24.3	23.9	24.0	285.7	1,243.1	92.2	300.2	0.95	0.95	0.95	49.94
14/05/15	4:50 PM	243.4	241.8	240.8	9.7	9.7	9.3	405	417	416	24.1	23.8	23.8	284.9	1,247.9	92.5	299.5	0.95	0.95	0.95	49.97
14/05/15	4:51 PM	246.2	244.5	243.4	9.6	9.6	9.2	395	406	405	24.2	23.8	23.8	280.8	1,252.5	90.1	294.9	0.95	0.95	0.95	50.01
14/05/15	4:52 PM	246.0	244.2	243.1	9.4	9.5	9.0	392	404	403	24.3	24.0	23.9	279.2	1,257.2	88.9	293.0	0.95	0.95	0.95	50.00
14/05/15	4:53 PM	245.7	244.0	243.0	9.5	9.6	9.2	397	409	408	24.5	24.0	24.1	282.2	1,261.9	90.3	296.3	0.95	0.95	0.95	49.99
14/05/15	4:54 PM	246.4	244.8	243.8	9.5	9.6	9.2	407	418	417	24.2	23.7	23.7	290.0	1,266.7	92.5	304.4	0.95	0.95	0.95	50.02
14/05/15	4:55 PM	246.6	244.9	243.8	9.3	9.4	8.9	407	418	417	24.3	23.8	23.9	290.1	1,271.6	92.3	304.4	0.95	0.95	0.95	50.01
14/05/15	4:56 PM	246.6	244.9	243.8	9.3	9.5	8.9	406	417	416	24.2	23.8	23.8	289.4	1,276.4	92.2	303.7	0.95	0.95	0.95	50.00
14/05/15	4:57 PM	247.0	245.2	244.1	9.4	9.5	9.0	400	411	411	24.2	23.8	23.8	285.8	1,281.2	91.2	300.0	0.95	0.95	0.95	49.98
14/05/15	4:58 PM	246.6	244.8	243.8	9.6	9.7	9.1	399	410	410	24.5	24.1	24.0	284.5	1,285.9	91.0	298.7	0.95	0.95	0.95	50.00
14/05/15	4:59 PM	246.2	244.7	243.7	9.4	9.6	9.1	396	408	407	24.5	24.0	24.1	282.3	1,290.6	90.4	296.5	0.95	0.95	0.95	50.04
14/05/15	5:00 PM	246.6	244.9	243.9	9.3	9.6	9.0	402	414	413	24.3	23.8	23.8	286.8	1,295.4	91.8	301.2	0.95	0.95	0.95	50.08

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1			Hz
14/05/15	5:01 PM	247.3	245.6	244.7	9.3	9.6	9.1	398	410	409	24.3	23.8	23.8	284.9	1,300.1	91.5	299.2	0.95	0.95	0.95	50.11
14/05/15	5:02 PM	247.8	246.0	245.0	9.4	9.6	9.0	394	406	405	24.3	23.8	23.8	282.5	1,304.8	90.9	296.8	0.95	0.95	0.95	50.14
14/05/15	5:03 PM	248.1	246.3	245.3	9.3	9.5	8.9	392	403	402	24.3	23.9	23.8	280.9	1,309.5	89.7	294.9	0.95	0.95	0.95	50.16
14/05/15	5:04 PM	248.6	247.0	245.9	8.9	9.1	8.6	390	401	400	24.5	24.0	24.0	280.6	1,314.2	88.8	294.4	0.95	0.95	0.95	50.16
14/05/15	5:05 PM	248.7	246.9	245.9	9.0	9.2	8.8	390	402	401	24.4	24.0	24.0	280.9	1,318.9	89.5	294.8	0.95	0.95	0.95	50.18
14/05/15	5:06 PM	248.5	246.7	245.7	9.0	9.3	8.8	393	405	403	24.7	24.2	24.2	282.8	1,323.6	90.2	296.8	0.95	0.95	0.95	50.15
14/05/15	5:07 PM	248.1	246.1	245.2	9.2	9.4	8.9	396	408	406	24.4	23.9	24.0	284.1	1,328.3	90.8	298.3	0.95	0.95	0.95	50.12
14/05/15	5:08 PM	247.5	245.5	244.7	9.3	9.5	9.1	400	412	410	24.3	23.8	23.8	286.1	1,333.1	91.6	300.4	0.95	0.95	0.95	50.09
14/05/15	5:09 PM	247.3	245.3	244.5	9.6	9.7	9.3	400	412	411	24.1	23.7	23.6	286.0	1,337.9	92.0	300.4	0.95	0.95	0.95	50.06
