Energy Audit Report

Site : Mr. Chordia's Residence At Baner.

Audit conducted on 30th,31st July and 1st Aug.

Audit conducted by:

SAS Powertech P Ltd.

101, Gera's Regent Manor, Survey No. 33, Area No. 39/570,
Behind Opulent Car Care Center Baner, Pune 411045
Tel: 020 65203015 Extention-111.

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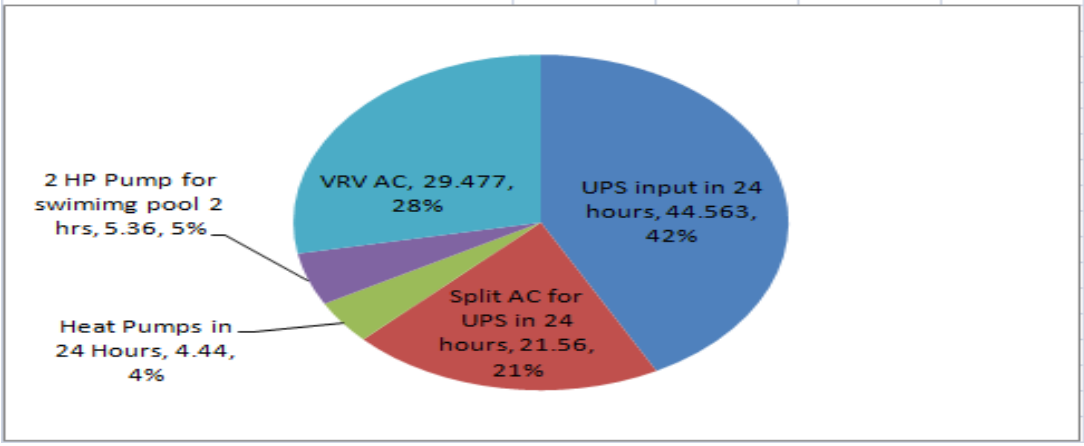
Executive summary:

Following table shows summary of audit observations.

Consumption Head	Kwh
UPS input in 24 hours	44.563
Split AC for UPS in 24 hours	21.56
Heat Pumps in 24 Hours	4.44
2 HP Pump for swimimg pool 2 hrs	5.36
VRV AC	29.477
Total Consumption in 24 hours	**105.4**
For 30 days	**3162**



Sr	Observation	Possible remedy	Daily KWh saving
1	UPS is grossly under loaded and operates at 68% efficiency.for supporting 30KWh load takes 45 Kwh from supply – Daily loss of 15 Kwh.	UPS resizing, Use Transformer less UPS only for critical load, like Home automation and CCTV. Bypass UPS during normal use and connect the same only during critical use.	10Kwh
2	UPS room air conditioner takes 20% of daily consumption.	Provide exhaust fan with timer to keep it ON for alternate hour. Use AC only during OCT, APRIL, MAY, JUNE. Replace AC with 0.9Tr split unit. This is enough for present load.	15 Kwh
3	Heat pumps consuming 4 to 5 Kwh per day.	USE roof top solar water heating with electrical standby for 9 months in year	3 Kwh
4	Normal load on UPS is 3KW and maximum is 7.5KW.	Part of this load may be supported by roof top PV solar system with net metering.	
5	50% consumption at present is for air conditioning.	Kindly check gas charging of these air conditioners at least twice a year, so that ON time of compressors is optimized and consumption is reduced.	
		Total	28 Kwh.

Present electricity consumption is metered and charged correctly. About 25% reduction is possible by correct sizing of UPS and ventilation for UPS room.

List of Equipment used and Audit team

Equipment:

1) KRYKARD make recording type power analyzers ALM 35 – 3 Nos.
2) KRYKARD make power analyzer NANO CLAMP – 1 Nos.

Audit Team:

SAS Powertech P Ltd.

