OxyBooster Swift™ O_2

Emerging opportunities and solutions for efficient steam generation and fuel cost saving in Paper Industry

By
P V Krishna Kumar
Co-Founder & Chief Marketing Officer

SUPREME ENERGY SOLUTIONS

Tiruchirapalli , Tamil Nadu

Paper & Pulp Industry – Global Energy Scenario

Paper & Pulp industry worldwide Accounts for 6% of the global Industrial Energy Consumption

4th Largest Energy Consumer in the world

Paper & Pulp Industry – Indian Energy Scenario

Energy cost range - 16% to 25 % of cost paper production

*** Energy input per Ton of Paper production**

Electrical	-	**1200 to 1700 kWh**
Steam	-	**10 tons to 16 Tons**
Coal	-	**1.5 tons to 3 Tons**

- *As per PAT Guidelines for Paper & Pulp industry by BEE and Ministry of Power , Government of India*

Heat Input Energy required per Kg of Steam (87 kcsg / 540 ° C Considering 55% Coal + 45% Biomass

- **Large size Plants - 850 to 875 Kcal/Kg of Steam**
- **Medium size Plants - 870 to 890 Kcal/Kg of Steam**

OxyBooster Swift™ O_2

Paper & Pulp Industry – Steam Generation Units available

Sl no	PARTICULARS	AFBC BOILER
1	Fuel Flexibility	2200 Kcal /kg and above any combination
2	Thermal Efficiency	80 % - 84 %
3	Quick Response to load variations	Good
4	Ease of Operation	Good . Needs maneuvering
5	Technological Advancement	Almost reached the optimum stage of design development – No major improvement in the last 15 years
6	Behavior of Furnace with fuel having heterogeneous properties	- Due to multipoint feeding of fuel , different zones are subjected to different heat pick up and de fluidisation and fluidization action. - This leads to dis harmony in different zones leading to uneven temperature profile across bed and higher unburnt carbon .