14/05/15	5:10 PM	246.8	244.8	244.0	9.3	9.5	9.0	401	412	411	24.2	23.8	23.8	285.8	1,342.6	91.6	300.2	0.95	0.95	0.95	50.04
14/05/15	5:11 PM	246.4	244.4	243.5	9.4	9.6	9.1	404	416	415	24.2	23.7	23.7	287.4	1,347.4	92.8	302.0	0.95	0.95	0.95	50.02
14/05/15	5:12 PM	245.8	243.9	243.0	9.3	9.4	9.0	404	416	415	24.3	23.8	23.9	287.1	1,352.2	92.1	301.5	0.95	0.95	0.95	50.04
14/05/15	5:13 PM	245.4	243.5	242.5	9.2	9.4	9.0	405	416	415	24.3	23.8	23.8	286.9	1,357.0	92.2	301.3	0.95	0.95	0.95	50.05
14/05/15	5:14 PM	245.0	243.3	242.3	9.2	9.4	9.0	405	417	415	24.3	23.9	23.8	286.8	1,361.8	91.9	301.1	0.95	0.95	0.95	50.05
14/05/15	5:15 PM	244.9	243.1	241.9	9.2	9.3	8.8	404	416	415	24.4	23.9	23.9	286.3	1,366.5	91.1	300.4	0.95	0.95	0.95	50.04
14/05/15	5:16 PM	244.7	242.9	241.7	9.2	9.4	8.9	406	417	416	24.4	23.9	23.9	286.9	1,371.3	91.8	301.2	0.95	0.95	0.95	50.05
14/05/15	5:17 PM	244.9	243.1	241.8	9.2	9.4	8.9	405	417	416	24.5	24.1	24.1	286.9	1,376.1	91.8	301.2	0.95	0.95	0.95	50.03
14/05/15	5:18 PM	245.7	243.9	242.6	9.2	9.4	8.9	405	416	415	24.6	24.1	24.1	287.3	1,380.9	91.9	301.7	0.95	0.95	0.95	50.04
14/05/15	5:19 PM	247.1	245.4	244.0	8.9	9.1	8.6	402	414	413	24.6	24.1	24.2	287.7	1,385.7	90.9	301.7	0.95	0.95	0.95	50.06
14/05/15	5:20 PM	248.2	246.5	245.1	8.8	8.9	8.5	400	412	411	24.6	24.1	24.1	287.7	1,390.5	90.6	301.7	0.95	0.96	0.95	50.08
14/05/15	5:21 PM	248.9	247.1	245.8	8.8	8.9	8.5	400	411	410	24.6	24.1	24.0	287.9	1,395.3	90.6	301.8	0.95	0.96	0.95	50.07
14/05/15	5:22 PM	248.8	247.0	245.7	8.9	8.9	8.5	399	411	409	24.6	24.1	24.1	287.3	1,400.1	90.6	301.2	0.95	0.96	0.95	50.07
14/05/15	5:23 PM	249.1	247.3	245.9	8.5	8.7	8.2	399	411	409	24.8	24.3	24.3	287.9	1,404.9	89.8	301.6	0.95	0.96	0.95	50.06
14/05/15	5:24 PM	248.8	247.1	245.7	8.5	8.6	8.2	397	409	407	24.9	24.3	24.3	286.2	1,409.6	89.4	299.9	0.95	0.96	0.95	50.05
14/05/15	5:25 PM	249.2	247.7	246.2	8.4	8.6	8.1	395	408	406	24.9	24.3	24.3	285.8	1,414.4	89.0	299.4	0.95	0.96	0.95	50.03
14/05/15	5:26 PM	248.8	247.2	245.8	8.4	8.5	8.1	395	407	405	25.0	24.4	24.4	285.0	1,419.1	88.6	298.4	0.95	0.96	0.95	50.01
14/05/15	5:27 PM	249.5	247.9	246.6	8.3	8.5	8.0	393	405	403	24.9	24.3	24.3	284.5	1,423.9	88.4	297.9	0.95	0.96	0.95	50.04
14/05/15	5:28 PM	249.5	247.9	246.6	8.2	8.3	7.9	392	404	402	24.9	24.3	24.3	283.9	1,428.6	87.9	297.2	0.95	0.96	0.96	50.05
14/05/15	5:29 PM	250.1	248.5	247.2	7.8	8.0	7.6	391	403	400	25.2	24.5	24.6	283.7	1,433.3	87.2	296.8	0.95	0.96	0.96	50.06
14/05/15	5:30 PM	250.0	248.4	247.1	7.9	8.0	7.7	389	401	398	25.1	24.5	24.6	281.9	1,438.0	87.1	295.0	0.95	0.96	0.96	50.07
14/05/15	5:31 PM	250.6	248.8	247.6	7.2	7.3	7.0	331	341	340	28.4	38.5	28.6	206.2	1,441.5	64.8	216.5	0.95	0.96	0.95	50.09