1) Mr. Narendra Duvedi –
   BEE Certified energy auditor, Chartered Engineer

2) Mr. Vijay Sonawne
3) Mr. Amit Jadhav

Client:

Mr. Anand Joshi and his team

Problem manifestation

The bungalow at Baner Pune is a luxurious residence having all modern amenities. Following are major amenities used by residents of this premises.

1) Outdoor swimming pool
2) Heat pumps for hot water.
3) Building automation system, CCTV, AV room and a 30 KVA online UPS supporting these systems. The UPS is housed in electrical control room on stilt floor and 1 split air conditioner is provided for this room and is continuously ON.
4) Other areas in Bungalow are equipped with VRV air conditioning system with one out door unit and FCUs in various rooms.
5) The average electrical consumption per month for normal use is around 3500 Kwh and it increases during the months of OCT, APRIL, MAY and JUNE. The tariff charged by MSEDCL is around Rs.15/Kwh.
6) The owners have an impression that the electricity bill is on higher side and they need to know correctness of the bill, contribution of different amenities used, wastage if any and recommendations for energy saving if possible. In short a energy audit needs to be conducted at site.

Methodology Followed

1) Previous 12 months electrical consumption data was collected to know the monthly as well as seasonal trends.
2) MSEDCL meter calibration was checked by comparing the readings with a calibrated power analyser records connected in parallel.
3) Daily consumption pattern was checked by recording energy parameters for almost 48 hours spread over Saturday – Sunday – Monday (30th July to 1st Aug 2016) encompassing a working day and a typical holiday.
4) Simultaneously, the loads which are not controlled by users, namely UPS, Heat pumps, AC for UPS room, were checked for longer duration to decide their contribution in total bill.
5) UPS efficiency at part load and available maximum load was measured using two power analysers simultaneously.
6) Based on analysis of this recorded data, this report is presented.

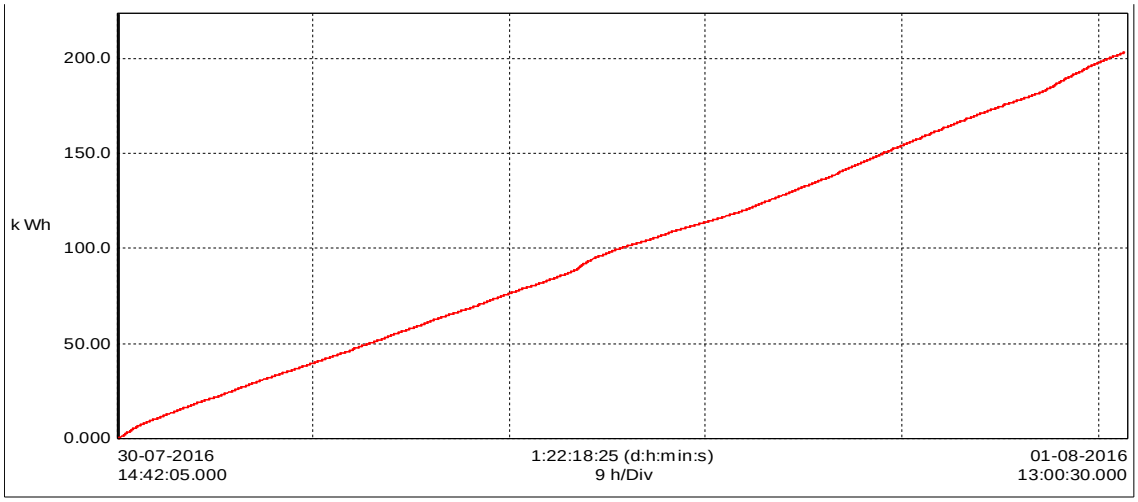
MSEDCL Meter calibration check

Time syncronized readings of MSEDCL meter and power analyzer to chek calibration					
MSEDCL Meter readings				Power analyser	
Date	Time	Kwh		Wh	Kwh
01-08-2016	12.45.01	96443		202585.5	202.59
30-07-2016	14.52.11	96240		1230.14	1.23
		203			**201.36**
Error over 46 hours is 0.81%					

Our power analyzers are having valid calibration certificates traceable to NABL standard meter. Such power analyzer was connected at main incomer – parallel to MSEDCL meter. Kwh readings were taken from MSEDCL meter at time stamps as shown above. The elapsed time is about 46 hours. Power analyzer was connected in recording mode and Kwh readings from power analyzer were obtained at same time stamps after down loading data from power analyzer on PC. The comparison is shown above.

