ENERGY CONSERVATION NOW,

IS THE COLLECTIVE

RESPONSIBILITY

FOR ALL OF US;

FOR A BETTER TOMORROW.

Energy conservation – our collective responsibility.

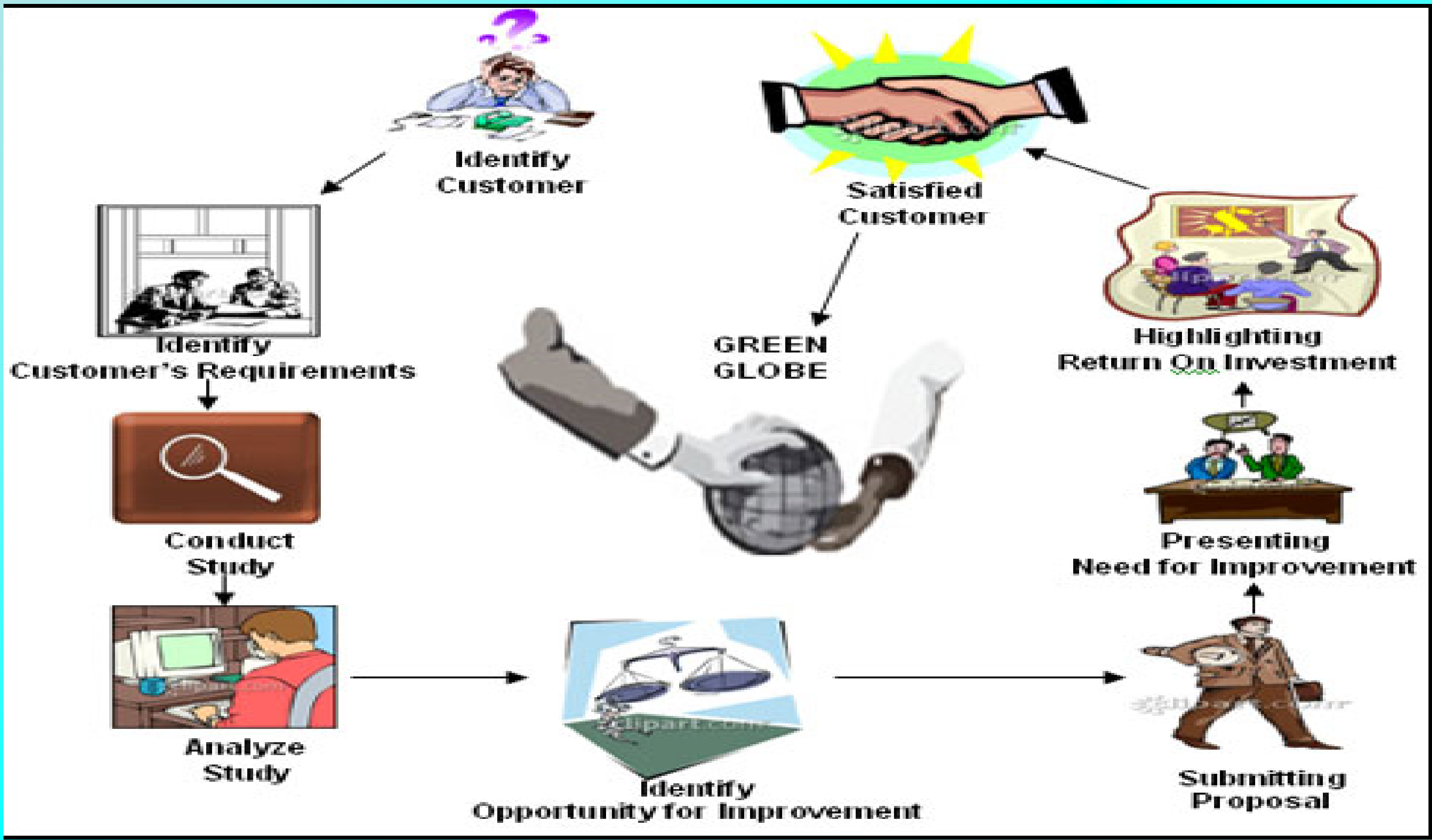
- We all individually and collectively, account for each of unit of electricity consumed by us

- as each unit of electricity had come to us by burning 1 Kg of coal elsewhere and after we consumed now,

- Each unit of electricity we spend, we liberate 1 Kg of Carbon di-oxide, warming locally & in turn globally.

- So by the electricity conservation, we are saving 1 Kg of coal and we are reducing emission by 1 Kg 0f CO_2.

Energy Auditor to team up with Industry Management, Production and Maintenance teams to catalyze & implement *Energy Conservation Measures.*



CONSUMER POWER BILL – WHAT IS THE BREAKUP ?

® **EB charges the industry in terms of KWH, KVA, PF and we in the industry maintenance must measure the same KW,** KVA, PF, KVAR and Harmonics at our load end machines.

- By energy conservation in industry, **we try to recover the losses which go as waste as Excess input, and wasted output** of machines.
- By Energy Measurement, **we draw a line between Avoidable and Unavoidable Losses and plan to minimize same**.

ENERGY AUDIT MACRO VIEW

- Production & utility – Linear & Non linear loads
- Now convert the utility to VSD for better saving
- Energy measure in individual utility is the need
- Closed loop control of production & utility

  machines to achieve steady process & utility
- Relative Condition Monitoring of equipments

Energy to Equipments – Target End Use

- The difference between the primary and final energy consumption lies in the Transport, Transmission & Distribution, and the Refinement.

- Apart from voltage regulation, the industry sees to it now, the % unbalance input voltage at the motor terminals doesn't exceed 1 % phase-to-phase volts.

- Power factor is a practical tool to assess the electrical network health of the industry. Motor is the pf puller in the plant and pf corrected at & from the motor end, the capacitor addition is less

Transformer Losses

ECBC recommended losses for oil cooled transformer

Rating kVA	Max. losses at 50% loading kW	Max. losses at 100% loading kW	Total losses at 50% loading kW	Total losses at 100% loading kW
	Up to 11 kV		Up to 22 kV	
100	0.5	1.8	0.6	1.8
160	0.8	2.2	0.8	2.6
200	0.9	2.7	0.9	3
250	1.1	3.3	NA	NA
315	1.1	3.6	1.3	4.3
400	1.5	4.6	1.5	5.1
500	1.6	5.5	2	6.5
1000	2	6.6	2.3	7.6
1250	3	9.8	3.5	11.4
	3.6	12	4	13.3
1600	4.5	15	4.9	16
2000	5.4	18.4	5.7	18.5
2500	6.5	22.5	7.1	23

