Energy Saving opportunities in Grinding system

Energy Saving Potential

- Cement production capacity as on 31st March 2010 ~ 260 MMTPA
- Power consumption for Cement Grinding alone CII Estimate ~ 1000 MW
- Saving potential ~ 150 -180 MW corresponding to Rs 370 Crores/annum

Energy saving opportunities

1. Installation of pre grinders
2. Right selection and operation of High Efficiency fans
3. High Efficiency separators
4. Grinding media fine tuning
5. Installation of high level control systems
6. Optimising Particle size Distribution in cement

Energy saving opportunities

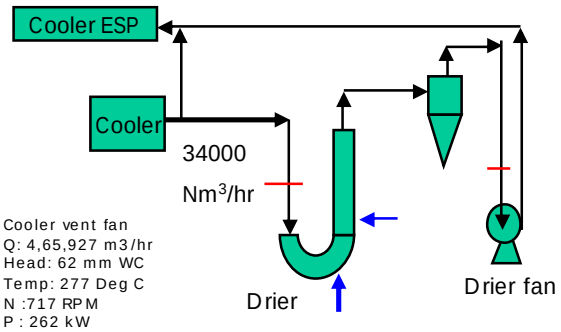
7. False air Infiltration reduction
8. Avoiding higher size grinding media
9. Optimising separator performance
10. Using CFD for cyclone & separator optimisation
11. Optimisation of Aux bag filter fans

False air Reduction

False air reduction

- Continuously monitored & Maintained in Pyro, Raw mill & Coal mill sections
  - Instrumentation Available & On line monitoring done
  - Further potential still exists (2 – 5%)
- False air in other areas (Cement mill, Pakcing house & bag filters)
  - Not generally monitored
  - Quantification – tricky
  - Loss can be very high

Optimise operation of Drier



Cooler vent fan
Q: 4,65,927 m3/hr
Head: 62 mm WC
Temp: 277 Deg C
N :717 RPM
P : 262 kW
η_{fan} : 34.3%

Optimise operation of Drier

- One Damper in Fan inlet & Slide gate at Drier inlet is provided for isolation from the cooler system
- False air ingress (34000 Nm^3/ hr) observed during idle condition through
  - Double flap
  - Wet fly ash weigh feeder
  - Saving potential : 32 kW

Optimise operation of Drier

- Motorised flap for foreign material collection and auto operation
- Fly ash feeder provided metal covering
- Auto interlock provided for closing inlet and outlet dampers during idle condition

Optimise operation of Drier

Annual Saving	-	Rs 1.6 Lakhs
Investment	-	Rs 1.0 Lakh
Pay back period	-	8 months

Optimising Grinding media

Optimising Grinding media

- Grinding media sizing : Depends on the following factors
  - Feed size & Type of Circuit
  - Material Hardness
  - Operating speed
  - Product fineness
- Improper sizing of media
  - No useful work
  - Results in high temperature

Optimising Grinding media

- Installed Roller press as a pre grinder
  - Ø Excellent initiative
- Semi ground clinker fed to separator in case of cement mill

Optimising Grinding media

Size in microns	25000	20000	12700	6300	1000	90	45
Fresh clinker	5	20	40	73	100	-	-
Separator reject	-	-	-	-	1	65	88

- Feed size of the material going to Mill
- For 20 mm size of clinker recommended ball size is 70 mm

Case Study
Optimise Grinding Media in Cement mill

- Utilizing the benefit of Pre grinder in ball mill
  - Ø Reduction of feed input size to ball mill results in
    - q Eliminates larger balls
    - q Leads to increase in Output

Case Study
Optimise Grinding Media in Cement mill

- Present size

First Chamber				
90	80	70	60	MT
23%	34%	19%	23%	26

Second Chamber			
17	15	12	MT
20%	45%	35%	71

Case Study
Optimise Grinding Media in Cement mill

v Recommended size

First Chamber				
40	30	25	20	MT
26%	35%	27%	12%	26

Second Chamber			
17	15	12	MT
20%	45%	35%	71

Optimise Grinding Media in Cement mill

5% increase in output achieved

Annual Saving	-	Rs 30 Lakhs
Investment	-	Nil
Payback period	-	Immediate

Optimising Separator Performance

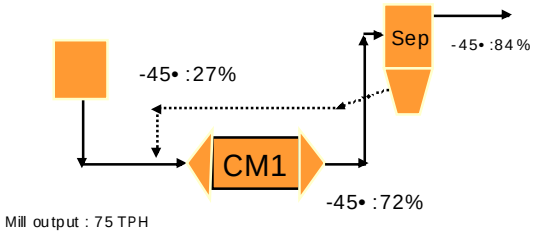
Optimising Separator Performance

- v High Efficiency Separator – Critical component of the grinding system
  - Ø Output
  - Ø Quality
  - Ø SEC
- v Performance Assessment
  - Ø Efficiency
  - Ø Tromp curve
  - Ø Fines in the reject

Optimising Separator Performance

- Classifier Efficiency
- Tromp curve
  - Requires PSA
  - Time consuming
- Quick & Easy method of estimation
  - Presence of fines in the reject
    - Generally : < 15%

Optimising Separator Performance



Optimising Separator Performance

- Currently fines returned in the separator reject is 27%
- Results in
  - Loss in production
  - Over grinding
  - Higher specific power

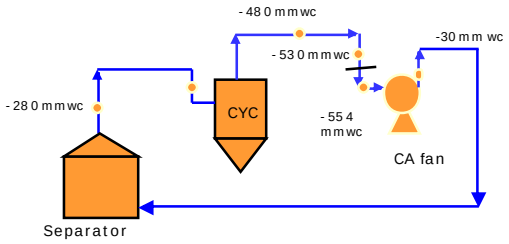
Optimising Separator Performance

- General reasons are
  - Improper material distribution
  - Low air volume
  - High circulation load
- Unexplored & Potential area for optimisation
  - 3-5% increase in output