The two readings almost match and the error is less than 1%. Hence MSEDCL is charging for correct consumption.

Main Incomer



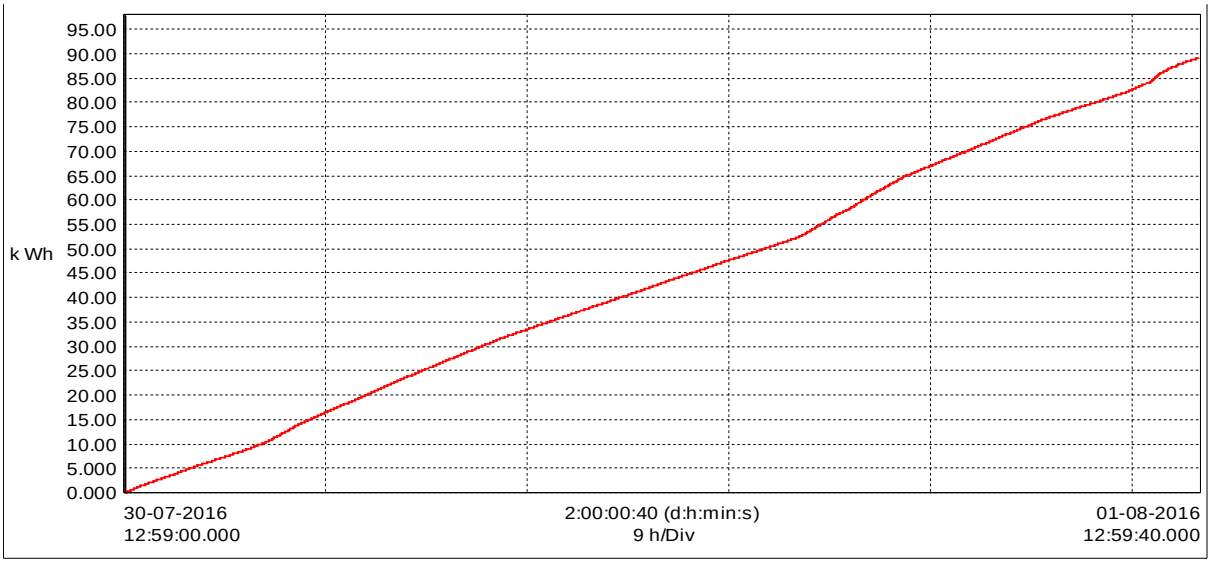
30-07-2016 14:42:05.000 - 203.333 kWh 1:22:18:30 (d:h:min:s)

Above record shows that

- The incomer parameters were recorded for "one day, twenty two hours, eighteen minutes and thirty seconds".
- The recording started at 14:42:05 hours on 30th July 2016 and ended at 13:00:30 hours on 1st Aug 2016.
- Electrical consumption in above period is **203.333Kwh** in **2778.5 mins**. (1x 24x60)+(22x60)+18.5 = 2778.5
- Above graph appears to be quite linear, So consumption in 24 hours (1440 mins) is 105.4Kwh.
- Above record shows that consumption during a normal working day and normal Sunday is almost same.
- So monthly consumption would be around 105 x 30 = 3150 units. Following table gives monthly consumption for last 12 months. The measured Kwh as above match with NON SUMMER months as per the data given bellow.