Date	Time	Voltage (Line)			%VTHD			Current (Line)			% ATHD			kW	kWh	kVAr	kVA	PF Line1		Hz
14/05/15	5:32 PM	254.0	252.1	251.1	4.2	4.4	4.2	1	1	1	36.3	81.7	35.7	0.1	1,441.5	0.8	0.8	0.95	-	0.02	50.11
14/05/15	5:33 PM	254.6	252.8	252.2	4.1	4.3	4.1	1	1	1	36.2	81.9	36.7	0.1	1,441.5	0.8	0.8	0.15	-	(0.01)	50.11
14/05/15	5:34 PM	255.2	253.4	253.1	3.7	3.9	3.7	1	1	1	36.1	80.6	37.2	0.1	1,441.5	0.8	0.8	0.10	0.03	(0.01)	50.10
14/05/15	5:35 PM	253.3	251.5	251.5	5.4	5.6	5.3	274	282	281	31.4	51.3	31.7	145.8	1,443.9	45.8	153.5	0.92	0.93	0.91	50.06
14/05/15	5:36 PM	251.0	249.3	249.2	7.6	7.7	7.3	379	391	389	25.5	24.9	24.9	276.9	1,448.5	84.1	289.5	0.95	0.96	0.96	50.06
14/05/15	5:37 PM	251.7	250.0	249.7	7.4	7.5	7.1	377	388	386	25.5	24.9	25.0	276.1	1,453.1	82.9	288.3	0.96	0.96	0.96	50.06
14/05/15	5:38 PM	251.5	249.9	249.4	7.5	7.6	7.2	376	387	385	25.6	24.9	25.0	275.1	1,457.7	82.7	287.2	0.96	0.96	0.96	50.06
14/05/15	5:39 PM	251.2	249.6	249.1	7.6	7.7	7.2	375	387	384	25.5	24.8	24.8	274.5	1,462.3	82.5	286.6	0.96	0.96	0.96	50.05
14/05/15	5:40 PM	251.3	249.6	249.1	7.9	7.9	7.5	375	386	385	25.3	24.7	24.6	274.2	1,466.9	82.7	286.4	0.96	0.96	0.96	50.01
14/05/15	5:41 PM	251.4	249.7	249.1	7.7	7.8	7.4	375	386	384	25.4	24.8	24.7	273.9	1,471.4	83.0	286.2	0.96	0.96	0.96	50.01
14/05/15	5:42 PM	250.7	249.2	248.4	7.3	7.4	7.0	363	375	372	25.7	25.1	25.1	261.6	1,475.8	81.8	274.8	0.94	0.95	0.94	50.04
14/05/15	5:43 PM	253.0	251.4	250.6	3.2	3.8	3.5	133	135	136	30.6	30.4	30.3	57.4	1,476.7	83.8	101.6	0.56	0.58	0.56	50.03
14/05/15	5:44 PM	253.7	252.0	251.6	3.1	3.6	3.3	122	124	125	30.5	30.3	30.2	52.9	1,477.6	77.1	93.5	0.56	0.58	0.56	50.01
14/05/15	5:45 PM	252.7	251.1	250.9	3.5	3.9	3.7	109	111	112	30.5	30.5	30.3	47.5	1,478.4	68.6	83.4	0.56	0.58	0.57	50.00
14/05/15	5:46 PM	251.5	249.8	249.9	4.0	4.5	4.3	104	106	106	30.6	30.5	30.3	45.4	1,479.2	65.0	79.3	0.57	0.58	0.57	50.00
14/05/15	5:47 PM	251.9	250.1	250.4	4.0	4.4	4.2	91	93	93	30.6	30.5	30.5	39.8	1,479.8	56.7	69.3	0.57	0.59	0.57	50.02
14/05/15	5:48 PM	252.8	251.0	251.4	3.8	4.1	3.9	77	78	79	30.7	30.5	30.5	33.7	1,480.4	48.1	58.8	0.57	0.59	0.57	50.06
14/05/15	5:49 PM	253.6	251.9	252.2	3.7	4.0	3.8	66	68	68	30.9	30.6	30.7	29.3	1,480.9	41.8	51.1	0.57	0.59	0.57	50.09
14/05/15	5:50 PM	254.4	252.6	253.1	3.6	3.9	3.7	56	57	57	30.9	30.7	30.9	24.7	1,481.3	35.3	43.1	0.57	0.59	0.57	50.10
14/05/15	5:51 PM	254.9	253.0	253.6	3.8	4.0	3.8	44	45	45	31.4	31.3	31.4	19.1	1,481.6	27.4	33.4	0.56	0.59	0.57	50.10
14/05/15	5:52 PM	255.0	253.2	253.9	4.0	4.2	3.9	30	30	30	32.7	32.5	32.6	13.0	1,481.8	18.7	22.8	0.56	0.58	0.56	50.08
