SATNA CEMENT WORKS,

SATNA

BIRLA CORPORATION LIMITED

SUB: Response to comments received from UNFCCC on "Energy Efficiency Measures at Cement Production Plant in Central India" (UNFCCC Ref. No.: 1072)

Reasons for request:
The PDD and monitoring plan, as appropriate, should transparently outline how the energy savings and emission reductions for each energy efficiency measure have been measured and/or calculated, and how the following sections of the methodology have been applied:
(a) Documenting the specifications of the equipment replaced
(b) Metering the energy use of the industrial facility, processes or the equipment affected by the project activity
(c) Calculating the energy savings using the metered energy obtained from subparagraph (b).

Explanation:

The emission reduction has been calculated as per methodology and guidelines. The following algorithm has been followed to arrive at emission reduction.

Before the project activity, the specific energy consumption of each component of the project activity has been calculated based on meter reading of control volume, time of operation and clinker production.

The similar specific energy consumption has been arrived during post project activity. The monitoring of energy consumption and clinker production has been monitored accordingly.

Emission reduction figure is arrived based on every year's clinker production and difference of specific energy consumption for which algorithm is provided in PDD

The specification of the VFDs and new fans are reflected in kW, Voltage, Serial No and Range. These are finalized once for all and documented during validation visit. As estimations are done on the basis of actual measurements and not on rated capacity, it is not monitored each year. However, Maintenance record are kept and adjusted with operating hours that would be evidenced during verification visit.

The details of each measure are evidenced with the validator and included in PDD enclosure 3. The calculation related to the measures as explained in the PDD page 6-8 are as follows respectively:

1. Project detail : High efficiency Fan for Primary Air Fan along with invertor drive panel for speed control of the fan at SCW

Write up :

Earlier Primary Air Fan (30 KW) was of old generation less efficient fan which was consuming more power. Hence, it was replaced with a High Efficiency Fan to further saving in power consumption. Further, the speed control of Fan was with damper control resulting in more power consumption, hence same was provided with an invertor drive panel for speed control which helps in reducing power consumption.

Calculation :

a) Earlier power consumption of ESP Fan : 23 Kwh/Hr.
(b) Power consumption of ESP fan after above modification : 10 Kwh/Hr.
(c) Power saving per day achieved = (23 – 10) : 13 Kwh/Hr.
(d) Power saving during year 00-01 (7404 Hrs.x 13) : 96252 Kwh/Hr.
Considering Clinker production as 831227 Tons

Savings in terms of KWH/ton of Clkr. : 96252/831227
: **0.11 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of P.A.Fan taken.

Investment : Rs. 2.25 Lacs

Date / Month of implementation : 28th July 2000

2. Project detail :

High efficiency Fans for V4, V5A and Primary Air Fan along with VVVF AC drives for speed control of these fans and provision of invertor only for K-12 Fan at BVCW

Write up :

After commissioning of CIS+CFG in Clinker cooler, the energy consumed by cooler fans had increased by approx. one unit/ton of clinker. At that time, Fans air volume was controlled by controlling the damper ,which consumes more energy ,hence it was planned to provide suitable speed control system for controlling the air volume, which reduces the energy consumption considerably. Further, earlier fans were also old generation less efficient fans, which were consuming more power and hence replaced with present generation high efficiency fans to further saving in power consumption.

So, to begin with, it was planned to first replace two cooler fans which were having higher rating motors of 132 kw each i.e. V4 and V5A, with high efficiency fans along with inverter drives for speed control.

On similar grounds, Primary air Fan was also selected for replacement with a High efficiency fan alongwith inverter drive for speed control.

Cooler Fan K-12 was provided with an inverter only for speed control without changing the Fan.

Calculation :

FAN NO.	Earlier Power consumption (Kwh/Hr.)	Achieved Power consumption with New Fan + Inverter (Kwh/Hr.)	Total Saving (Kwh/Hr.)
V4	90	70	**20**
V5A	90	63	**27**
P.A.Fan	30	22	**8**
K-12	85	70	**15**
TOTAL	295	225	**70**

Savings of units per annum = 7755 hrs. x 70 = 542850 Kwh
Actual Clinker production as 858954 Tons
Savings in terms of KWH/ton of Clkr. : 542850/858954
: **0.65 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of various above Fans taken.

Investment : Rs. 26.50 Lacs

Date / Month of implementation : 28th July 2000

3. Project detail :

High efficiency Fans for V5B, V6 and K-20 Fans along with VVVF AC drives for speed control of these fans at BVCW

Write up :

After commissioning of CIS+CFG in Clinker cooler, the energy consumed by cooler fans had increased by approx. 1.0 unit/ton of clinker. Earlier, Fans air volume was controlled by controlling the damper, which consumes more energy, hence it was planned to provide suitable speed control system for controlling the air volume, which reduces the energy consumption considerably. Further, existing fans were also old generation less efficient fans, which were consuming more power and hence, these Fans were replaced with present generation high efficiency fans, resulting to lead to further saving in power consumption.