Bill Month	Kwh / Month	Bill Amount	Paid Amount Rs	Bill Date
Jun-16	3,306	48,530.00	82,880.00	20-Jun-16
May-16	5,412	83,610.00	86,880.00	25-May-16
Apr-16	5,502	87,630.00	82,980.00	19-Apr-16
Mar-16	5,426	83,700.00	48,680.00	19-Mar-16
Feb-16	3,284	49,110.00	1,09,270.00	22-Feb-16
Jan-16	3,444	1,09,720.00	55,220.00	30-Jan-16
Dec-15	3,612	55,700.00	60,480.00	28-Dec-15
Nov-15	3,941	61,000.00	81,000.00	02-Dec-15
Oct-15	5,192	81,710.00	54,540.00	29-Oct-15
Sep-15	3,772	55,020.00	33,340.00	26-Sep-15
Aug-15	2,392	33,630.00	36,370.00	27-Aug-15
Jul-15	2,628	36,680.00	63,350.00	27-Jul-15
Avg / Month	**3,993**	**7,86,040.00**	**Paid for 12 Months**	
Avg / Day	**133.09**	**65503.33**	**Avg Payment per month**	

UPS Input



30-07-2016 12:59:00.000 89.126 k Wh 2:00:00:45 (d:h:min:s)

- Electrical consumption is 89.126 Kwh in 2880 mins.
- So consumption in 24 hours is 44.563 Kwh.

- A 30 KVA ONLINE UPS is installed for lighting. Home automation system and AV room etc in the house. This UPS converts input AC to DC and again DC to AC with batteries floated on DC bus. This supplies regulated and uninterrupted power to load connected at output of the UPS.

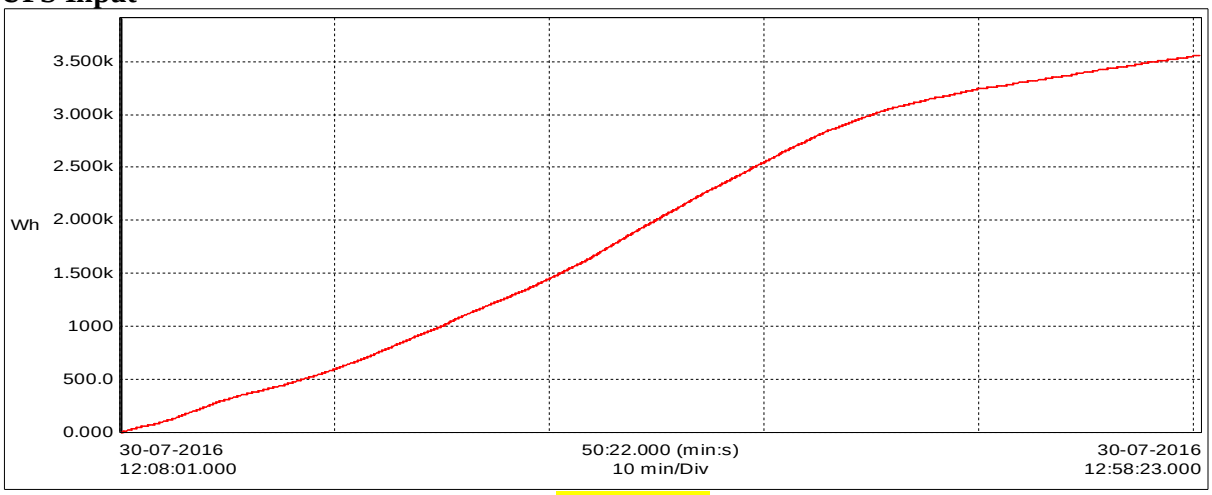
- Above graph shows energy consumption at UPS input for 2 days or 48 hours under normal conditions and usage. This graph also appears to be linear so consumption for 24 hours is calculated based on consumption for 48 hours.

- Maximum load on this UPS is 7.5KW while average loading on a normal day is about 3KW. At average loading UPS efficiency is 67% and hence it consumes 1.5Kwh to support 1KWh output load.

- The UPS efficiency is low as the same is under loaded.

