2ND WORKSHOP ON "BEST PRACTICES IN ENERGY EFFICIENCY IN CEMENT SECTOR" UNDER KEP INITIATIVE

ENERGY EFFICIENCY BENCHMARKING FOR CEMENT INDUSTRY- IMPROVEMENT OPPORTUNITIES

7th & 8th July'16, at My Home Industries Pvt. Ltd., Mellacheruvu

Confederation of Indian Industry

Knowledge Exchange Platform
Transmitting Knowledge through Best Practices

ENERGY IS LIFE
BEE
CONSERVE IT

SEC reduction – CII Experiences

	Electrical SEC reduction range	Thermal SEC reduction range
Reduction in 2014-15 (%):	0.00 – 6.581 Average – 2-3%	0.00-4.40 Average – 1-1.5%
Average reduction % (last 3 yrs):	0.00-8.712	0.00-2.55
Average yearly reduction % (for 40+ cement plants)	2.04	0.831

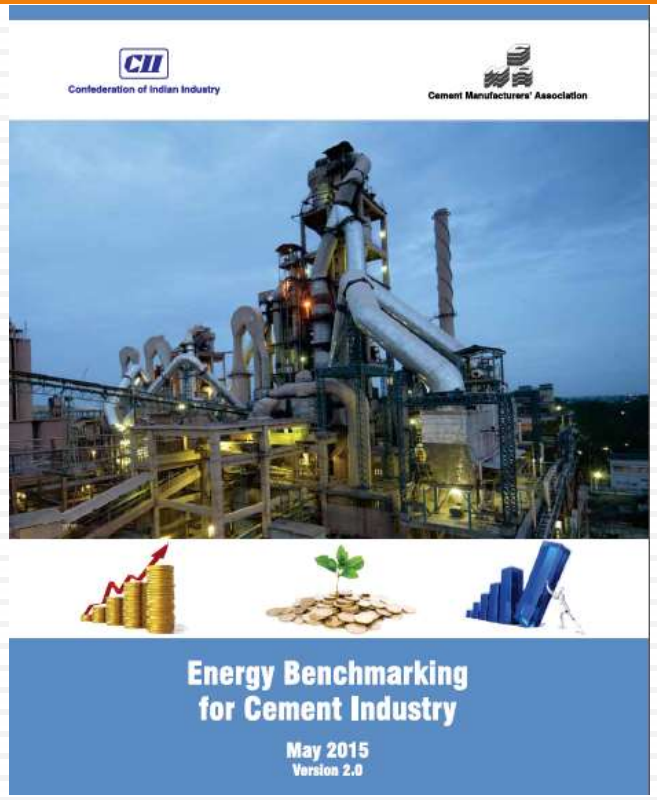
PAT GTG Energy Reduction

- Escerts gain (PAT cycle -1) – 50,000 +
- Main factors for achieving target
  - Improvement in clinker factor
    - From 0.741 to 0.640 in PPC
      - Flyash % : From 23% to 32.5 %
  - Reduction in energy consumption by various energy conservation measures
    - Clinkerization : 55.4 kWh/Mt clk to 52.3 kWh/MT clk
    - Cement grinding: 27.7 kWh/MT to 26.1 kWh/MT cement
    - Thermal: 714 kcal/kg clk to 705 kcal/kg clk
    - CPP heat rate: 3169 kcal/kWh to 3036 kcal/kWh
  - AFR utilization Increased by 4% +

Approach #1
Energy Benchmarking

Energy Benchmarking - Objective

- Awareness and identification of Best Available Technologies & Best Practices
- Assess our own energy performance
- Comparison with peers
- Identify gaps and possible solutions
- Formulate the strategies
- Monitor key parameters to maintain and sustain benefits

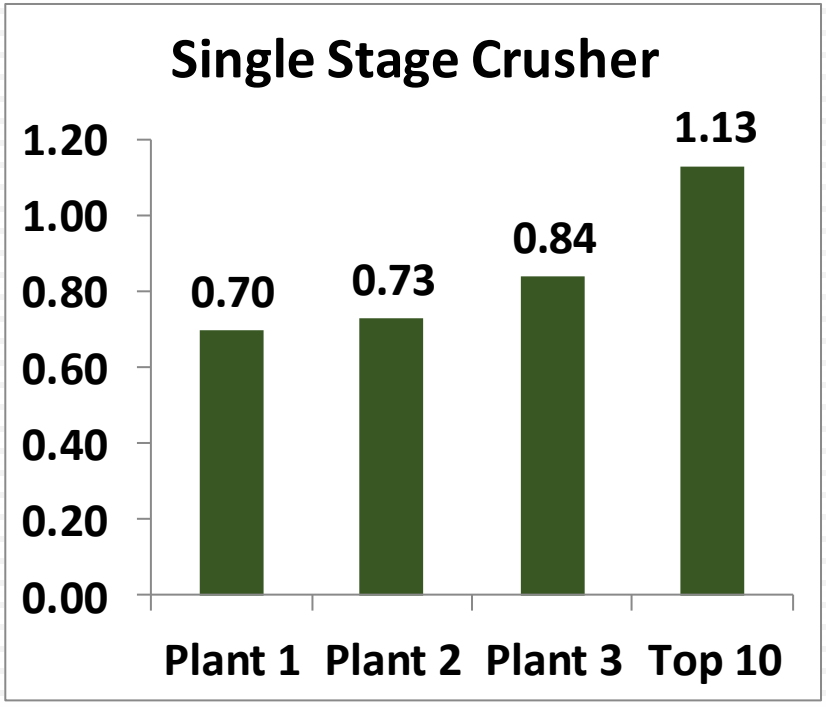


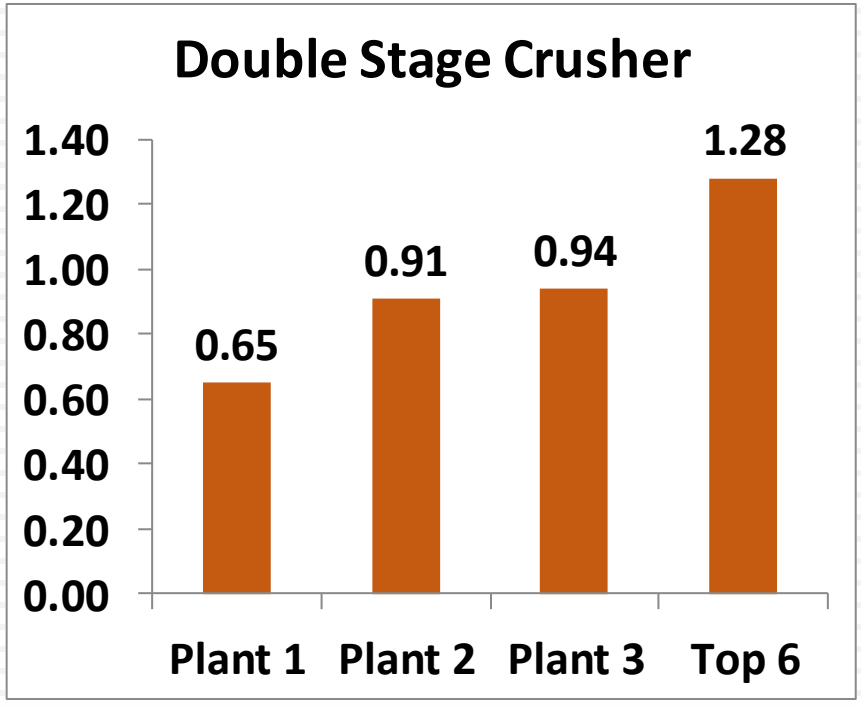
CII EE Benchmarking Manual contains…

1. Performance of Top 10 Plants : Section wise & Technology Wise
2. Analysis and Potential areas of improvement with cost economics
3. Case studies to bridge the gap
4. 50 Energy Indicators – Islands of Excellence
5. 325 Best Practices
6. 139 Monitoring Parameters to achieve EE

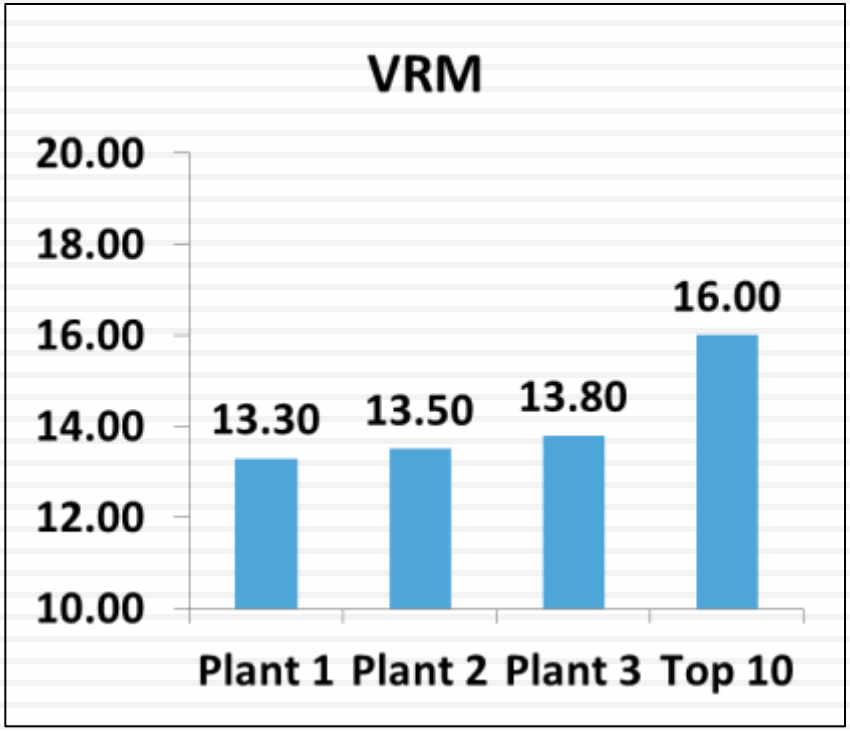
Benchmarking is Dynamic : It is highly possible that few plants may operate energy levels lower than best values mentioned in this manual !!!!!