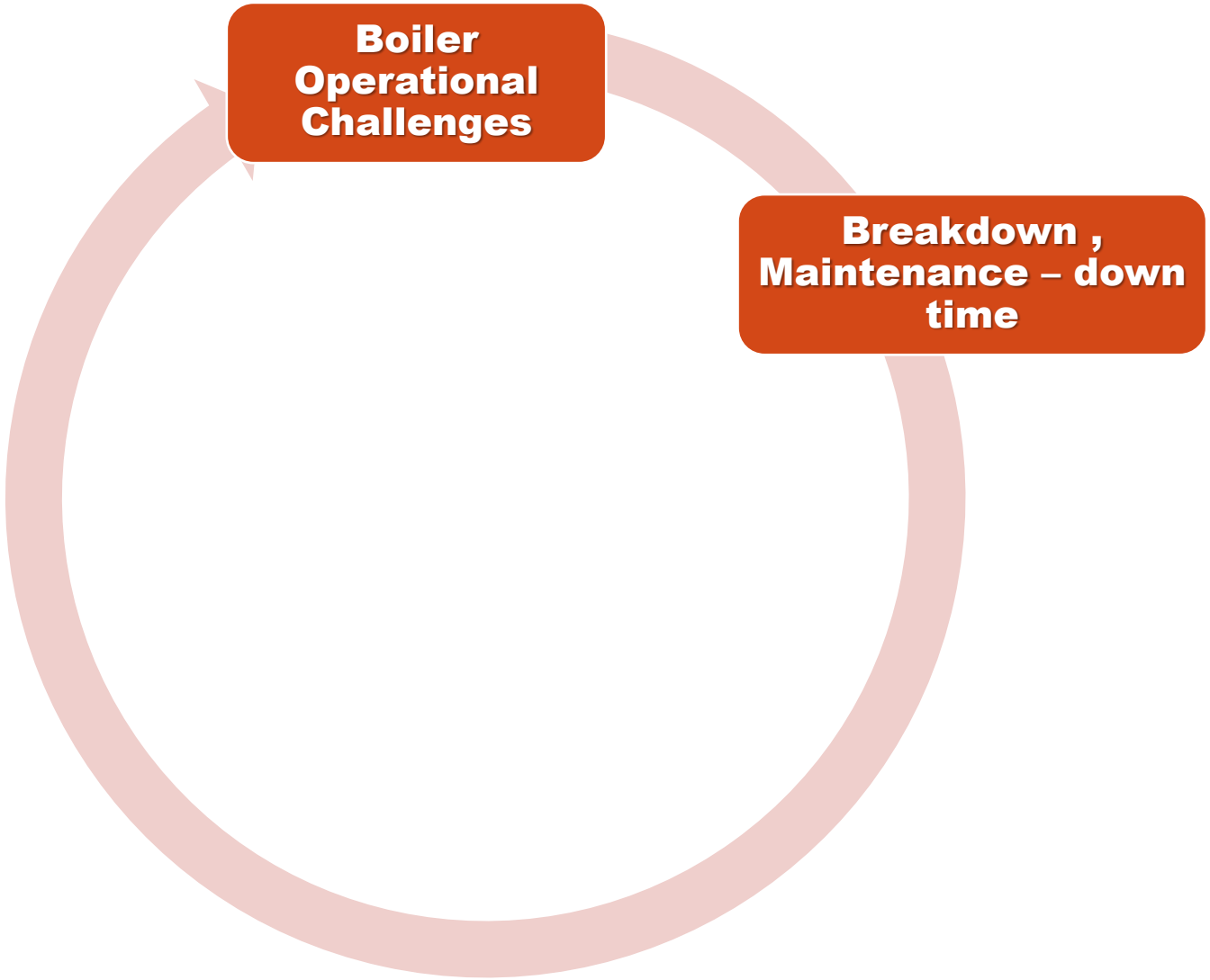
OxyBooster Swift™ O_2

Paper & Pulp Industry – Steam Generation Units available

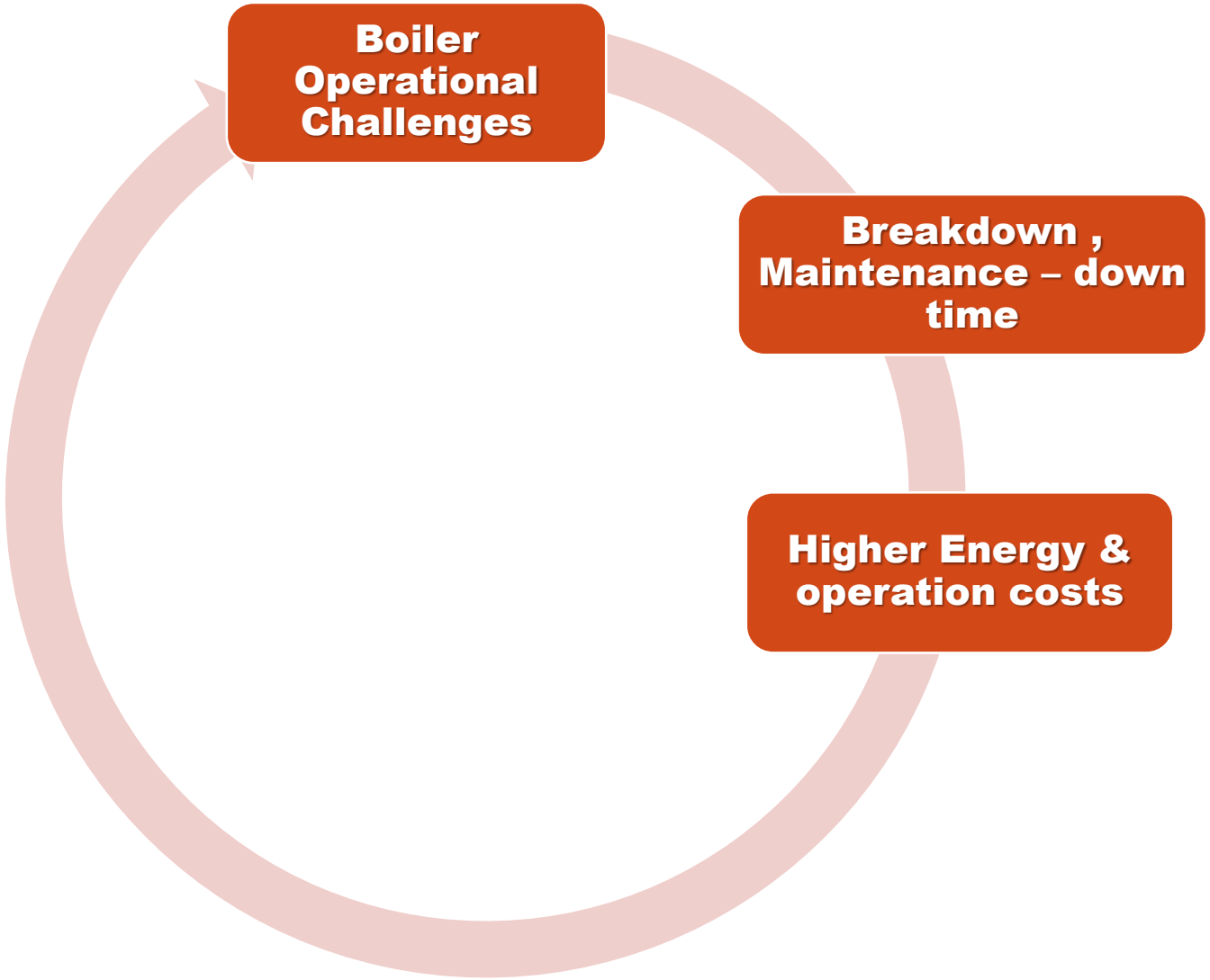
Sl no	PARTICULARS	AFBC BOILER	CFBC BOILER
1	Fuel Flexibility	2200 Kcal /kg and above any combination	1800 Kcal/kg and above in any combination
2	Thermal Efficiency	80 % - 84 %	86% - 88 %
3	Quick Response to load variations	Good	Very Good
4	Ease of Operation	Good . Needs maneuvering	Very good . Minimum manevering
5	Technological Advancement	Almost reached the optimum stage of design development – No major improvement in the last 15 years	Almost reached the optimum stage of design development – No major improvement in the last 10 years
6	Behavior of Furnace with fuel having heterogeneous properties	- Due to multipoint feeding of fuel , different zones are subjected to different heat pick up and de fluidisation and fluidization action. - This leads to dis harmony in different zones leading to uneven temperature profile across bed and higher unburnt carbon .	- Velocity profile increases across the boiler with change in quality and mix of fuel , resulting in higher SA flow. - The temperature profile also increases due to this and ΔT between Bed and furnace increases . - Higher % of fines results in soot formation increasing the soot blowing cycle – higher radiation losses.