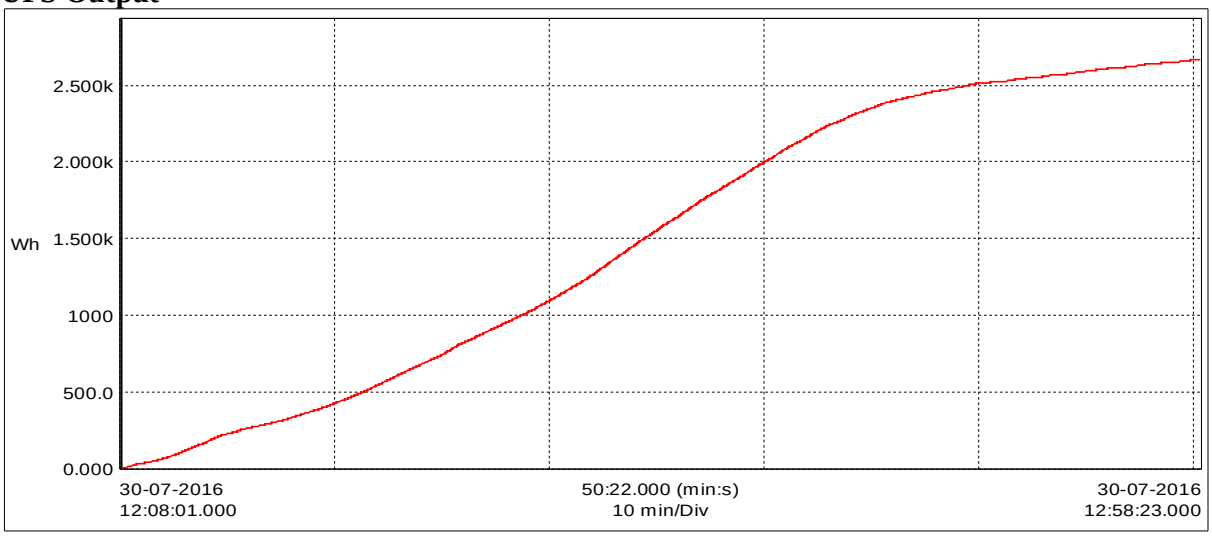
UPS efficiency calculations

UPS Input



30-07-2016 12:08:01.000 **3.557 kWh** 50:23.000 (min:s)

UPS Output



30-07-2016 12:08:01.000 **2.667 kWh** 50:23.000 (min:s)

UPS efficiency = 2.667/3.557 = 75%

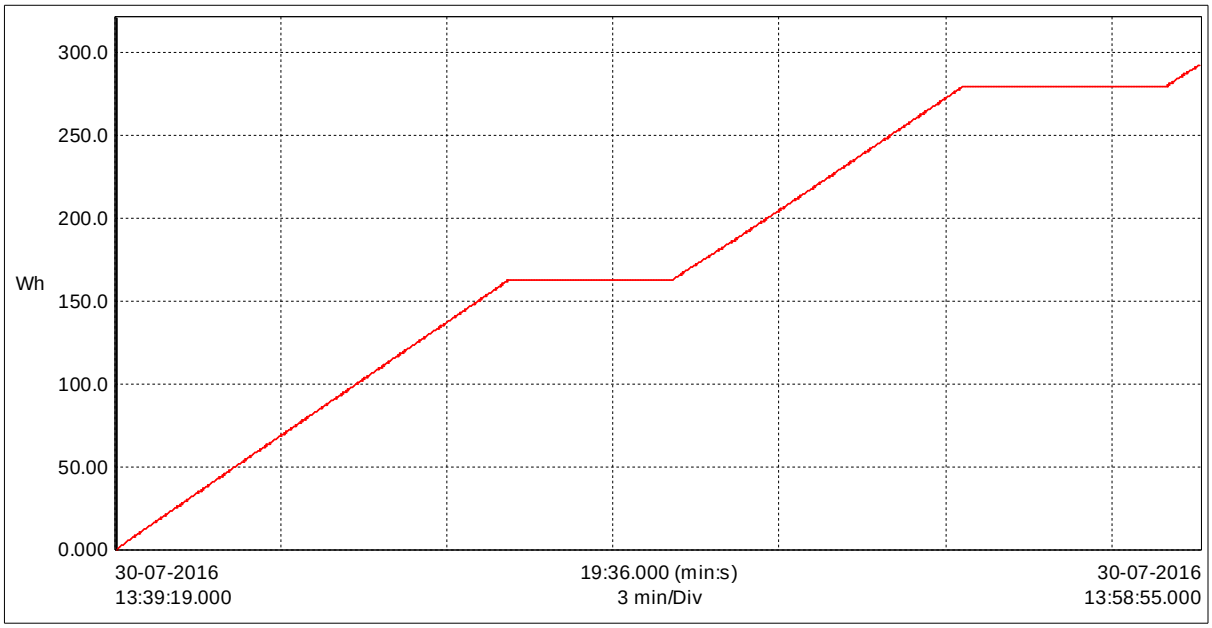
This is average efficiency at maximum 7KW load.