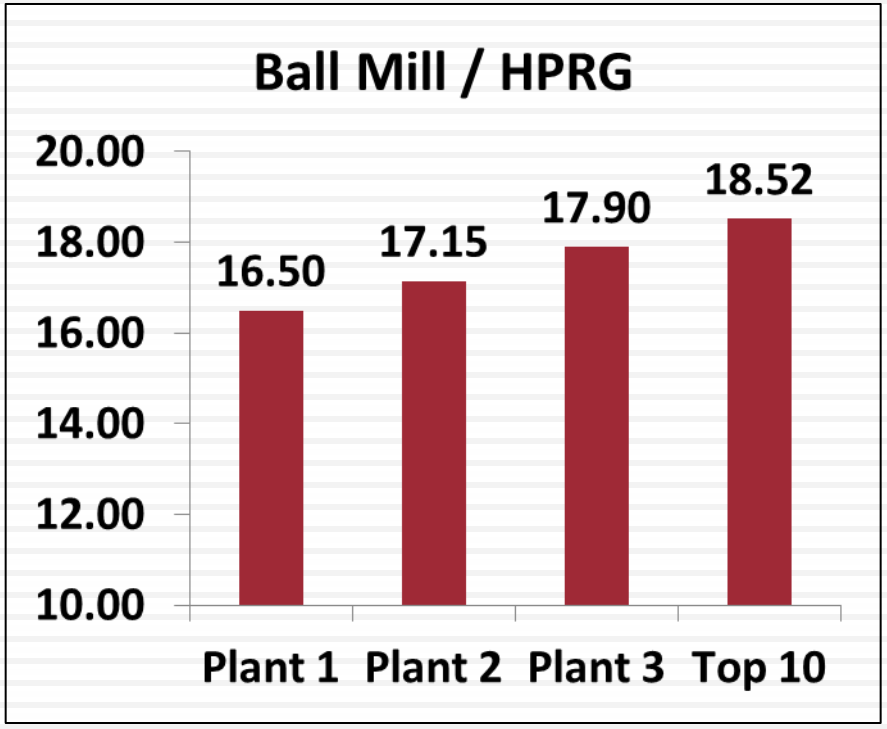
Crusher SEC : kW / MT Material



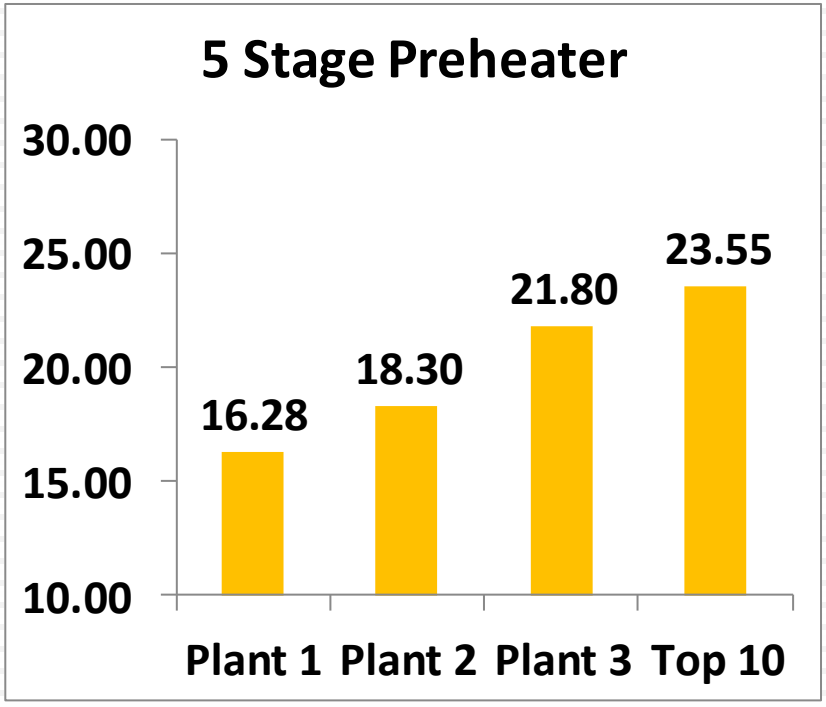


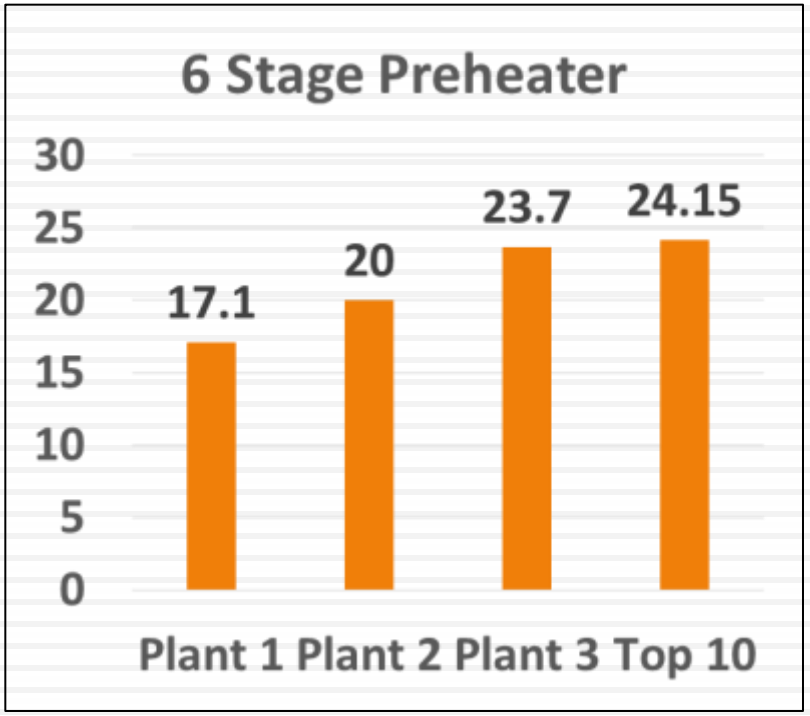
Raw Mill SEC : kW / MT Material



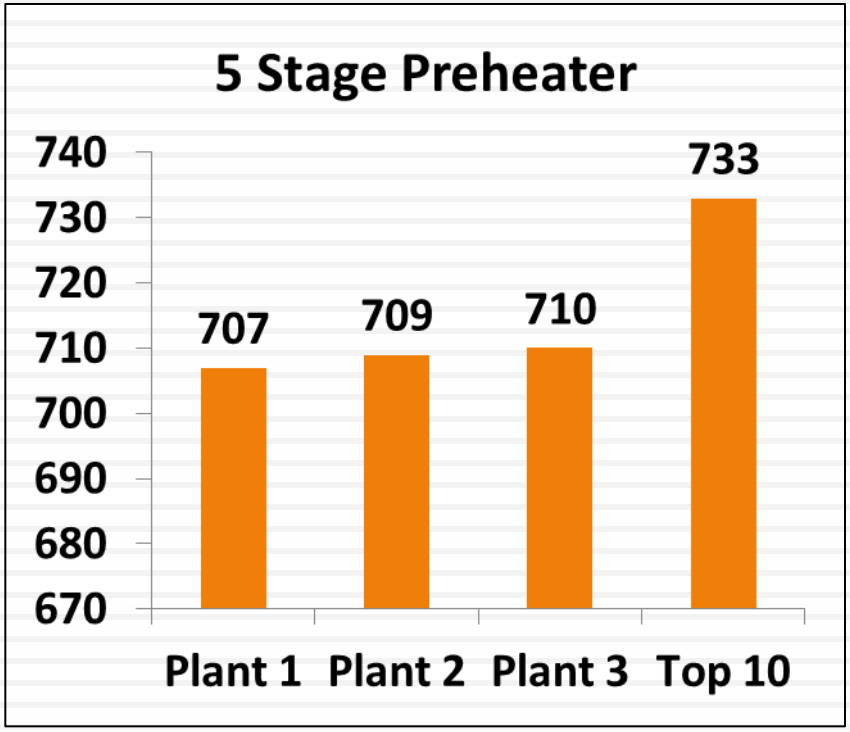


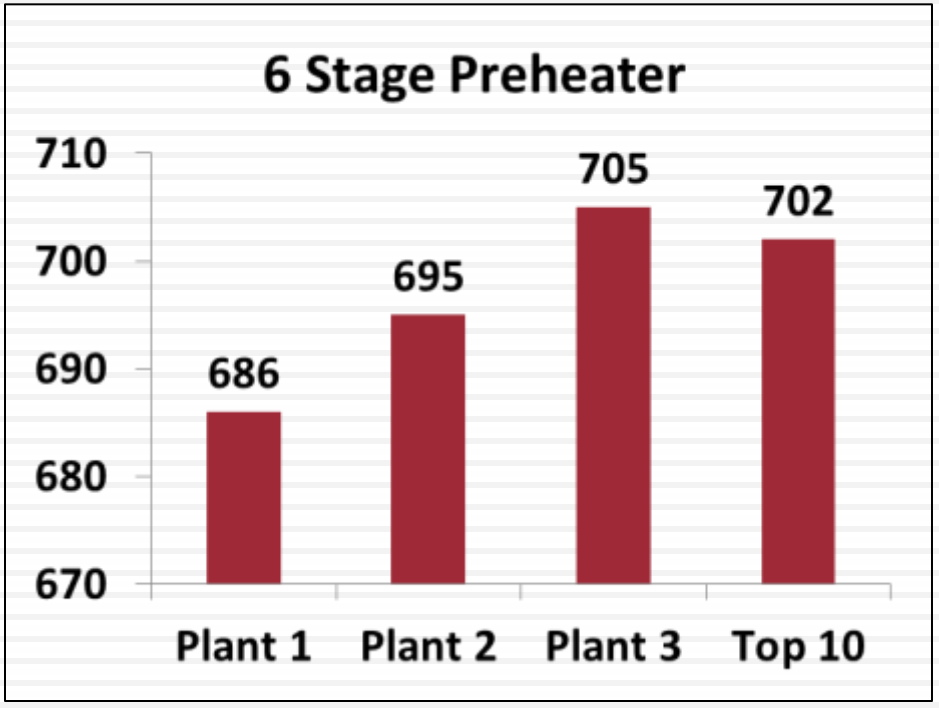
Pyro Section SEC : kW / MT Material



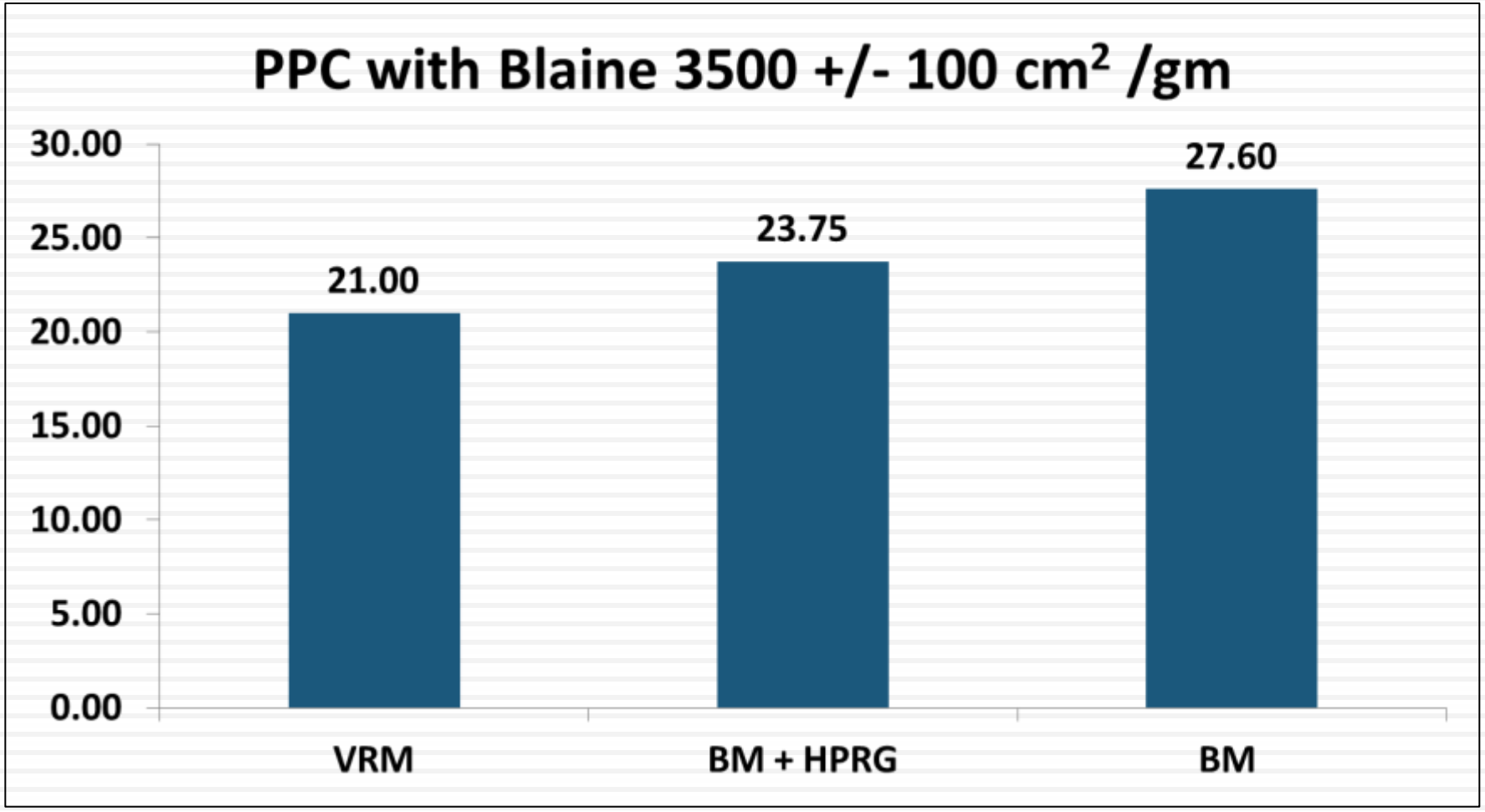


Thermal SEC: kcal/ kg Clinker

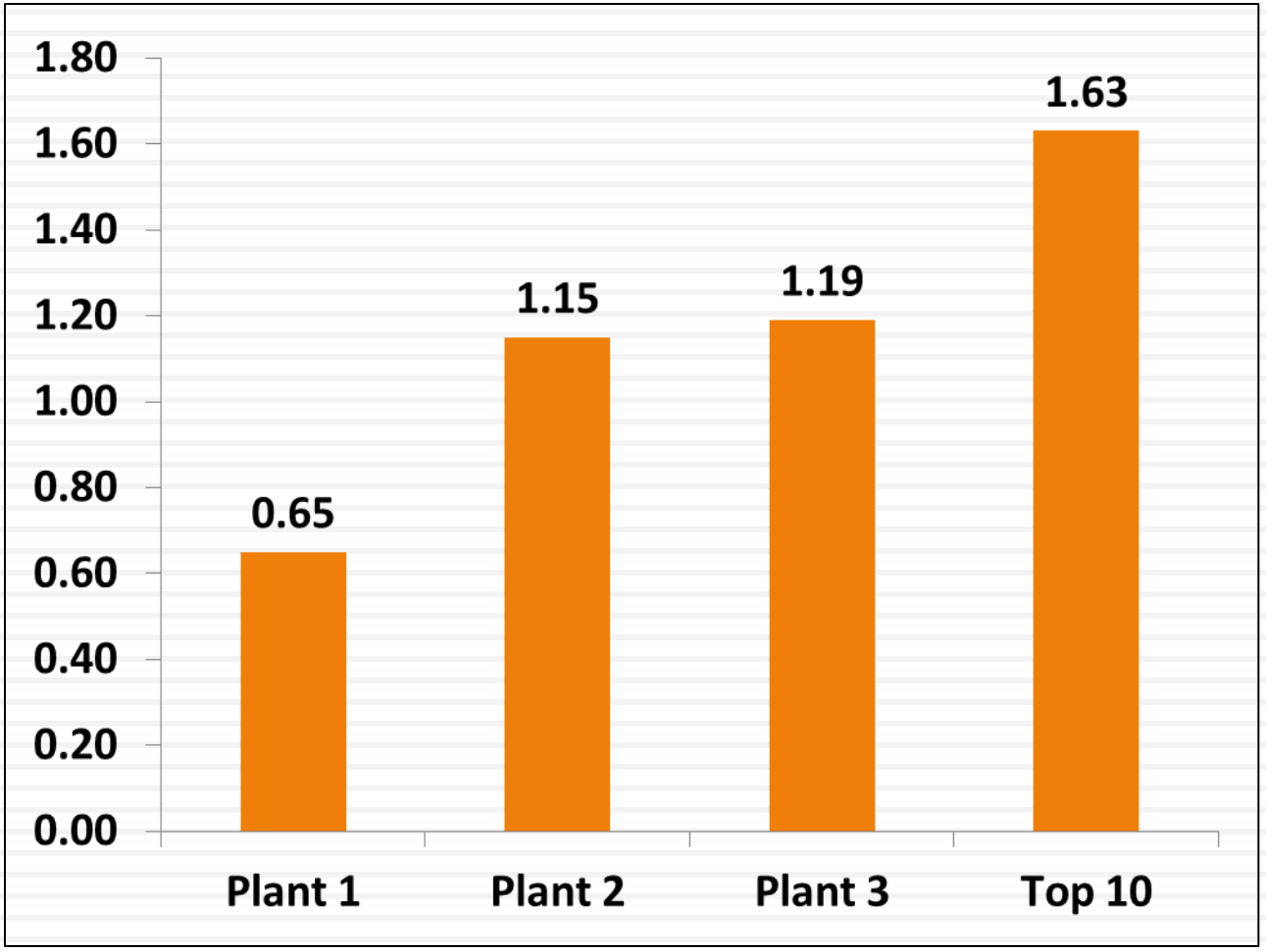