Calculation :

FANNO.	Earlier Power consumption (Kwh/Hr.)	Achieved Power consumption with New Fan + Inverter (Kwh/Hr.)	Saving (Kwh/Hr.)
V5B	73	47	**26**
V6	170	79	**91**
K-20	75	44	**31**
TOTAL	318	170	**148**

Savings of units per annum = 7755 hrs. x 148 = 1147740 Kwh
Actual Clinker production as 858954 Tons
Savings in terms of KWH/ton of Clkr. : 1147740/858954
: **1.34 Kwh/ton Clkr.**

Monitoring aspects :
Energy meter readings of various above Fans taken.

Investment : Rs. 36.34 Lacs

Date / Month of implementation : 11th Dec.2000

4. Project detail: Installation of SPRS (Slip power recovery system) for PC Fan speed control (70% to 100%) at BVCW

Write-up :

Earlier, a liquid rotor regulator was being used for the speed reduction of PC fan, which was resulting in wastage of about 75 Kw and moreover, sometimes due to problem in the liquid rotor, we had to restore to damper control, thereby wasting enormous energy. Therefore, it was decided to install slip power recovery system for 70% to 100% speed control for power saving.

Calculation :

(a)Earlier Power consumption of PC Fan	: 1175 Kwh/hr.
(b)Power consumption with SPRS	: 1105 Kwh/hr.
(c)Power saving per hr.(1175-1105)	: 70 Kwh/hr.
(d)Power saving per annum 7623 hrs. x 70	: 533610 Kwh

Actual Clinker production as 858954 Tons

Savings in terms of KWH/ton of Clkr. : 533610/858954
: **0.62 Kwh/ton Clkr**.

Monitoring aspects :

Energy meter readings of various above Fans taken.

Investment : Rs. 26.13 Lacs

Date / Month of implementation : 11th Dec.2000

5. Project detail : Replacement of Pre-Heater Fan with a high efficiency Fan at BVCW

Write-up :

Earlier PH Fan was old generation less efficient fan, which was consuming more power. Therefore, it was replaced with a present generation high Efficiency fan for saving in power, for existing capacity.

Calculation :

(a)Earlier Power consumption of PH Fan	: 398 Kwh/hr.
(b)Power consumption after replacement with H.E.Fan	: 320 Kwh/hr.
(c)Power saving per Hr.(398-320)	: 78 Kwh/hr.
(d)Power saving per annum 7755 hrs. x 78	: 604890 Kwh

Actual Clinker production as 858954 Tons

Savings in terms of KWH/ton of Clkr. : 604890/858954

: **0.70 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of PH Fan were taken.

Investment : Rs. 25.59 Lacs

Date / Month of implementation : 11th Dec.2000

6. Project details :

Modification of LKS Classifier of VRM with LV_technology Classifier at SCW

Write up :

Earlier VRM 36.41 classifier of old technology was modified and up-graded with LV-Technology classifier. The basic idea of LV technology is to improve aerodynamics inside the mill by directing the ground material upto the full length of modified classifier by increasing the velocity from bottom to the top by suitably modifying the cross sectional area from the bottom of the mill to the top of the classifier, thereby reducing the pressure drop and turbulance with in the mill body. This has resulted in increase of Mill output and reduction in specific power consumption.

Savings in pressure drop has resulted in higher production rate and reduction in specific power consumption.

Calculation :

(a) Earlier power consumption (VRM+ESP Fan & Classifier)	: 15.65 Kwh/Ton.
(b) Power consumption after modification	: 14.61 Kwh/ton.
(c) Actual Power saving	: 1.04Kwh/ton of Raw meal
or it is equivalent to (1.56 factor)	: **1.62 Kwh/ton Clkr**.

Monitoring aspects :

Energy meter readings of VRM+ESP Fan & Classifier taken.

Investment : Rs. 64.48 Lacs

Date / Month of implementation : 1st March 2001

7. Project details :

Installation of Vortex Finder Vanes on top stage Cyclones for reduction in differential pressure at SCW

Write up :

The conventional immersion tube of PH stage-I twin Cyclone was replaced with state of the art technology "Vortex Finder Vanes" designed by M/s PMT-Zyklontechnic, Austria. Vortex finder vane is the latest technology of Cyclone immersion tube, which reduces the pressure drop across the Cyclone by 30%, thereby saving in the Fan power.

