

*Energy Efficiency &
Energy Management Systems
in Automobile Industry*

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A life cycle approach with active Energy Efficiency



Measurement & Consulting

- Power meters
- Energy audits
- Power quality audits

MEASURE

FIX

Fix the basics

- Power factor correction
- Harmonic filters
- Low consumption devices
- Insulation material

Monitoring & verification

- Energy management system
- Online monitoring
- Remote monitoring services

MONITOR

AUTOMATE

Automation & regulation

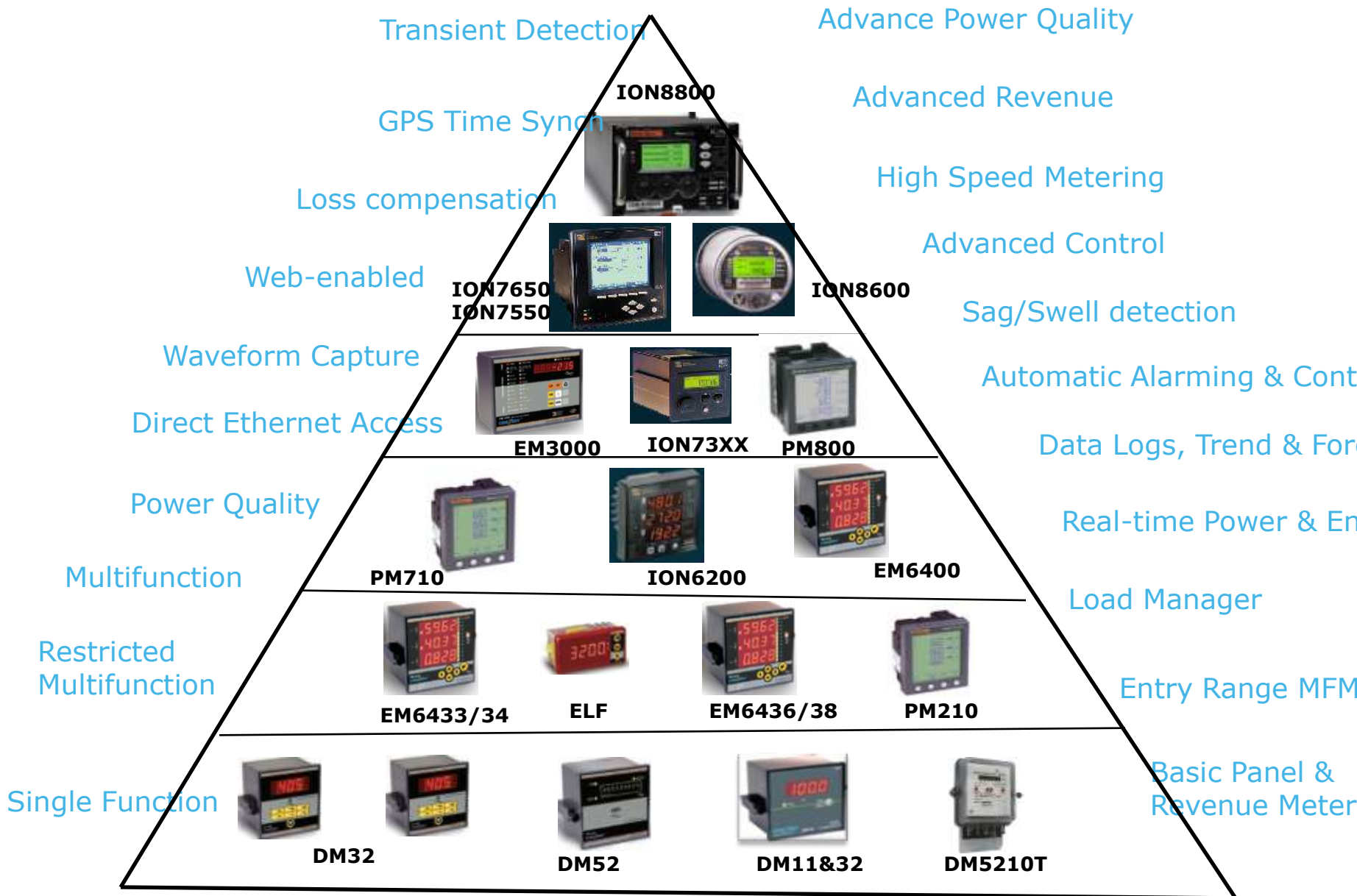
- Building management system
- Lighting management system
- Motor control systems
- Home control systems
- Variable speed drives



Measure









- Efficient energy management begins with accurate measurement, first step being measuring and monitoring critical parameters in real time. Measurement of parameters helps to control energy related costs, improve energy efficiency, power quality & reliability and enhance accuracy of billing and cost allocation.
- Further for an effective energy improvement program, one of the main activities is an Energy Audit that assists the facilities to decide an appropriate energy mix and using the right equipment and technologies for improved energy efficiency.



ACCREDITATION

Schneider Electric (thru Conzerv) is accredited for Energy Audit by Bureau of Energy Efficiency, Ministry of Power, Govt of India under Energy Conservation Act 2001

OUTPUT OF ENERGY EFFICIENCY ANALYSIS – *ENERGY SAVING MEASURES*

Measures	Examples	Emphasis	Typical savings
Low cost 	<ul style="list-style-type: none"> • resetting controls • switch off when not required • repair leaks • reschedule loads/usage 	Payback time : immediate	
Medium cost 	<ul style="list-style-type: none"> • maintenance • meters • M&T • simple controls • training end users • Energy management systems 	Payback time : < 1 year	
High cost 	<ul style="list-style-type: none"> • heat recovery systems • cogeneration of heat and power • fuel conversion 	Payback time: 1 year to 5 years	

Fix the basics

- Power factor correction

- >> Avail rebates and reduce electricity bills
- >> Reduce distribution losses and overheating of network
- >> Reduced maximum demand charges and voltage drop

- Harmonic filters

- >> Increase life span of equipment
- >> Reduce overheating or de-rating of transformers, motors and other wound equipment
- >> Avoid nuisance tripping of Switchgear / Relays
- >> Save frequent failure of capacitors
- >> Eliminate negative impact on electronic equipment

Power Factor Correction



- Capacitors

- >> Range of LV and MV capacitors for PF improvement
- >> LV 415/440/480/525/620/690V, 150/200% In
- >> MPP/APP Technology, Self healing/non self healing
- >> From standard to most demanding application

- APFC systems

- >> Maintain PF under varying load conditions
- >> Thyristor switches for fast fluctuating loads



Power Quality



- Filter Applications

- >> Detuned filters for PF improvement in harmonic-rich environment

- >> Tuned / Broadband / Active filters for harmonics mitigation

- Systems and Applications

- >> HT/MV capacitor banks, PFC projects

- >> Harmonic audits, PFC training and consultancy



Automate

- Variable speed drives:
 - >> Applications: Variations, pumping, Cooling towers, HVAC
 - >> Energy saving with precise motor speed adjustment
 - >> Precise regulation of air flow or water pressure
 - >> Motor protection and soft starting
- HVAC Control
 - >> Centralised system for AHUs, screw chiller and drives
 - >> Complete control with Scada, PLCs, HMIs
 - >> Sequence control and power saving
 - >> Data exchange with BMS and remote control

Automate

- Building automation systems (TAC)
 - >> On demand energy management
 - >> Customised energy analysis and reports
 - >> Reduce installation, operation and maintenance costs
 - >> Enhance comfort and security
 - >> Simplified administration
- Lighting management systems
 - >> Occupancy based sensing & scheduled switching
 - >> Daylight harvesting, shade & blind control
 - >> Switching & dimming, outdoor lighting control
 - >> Integration with BMS