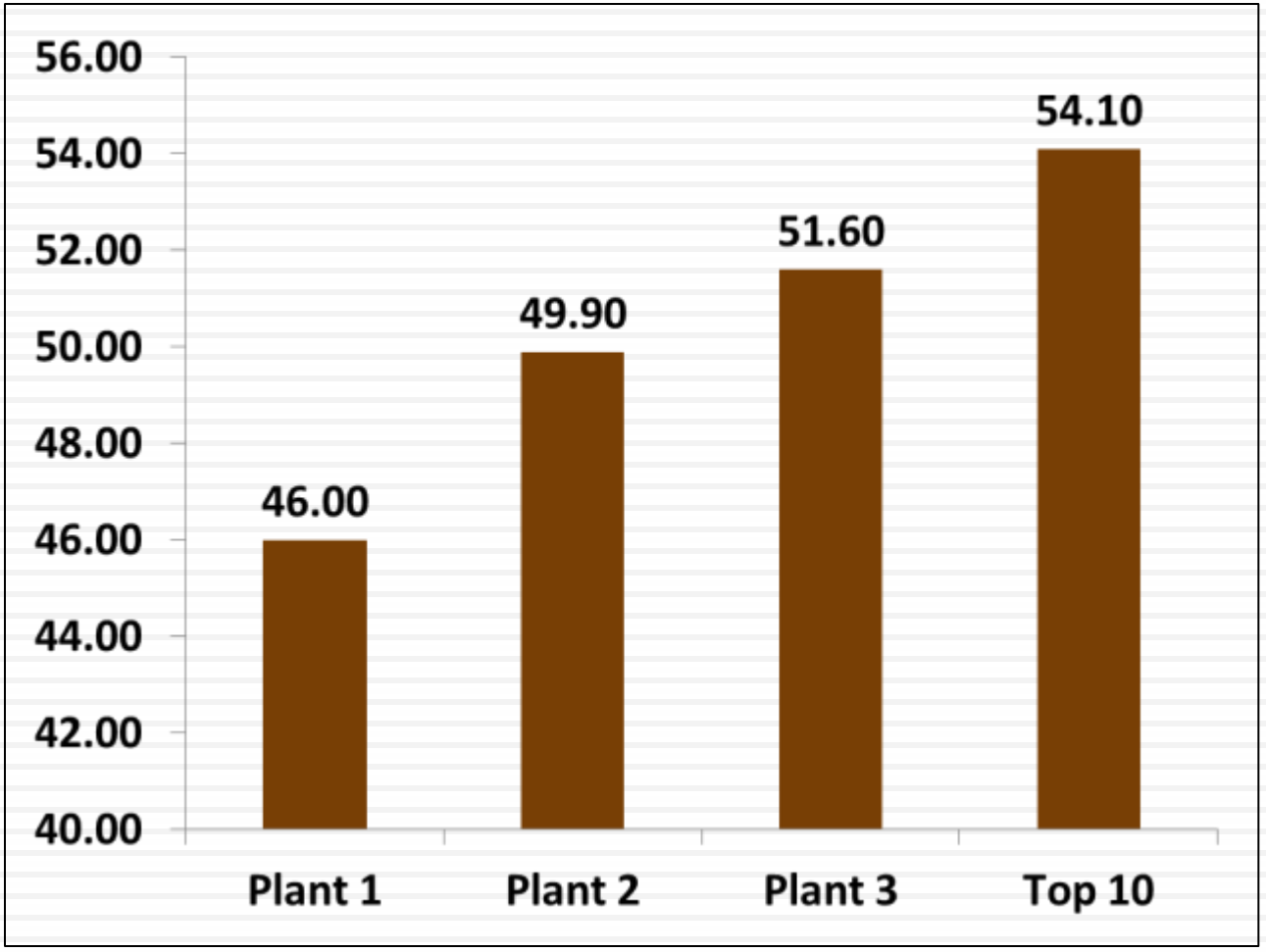
Cement Grinding SEC : kW / MT Material



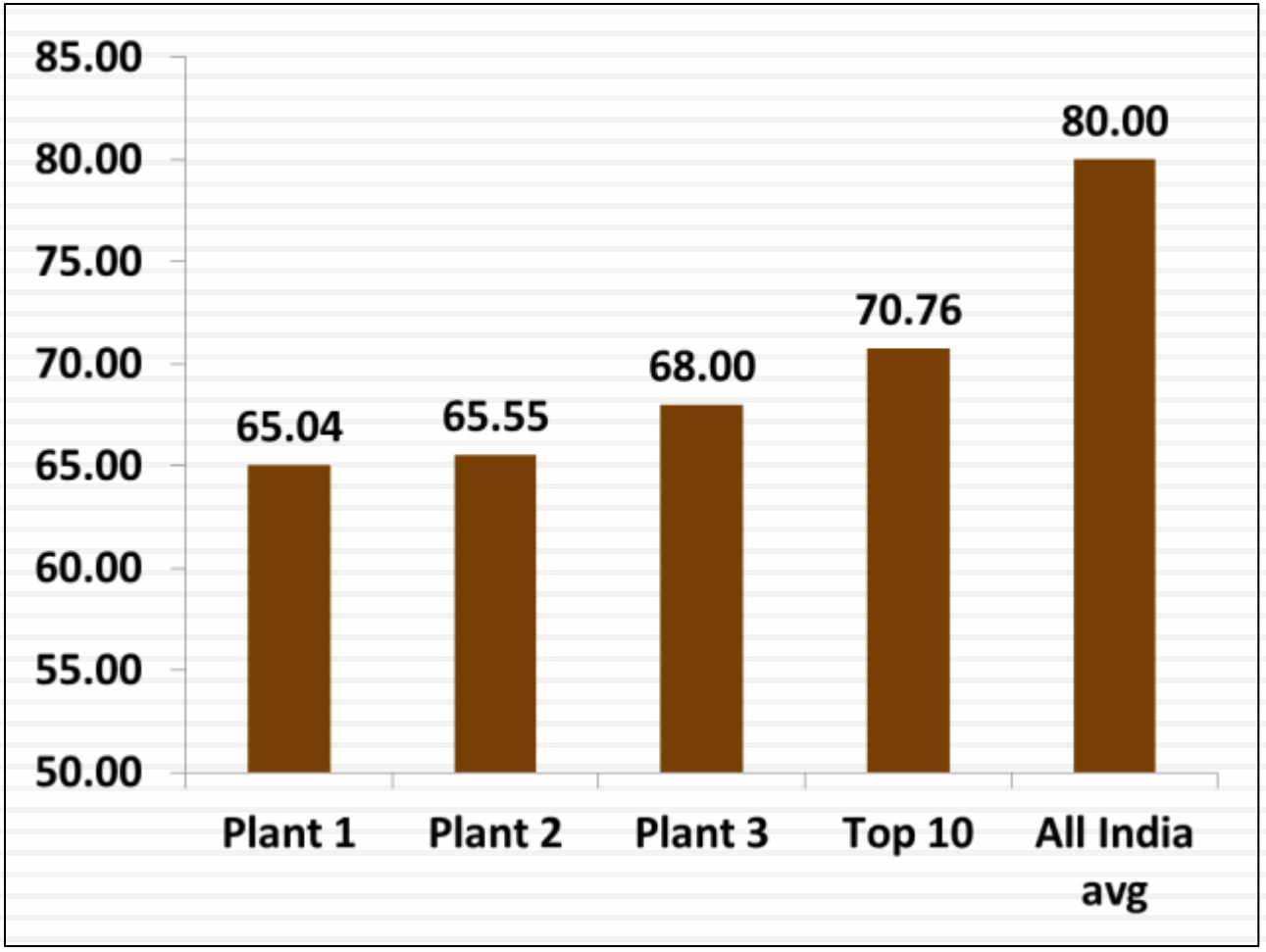
Packing SEC : kW / MT Material



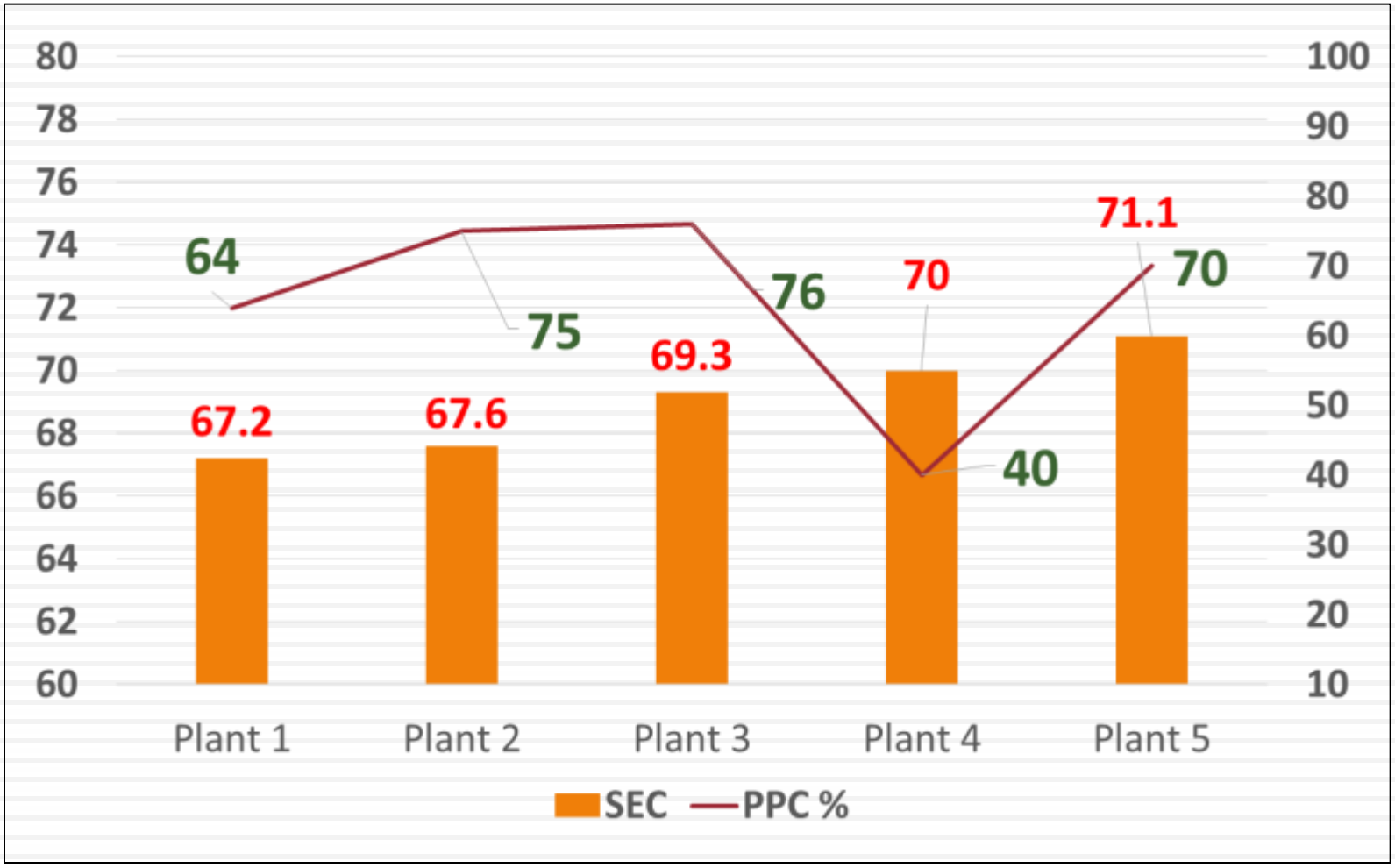
Electrical Energy – Upto Clinkerisation SEC : kW / MT Clinker



Electrical Energy – Overall SEC : kW / MT cement



Overall SEC kW / MT Cement- CII Energy Award 2014-15



Best Number possible with BAT- kW / MT OPC