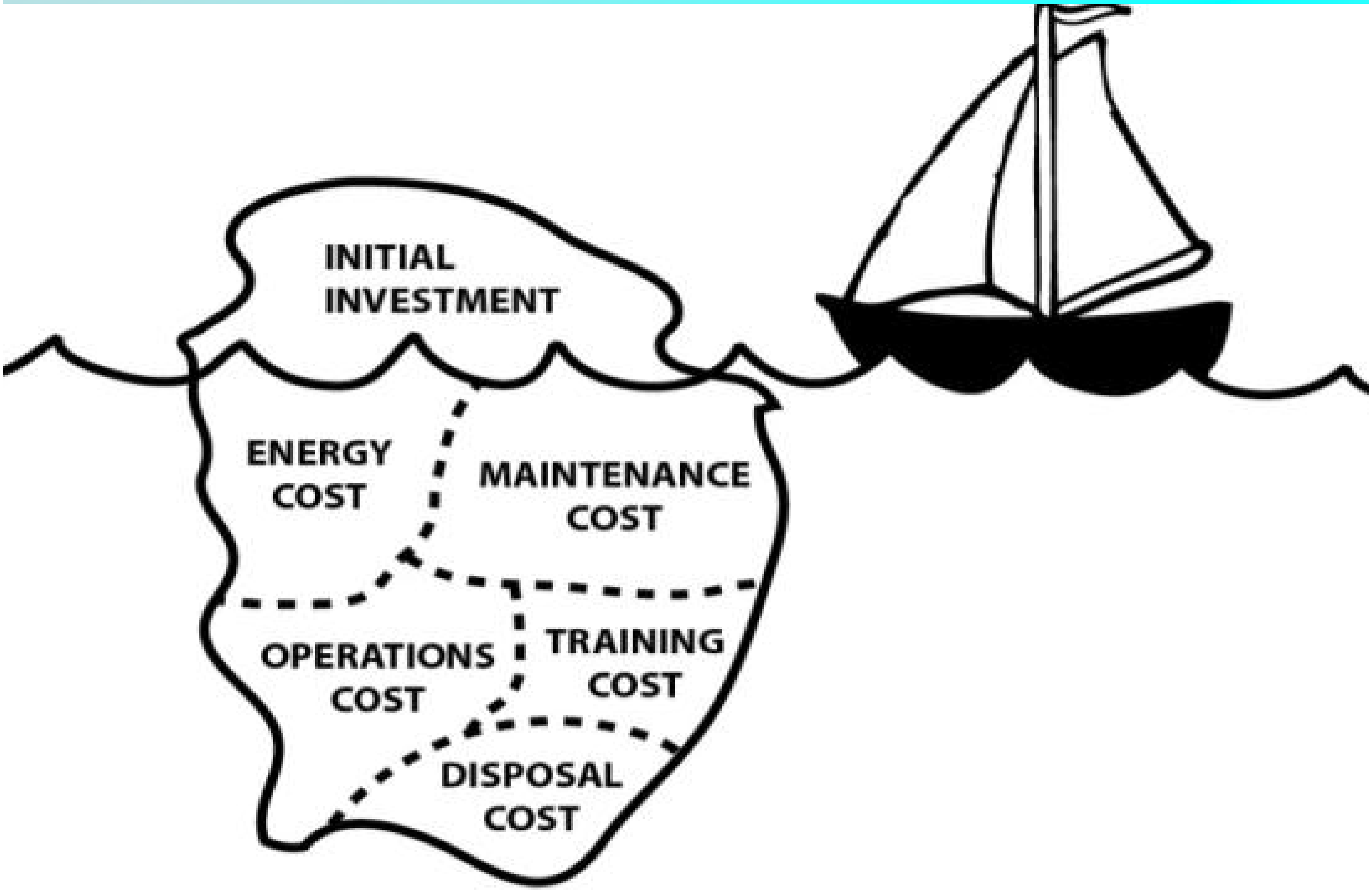
BEE case study show that due to harmonic loads, the full load losses on transformer have gone up by 40 % in 1250 kVA,

This leads to de-rating to around 80 % of the rated KVA of the transformer. **Here we are losing around 200 units per day in a transformer from operating at half load to full load. So Monitor the KWH at HT and LT of each transformer for savings now.**

So the KVA demand reduction by Harmonic reduction filter indirectly provides more KVA released to productivity.

(Oil Transformer) Losses		
KVA	Half Load (w)	Full Load (w)
500	2465	4930
750	3950	7900
1000	4360	8720
1500	6940	13880
2000	8155	16310

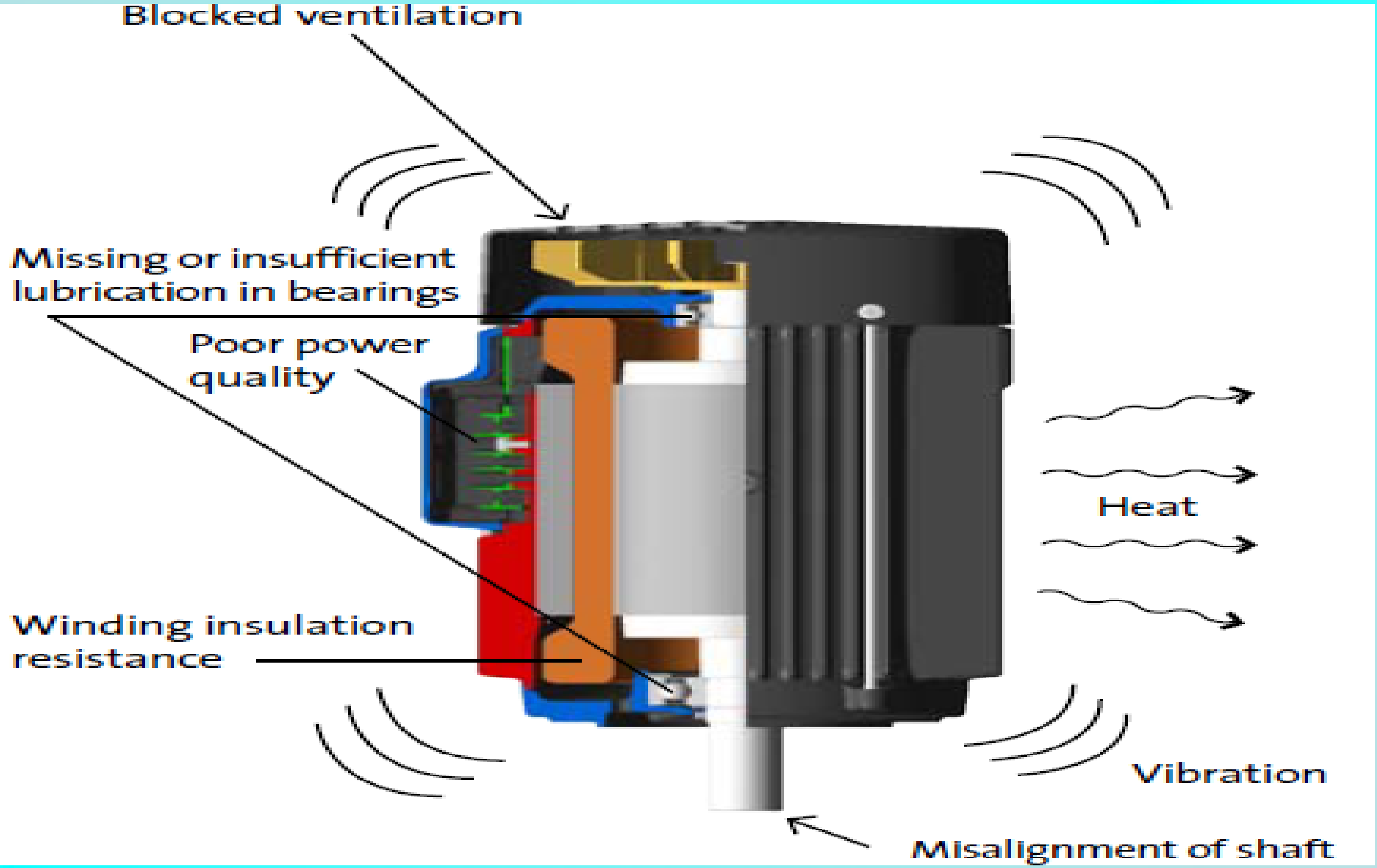
The essence of life cycle costing



Motor 15 KW-Good Vs Bad - in work

Motor status	Rewound motor	Efficient motor
Rated current	28 A	26 A
Speed Rpm	1445 rpm	1450 rpm
No load current	24 A (85 %)	6.6 A (25 %)
No load power	2.3 KW (15 %)	0.87 KW (6 %)
No load Power	1.46 KW	nil
Efficiency	76 %	91 %
Motor loss / day	35 units	Nil
Motor loss/ month	1050 units	nil
Motor loss / year	12600 units	nil