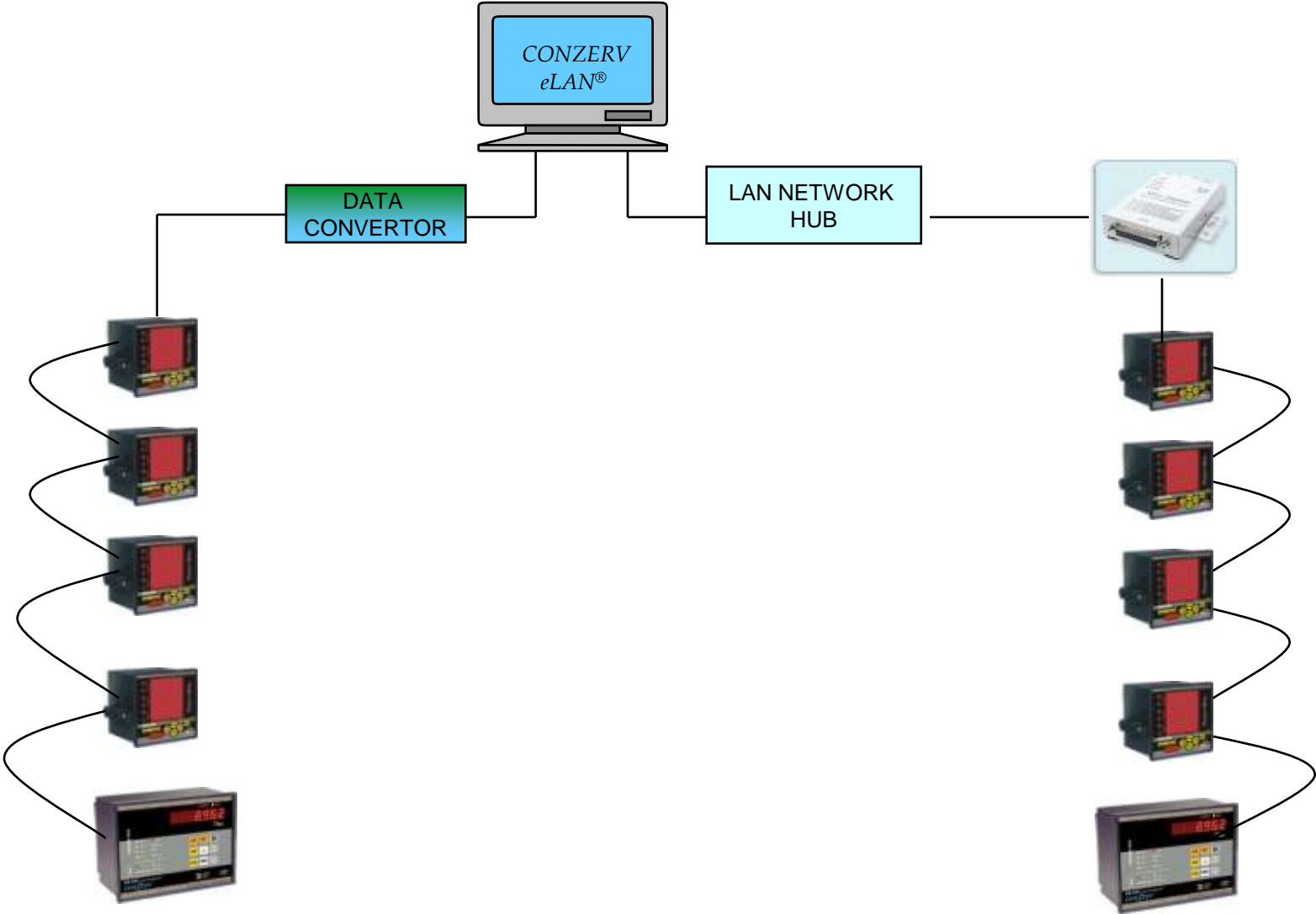
Monitor

- Complete range of advanced EMS solutions for real benefits of centralised monitoring of electrical and non electrical parameters for efficient management of system
- Real time monitoring of an installation via web technologies
- Aid preventive and corrective maintenance ensuring continuity for condition monitoring
- Simple solutions, web enabled energy management and advanced software incl WAGES (water, air, gas, electricity, steam) and GHG calculations
- Seamless integration with 3rd party EMS, BMS, ECS, DCS, DMS, Scada, Business systems etc

Stand-Alone Meters are not enough

- Generally provide only Raw Data
- Readings cannot be correlated on-line, in Real-Time
- Difficult to relate Energy Consumption to production
- Optimisation requires On-Line Data. Difficult to achieve with Stand-Alone Instruments.