SL No	Section	kW / Material	kW / MT Cement	kW / Material	kW / MT Cement
		5 Stage PH		6 Stage PH	
1	Crusher	0.7	1.03	0.7	1.03
2	Raw Mill - VRM	13.3	18.95	13.3	18.95
3	Coal Mill – VRM	23.9	2.97	23.9	2.97
4	Pyro	16.28	15.47	18.7	16.25
	Up to Pyro		38.42		39.20
5	Cement Mill VRM	21.00	21.00	21.00	21.00
6	Packing	0.65	0.65	0.65	0.65
7	Misc.	2.00	2.00	2.00	2.00
	Overall		62.07		62.85

Islands of Excellence

- PH fan lowest SEC – 3.88 kWh/MT clinker
- Lowest pressure drop in PH : 375 mmWc for 5 stage and 470 mmWc for 6 stage
- Fine coal phase density : 5.5 kg coal / kg air
- Lowest RM Cyclone pressure drop : 50 mmwc
- Lowest false air across RM circuit : 11%
- Lowest compressed air generation pressure for plant air requirement : 4.5 bar
- Lowest CA fan power : 1.2 kWh/Mt cement
- Lowest APC in CPP : 5.36%

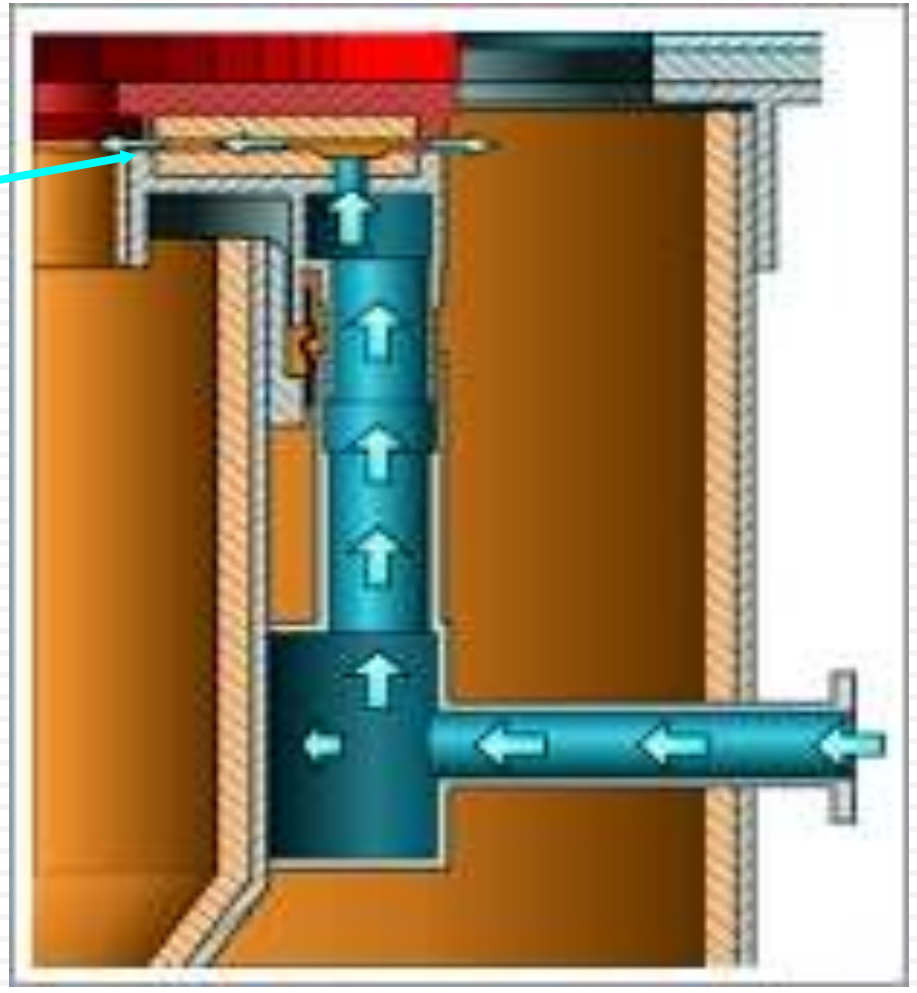
Approach #2
Innovative Projects to reduce SEC