Motor life span – Factors affecting the life due to lack of maintenance



WHAT ARE THE LOSSES IN A.C.MOTORS

LOSSES IN THE INDUCTION MOTOR CAN BE DIVIDED IN TO TWO TYPES

1. NO LOAD LOSSES (CONSTANT LOSSES)

   A. FRICTION (BEARING)

   B. WINDAGE (FAN)

   C. CORE (IRON LOSS)

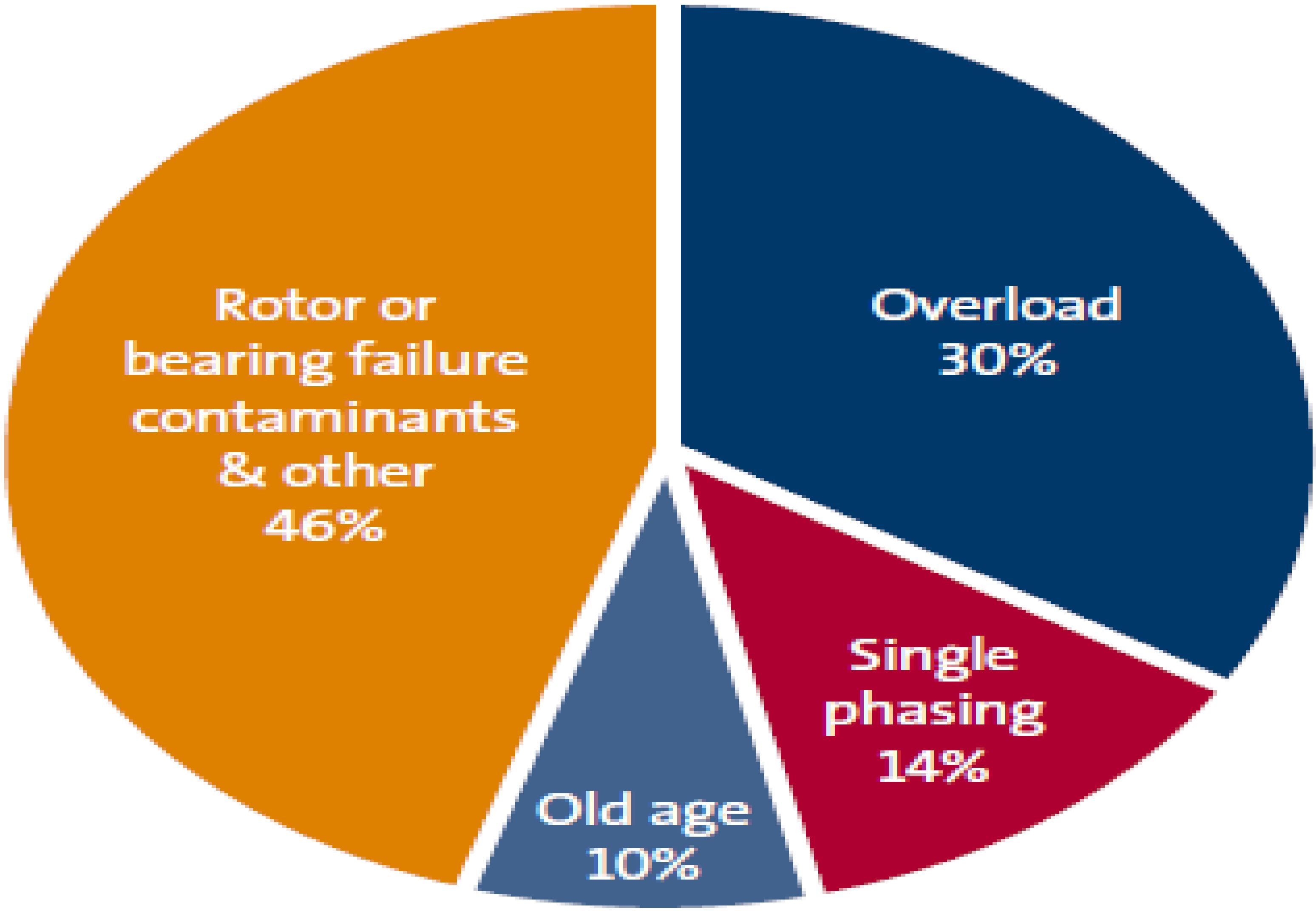
   D. STRAY LOAD LOSSES

2. LOAD LOSSES (VARIABLE LOSSES)

   A. STATOR COPPER LOSS (CONDUCTOR LOSS)

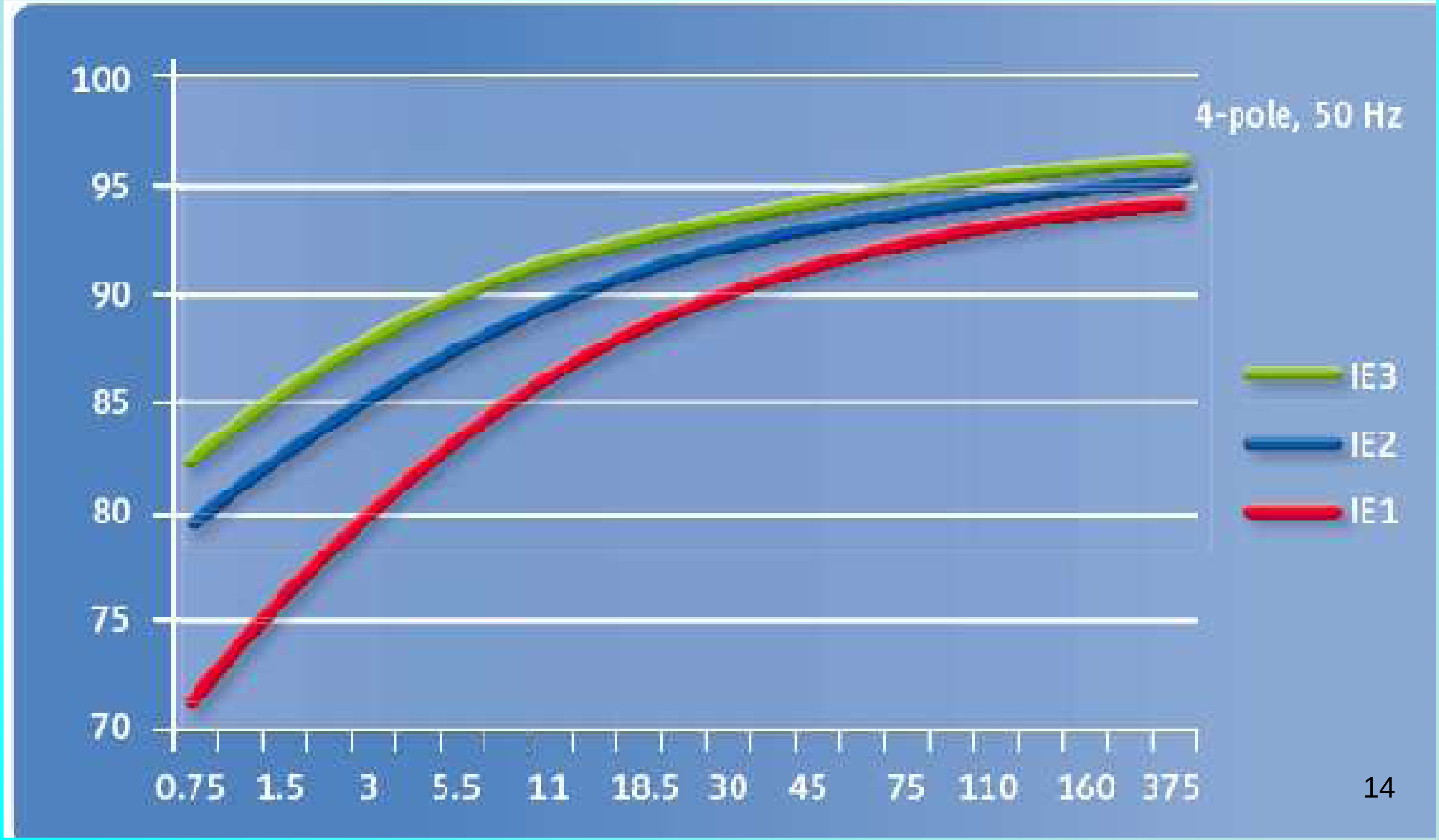
   B. ROTOR COPPER LOSS (CONDUCTOR LOSS)

Motor failure – major causes



The major causes of motor failure, according to the Electrical Research Association, USA

WHERE DO OUR MOTORS STAND IN EFFICIENCY – Standard EFF 2(IE 1) or High EFF 1 (IE 2) or Premium EFFY (IE3) in the lower HP ratings 1 to 10 HP ?