Paper & Pulp Industry – The Energy cost cycle

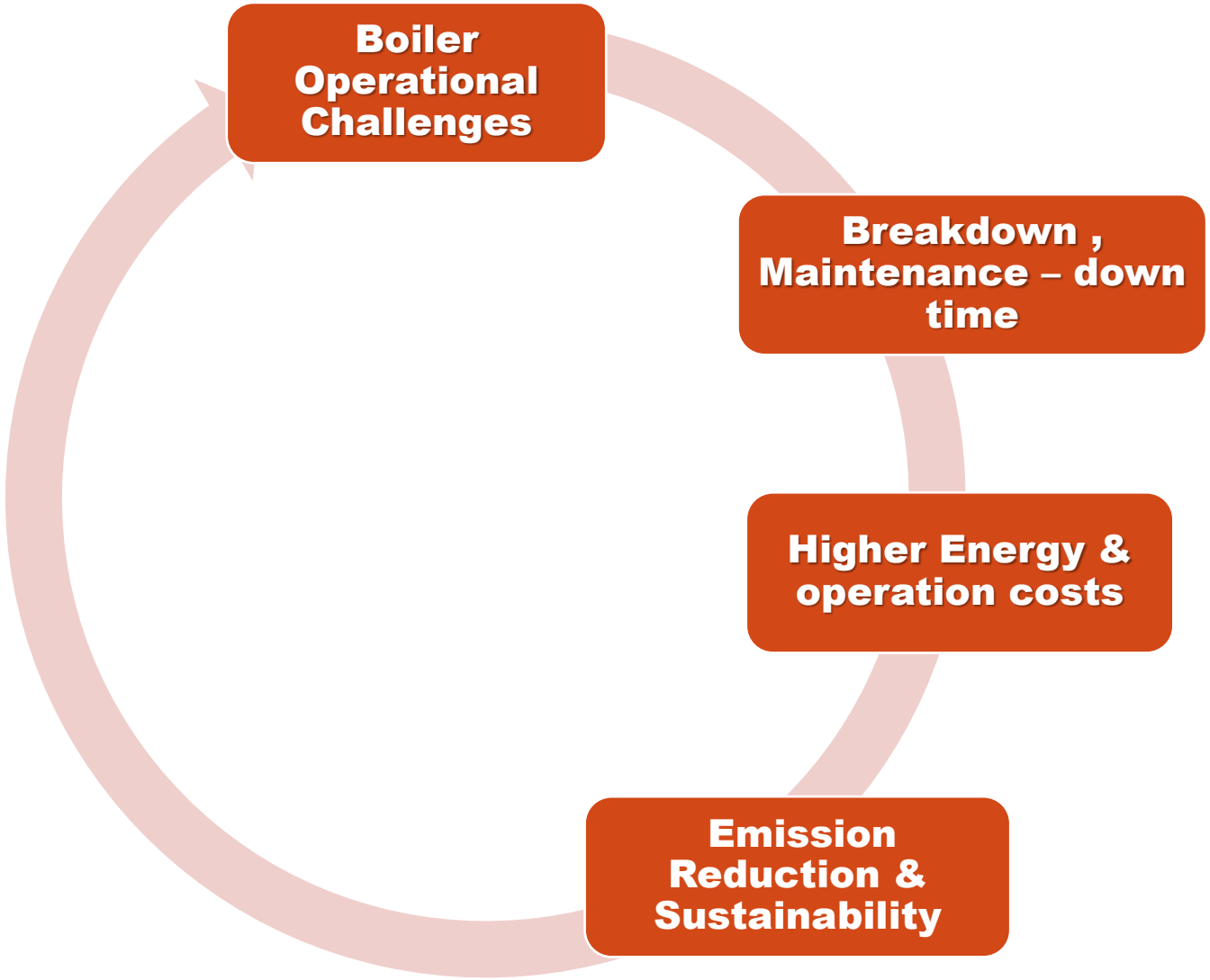
Paper & Pulp Industry – The Energy cost cycle



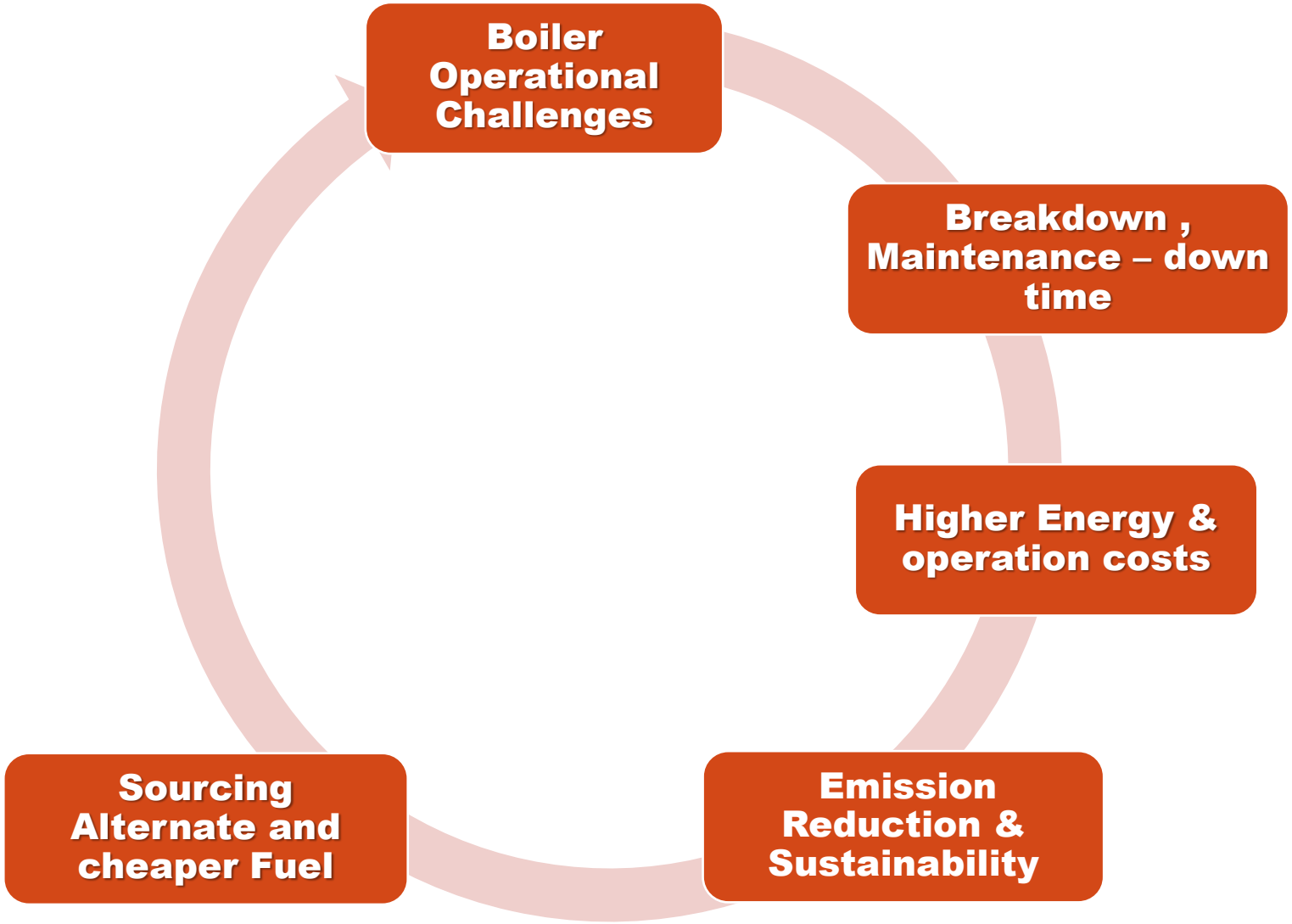
Paper & Pulp Industry – The Energy cost cycle