CASE STUDY: Installation of High Efficiency Separators

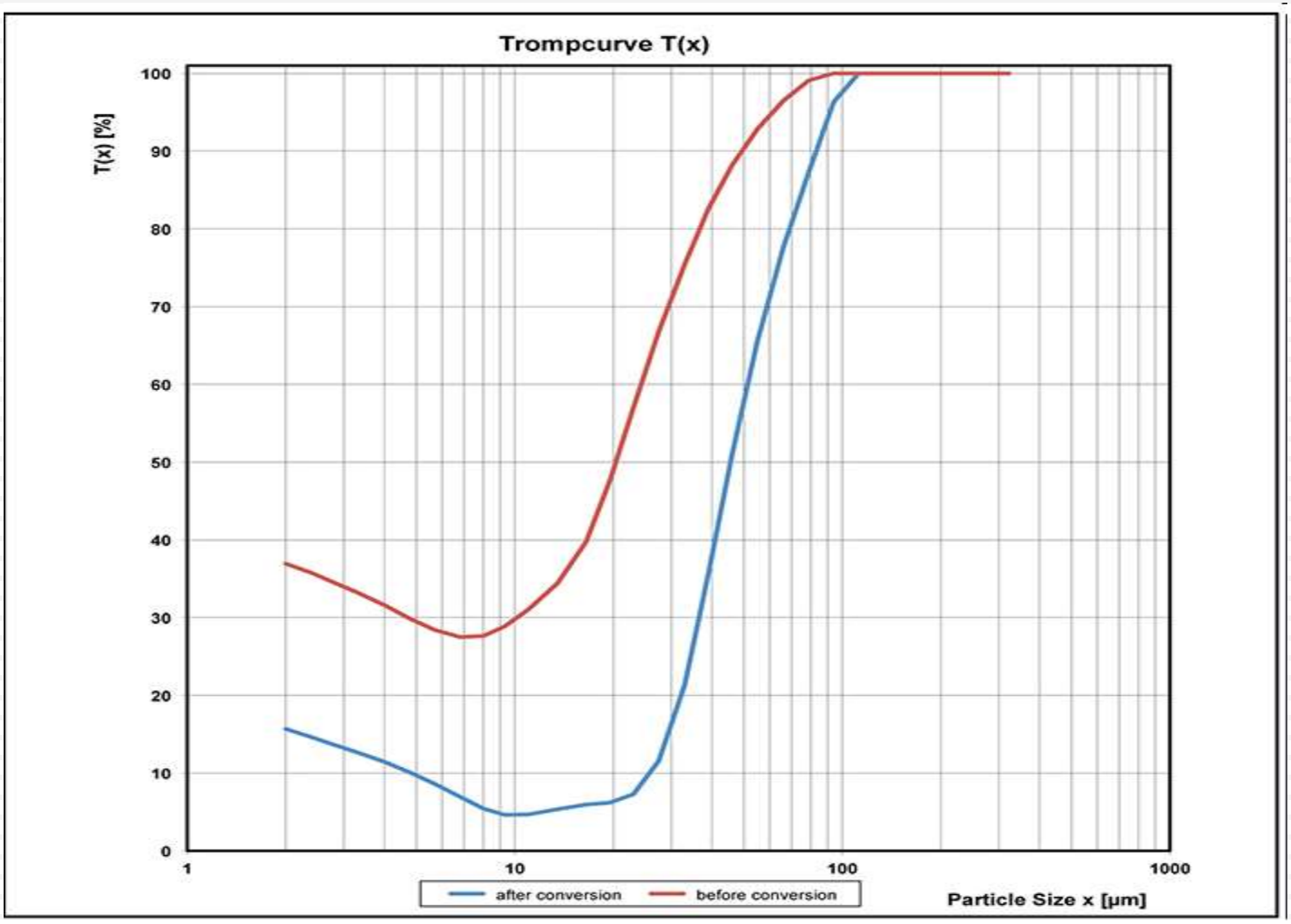
Seal Gap

Features:

Air is blown in this gap to avoid any bypass of coarse material to get into the fine product



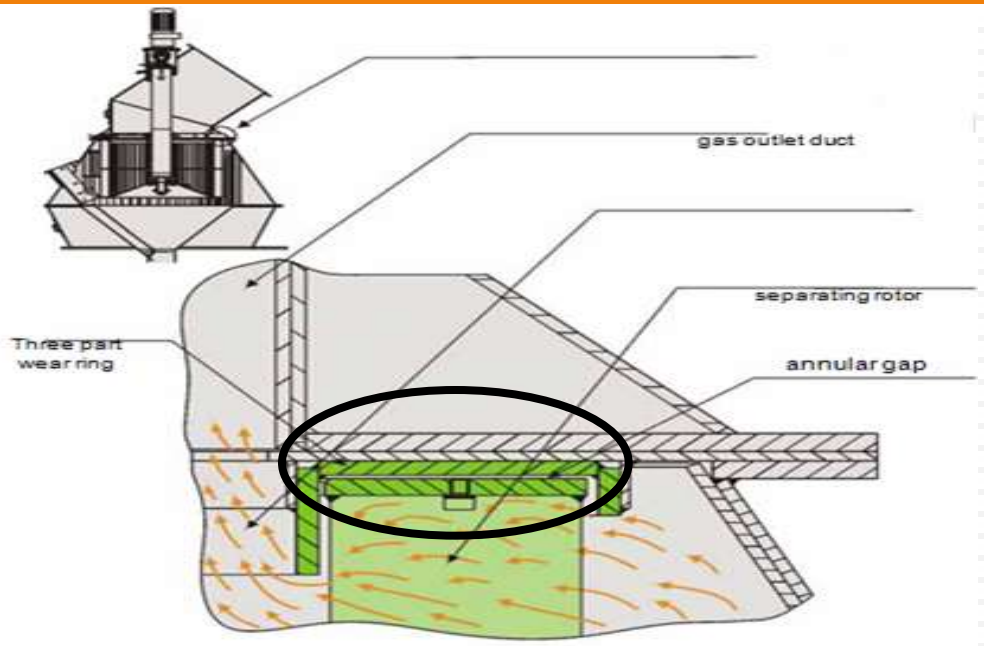
CASE STUDY: Improving Separator Efficiency

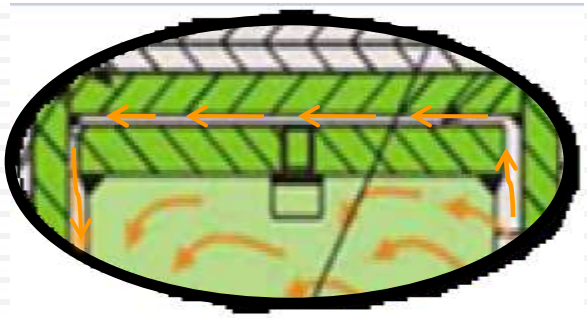


CASE STUDY: Improving Separator Efficiency

- **Benefits Achieved:**
  - Bypass is reduced from 28 % to 7 %.
  - Production increase by 14 %
  - Specific energy reduced by 13.8 %
  - Blaine reduced from 3800 cm^2/gm to 3600 cm^2/gm
  - Same early and final strength achieved with reduced blaine

Improving VRM classifier performance





Annular Gap between Dynamic seal and rotor to be close.

Additional Air – **"Sealing Air"** to be provided by a radial fan with a static pressure of 40 to 50 mbar to stop/direct passive particles

Saving & Benefits

Without seal air

Sep.speed (RPM)	Fan power (KW)	Main motor load (KW)	Grinding pressure (mbar)	Vibration	Feed (TPH)	Residue (212 µ)
80	834	1240-1260	120	3.8-4.2	170	**4.6%**

With seal air

Sep.speed (RPM)	Fan power (KW)	Main motor load (KW)	Grinding pressure (mbar)	Vibration	Feed (TPH)	Residue (212 µ)
80	820	1230-1250	120	3.8-4.2	175	**3.6%**

Through **4th Generation Classifier**

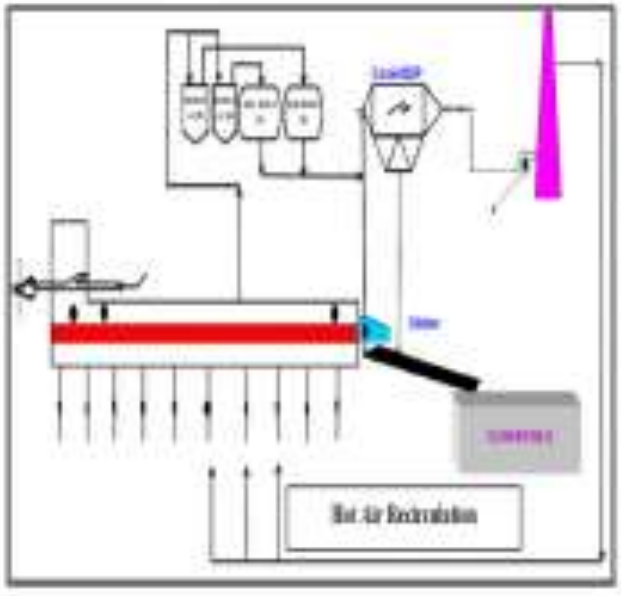
- Benefits in quality of raw mill product
- Power saving in VRM main fan & main drive
- Increase output of VRM

Through study we get that power saving of **30 kW/Hr** & Increase In production by **5 TPH**

Total Annual Savings – RS. 221 Lakhs

Cooler hot gas recirculation

- **Recirculation of cooler stack hot air at 110-130°C inside cooler**
  - **Increase in steam generation**
  - **Increase in power generation**



Recirculation duct tapping from Stack

Entry at fan inlet

Cooler hot gas recirculation- J K Lakshmi Cement

With the use of waste hot air having temperature 110-130 deg.c to the cooler through Fan no. 6,7 and 8, we are able to produce 2.5 tph more steam contributing more green power generation.