EMS SYSTEM



EM 6000 Series



EM 3000 Series

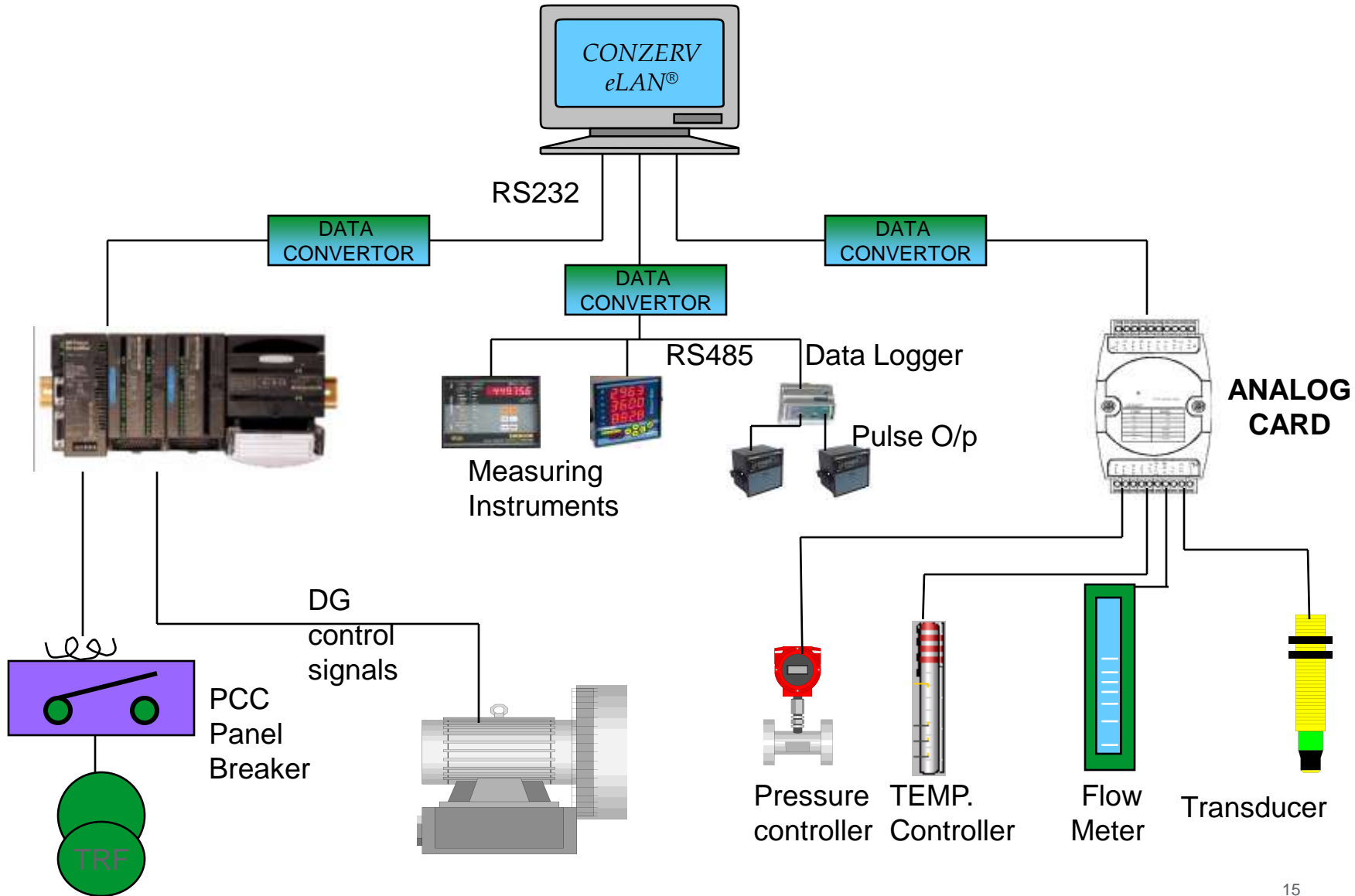


ETHERNET
CONVERTOR

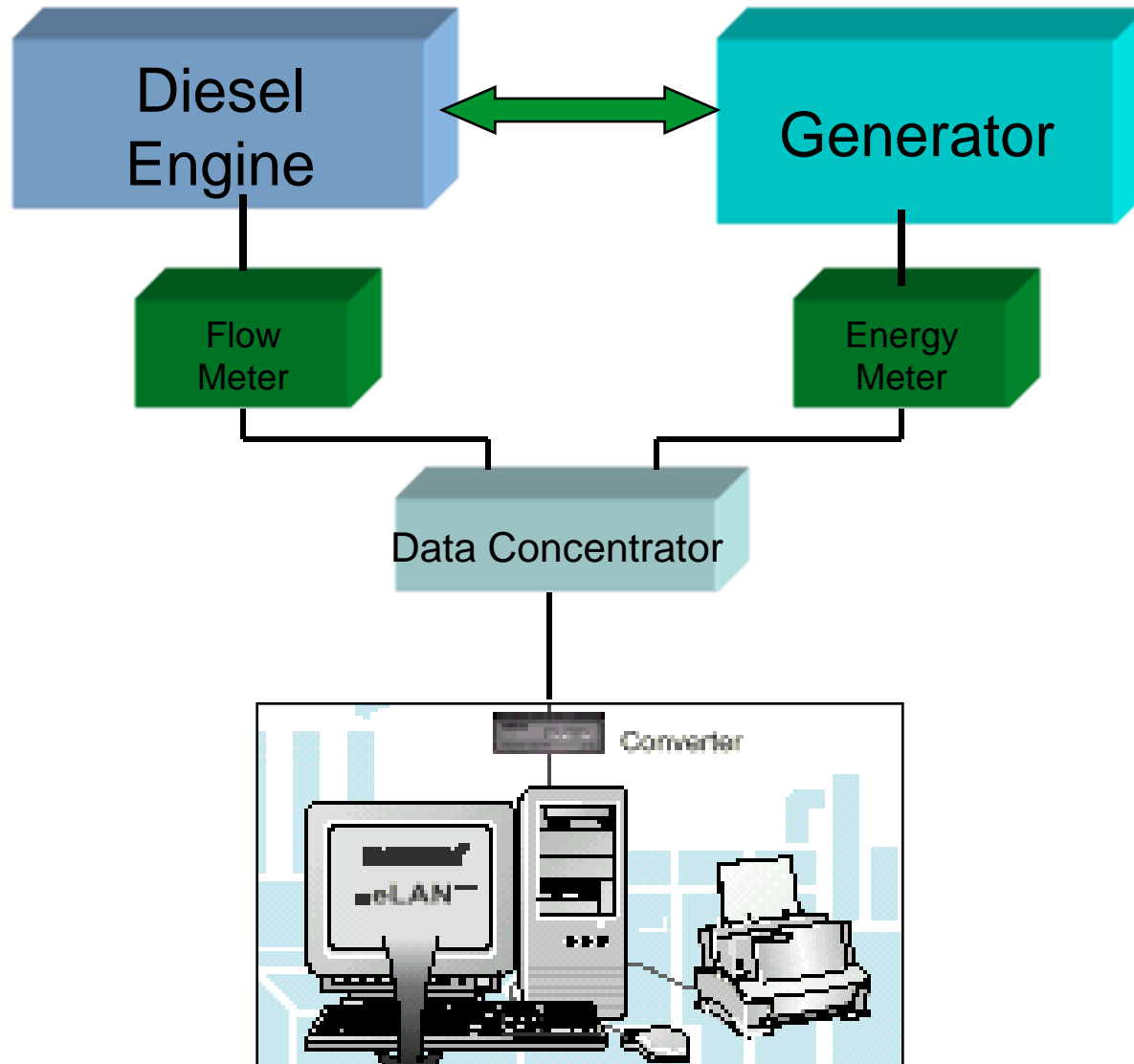


RS 485-RS232
CONVERTOR

EMS (eLAN)[®] for Process Optimization



Generator Optimisation

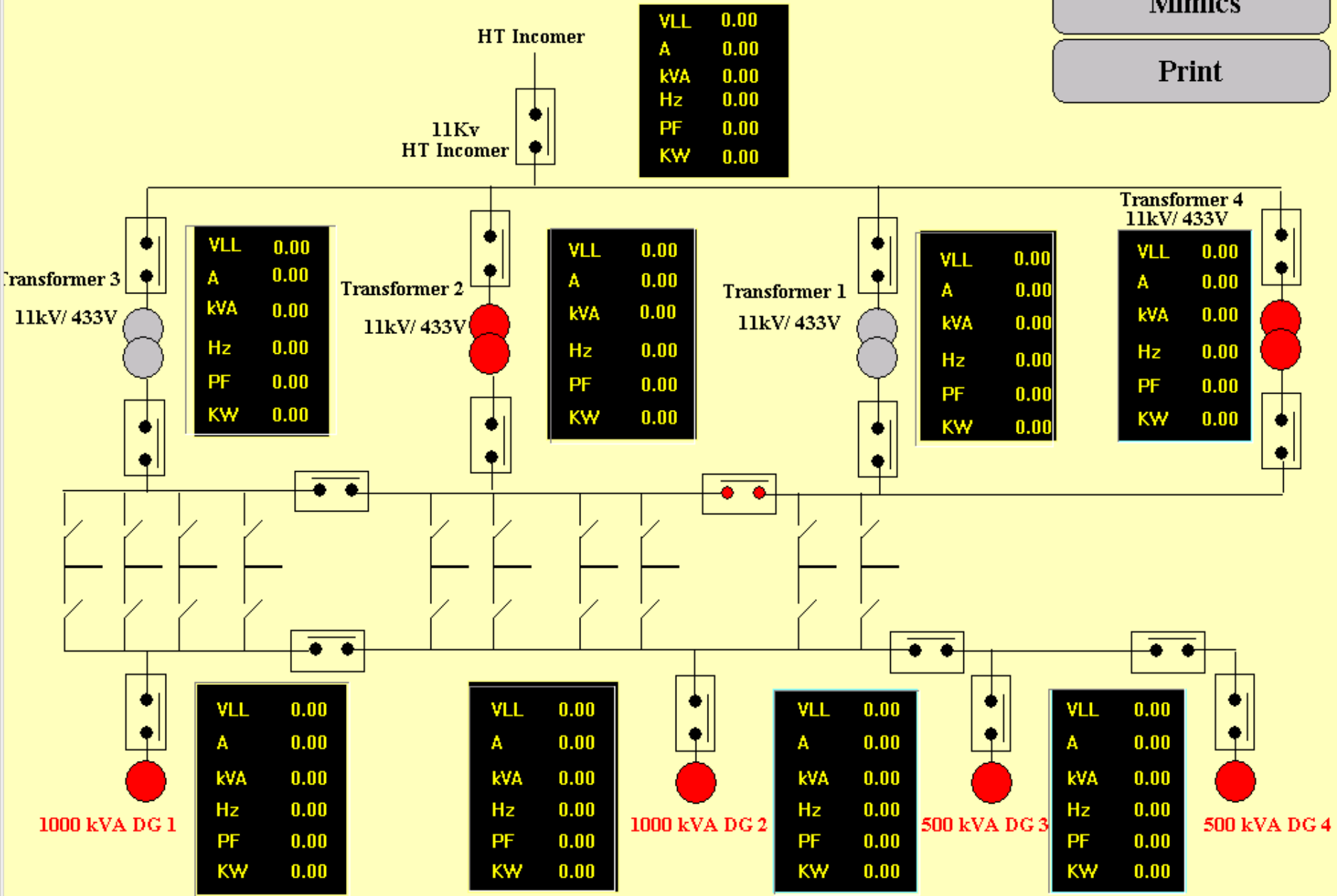


SINGLE LINE DIAGRAM

Schematic Representation of the Power Diagram

Mimics

Print





HYUNDAI MOTOR INDIA LTD

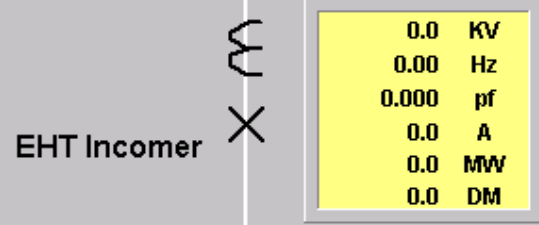
27/08/2002
12:15:25

MIMIC SCREEN - SINGLE LINE DIAGRAM



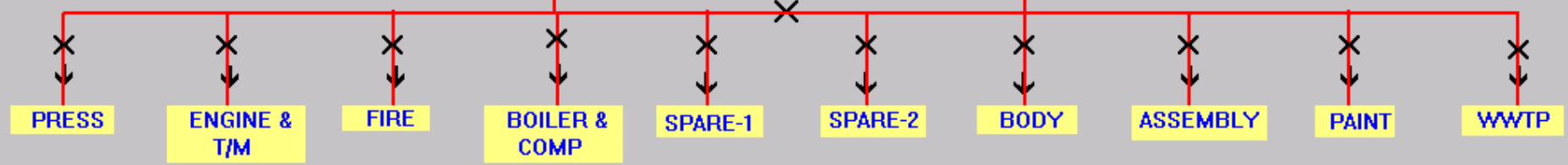
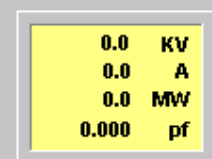
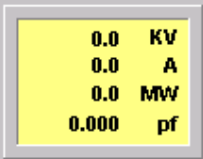
Main

230 KV INCOMER



30/40 MVA
TR -1

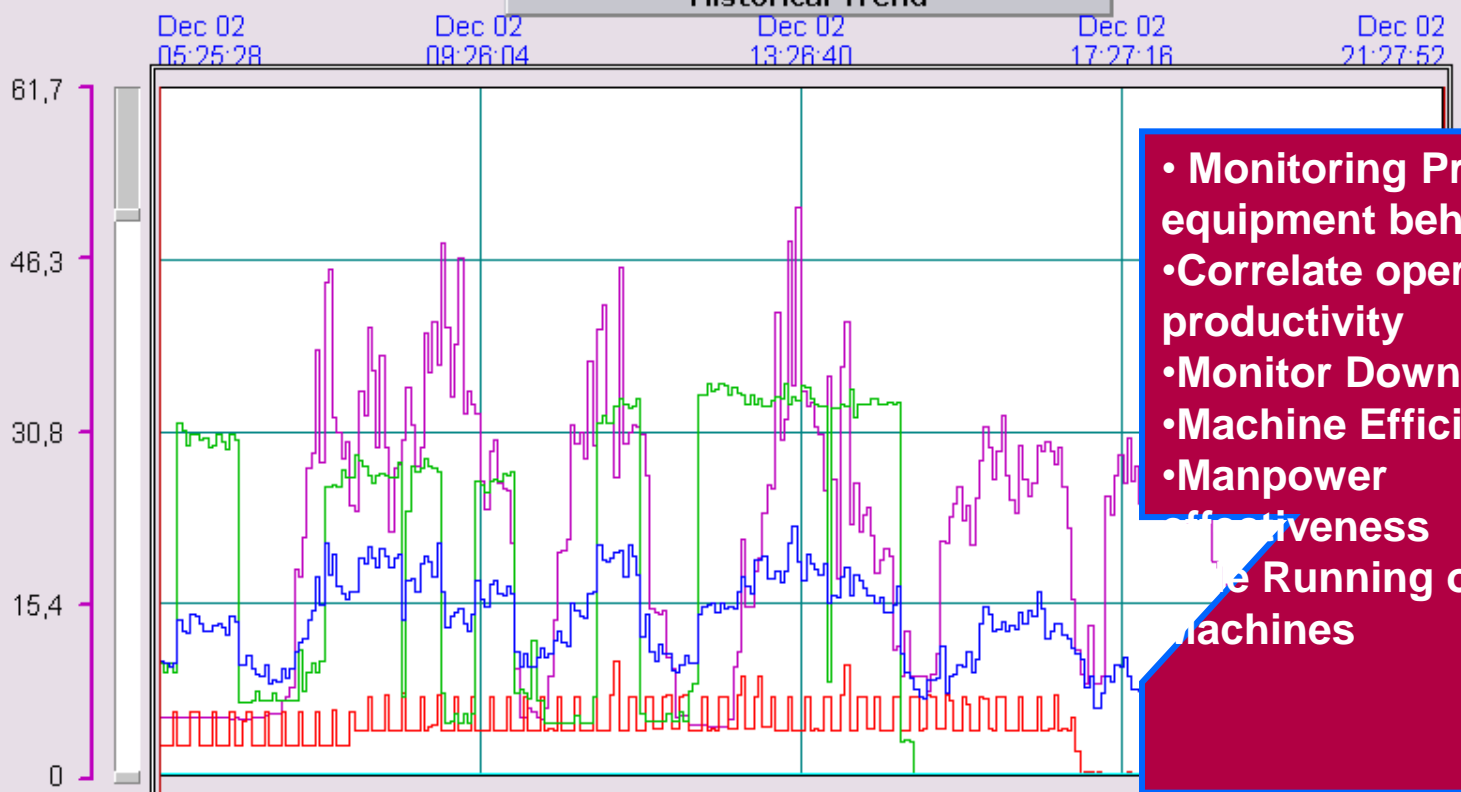
30/40 MVA
TR -2



0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf	0.0 A 0.0 KW 0.000 pf
-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------