Every 1 unit consumed by load connected to UPS output, requires 1.33 units at input.

Normal load is only 3KW. Calculations show that efficiency is 67% at this load.

Every 1 unit consumed by load connected to UPS output, requires 1.5units at input.

Split Ac for UPS room

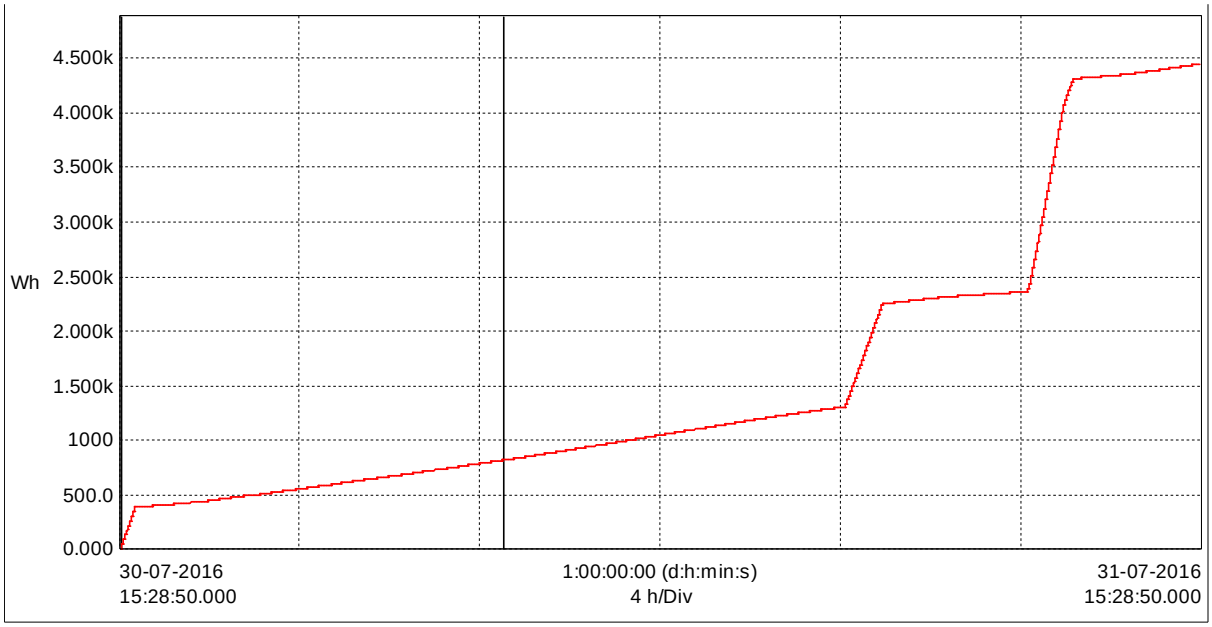


30-07-2016 13:39:19.000 0.292 KWh 19:37.000 (min:s)