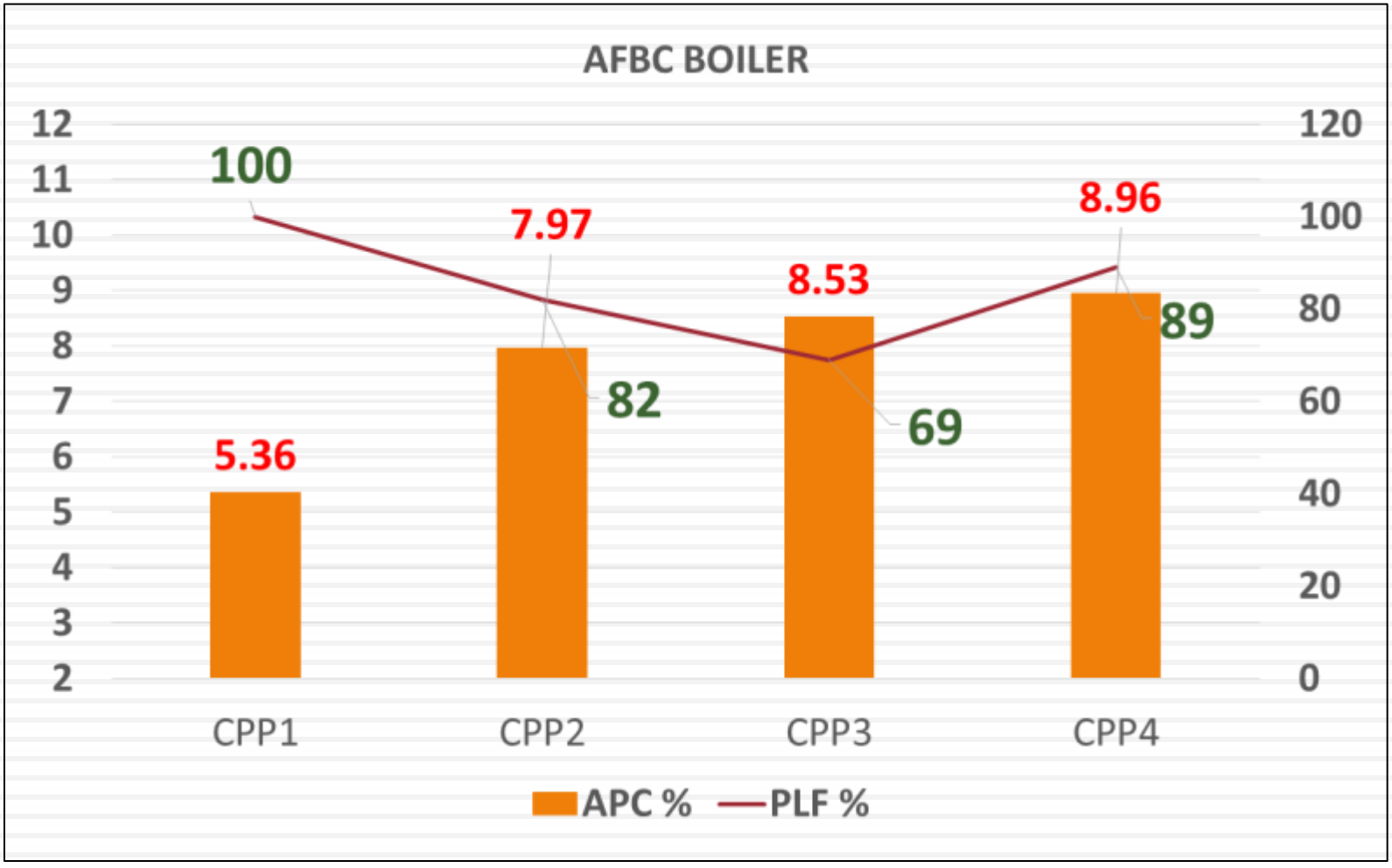
Results-:

Parameters	Without Hot Air Recirculation	With Hot Air Recirculation
Total Steam Generation (TPH)	73.05	75.55
Net power generation (Units/day)	292153	300322

Increase in WHR power generation-: 8169 units/day

Approach #3
Performance Improvement in CPPs

CPP – APC % & PLF



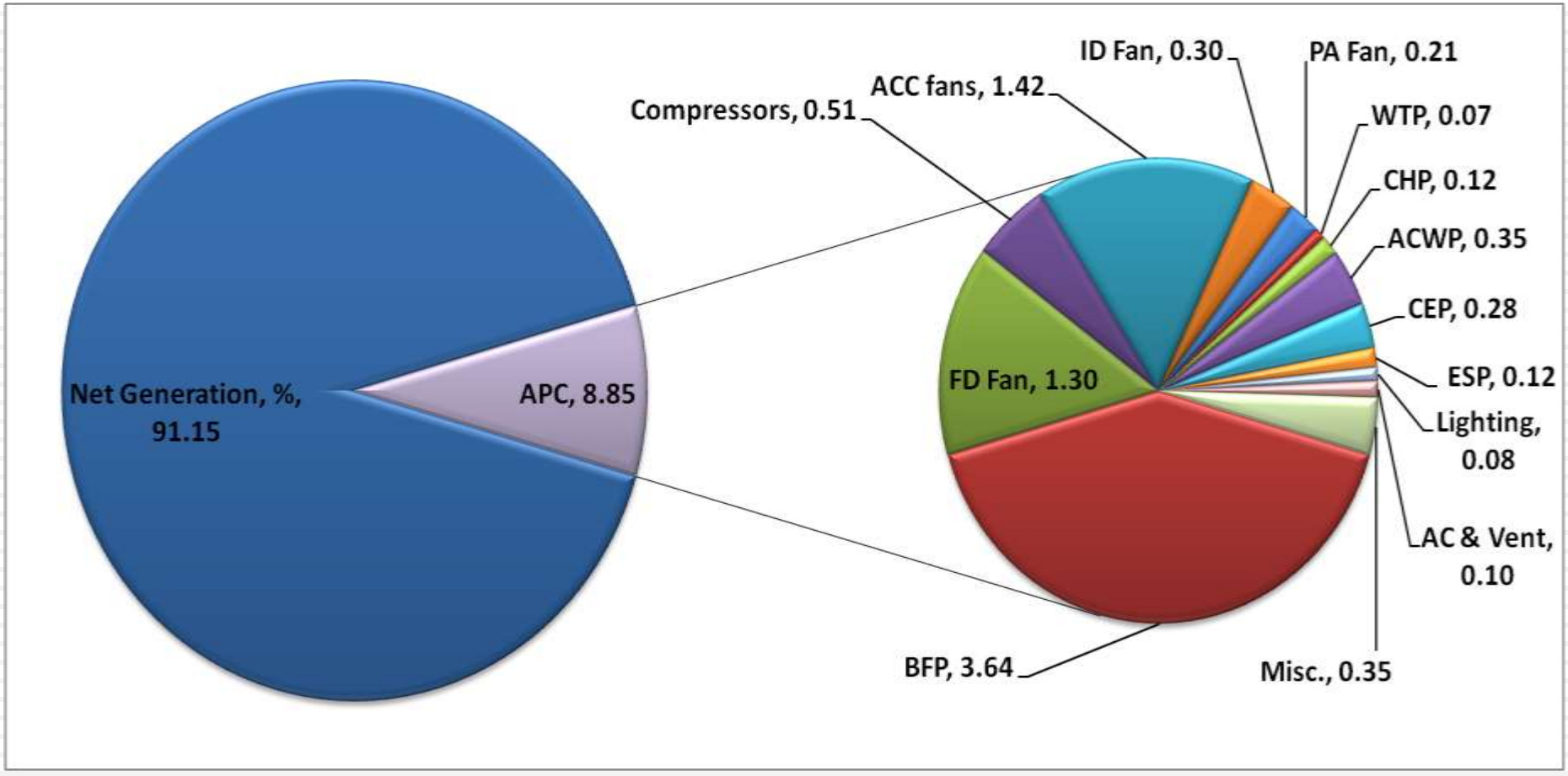
APC % - Captive Power Plant Scenario

Sl. No	Operating Capacity, MW	APC %
Plant A	06	13.5
Plant B	15	9.82
Plant C	15	7.73
Plant D	15	7.57
Plant E	18	7.80
Plant F	25	8.15
Plant G	25	10.95
Plant H	27	7.69
Plant I	30	6.96
Plant J	33	11.0

Estimated potential available in Indian CPP

- Captive power plants
  - APC % ranges : 5 – 12.5%
    - Large Bandwidth
- Example:
  - Installed capacity :34444.12 MW
  - Operating Capacity : 27555.3 MW @ 80% PLF
  - APC power : 2342.2 MW @ 8.5% APC (average)
- At least 1% reduction in APC%
  - Huge increase in the Net Power Generation
    - Approx. 275 MW