Historical Trend

M8-Slitter, K4 KT_A



- Monitoring Production equipment behavior
- Correlate operation Vs productivity
- Monitor Downtime
- Machine Efficiency
- Manpower effectiveness
- The Running of machines

05:25:28 21:27:52

Zoom In 16h 2m 24s Zoom Out

4 hours 1 hour 1 minutes 30 minutes 10 minutes

Max Value
512.0

Min Value
42.9

M8-Slitter, K4 KT_A 50.85 59.89

M12-U65, KK_A 26.42 0.00

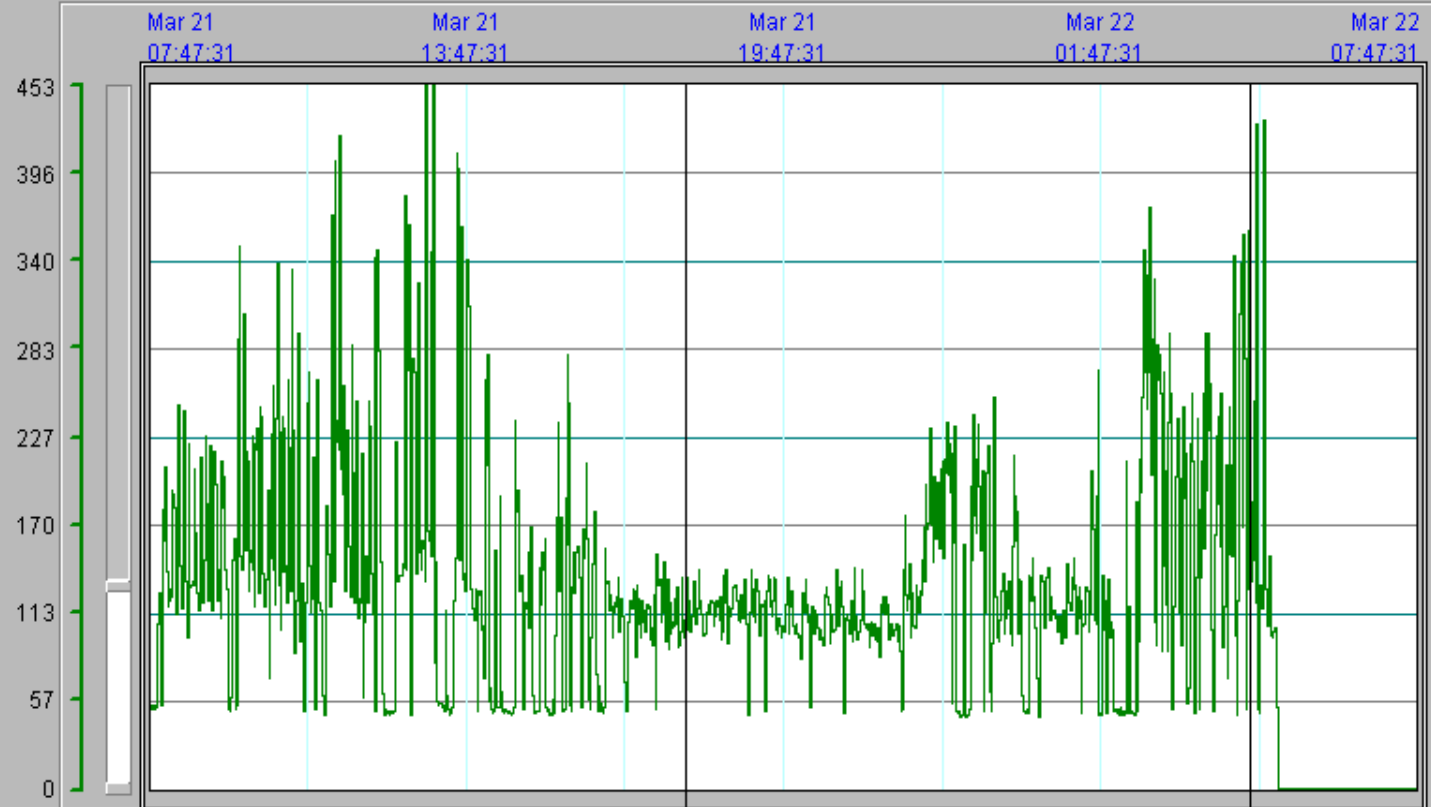
M11-U45, kk_A 100.21 0.74

M1-Transformer T-1_KW 273.28 107.50

M14-U90, KK_KW 0.00 0.00

Case : 2

History Trend



CRUSHER - B (STATION-2B)_KW
137.16 415.51

- Red line
- Yellow line
- Black line
- Blue line
- Magenta line
- Teal line
- Purple line

17:57:21

04:37:26

12:30:18
25/03/06

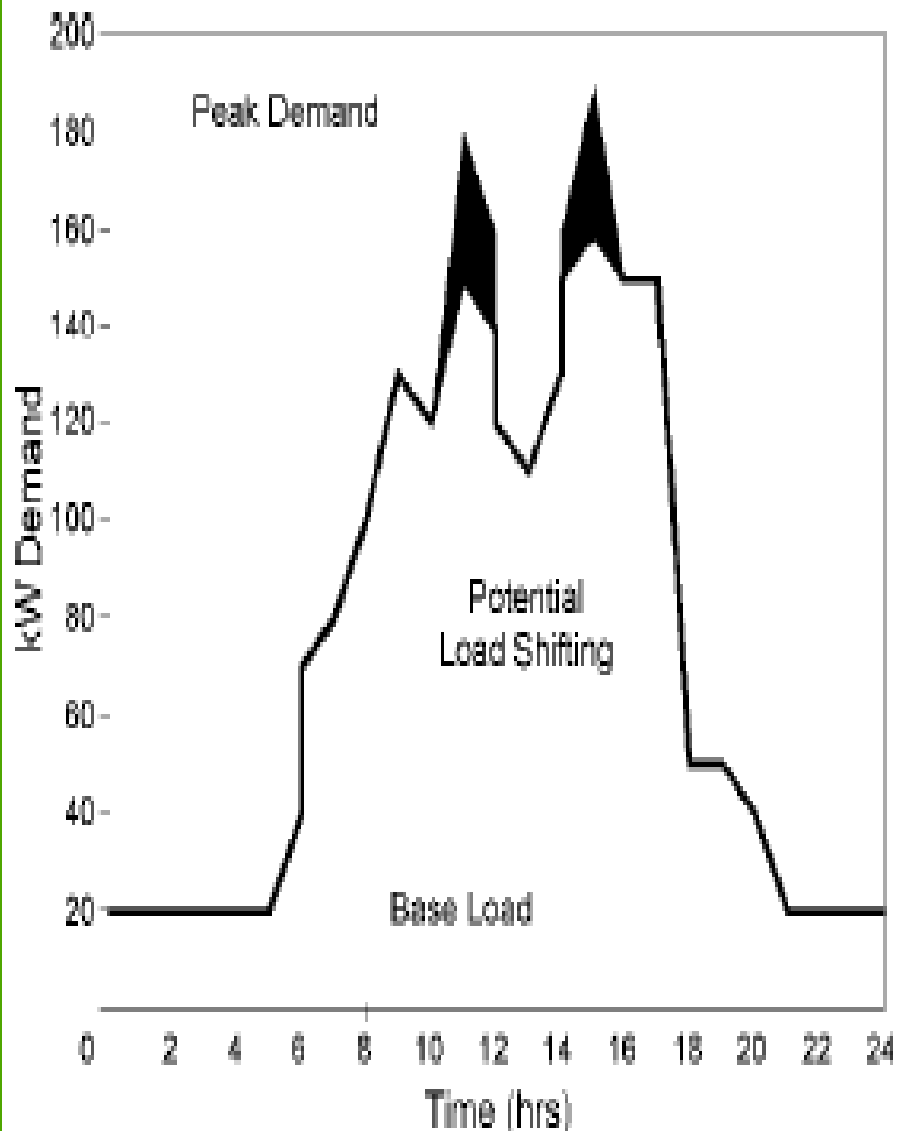
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◀ 07:47:31 ▶ Zoom In 1d Zoom Out ▶ 07:47:31 ▶
4 hours 1 hour ◀◀ ◀ Minutes ▶▶ 30 minutes 10 minutes ▶▶▶