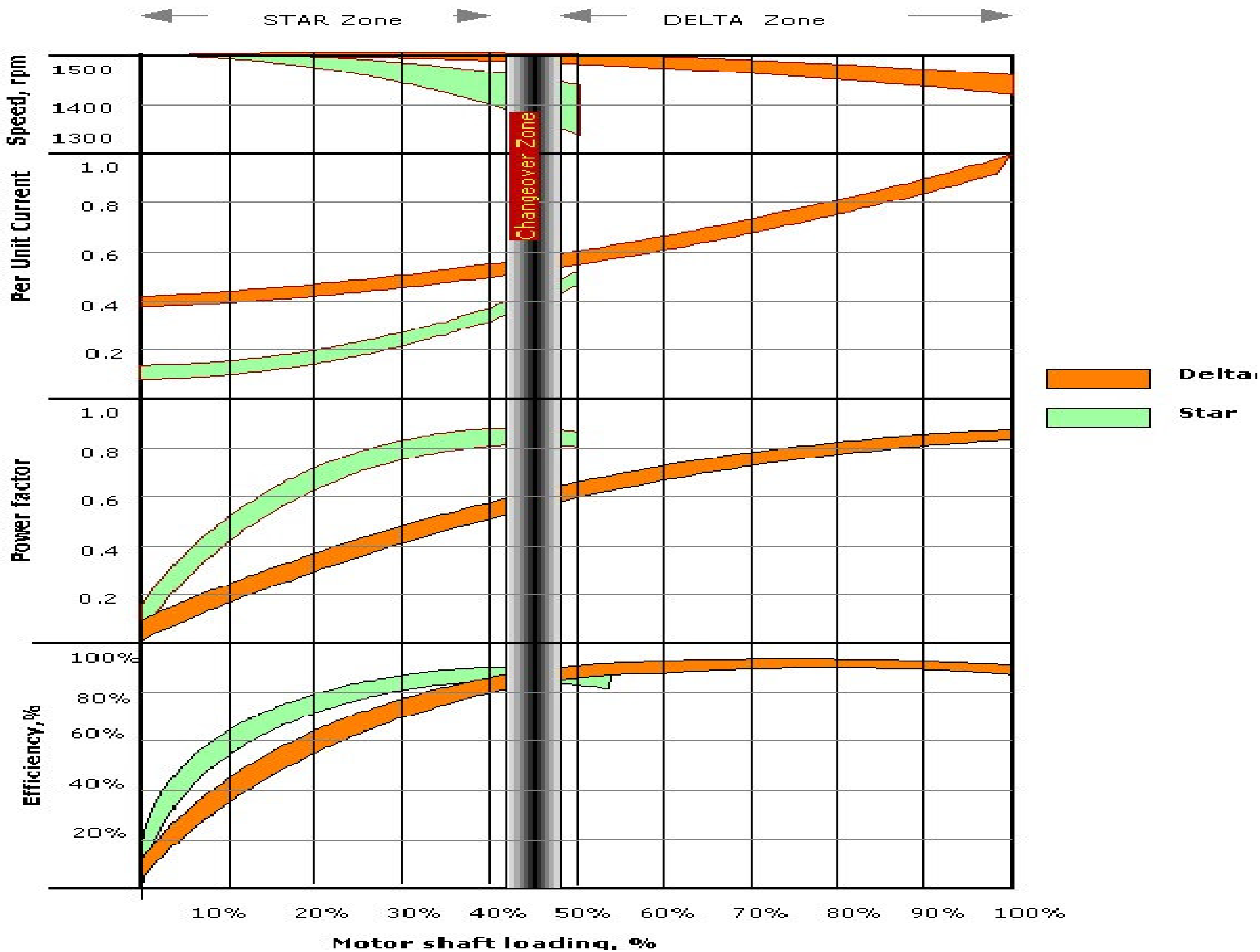
THE TABLE BELOW COMPARES THE BEHAVIOUR OF

5 H.P MOTOR AT HIGHER THAN 400 VOLTS

Study taken by Reputed Servo stabilizer Manufacturer

The savings are more visible in lower HP motors than the higher HP motors in the industry.

Input Voltage	Current	KVA	PF
400	7.5 Amps	5.2 Kva	0.8
425	8.3 Amps 11% More	6.2 Kva 18% More	0.7



STAR Zone
DELTA Zone
Speed, rpm
1500
1400
1300
Per Unit Current
1.0
0.8
0.6
0.4
0.2
Changeover Zone
Power factor
1.0
0.8
0.6
0.4
0.2
Efficiency, %
100%
80%
60%
40%
20%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Motor shaft loading, %
Delta
Star