14/05/15	5:53 PM	125.1	124.3	125.9	15.4	15.3	15.5	9	9	9	71.5	72.3	74.5	1.2	1,481.9	2.1	2.5	0.56	0.59	0.56	50.07
14/05/15	5:54 PM	1.7	1.7	1.7	18.2	18.3	18.3	1	1	1	79.7	76.3	79.9	-	1,481.9	-	-	0.56	0.59	0.56	50.07
14/05/15	5:55 PM	1.7	1.7	1.7	18.8	18.9	18.9	1	1	1	87.2	74.1	78.5	-	1,481.9	-	-	0.56	0.59	0.56	50.07

Annexure: 5.3 Details of pumps proposed

Description	Coil cooling pump	Raw water pump
Product name:	NB 32-160.1/177 A-F-A-BAQE	NB 32-125/142 A-F-A-BAQE
Technical:		
Speed for pump data:	2880 rpm	2880 rpm
Actual calculated flow:	10.44 m /h	18.0 m /h
Resulting head of the pump:	46 m	30 m
Actual impeller diameter:	177 mm	142 mm
Impeller nom:	160.1 mm	125 mm
Impeller max:	177 mm	142 mm
Shaft seal:	BAQE	BAQE
Secondary shaft seal:	NONE	NONE
Shaft diameter:	24 mm	24 mm
Curve tolerance:	ISO9906:2012 3B	ISO9906:2012 3B
Pump version:	A	A
Materials:		
Pump housing:	Cast iron	Cast iron
	EN-GJL-250	EN-GJL-250
	ASTM A48-40 B	ASTM A48-40 B
Impeller:	Cast iron	Cast iron
	EN-GJL-200	EN-GJL-200
	ASTM A48-30 B	ASTM A48-30 B
Material code:	A	A
Installation:		
Maximum ambient temperature:	55 C	55 C
Maximum operating pressure:	16 bar	16 bar
Flange standard:	EN 1092-2	EN 1092-2
Connect code:	F	F
Pump inlet:	DN 50	DN 50
Pump outlet:	DN 32	DN 32

Description	Coil cooling pump	Raw water pump
Pressure stage:	PN 16	PN 16
Wear ring(s):	neckring(s)	neckring(s)
Liquid:		
Liquid temperature range:	0 - 120 C	0 - 120 C
Liquid temp:	20 C	20 C
Density:	998.2 kg/m	998.2 kg/m
Kinematic viscosity:	1 mm2/s	1 mm2/s
Electrical data:		
Motor type:	SIEMENS	SIEMENS
IE Efficiency class:	NEMA Premium / IE3 50Hz	NEMA Premium / IE3 50Hz
Number of poles:	2	2
Rated power - P2:	4 kW [4.6 kW]	4 kW [4.6 kW]
Mains frequency:	50 Hz	50 Hz
Rated voltage:	3 x 380-420D/660-725Y V [3 x 440-480D/0-0Y V]	3 x 380-420D/660-725Y V [3 x 440-480D/0-0Y V]
Rated current:	7,60-6,90/4,40-4,00 A [7,60-6,90/- A]	7,60-6,90/4,40-4,00 A [7,60-6,90/- A]
Starting current:	710-710 % [820-820 %]	710-710 % [820-820 %]
Cos phi - power factor:	0,91	0,91
Rated speed:	2880 rpm	2880 rpm [3555 rpm]
Efficiency:	IE3 88,5%	IE3 88,5%
Motor efficiency at full load:	88,5-88,5 %	88,5-88,5 %
Motor efficiency at 3/4 load:	89,4-89,4 % [89,2-89,2 %]	89,4-89,4 % [89,2-89,2 %]
Motor efficiency at 1/2 load:	89,4-89,4 % [88,8-88,8 %]	89,4-89,4 % [88,8-88,8 %]
Enclosure class (IEC 34-5)::	55 (Protect. water jets/dust)	55 (Protect. water jets/dust)
Insulation class (IEC 85):	F	F
Motor protec:	PTC	PTC
Motor No:	83U15213	83U15213
Lubricant type:	Grease	Grease