Close

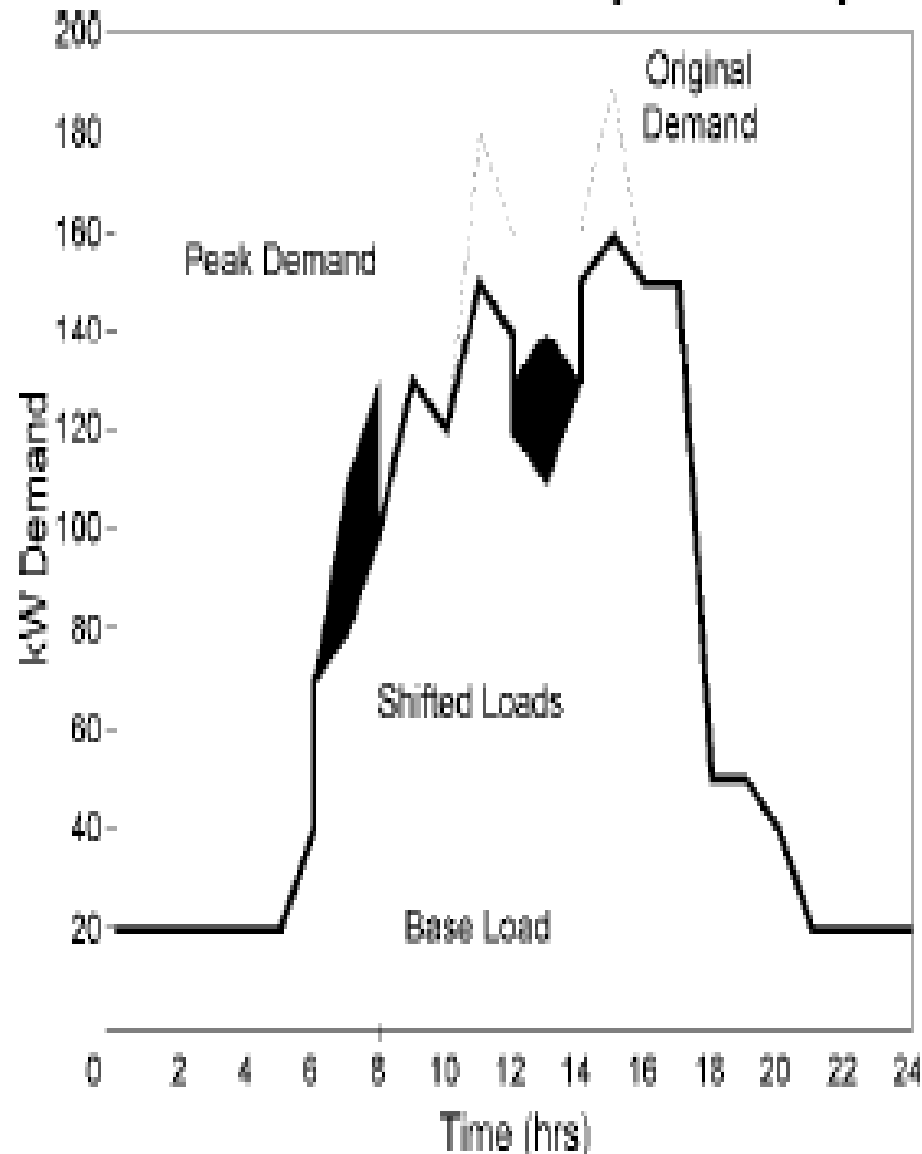
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Proper load scheduling (Demand Mgmt)

LOAD SHIFTING (BEFORE)



LOAD SHIFTING (AFTER)



Max Min Report of VLL, Amps, kW & PF - Hourly wise with Time of Occurrence

		Date:	20/02/2006																									
Feeder name		Pump No.1	Pump No.2	Pump No.3	Pump No.4	Pump No.5	Pump No.6	Pump No.7	Pump No.8	F.S 1	F.S 2	F.S 3	F.S 4	V.S 1														
0:00 - 1:00	Voltage - LL	max	0	3395.537	3394.768	3394.939	3405.845	3405.842	3408.068	3407.827	3369.749	3373.4	3371.475	3374.791	3372.906													
			00:05:00	01:00:00	01:00:00	01:00:00	01:00:00	01:00:00	01:00:00	01:00:00	01:00:00	00:55:00	00:55:00	00:55:00	00:50:00													
		Min	0	3338.001	3337.357	3337.057	3348.387	3348.024	3350.132	3350.277	3328.445	3331.23	3329.537	3332.654	3330.545													
			01:00:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00													
	CURRENT	Max	0	143.0988	150.565	2.5E-17	2.5E-17	5E-17	164.6573	194.6063	193.7987	194.0418	206.2328	194.1221	2.5E-16													
			00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00													
		Min	0	133.3767	144.3189	2.5E-17	2.5E-17	5E-17	155.5608	182.9423	184.141	184.0738	195.9671	184.1459	2.5E-16													
			01:00:00	00:55:00	00:30:00	00:05:00	00:05:00	00:05:00	00:45:00	00:40:00	00:55:00	00:55:00	00:55:00	00:55:00	00:05:00													
	KW	Max	0	813.3397	869.3724	7.5E-19	7.5E-19	1.5E-18	949.2838	1115.041	1089.223	1104.452	1172.426	1098.839	7.4999E-18													
			00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00	00:05:00													
		Min	0	767.8888	834.5871	7.5E-19	7.5E-19	1.5E-18	903.6476	1060.774	1050.255	1063.476	1126.177	1053.018	7.4999E-18													
			01:00:00	00:55:00	00:30:00	00:05:00	00:05:00	00:05:00	00:40:00	00:30:00	00:55:00	00:55:00	00:55:00	00:55:00	00:05:00													
	PF - lag	Max	0.000	0.985	0.998	0.000	0.000	0.000	0.993	0.988	0.976	0.988	0.987	0.980	0.000													
			00:05:00	00:35:00	00:05:00	00:05:00	00:05:00	00:05:00	01:00:00	00:40:00	00:55:00	00:55:00	00:50:00	00:05:00	00:05:00													
		Min	0.000	0.981	0.990	0.000	0.000	0.000	0.988	0.983	0.971	0.983	0.983	0.977	0.000													
			01:00:00	00:25:00	01:00:00	00:05:00	00:05:00	00:05:00	00:25:00	00:25:00	00:25:00	00:25:00	00:10:00	00:40:00	00:05:00													
1:00 - 2:00	Voltage - LL	Max	0	3405.15	3404.874	3404.484	3415.488	3415.43	3417.158	3417.324	3351.626	3354.689	3352.8	3356.155	3353.763													
			01:05:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00	01:15:00													
		Min	0	3390.626	3390.027	3390.109	3390.109	3390.109	3390.109	3390.109	3390.109	3337.083	3340.632	3338.448	3341.638	3339.796												
			MAX & MIN OF VITAL PARAMETERS WITH DATE AND TIME OF OCCURRENCE - PER HOUR BASIS													01:10:00												
	CURRENT	Max																										2.5E-16
																												01:05:00
		Min														0	129.7282	142.931	2.5E-17	2.5E-17	5E-17	153.7565	179.9583	184.4271	184.2615	196.5299	184.8727	2.5E-16
			02:00:00	01:35:00	01:45:00	01:05:00	01:05:00	01:05:00	01:35:00	01:35:00	01:35:00	01:35:00	01:35:00	01:35:00	01:35:00	01:05:00												
	KW	Max	0	805.6874	874.2569	7.5E-19	7.5E-19	1.5E-18	955.9848	1111.471	1097.157	1109.255	1174.444	1100.545	7.4999E-18													
			01:05:00	02:00:00	02:00:00	01:05:00	01:05:00	01:05:00	02:00:00	02:00:00	02:00:00	02:00:00	02:00:00	02:00:00	01:05:00													
		Min	0	751.9826	838.2083	7.5E-19	7.5E-19	1.5E-18	901.5816	1050.087	1039.471	1054.926	1123.259	1050.741	7.4999E-18													
			02:00:00	01:35:00	01:10:00	01:05:00	01:05:00	01:05:00	01:35:00	01:35:00	01:35:00	01:35:00	01:35:00	01:35:00	01:05:00													
	PF - lag	Max	0.0000	0.9869	0.9974	0.0000	0.0000	0.0000	0.9946	0.9895	0.9760	0.9887	0.9858	0.9818	0.0000													
			01:05:00	01:10:00	01:35:00	01:05:00	01:05:00	01:05:00	01:15:00	01:05:00	01:10:00	01:50:00	01:25:00	01:10:00	01:05:00													



Home

PACKAGING & PRINTING DIVISION- CHENNAI

DASHBOARD

EMS Operator

Mgr- Maintenance

CFO

CEO



Dashboard - Mgr Maintenance

::: DG-1 Incomer Details :::

*Rated Load in KVA	2000
Actual Load in KVA	1171.2
Load Factor	0.00
Frequency in Hz	-0.51
Average PF	0.85

::: DG-2 Incomer Details :::

*Rated Load in KVA	2000
Actual Load in KVA	1171.2
Load Factor	-0.51
Frequency in Hz	-0.51
Average PF	0.84

::: Main LT Transformer Details :::

*Transformer rating in Kva	2500
Actual Load in Kva	1555.6
Average VLL	0.98
Average Amps	0.98
Average PF	0.98
Harmonics (THD) in %	V- 3.1 I- 8.2

Last Specific Energy Consumption Values

NSS PSB-6	525	525	525
SEC for the Prev Day	20000	& Today	15000
SEC for Prev Month	245600	& This Month	185670

::: TNEB Incomer Meter Details :::

*No of HT Incomers	1
*Contract Demand	9000
Actual Load in Kva	2311.3
Average Amps	200.0
Average PF	-0.51

::: 11 kV SB-1 Inc Details :::

*Rated Load in Kva	2500
Actual Load in Kva	1555.6
Average PF	0.98
Average Amps	3214.84
Harmonics (THD) in %	V- 9.7 I- 56.7

::: Alarm Window :::

ALARM COUNTS : 140
 DATE : Aug 29
 TIME : 10:13

Time	Reference	Message
10:1...	S1N30_KW	Alarm HiHi. Limit is 150.000000 and Current value is 1171.198375
10:1...	S1N30_KVA	Alarm HiHi. Limit is 175.000000 and Current value is 2311.293000
10:1...	S1N29_KW	Alarm HiHi. Limit is 250.000000 and Current value is 1171.198375
10:1...	S1N29_KVA	Alarm HiHi. Limit is 300.000000 and Current value is 2311.293000
10:1...	S1N30_VLN	Alarm HiHi. Limit is 260.000000 and Current value is 3851.594971
10:1...	S1N30_VLL	Alarm HiHi. Limit is 440.000000 and Current value is 6659.905273