Further, keeping the Fan power consumption at the earlier level, PH fan flow could be increased after installation of VFV and subsequently increase in about 50 TPD clinker production was achieved.

Calculation :

(a) Earlier power consumption in PH Fan	: 1068 Kwh/hr.
(b) Power consumption after VFV installation	: 1012 Kwh/hr.
(c) Power saving	: 56 Kwh/hr.
(d) Power saving per annum 7404 hrs.x 56	: 414624 Kwh

Actual Clinker production as 831227 Tons

Savings in terms of KWH/ton of Clkr. : 414624/831227
: **0.5 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of PH Fan taken.

Investment : Rs. 24.62 Lacs

Date / Month of implementation : 1st March 2001

8. Project details :

Installation of Vortex Finder Vanes for stage-1 Cyclones of PC & PH Strings for reduction in differential pressure at BVCW

Write up :

The conventional immersion tube of PH & PC strings stage-I twin Cyclone was replaced with state of the art technology "Vortex Finder Vanes" designed by M/s PMT-Zyklontechnic, Austria. Vortex finder vane is the latest technology of Cyclone immersion tube, which reduces the pressure drop across the Cyclone by 30%, thereby saving in the Fan power.

Further, keeping the Fan power consumption at the earlier level, PH & PC fans flow could be increased after installation of VFV and subsequently increase in clinker production to some extent.

Calculation :

PC FAN

(a) Earlier power consumption in PC Fan	: 1173Kwh/hr.
(b) Power consumption after VFV installation	: 1116 Kwh/hr.
(c) Power saving	: 57 Kwh/hr.

PH FAN

(a) Earlier power consumption in PH Fan	: 365 Kwh/hr.
(b) Power consumption after VFV installation	: 352 Kwh/hr.
(c) Power saving	: 13 Kwh/hr
TOTAL POWER SAVING	**: 70 Kwh/hr.**

(d) Power saving per annum 7938 hrs.x70 : 555660 Kwh

Actual Clinker production as 892251 Tons

Savings in terms of KWH/ton of Clkr. : 555660/892251
: **0.62 Kwh/ton Clkr**.

Monitoring aspects :

Energy meter readings of PH & PC Fans taken.

Investment : Rs. 26.51 Lacs

Date / Month of implementation : 20th October 2001

9. Project details :

Installation of an efficient modified Grit Separator in place of old separator in Coal mill circuit at BVCW

Write up :

Earlier, the pressure drop across the original Coal mill separator was 200-250 mmWG , as compared to 100-125 mmWG for the SCW Coal mill separator , resulting in higher power consumption of BDC Fan. It was replaced with a modified separator of similar design of SCW, to reduce pressure drop across separator by approx.120 mmWG. The earlier motor of 300 Kw/1500 rpm was replaced with available 200 Kw/1000 rpm, due to change in reduced inlet draft of BDC Fan, thus saving in Fan power.

Calculation :

(a)Earlier power consumption of BDC Fan	: 176 Kwh/hr.
(b)Power consumption with new separator	: 131 Kwh/hr.
(c)Power saving per day (176 – 131)	: 45 Kwh/hr.
(d)Power consumption per day (Avg.16Hrs.running)45x16	: 720 Kwh

d) Power saving per annum 330 days.x720 : 237600 Kwh

Actual Clinker production as 892251 Tons

Savings in terms of KWH/ton of Clkr. : 237600/892251
: **0.26 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of Coal Mill BDC Fan taken.

Investment : Rs. 4.12 Lacs (In-house Design & manufacturing)

Date / Month of implementation : 20th October 2001

10. Project detail :

High efficiency Fans for Raw Mill Vent Fan alongwith VVVF AC drive inverters at BVCW.

Write up :

Above mentioned fans were old generation less efficient fans, which were consuming more power and hence, these Fans were replaced with present generation high efficiency fans, resulting to lead to further saving in power consumption. Further, the air volume of these fans was controlled by controlling the damper, which consumes more energy, hence it was decided to provide suitable speed control system of VVVF AC drives for controlling the speed., which reduces the energy consumption considerably.

Calculation :

FANNO.	Earlier Power consumption (Kwh/Hr.)	Achieved Power consumption with New Fan + Inverter (Kwh/Hr.)	Saving (Kwh/Hr.)
Raw Mill Vent Fan	170	130	**40**

Raw Mill Vent Fan

Savings of units per annum = 7938 hrs.x40 = 317520 Kwh
Actual Clinker production 892251 Tons
Savings in terms of Kwh/ton of Clinker : 317520/892251
: =**0.36 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of various above Fans taken.