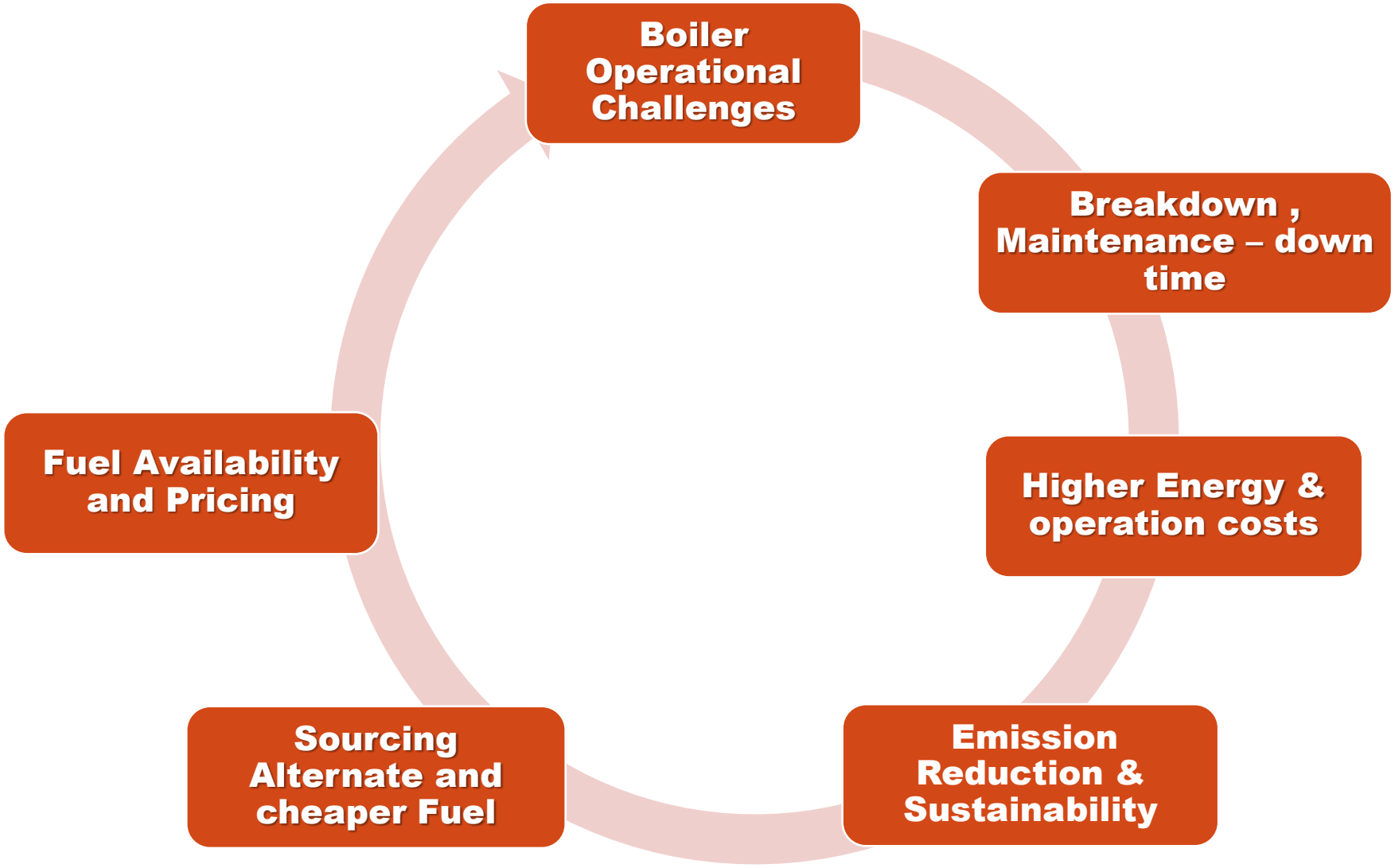
Paper & Pulp Industry – The Energy cost cycle