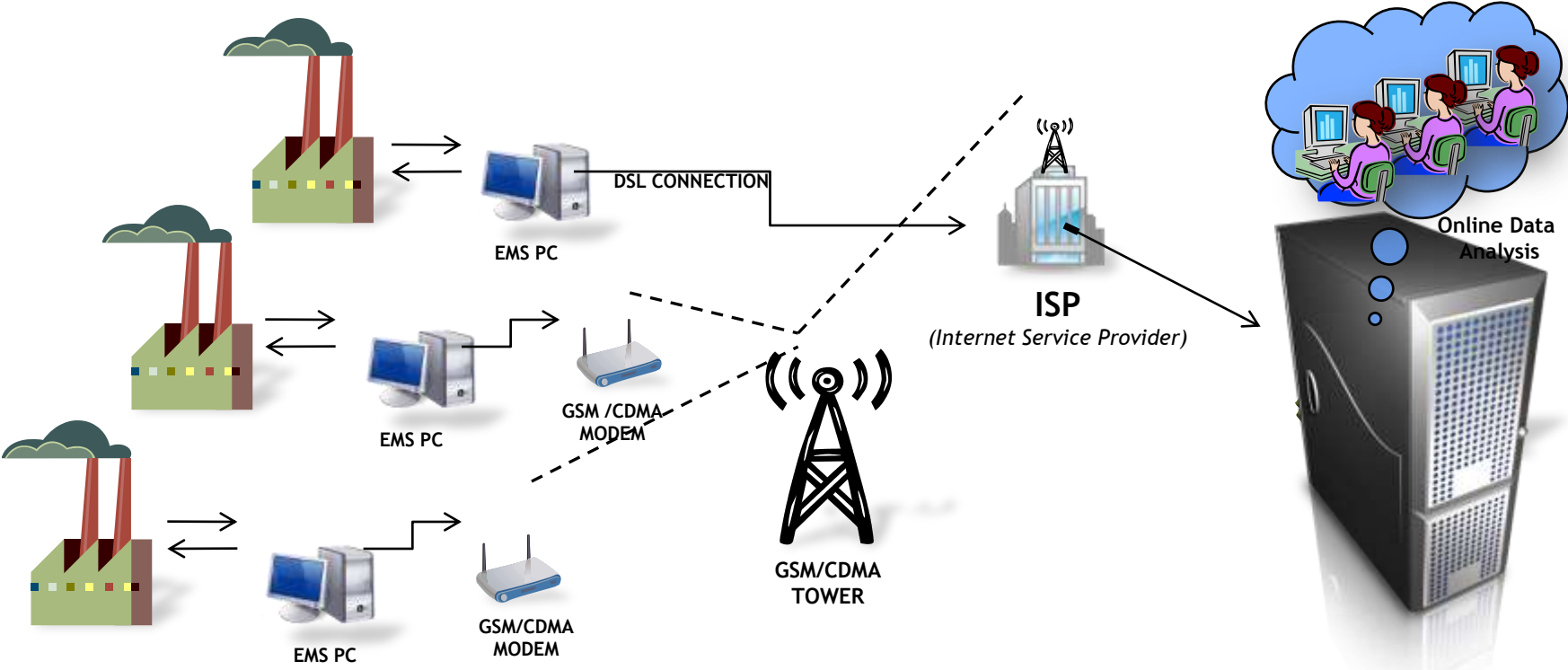
Ack Delete Ack All

Energy Management System Applications

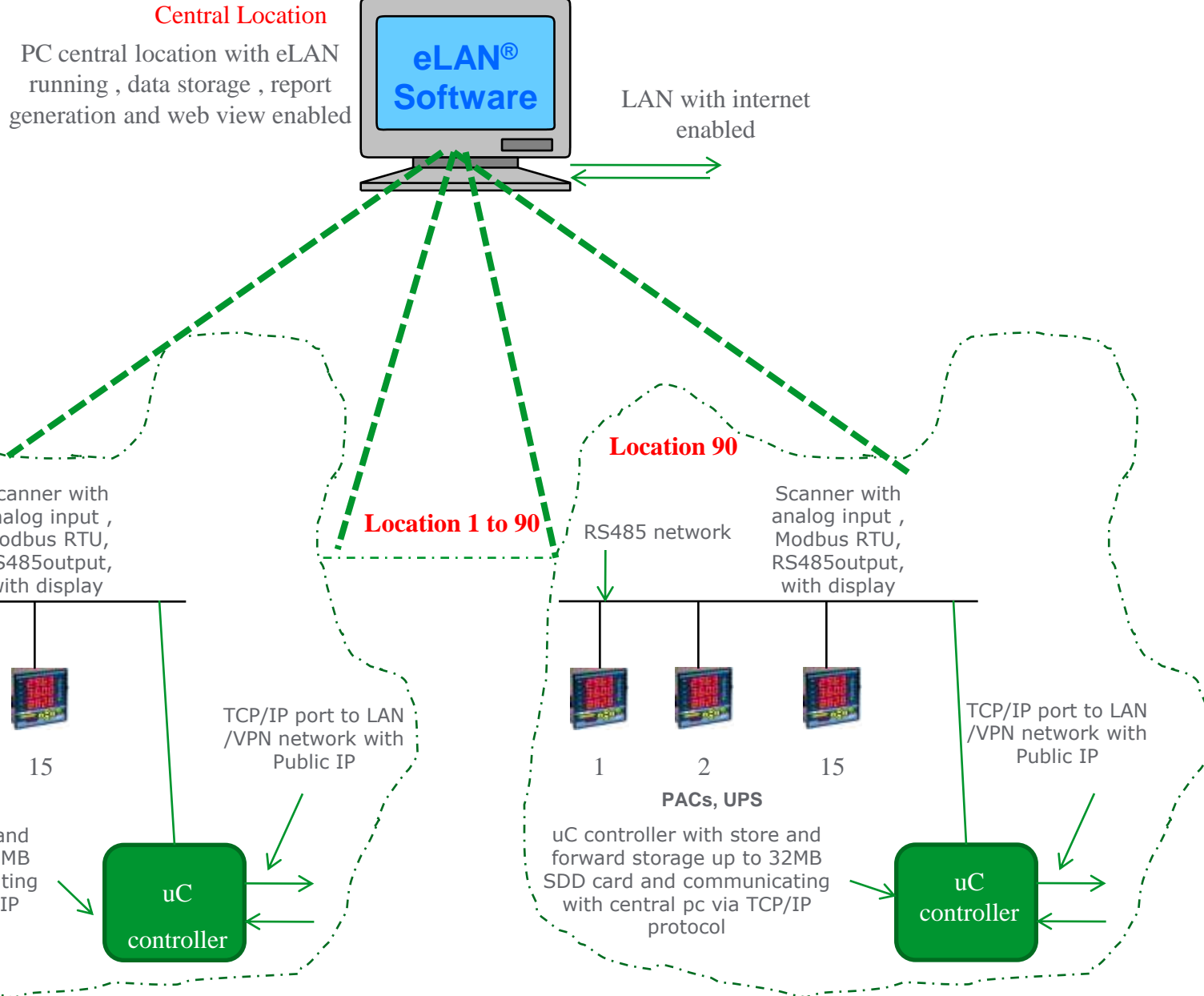
- Benchmarking
- Predictive Maintenance
- Root Cause Analysis
- Power Quality
- Measurement and Verification
- Cost Allocation
- Smart Power Management
- Energy Resource Planning
- Energy Balancing
- Breaker Status – remote monitoring
- Automated Energy Billing System for Townships

Remote Monitoring System

Remote Monitoring System



System Architecture (Basic)



We are
the global specialist in
energy management

A Global Company

INR 119,450 crore revenue in 2009

114,000 people in more than 100 countries

>200 factories around the world

R&D centres in **25 countries**

Schneider Electric in India

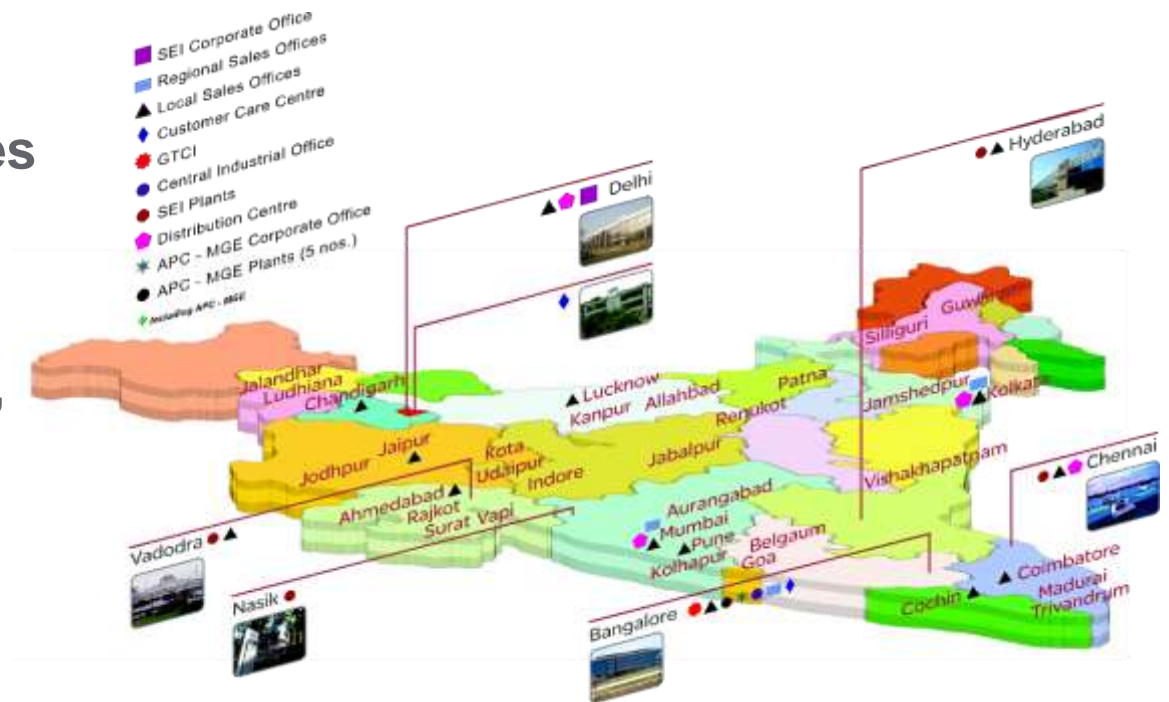
6,500 employees

9 manufacturing sites,

6 R&D centers

400 authorized partners (Distributors, System Integrators and Panel Builders)

One Regional Project & Engineering Centre



Schneider Electric + Conzerv + Meher Capacitors = EE^{3*}

* Energy Efficiency

Schneider
Electric

COMPRESSED AIR SYSTEM

Compressed Air System

- Problem of leakages

- >> Compressed Air Efficiency:

- > 60 to 80% of the power of the prime mover is converted into an unusable form of energy (HEAT)

- > And to a lesser extent, into friction, misuse and noise.