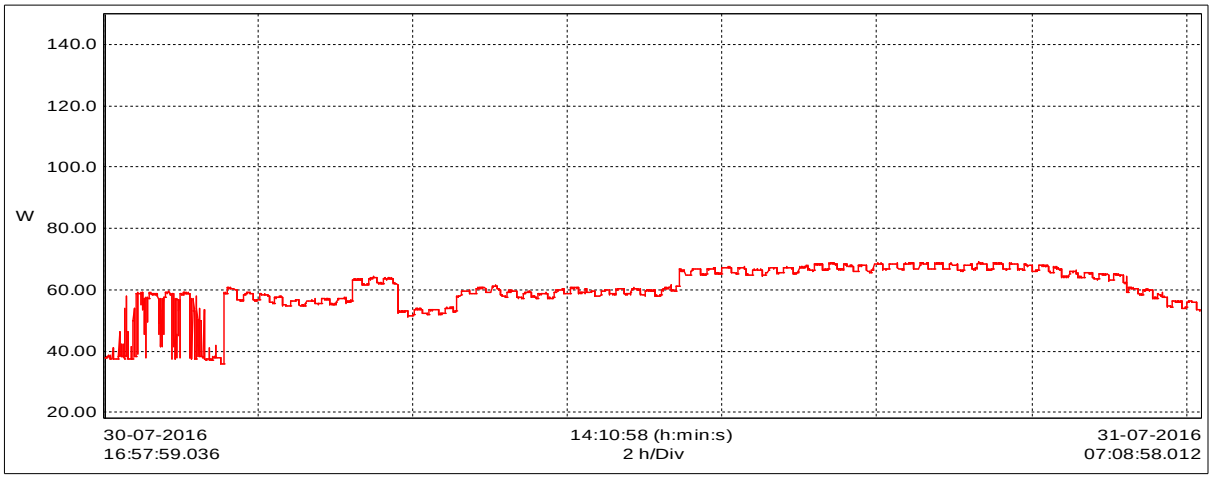
- The consumption is 0.292Kwh in 19.5 Mins
- The consumption in 24 hours would be 21.56 Kwh.

This split air conditioner is installed for cooling UPS and electrical distribution use. This is consuming almost one unit per hour in the month of July when ambient temperature is around 24 Deg C.

Heat Pumps



30/7/2016	3:29:00 PM	6.84
31/7/2016	3:29:40 PM	4448.68
	Wh	4441.84
	Kwh	4.44184
Heat Pump consumption in 24 hours		4.44



The heat pumps demand peak 2.26KW for 3 hours in 24 hours and consume about 60Watts continuously. This contributes around 1.26Kwh in 24 hours, which is not very significant.