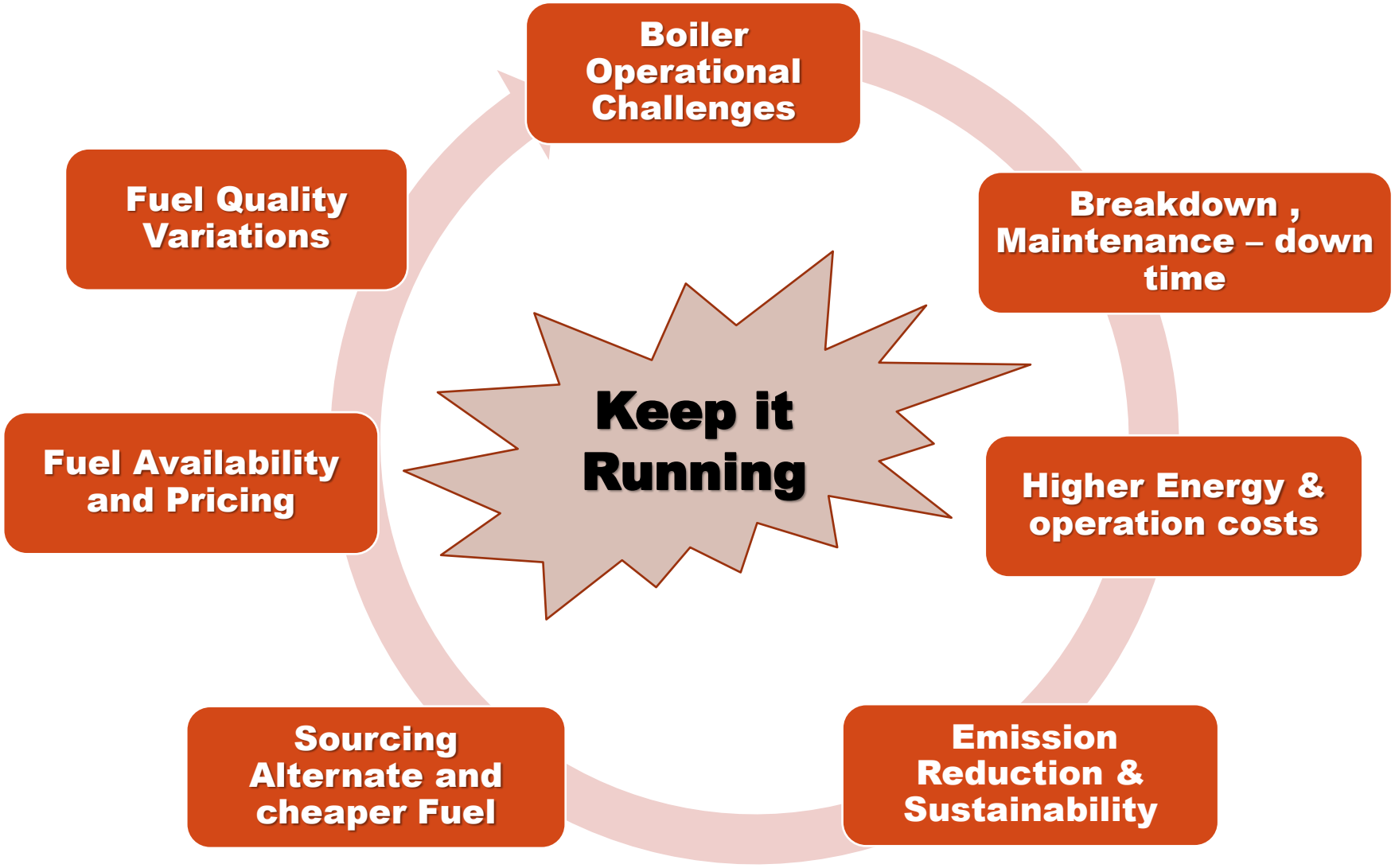
Paper & Pulp Industry – The Energy cost cycle



Paper & Pulp Industry – The Energy cost cycle



Paper & Pulp Industry – The Energy cost cycle



What is the way Out ??

Oxy Booster Swift O_2 ™

Bio Enzyme Combustion Catalyst

Oxy Booster Swift™ O_2

What is Oxybooster O2 Swift

Oxybooster O2 Swift is an agglomerated bio enzyme treated configured material 100% eco friendly , non-toxic , non-reactive and safe bio material , that syncronises the heat input of various heterogeneous energy inputs in the Kiln/Furnace and maintains thermal equilibrium , by reducing undue heat losses .

OxyBooster Swift™ O2

Composition of Oxybooster O2 Swift

It consists of different waste wood chips , pyrolysis processed derivative bio carbon all treated with proprietary bio enzymes .

What does it do

Oxybooster O2 Swift reduces the losses due to use of energy input material by

- Completes combustion of fines
- By Lowering the Δt within the furnace.
- Reducing the quantity of Combustion air required.
- Reduces Soot formation thereby reducing radiation losses

Oxybooster – How it acts inside the furnace

BIO ENZYME

It’s a protein molecule , that acts as a Catalyst to facilitate bio chemical reaction especially combustion

Oxybooster – How it acts inside the furnace

BIO ENZYME

It's a protein molecule , that acts as a Catalyst to facilitate bio chemical reaction especially combustion

OXYGEN / HYDROGEN SPLITTING

The Micro-organisms in the Oxybooster breaks down into nano particles , which allows the molecular Oxygen and Hydrogen present in the fuel moisture (both inherent & surface) to be released instantly .

This process potentially increases the reactivity of Oxygen & Hydrogen , making it readily available for combustion reaction

Oxybooster – How it acts inside the furnace

BIO ENZYME

It's a protein molecule , that acts as a Catalyst to facilitate bio chemical reaction especially combustion

OXYGEN / HYDROGEN SPLITTING

The Micro-organisms in the Oxybooster breaks down into nano particles , which allows the molecular Oxygen and Hydrogen present in the fuel moisture (both inherent & surface) to be released instantly .

This process potentially increases the reactivity of Oxygen & Hydrogen , making it readily available for combustion reaction

RELEASE OF FIXED & FREE CARBON

More Oxygen available helps to rapidly release fixed carbon which are stable , as well as Free carbon which mostly comes out as unburnt carbon. Rapid release will make the carbon burn out more efficient.

Oxybooster – How it acts inside the furnace

BIO ENZYME

It's a protein molecule , that acts as a Catalyst to facilitate bio chemical reaction especially combustion

OXYGEN / HYDROGEN SPLITTING

The Micro-organisms in the Oxybooster breaks down into nano particles , which allows the molecular Oxygen and Hydrogen present in the fuel moisture (both inherent & surface) to be released instantly .