- > Overall efficiency of compressed air is 10 to 20 %

Air Compressors - Leaks

Orifice Size mm	KW Wasted	* Energy Waste (Rs/Year)
0.8	0.2	8000
1.6	0.8	32000
3.1	3.0	120000
6.4	12.0	480000

* based on Rs. 5 / kWh ; 8000 operating hours; air at 7.0 bar

Solution for Compressed Air System Efficiency Monitoring

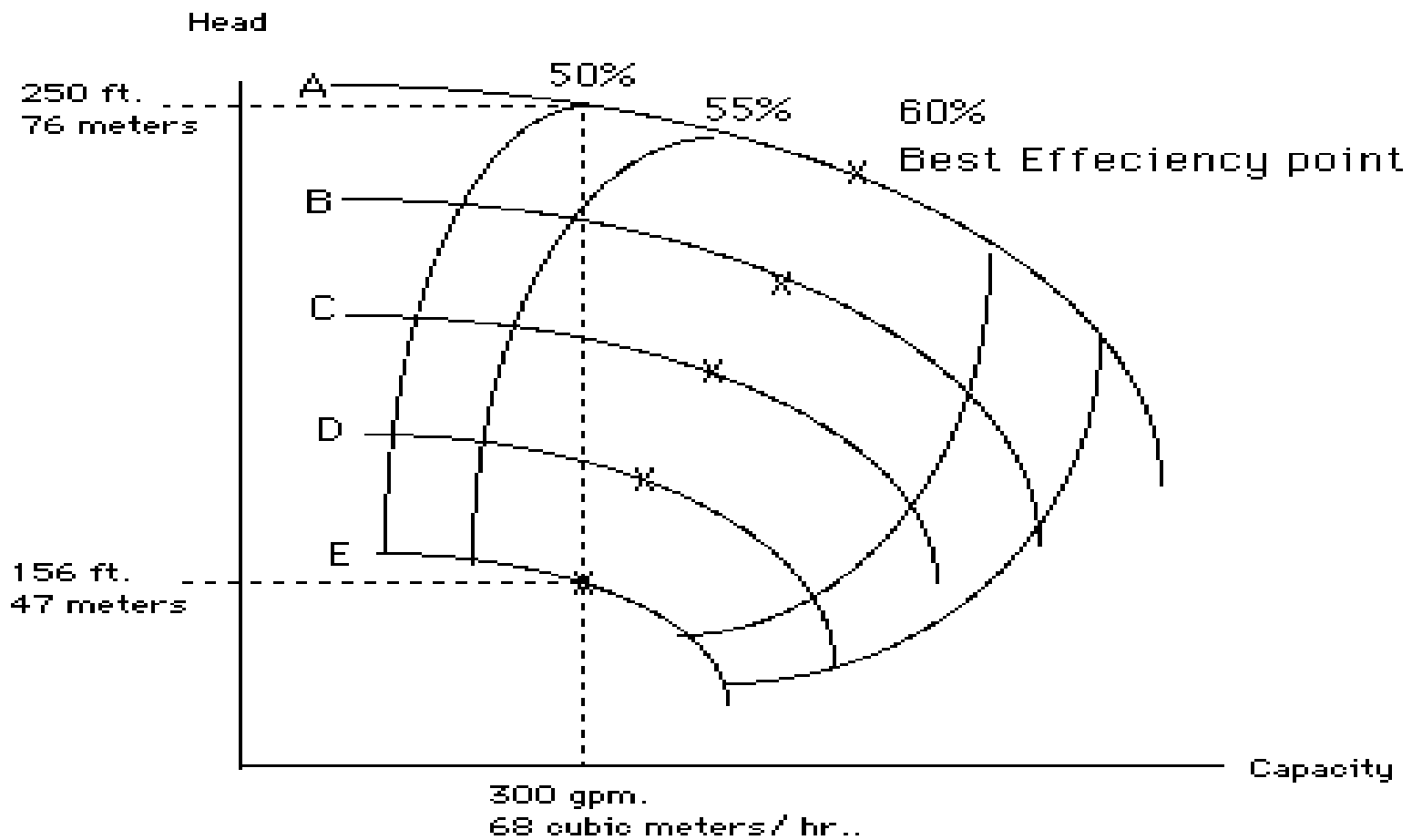
- Observe change in duty cycle – load / unload – times. If load duration increases, efficiency is declining.
- Energy audit will determine ideal duty cycle.
- EMS can indicate on line changes in efficiency by increases in load cycle and consequent energy consumption.
- During unload cycle air compressor should not consume over 25 to 30 % rated power. EMS can continuously check.
- Leakages can be checked by monitoring energy consumption.

PUMPING SYSTEM

PUMPING EFFICIENCY

- Pumps running at low efficiency as:
 - >> Discharge pressure too high
 - >> Energy consumption high
 - >> Overrated pumps in operation
- Norms are:
 - >> Filtration - 0.11 – 0.13 kWh/KL
 - >> Hydro pneumatic- 0.15 – 0.35 kWh/KL
 - >> Hot water re-circulation- 0.05 - 0.08 kWh/KL

Efficiency Curves



Solution for Achieving Pumping Efficiency

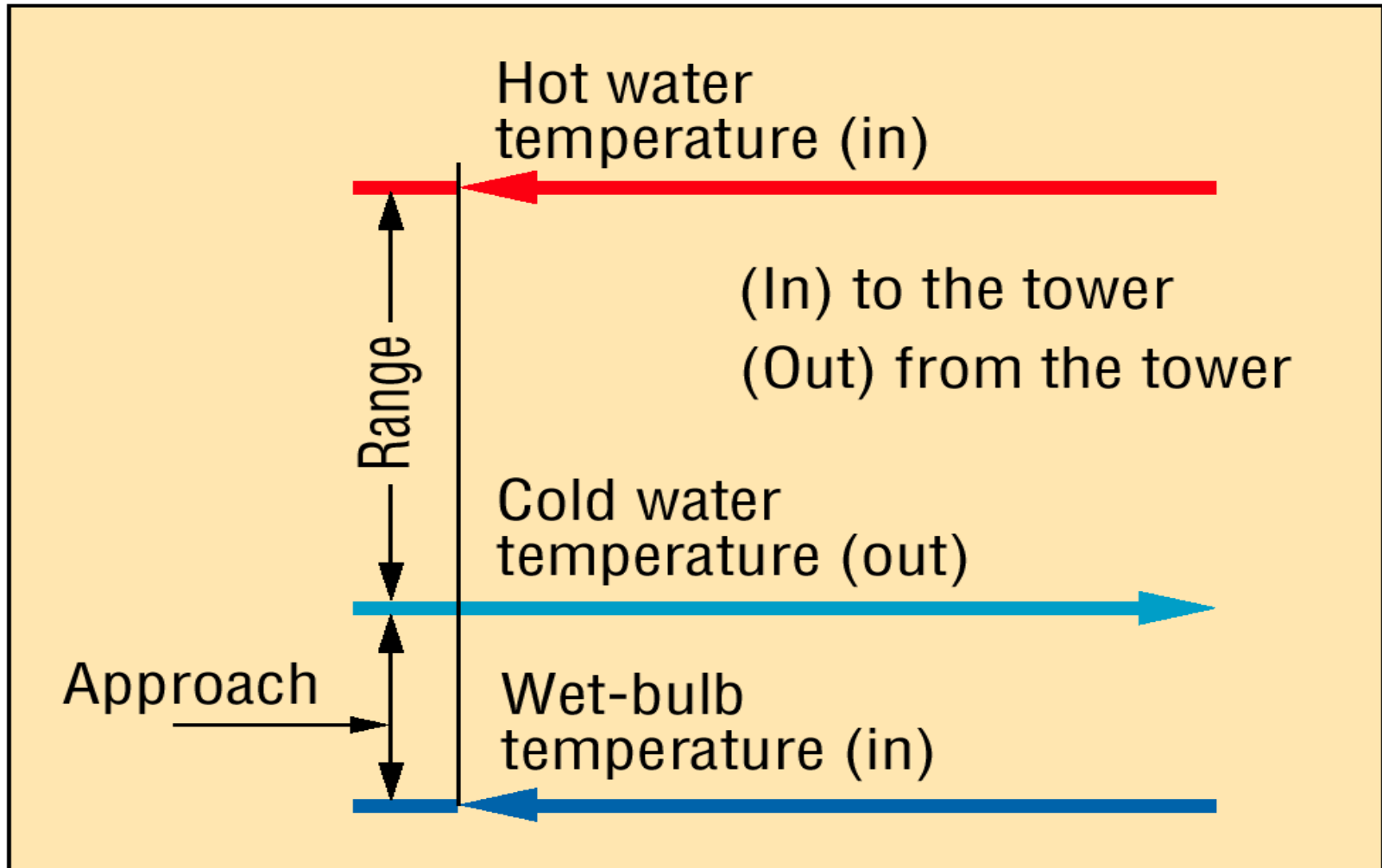
- Often, Pumps operate at very moderate efficiency of 30 to 40 % even though motor efficiency is quite high say 88%. Pumping efficiency should be thoroughly checked during Energy audit to upgrade operating point to 50 to 60 %.
- EMS provides continuous data of energy efficiency of pumps by monitoring flow as well as energy.
- For Pumps above 100 KW a multi function meter is recommended.