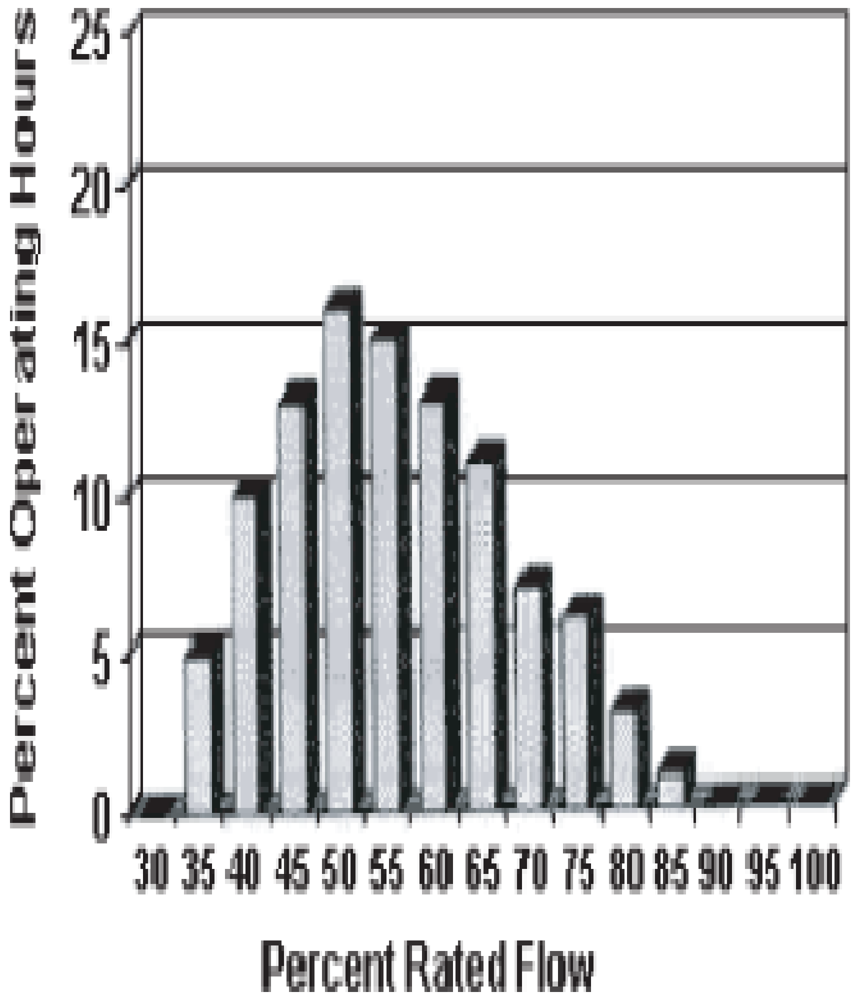


Figure 5.3 Example of an excellent variable speed drive candidate

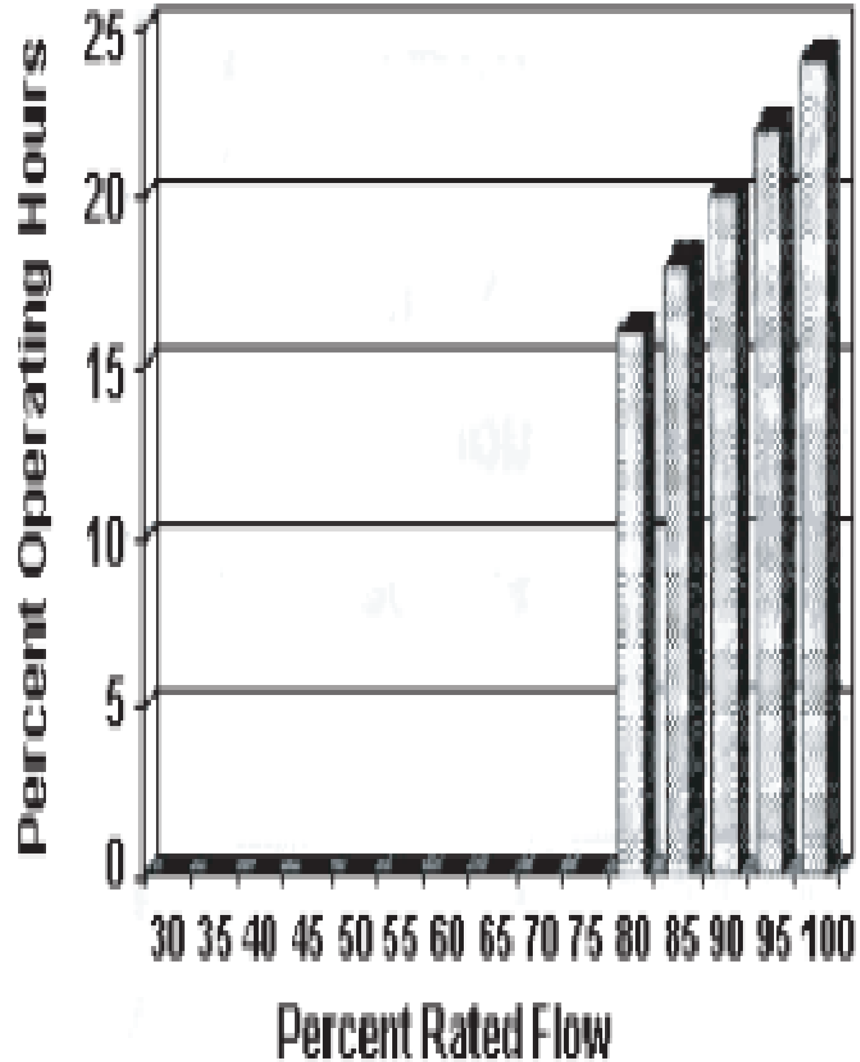


Figure 5.4 Example of a poor variable speed drive candidate

Normal Motors operating above 50 Hz, lose around 2 % efficiency due to core, friction & windage losses.

Table 2.2 Motor Loss Categories

Losses	2- Pole average	4- pole average	Factors affecting losses
Core losses	19%	21%	Electrical steel, air gap, saturation
Friction & Windage losses	25%	10%	Fan efficiency, Lubrication, bearing
Stator Copper losses	26%	34%	Conductor area, mean length of turn, heat dissipation
Rotor Copper losses	19%	21%	Bar and end ring area and material
Stray Load losses	11%	14%	Manufacturing process, slot design, air gap

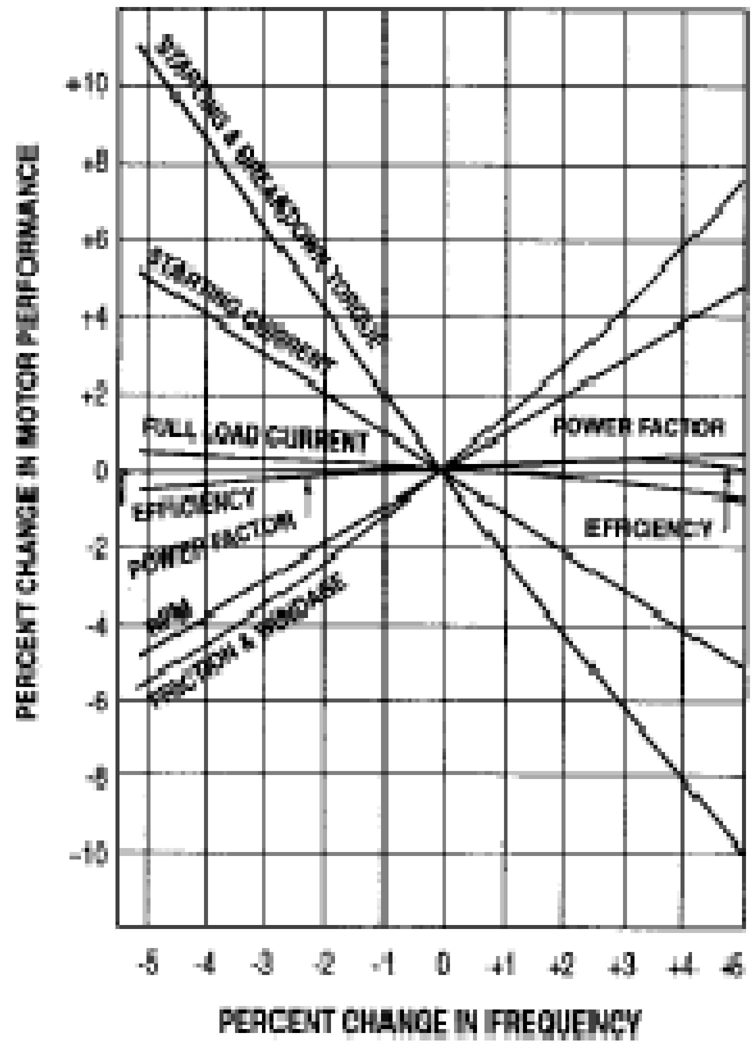
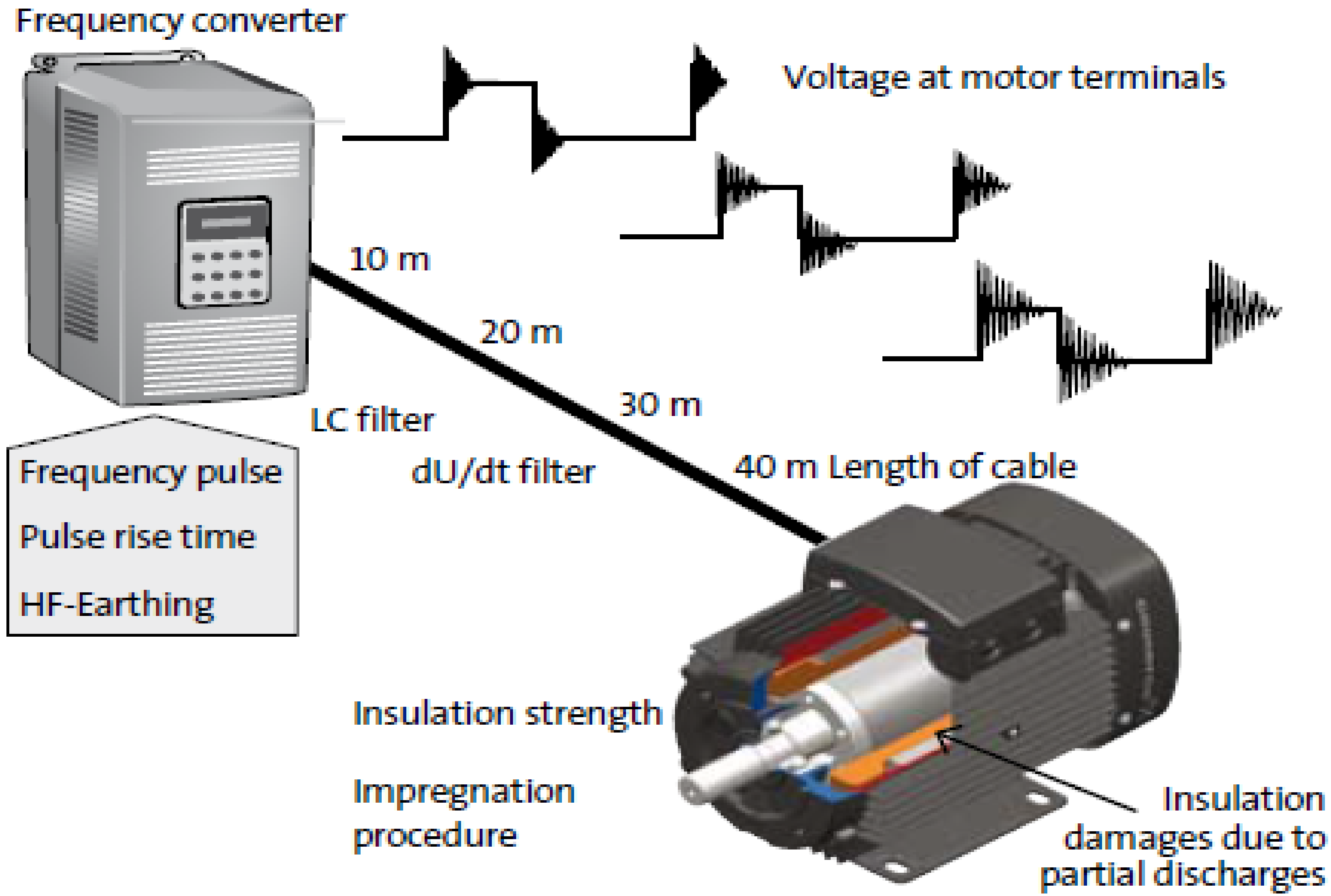