This process potentially increases the reactivity of Oxygen & Hydrogen , making it readily available for combustion reaction

RELEASE OF FIXED & FREE CARBON

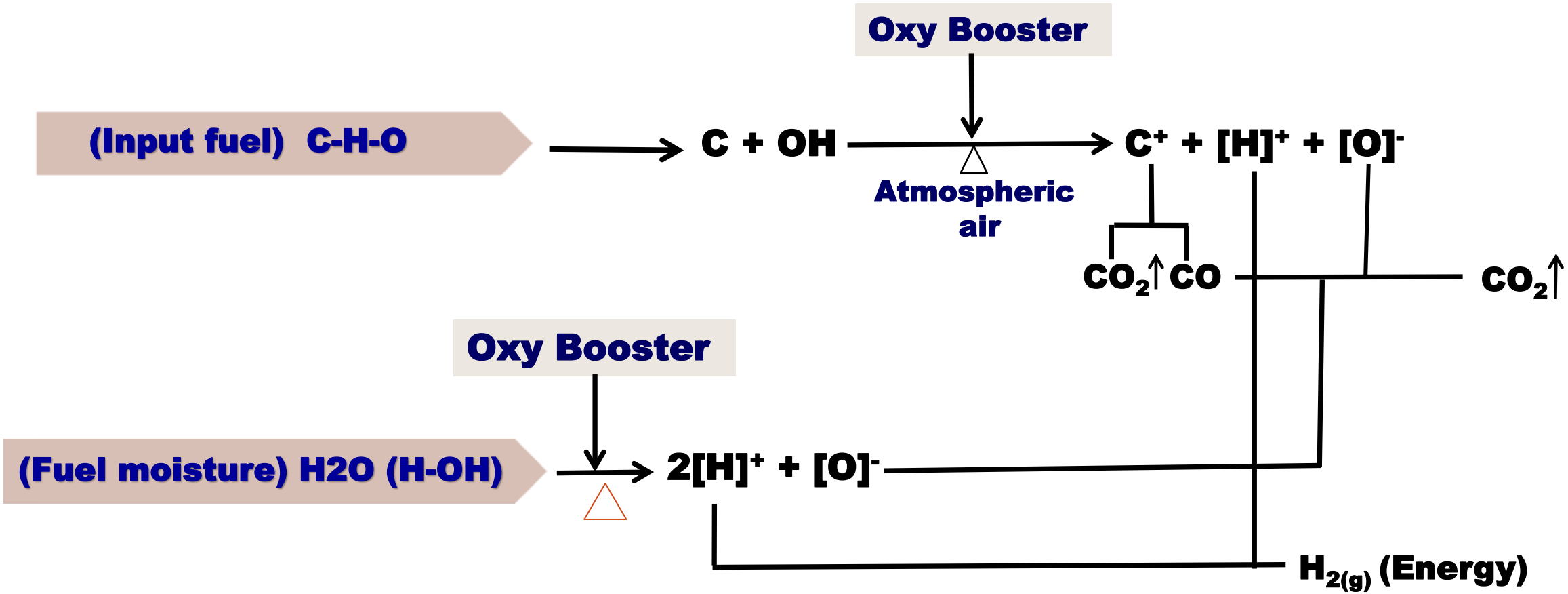
More Oxygen available helps to rapidly release fixed carbon which are stable , as well as Free carbon which mostly comes out as unburnt carbon. Rapid release will make the carbon burn out more efficient.

REDUCTION OF EXCESS AIR

By improving the availability of reactive oxygen for combustion close to the Specific Air to fuel ratio , there is a reduction of excess air required for completing combustion , there by improving overall combustion efficiency

OxyBooster Swift™ 2

REACTION OF OXYBOOSTER WITH ANY FUEL INSIDE THE FURNACE

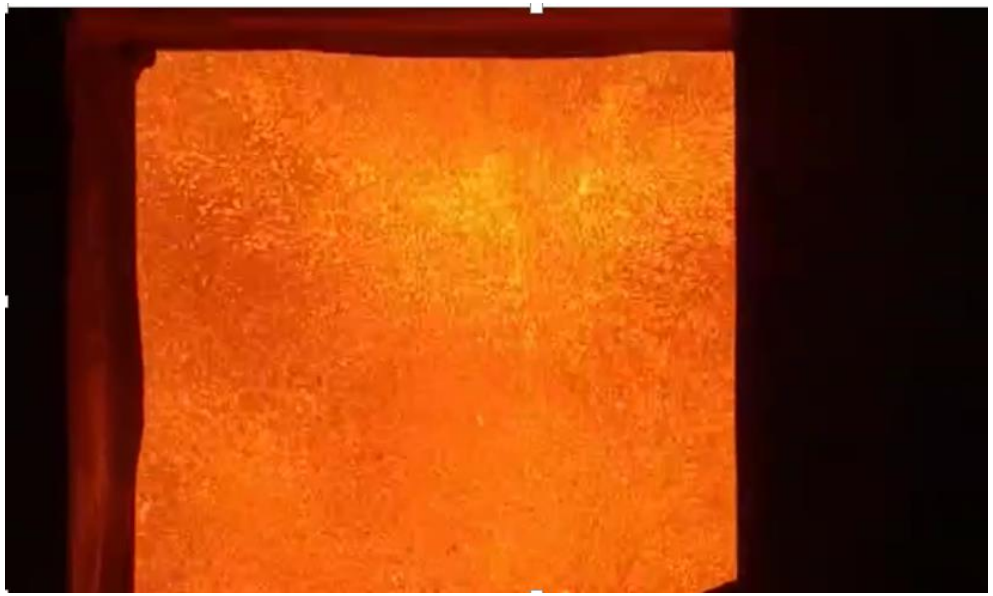


34 TPH AFBC BOILER FURNACE COMPARISON

Furnace before use of Oxybooster O2 Swift

- Fuel used is Imported coal with high VM
- Fixed Carbon & free carbon can be seen escaping from Fluidised bed → higher unburnt
- Reddish Yellow colour Bed indicates uneven combustion.