COOLING TOWER

Cooling Tower Efficiency

- Problem areas:
 - >> Pump consumption high
 - >> Approach factor high
 - >> Nozzles blocked

Cooling Tower Performance



Efficiency of Cooling Tower

- Efficiency of Cooling Tower is indicated mainly by the factor called 'Approach'.
- 'Approach' is the difference between wet bulb temperature and the cooling water outlet.
- 'Approach' is a design parameter and typical values are 3^o to 5^o C.
- Actual measurement was higher than design value.

Solution for Achieving Efficiency of Cooling Tower

- Energy audit will include measurement of 'Approach', 'Range' and absolute values of inlet and outlet temperatures to arrive at efficiency as well as establish causes of lower efficiency. Solutions will also form part of report.
- EMS can enable monitoring of energy as well as temperatures on a continuous basis. Any deterioration in efficiency will be indicated thru the system.
- Nozzles should be checked periodically and replaced with non choking ones

MOTOR EFFICIENCY

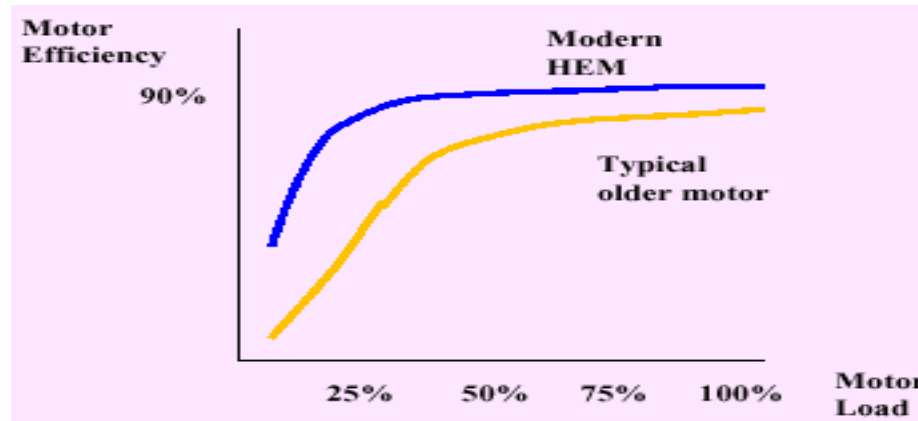
Motor Efficiency

- Motor audits indicate:
 - >> Motors running at very low loads
 - >> Efficiency observed to be low
 - >> Consumption high

Motors

- Motors consume 70% to 80% of the electric power. The basic approach for efficiency is:
 - Provide better controls (VSD instead of throttling)
 - Process re-engineering
 - Maintain voltage levels
 - Minimise phase unbalance
 - Minimise rewound motor losses (no load pf 0.2 or below)
 - Avoid over / under capacity
 - Use energy efficient motors (92%)

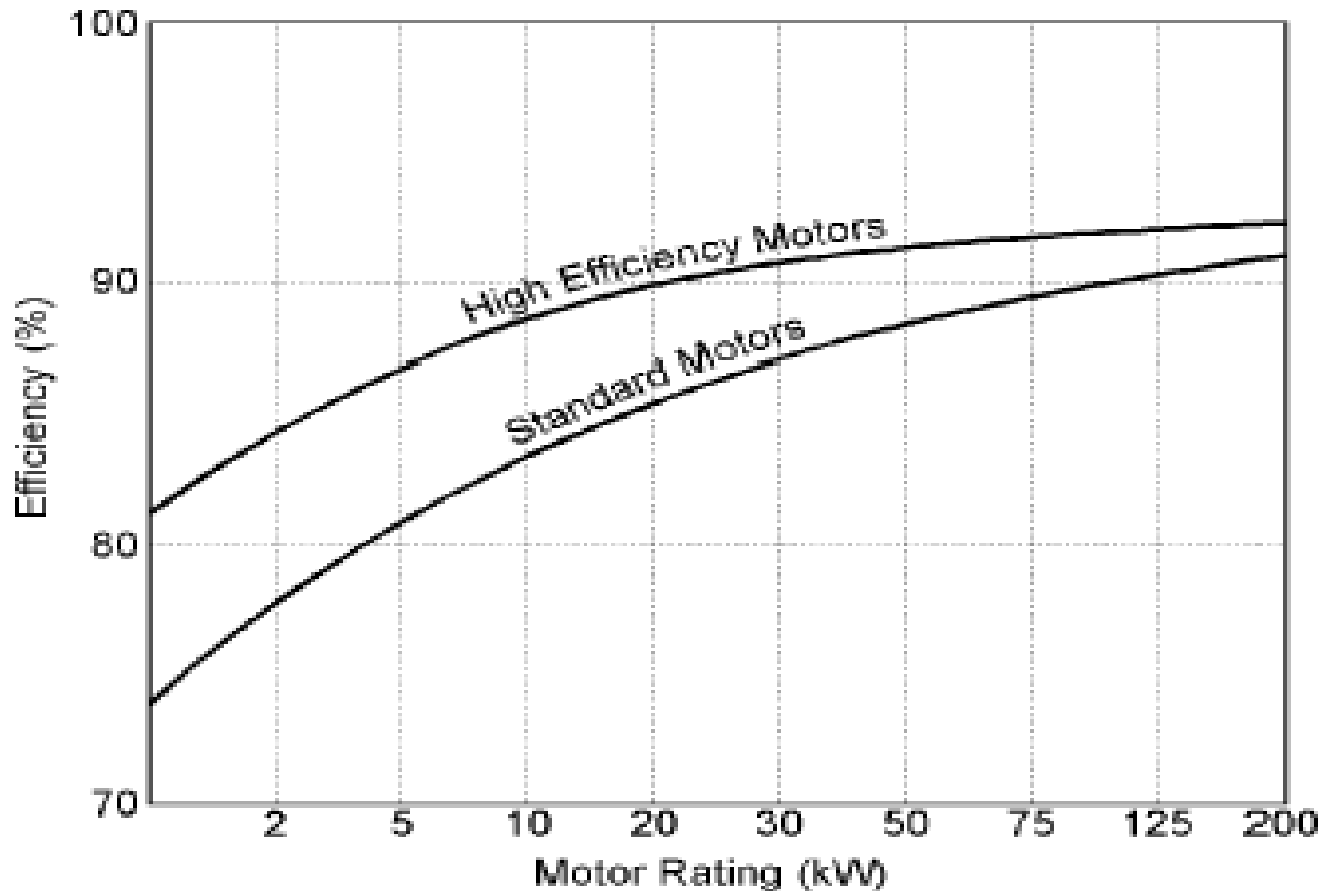
Motors – Effect of Using Higher than required Rating



Parameter	Case 1	Case 2	Case 3
Motor Load	7.5 kw at F.L.	10 kw at 3/4 load	15 kw at 1/2 load
Required load	7.5	7.5	7.5
Motor EFF (%)	88	84	79
Motor input kw	8.5	9.0	9.5
Unit consumed kwh	42500	45000	47500
% increase	--	5.8	11.76

High Efficiency Motors

**STANDARD vs HIGH EFFICIENCY MOTORS
(Typical 3-Phase Induction Motor)**



Solution for Energy Efficiency in Motors

- Energy audit can assess efficiencies of motors and can also provide info on underloading of certain motors.
- EMS can indicate any loss of efficiency of heavy motors on a continuous basis and assist in maintenance so that problem can be attended to before burnout.
- Rewinding of motors below 50 HP should be avoided, if possible, as consumption of rewind motors maybe higher by 5 to 10 %. Replacement can give a payback in less than a year. Keep motors rewind thrice or more as standby for emergency usage only.

LIGHTING EFFICIENCY

Lighting solutions

- **The voltage used for lighting is 230 to 245 volts.**
- **Reduce the costs and improve your lighting experience by scene control (lighting control system)**
- **Choose from Stand Alone , Bus Control and Wireless Control to suit your applications**
- **A wide range of high end aesthetic designs for different User Interfaces is available - Colour touch screens , Wall switches and Dimmers , Input units and matching Electrical Accessories .**

Lighting Energy Saver CoolLite™ – Features

% Savings, One Time Setting

20% Tech parks
OLTC / UPS Stabilized Supply
PFC Ballasts, New Lamps

15% General Use
Malls, Offices, Multiplexes, Auditoriums
OLTC Stabilized
Mixed Old / New Lamps

10% Buildings older than 5 yrs
Supply goes down to 200v occasionally
Very Old Fluorescents

Bypass - Supply < 200v

Savings Spot Check

Factory Option Meter

Short circuit,
Over load protection

Electronic Line Monitor
Lo, OK, Hi voltage and
Trip with Alarm Relay o/p



Summary

- Use step wise approach to implement energy efficiency in your plant.
- Focus on plant utilities to reduce energy consumption.
- At the first available opportunity replace energy inefficient systems like compressed air usage, rewound motors with energy efficient motors, more efficient lighting etc

Customer **Care** centre



1800 111 341

MTNL/BSNL toll-free

1800 103 0011

Airtel toll-free

011-41682434/35

General numbers

email: in-care@in.schneider-electric.com

in-opcccc@in.schneider-electric.com

Fax : 011 – 42590088 (CCC)

011 – 42590077 (OPC)

Open: Monday to Saturday 9:00 AM to 8:00 PM

Make the most of your energy



Thank you