Figure 2. Frequency Variation

VFD to motor distance is critical?



Motor drive transmission efficiency - Visible losses seen in Belt Losses from motor to load

The efficiency of mechanical power transmission depends on grip between pulley and belt, further depends on µ (Co-efficient of friction) and strength (Tensile) of the belt. In case of

Table 3.4: Losses in V Belts

Sr. no.	Motor HP	Losses %
1	2	8-15
2	3	7-13
3	4	6-12
4	6	5.5-10
5	8	5-9
6	10	4.5-8.2
7	20	3.5-7
8	30	3.2-6
9	40	3-5.5
10	60	2.8-5
11	80	2.5-4.5
12	100	2.5-4.5

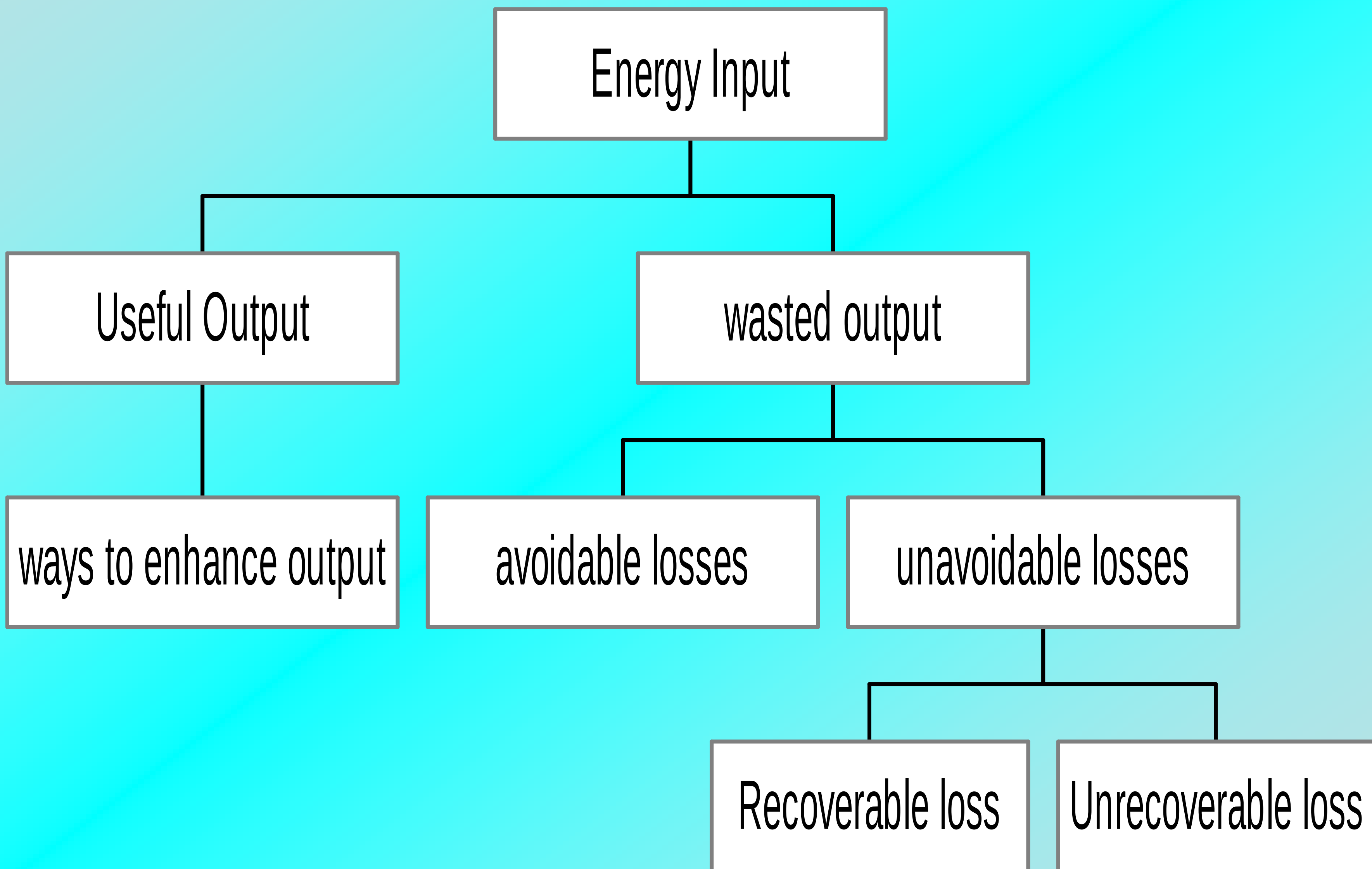
Pumping system – savings

parameters	existing'	new pump
Motor rating hp	7.5	5
Suction pipe mm	65	75
Delivery pipe mm	50	75
Piping material	GI	White PVC
Foot valve	local	ISI
Discharge LPS	3.68	5.03
Input power KW	**6.18**	**4.35**
Increase in discharge	--	36.7 %
Input power reduction	29.66 %	--
Saving in Energy	**--**	**48.44 %**