Furnace during use of Oxybooster O2 Swift



- With same fuel and steam load conditions furnace behavior with Oxybooster O2 Swift
- Fixed and Free Carbon combustion can be seen in the form of sparkles.
- Orangish Yellow colour indicates uniform combustion

HOW THE SAVINGS IN FUEL COMES ABOUT

SAVINGS IN FUEL IS DUE TO

- Reduction in Unburnt Carbon in Ash
- Lower Bed Temperature and Furnace Temperature for similar Steam Generation conditions
- Reduction in Combustion Air Quantity
- Minimum difference between Bed & Furnace Temperature

DOSAGE OF OXYBOOSTER O2 SWIFT PER DAY

Upto first 60 Tons per day fuel consumption	Oxybooster O2 Swift 36 Kgs per Day
Above 60 Tons per day of fuel consumption , For every 9 Tons of fuel	1 Kg of Oxybooster O2 Swift

Maximum quantity of Oxybooster O2 Swift not to exceed 108 Kgs per day irrespective of fuel consumption

FEEDING ARRANGEMENT FOR OXYBOOSTER O2 SWIFT IN BOILER

For AFBC Boilers

As the Quantity of Oxybooster O2 Swift is below 100 kgs per day , it can be added in the surge hopper / Vibratory Feeder , as per the cycle and sequence recommended by us.

Depending on the requirement from site to site , a day hopper with variable speed rotary feeder for automatic feeding of Oxybooster O2 Swift can be given , which can be interfaced with existing DCS Control .

FEEDING ARRANGEMENT FOR OXYBOOSTER O2 SWIFT IN BOILER

For CFBC Boilers

Since the fuel feeding system in CFBC Boiler is pressurized , the Oxybooster feeding system consisting of a small hopper , two pneumatic controlled duplex valve and pipe , can be supplied or be fabricated at site as per drawings provided by us.

This can be installed on each Drag Chain Feeder Or bottom of lime stone bunker line , as per site conditions.

Depending on the requirement from site to site , a day hopper with suitable system for automatic feeding of Oxybooster O2 Swift can be given , which can be interfaced with existing DCS Control .

ENABLING SUSTAINABLE DEVELOPMENT GOALS OF UN

Our solutions advance 5 of 17 SDGs of United Nations

Oxybooster Product solutions helps advance 5 of the 17 SDG Goals of the UN towards a better world By 2030

CARBON CREDIT

1) All Oxybooster products are 100% Bio material

2) Oxybooster helps reduce the Carbon footprint by reducing the consumption of fossil fuel

It is eligible for Green Credit

We are in advance stage of getting Approvals for qualification

CASE STUDIES FOR OXYBOOSTER O2 SWIFT

OxyBooster Swift™ O_2

Case Study – Kraft Paper Mill

Client : Urvashi Pulp & Paper Mills Pvt Ltd, Ankleshwar , Gujarat

Boiler Type	:	**AFBC**
Make	:	**IBL**
Capacity	:	**10 TPH**
Pressure	:	**10.5 Kg/cm2**
Temperature	:	**Sat.**
Fuel Used	:	**Imported Coal**
GCV range	:	**4800 – 5000 Kcal/Kg**

Case Study – Kraft Paper Mill

Client : Urvashi Pulp & Paper Mills Pvt Ltd, Ankleshwar , Gujarat

Challenges faced by Client

- **High cost of Steam – Rs.1343.82 per Ton of Steam**
- **Varying quality of coal leading to erratic behavior of boiler and its performance.**
- **Higher Unburnt Carbon in Ash .**
- **Average Steam Generation per Day = 240.60 Tons / Day**
  Average Coal consumption per Day = 39.19 Tons / Day.

Dosage of Oxybooster O2 Swift suggested & KPI

- **Oxybooster O2 Swift feeding per Day = 36 Kgs**
- **Guaranteed Key Performance Indicator (KPI)**

Heat input saved per Kg of steam generation = 74 Kcal / Kg of Steam
Coal Savings per Day = 3700 Kgs/Day