Optimising Separator Performance

Annual Saving	-	Rs 9.1 Lakhs
Investment	-	Rs 10.0 Lakhs
Payback	-	13 months

Optimising pressure drop in Cement mill cyclones



Pressure drop across separator outlet to CA fan inlet = 250 mmwc

Optimising pressure drop in Cement mill cyclones

Separator outlet to CA fan inlet	Existing DP	Fan head	Motor	Extra DP Loss	Savings Achieved
	mm WC	mm WC	kW	%	kW
CM 1	250	439	244	25	62
CM 2	200	435	240	13	33
CM 3	171	444	238	7	16
Total					111

Optimising pressure drop in Cement mill cyclones

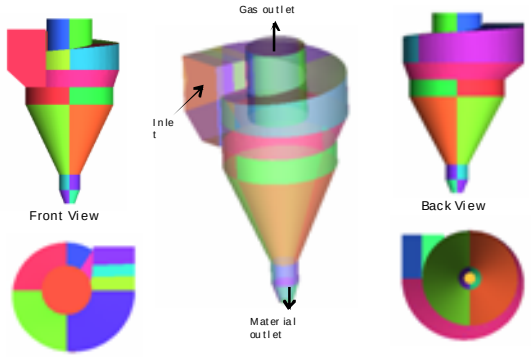
v General reasons for High pressure drop

- Ø Bends & Change in cross section
- Ø Higher dust loading than design
- Ø Restrictions due to formation of coatings / dust accumulation
- Ø Infiltration

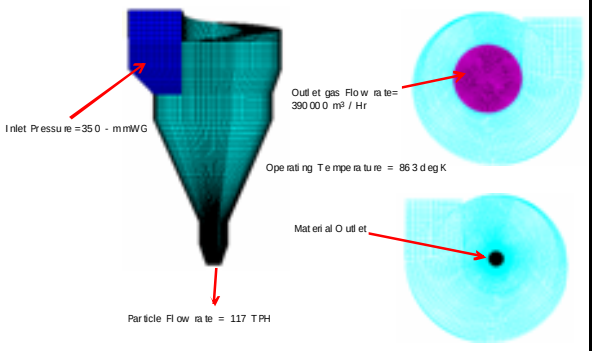
Optimising pressure drop in Cement mill cyclones

- Options explored to reduce pressure drop
  - Ø CFD
  - Ø Replacement with low DP cyclones

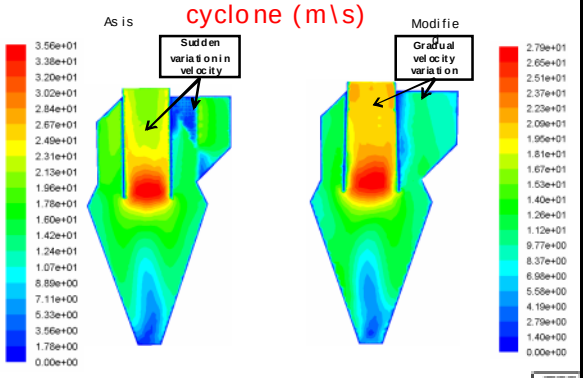
3D Model used for CFD analysis



Structured grid used for analysis



Velocity Contours of gas at mid plane of cyclone (m\s)



Optimising pressure drop in Cement mill cyclones

Annual Saving	-	Rs 31.2 Lakhs
Investment	-	Rs 30.0 Lakhs
Payback	-	12 Months

Auxiliary Bag filters

Auxiliary Bag filters

- Auxiliary bag filters in a large cement plant
  - 30 - 80 Numbers with SEC of >1.0 kW / MT cement
  - Considerable portion & less priority area
- Some of the plants have achieved as high as 0.5 kW / MT cement by optimising Aux bag filters

Auxiliary Bag filters

- Energy saving opportunities
  - Damper loss
  - High / Low pressure drop across BF
  - Capacity more than requirement
  - Idle running

Optimise operation of Raw Mill Silo-top Bag Filter Fan

- Measured Flow - 21200 m3/h
  - Installed for pneumatic conveying system
- Fan power - 32.25 kW
  - Rated - 45 kW
- Conveying system changed
- Volume of air to be handled reduced

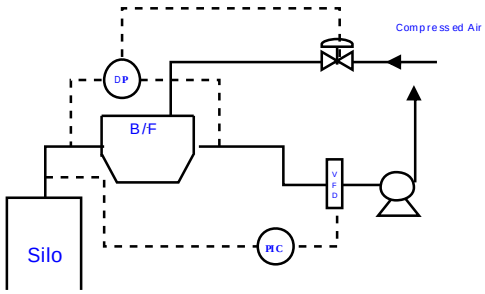
Optimise operation of Raw Mill Silo-top Bag Filter Fan

- Required flow 8000 m^3/h (max.)
- Install smaller size fan
  - 8000 m^3/h
  - 200 mm WC
  - Power - 9 to 10 kW

Optimise operation of Raw Mill Silo-top Bag Filter Fan

- Further Optimisation of B/F fan
  - Install VFD
  - Maintain Silo draught (50 mmWc)
  - Compressed air based on DP (125 mmWC)
- Further reduction in energy consumption

Most Suitable System



Optimise operation of Raw Mill Silo-top Bag Filter Fan

Annual saving	-	Rs 5.3 Lakhs
Investment	-	Rs 1.5 Lakhs
Payback	-	4 Months

To sum up

- Grinding is an essential component of cement manufacturing
  - Ø Significant Energy consuming area
- Several Opportunities for power reduction exists
- Need to tap the opportunities and benefit

Thank you

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