Pie charting of electrical consumption

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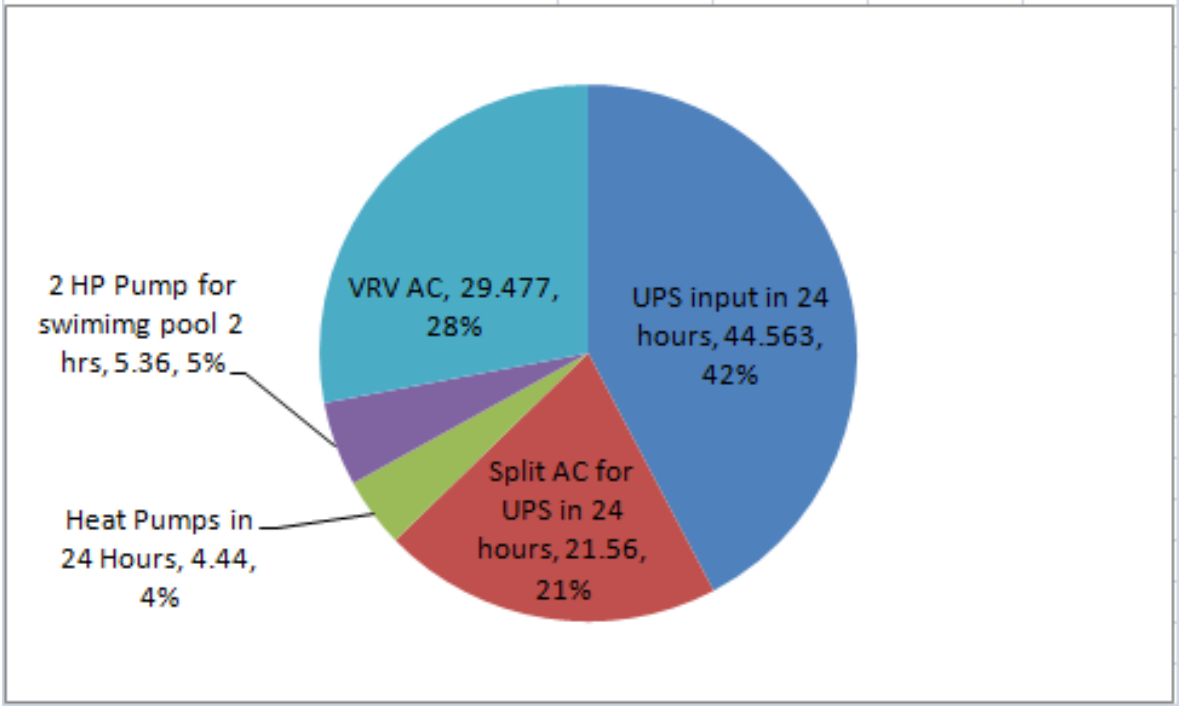

Assessment of electrical consumption for previous year

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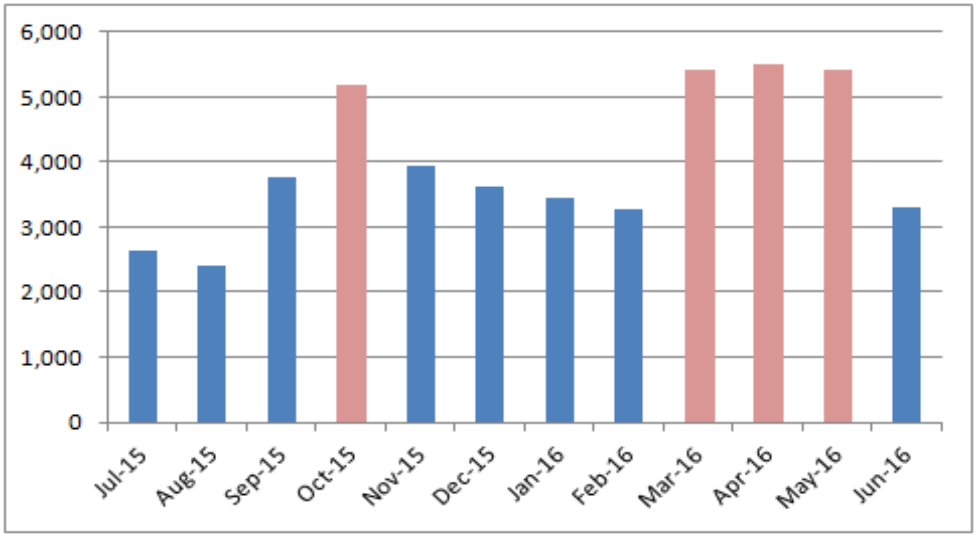
BAR Chart shows KWh consumption for last 12 months.



It can be seen that the consumption for summer months of OCT, MARCH, APR, MAY is substantially high as air conditioners consume more energy during these years.

Increase or decrease in other months may be due to actual usage, which the occupants will be in a better position to explain.

Saving of Rs.15000 per month or Rs.180000 annually is possible by various remedies explained in executive summary of this report.

Roof top solar power plant (If feasible) can bring down day consumption substantially.

----------END OF REPORT----------