Typical APC % Breakup



APC% Benchmarking - AFBC boilers

Sl. No.	Auxiliary Name	Specific Power Consumption, kW/MW
1	Fans (PA, SA, ID & ACC fans)	17.9
2	Pumps (BFP, CEP, & ACWP)	24.6
3	BOP (WTP, CHP, ESP, Lighting, AC, CHP, Compressors & Misc.)	11.1
	Total	53.6 (APC – 5.36%)

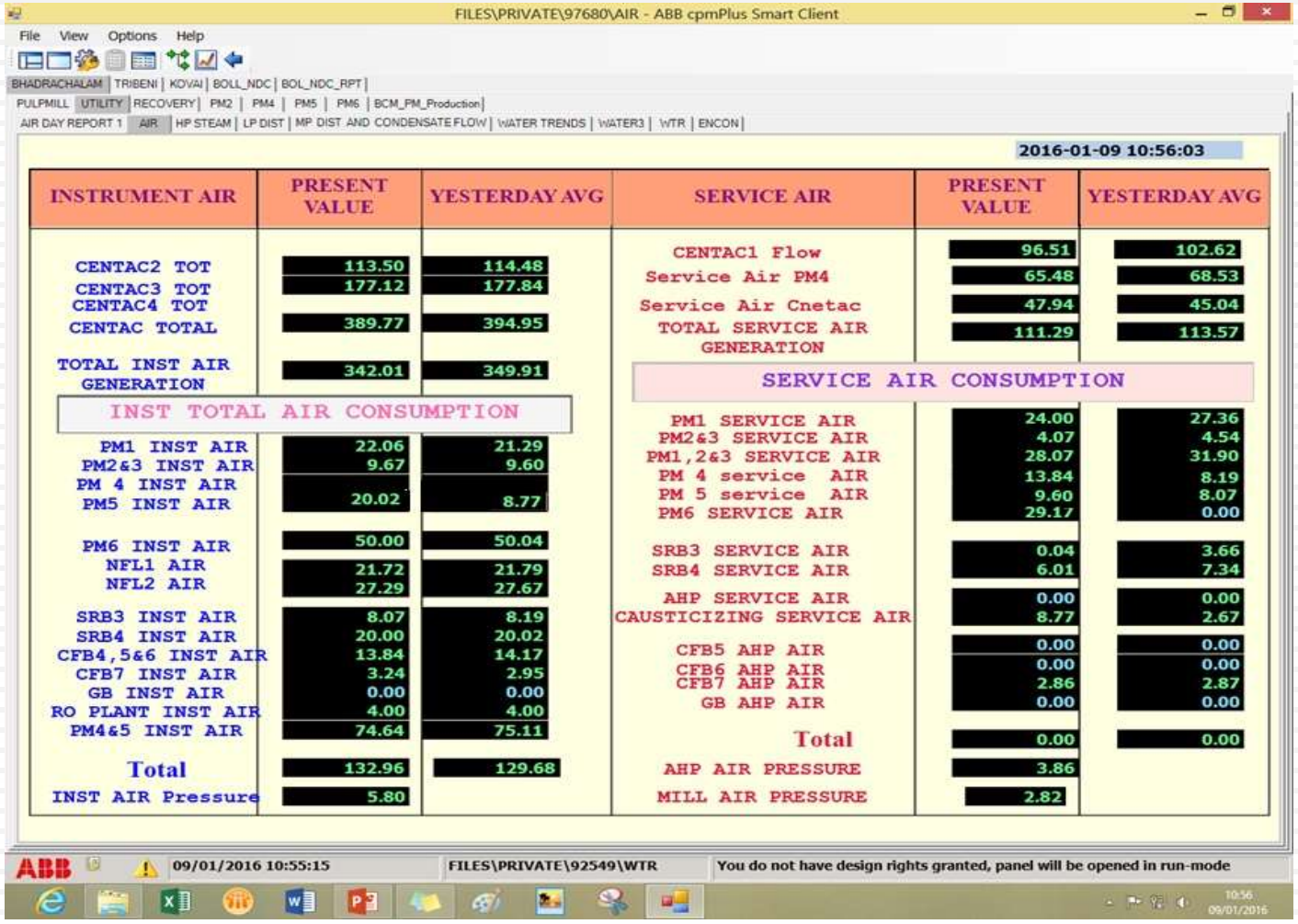
APC% Benchmarking - CFBC boilers

Sl. No.	Auxiliary Name	Specific Power Consumption, kW/MW
1	Fans (PA, SA, ID & ACC fans)	29.79
2	Pumps (BFP, CEP, & ACWP)	25.74
3	BOP (WTP, CHP, ESP, Lighting, AC, CHP, Compressors & Misc.)	9.83
	Total	65.36 (APC – 6.53%)

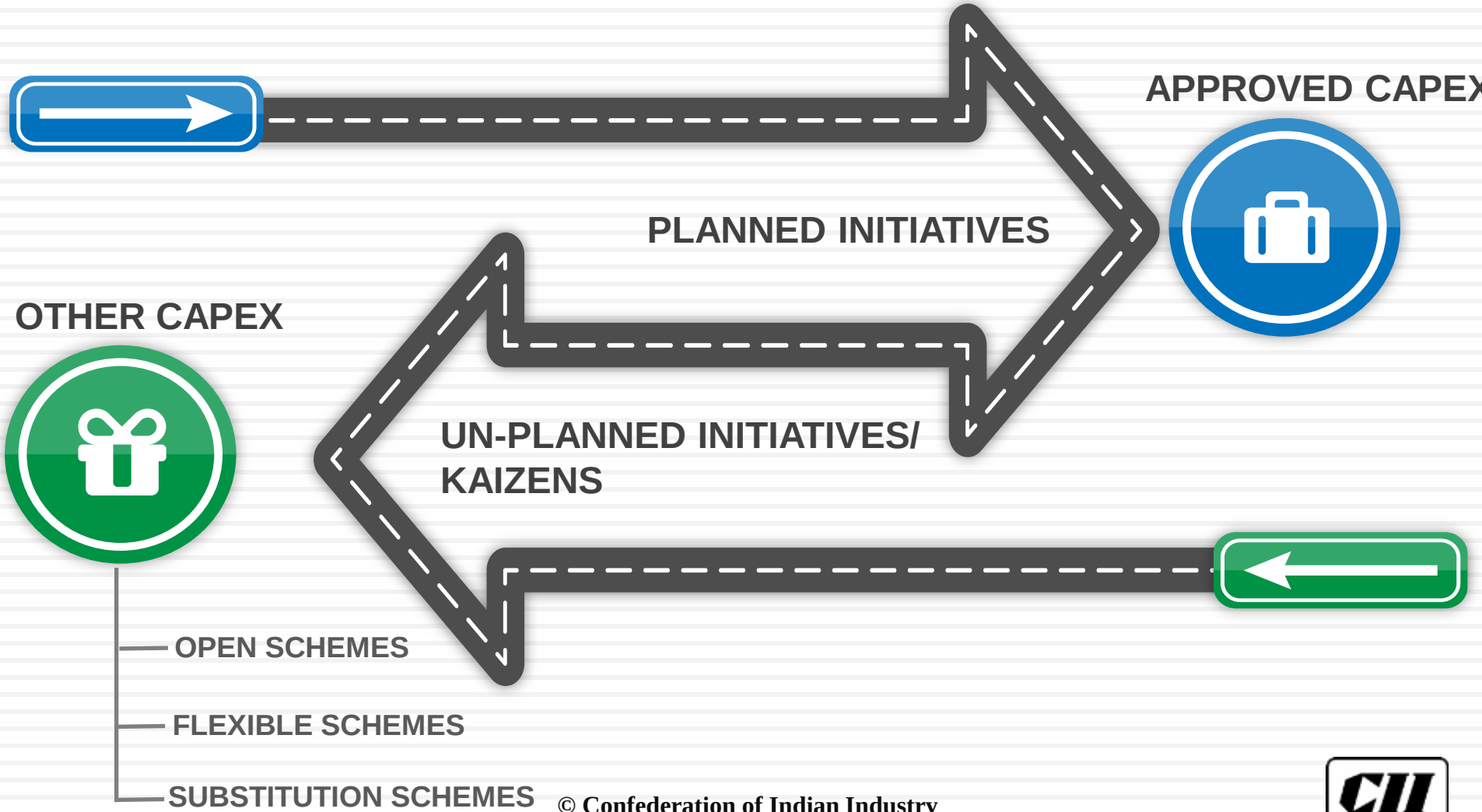
Approach #4
Innovative Ideas from Other Sectors

Shift-wise Energy Monitoring …

Detailed monitoring of minor areas …



Resource Allocation for EE …



Campaings on EE …

Approach #5
Major Levers to achieve PAT Targets

Levers towards PAT targets

1. Increasing additives in blended cement
2. Waste Heat Recovery
3. Alternate Fuel Utilization
4. On-site Renewable Energy options

To sum up …

- Several opportunities to improve SEC
- Successful examples within this sector and beyond
- Newer innovative technologies also finding acceptance & adoption
- Energy managers play a vital role in units' performancee

Thank you!

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