System Approach to Water Pumping

WELL DESIGNED PUMPING SYSTEM	MANY ACTUAL INDUSTRIAL SYSTEM
Motor Efficiency 90 % (100 % Motor Input) (10 % motor losses)	**Motor Efficiency 85 %** (100 % Motor Input & 15 % Motor Losses) Oversized Motor or Low Effy Motor
Pump Efficiency 85 % (90 % Pump Input) (13.5 % pump losses)	**Pump Efficiency 70 %** (85 % Pump Input , 25.5 % Pump losses) Over Designed or Low Effy Pump
Head lost in valves & piping 20 % (76.5 % pump output) (15.3 % throttling valve losses)	**Head lost in Valves & Piping 50 %** (59.5 % Pump Output) (29.25 % Valve Losses)
losses due to leakage,extra flow 20 % (61.2 % Head output) (12.2 % leakage, Xtra flow losses)	**losses due to leakage , Excess flow 50 %** (29.75 % Head Output) (14.75 % leakage, excess flow,undersized pipe)
49 % work required to circulate water for Static Head & Pipe friction	**15 % Work** required to circulate water for Static Head & Pipe Friction

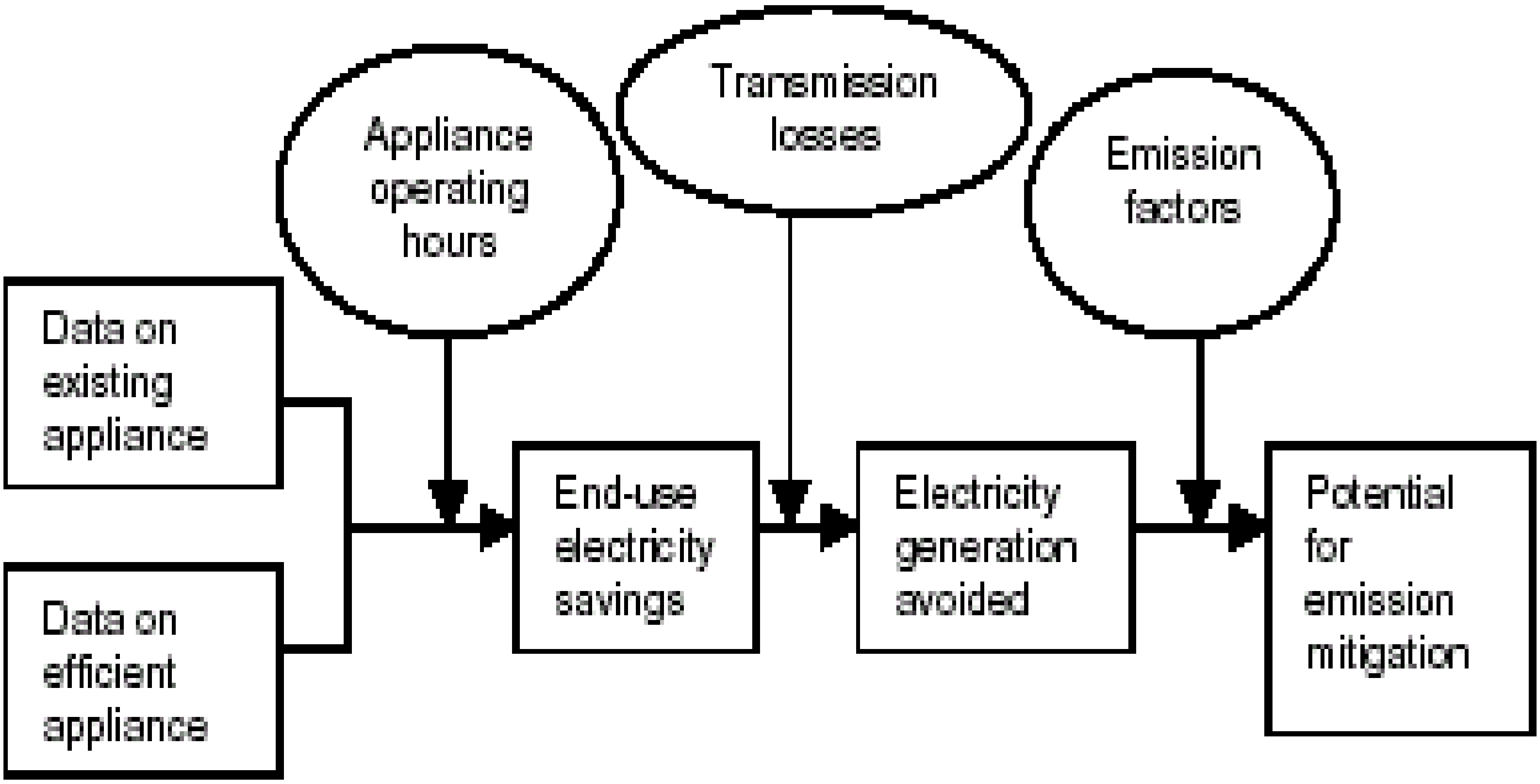
ENERGY AUDIT



Energy Audit Indicates you

- **What to do,**
- **where to start,**
- **at what cost and**
- **for what benefits**
- **Indicative saving potential to achieve**
- **Good House-keeping yields 5-10%**
- **Minor Investment gives 10-15%**
- **Reasonable Investment pays back 20-25%**