Investment : Rs. 12.89 Lacs

Date / Month of implementation :

Raw mill vent Fan : 22nd October 2001

11. Project detail : High efficiency Fans for Coal mill Circulating Fan along with inverters at SCW

Write up :

Above mentioned fans were old generation less efficient fans, which were consuming more power and hence, these Fans were replaced with present generation high efficiency fans, resulting to lead to further saving in power consumption. Further, the air volume of these fans was controlled by controlling the damper, which consumes more energy, hence it was decided to provide suitable speed control system of VVVF AC drives for controlling the speed., which reduces the energy consumption considerably.

Calculation :

FANNO.	Earlier Power consumption (Kwh/Hr.)	Achieved Power consumption with New Fan + Inverter (Kwh/Hr.)	Saving (Kwh/Hr.)
Coal mill circulating Fan	181	166	**15**

Coal Mill Circulating Fan

Savings of units per annum = 7683 hrs.x15 = 115245 Kwh

Actual Clinker production as 892195 Tons

Savings in terms of KWH/ton of Clkr. : 115245/892195

: = 0.13 Kwh/ton Clkr.

Monitoring aspects :

Energy meter readings of various above Fans taken.

Investment : Rs. 40.91 Lacs

Date / Month of implementation :

Coal Mill Circulating Fan : 8th January 2002

12. Project detail : Installation of 3-Fan System with LP Cyclones for VRM at SCW

Write-up :

The Pyro-process and Raw grinding system was originally designed for 2475 TPD clinker production. Gas and heat balancing of system was designed with 2-Fan system i.e. ESP Fan and PH Fan for optimum operation of 2475 TPD. In 2-fan system, all PH flue gases from PH fan had to pass through the VRM during Raw mill "ON" and part of the gases were taken to Coal mill during 14-16 hours of coal mill running. During Raw Mill "OFF", the gases were taken directly to ESP inlet through a by-pass circuit of VRM. The ESP Fan served dual purpose of Mill Fan and ESP Fan both. At the production level of 2475 TPD, the system was operating without any difficulty.

With earier above system of 2-Fan circuit & downcomer water spray system, production of 2750 TPD was achieved. During Coal Mill "OFF", the Kiln production was required to be reduced as Raw Mill was unable to take additional volume of PH flue gases which were drawn to Coal Mill. During Coal Mill "OFF", due to limitation of 2-Fan circuit, excess gases of PH exit could not be partially by-passed.

To overcome this limitation, a 3-Fan system was installed, which has a separate mill fan to take care of VRM operation. This has facilitated by-passing excess PH flue gases at increased production through VRM by-pass circuit. VRM exit gases and excess PH flue gases are mixed at ESP inlet and are handled by the ESP Fan, thus avoiding the production loss of about 100 TPD, during coal mill "OFF" and optimum clinker production of 2850 TPD (sustained) has been achieved, i.e. increase of 100 TPD clinker.

Further, ESP condition is deteriorating day by day due to corrosion because of down comer water spray. By above 3-Fan provision, due to increased ESP inlet temperature to 120 to 130 deg.C, difference of DPT & gas temp.has increased to 60-70 deg.C to avoid condensation in the ESP. This has retarded corrosion of ESP casing components. With this we have been able to avoid the losses due to false air entry , resulting in power saving in ESP fan.

Calculation :

(a) Power saving achieved : **2.3 Kwh/ton of Clkr.**
(b) Increase in Clinker production : **100 TPD**

Monitoring aspects :

Energy meter readings of VRM & Clinkerisation section
Log sheet of production before & after modification

Investment : Rs. 372.28 Lacs

Date / Month of implementation : 6th Jan. 2002

13. Project details :

Increase of PH exit gas downcomer duct dia. from 2.8 Mtr. to 3.5 Mtr at SCW

Write up :

The diameter of earlier downcomer duct from stage-1 to PH Fan was increased from 2.8 Mtr. to 3.50 Mtr.. This has resulted in decrease in pressure drop by about 25mmWg and thereby saving in PH Fan power by 35-40 Kwh/hr.

Calculation :

(a) Earlier power consumption of PH Fan : 1104 Kwh/hr.
(b) Power consumption after increase in dia. of DC duct :1064 Kwh/hr.
(c) Power saving : 40 Kwh/hr.

(e) Power saving per annum=7796 hrs..x 40 : 311840 Kwh

Actual Clinker production 953721 Tons
Savings in terms of Kwh/ton of Clinker : 311840/953721
: =**0.32 Kwh/ton Clkr.**

Monitoring aspects :

Energy meter readings of PH Fan taken

Investment : Rs. 25.00 Lacs

Date / Month of implementation : 11th December 2002

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