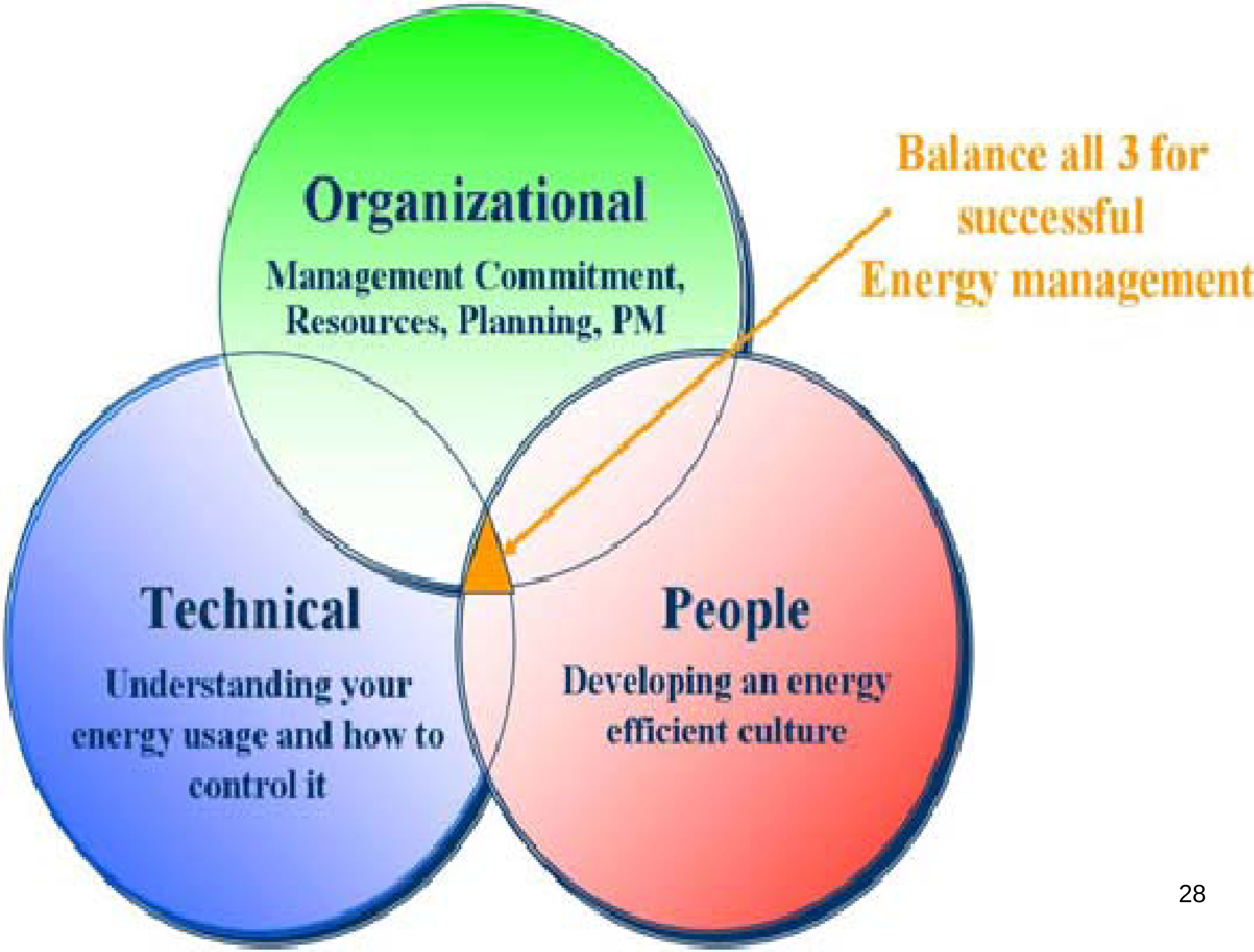
Equipment efficiency parameters



Electrical Energy Conservation – How can we do?

- **Energy Flow diagram in Production & Utility**
- What is the EB power bill say and how do you measure?
- Best operating practices in all the Utilities
- **Where can we save Energy easily & quickly**?
- What matters to Power to Production cost?
- **Safety measures in handling Electrical based Utility**
- **Electrical man to team up with Production to give**
- **Electricity to Machines, measure & reduce consumption**

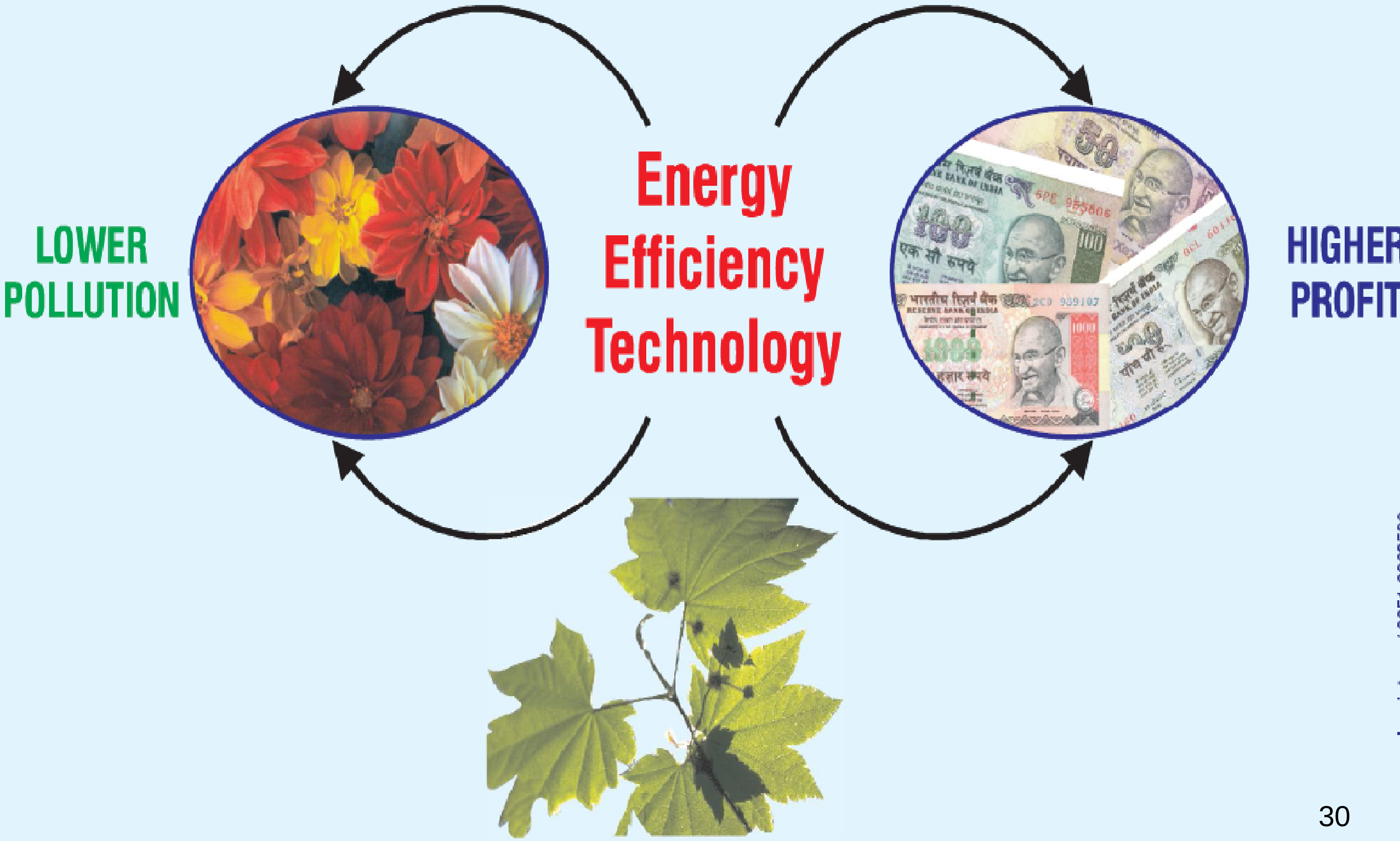
ENERGY AUDIT INSTRUMENTS USED by us FOR INSTANT AND TREND MEASUREMENTS to measure Electrical, Power Quality, Lighting lumens, fans flow, temperature in *C


Organizational
Management Commitment, Resources, Planning, PM
Balance all 3 for successful Energy management
Technical
Understanding your energy usage and how to control it
People
Developing an energy efficient culture

FIVE COST REDUCTION MEASURES OF ENERGY CONSERVATION

- Identify inefficient energy use
- Upgrade machinery & process in context of energy efficiency
- Improve maintenance practice
- Promote employee awareness and
- Conservation in domestic consumption.

Be energy efficient to gain higher profits and keeping only lower pollution



FOUR FUNDAMENTAL WAYS OF SAVING ENERGY:

- Accurate monitoring of the utilities in plant.
- Reduction in the amount of Energy required
- for the generation and use of the utility.
- Trapping of any unused energy
- Recycling and use of energy over & again.

Thinking & Acting on Conservation Measures

catalyzes our social responsibility,

caring for others and

sacrificing our selfish comforts.

"Conserving energy is our collective responsibility for a better tomorrow."

Govt. gives subsidy to us on Electricity, LPG etc.
It is our moral duty to conserve the rationed commodity

Thank you

- **S.ASHOK, BEE Accredited Energy Auditor /**
- **POWERON Projects / Coimbatore / 94437 20220**

Please visit :- www.energymeasuretosave.com

www:poweronprojects.in

- **we take pride on saving Electricity, LPG in house.**
- **Conservation is a Habit and begins at Home only.**
- ***As Conservation is all about***

our collective responsibility for better tomorrow.