OxyBooster Swift O2 ™

Case Study – Kraft Paper Mill

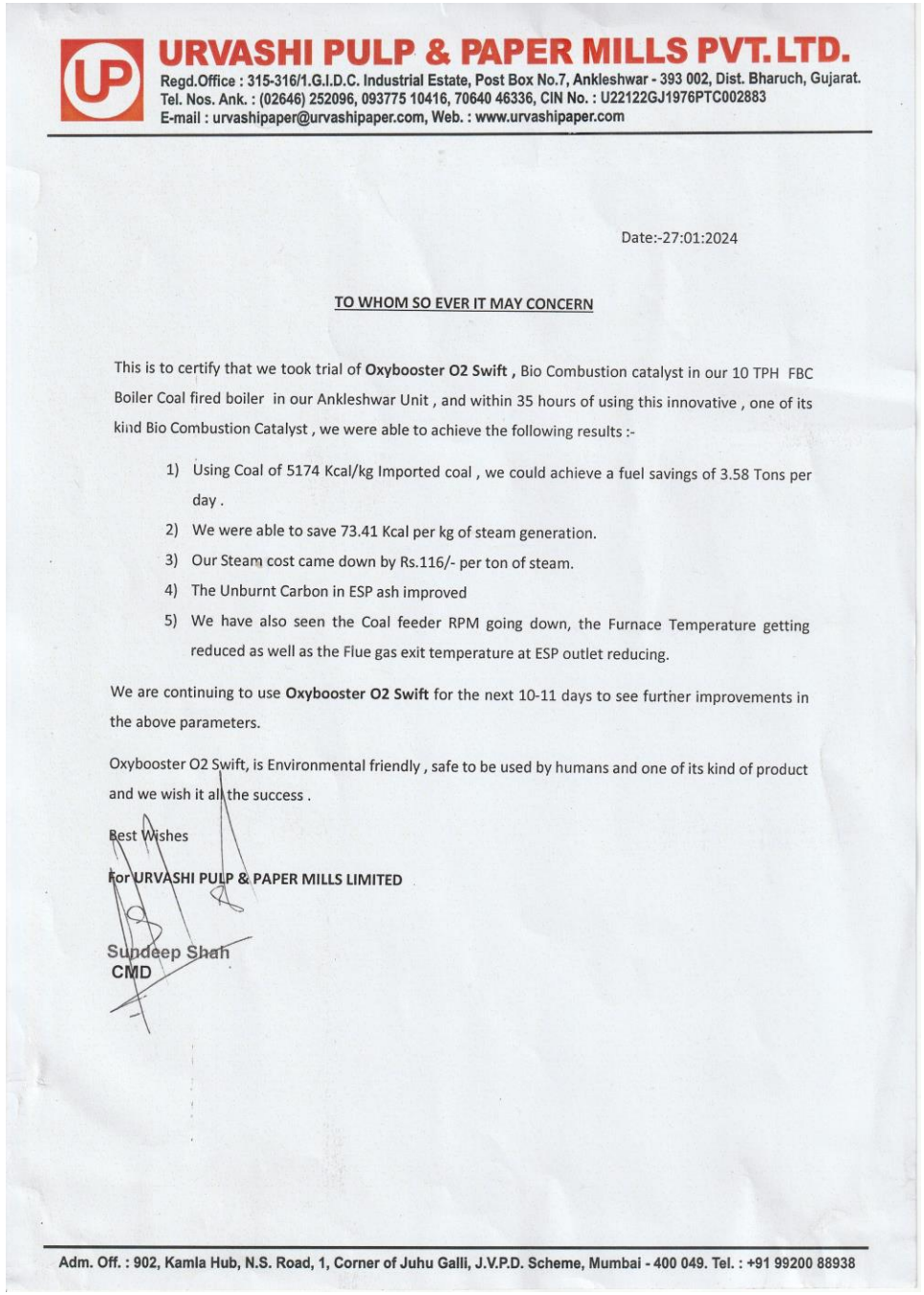
Client : Urvashi Pulp & Paper Mills Pvt Ltd, Ankleshwar , Gujarat

Performance after 35 hours of using Oxybooster O2 Swift

- **Steam Cost achieved – Rs. 1227.20 per Ton of Steam** → **Cost reduced by Rs.116.62 per ton of steam**
- **Heat input Saved per Kg of Steam – 73.41 Kcal/Kg** → **Fuel Savings Of 3581 Kgs per Day**

Nett Savings in Fuel Cost per Day = Rs.23,008/-
Nett Savings in Fuel Cost per Annum = Rs.75.92 Lakhs

Appreciation Letter of Our Client



URVASHI PULP & PAPER MILLS PVT. LTD.

Regd.Office : 315-316/1.G.I.D.C. Industrial Estate, Post Box No.7, Ankleshwar - 393 002, Dist. Bharuch, Gujarat.
Tel. Nos. Ank. : (02646) 252096, 093775 10416, 70640 46336, CIN No. : U22122GJ1976PTC002883
E-mail : urvashipaper@urvashipaper.com, Web. : www.urvashipaper.com

Date:-27:01:2024

TO WHOM SO EVER IT MAY CONCERN

This is to certify that we took trial of **Oxybooster O2 Swift ,** Bio Combustion catalyst in our 10 TPH FBC Boiler Coal fired boiler in our Ankleshwar Unit , and within 35 hours of using this innovative , one of its kind Bio Combustion Catalyst , we were able to achieve the following results :-

1) Using Coal of 5174 Kcal/kg Imported coal , we could achieve a fuel savings of 3.58 Tons per day .
2) We were able to save 73.41 Kcal per kg of steam generation.
3) Our Steam cost came down by Rs.116/- per ton of steam.
4) The Unburnt Carbon in ESP ash improved
5) We have also seen the Coal feeder RPM going down, the Furnace Temperature getting reduced as well as the Flue gas exit temperature at ESP outlet reducing.

We are continuing to use **Oxybooster O2 Swift** for the next 10-11 days to see further improvements in the above parameters.

Oxybooster O2 Swift, is Environmental friendly , safe to be used by humans and one of its kind of product and we wish it all the success .

Best Wishes

for URVASHI PULP & PAPER MILLS LIMITED

Sundeep Shah
CMD

Adm. Off. : 902, Kamla Hub, N.S. Road, 1, Corner of Juhu Galli, J.V.P.D. Scheme, Mumbai - 400 049. Tel. : +91 99200 88938

OxyBooster Swift™ O2

Case Study - Writing & Printing Paper Mill

Client : Kuantam Papers Limited , Saila Khurd , Punjab

Power Plant	:	30 MW
Boiler Type	:	CFBC
Make	:	IJT
Capacity	:	130 TPH / 110 kgcm2 / 545 Deg.C
Steam Gen. Per Day	:	2833 Tons per Day
Total Fuel per Day	:	584.6 Tons
Fuel Used	:	Indian Coal - 3954 CV – 76% Khuddi - 3118 CV - 14% Wood Dust - 2334 CV - 5% Straw Dust – 3222 CV - 5%
Aver. Fuel Cost Per Ton	:	Rs.6323 / Ton

Client : Kuantam Paper Limited , Punjab

Challenges faced by Client

- Improper Combustion due to Multi Fuel combination
- Varying quality of fuel mixture , Increase of Biomass leading to O2 Levels becoming 0
- Higher Unburnt Carbon in Ash .
- Average Steam Generation per Day = 2833 Tons / Day
  Average Mix Fuel consumption per Day = 584.6 Tons / Day.

Dosage of Oxybooster O2 Swift suggested & KPI

- Oxybooster O2 Swift feeding per Day = 101 Kgs
- Guaranteed Key Performance Indicator (KPI)

  Heat input saved per Kg of steam generation = 23 Kcal / Kg of Steam

Fuel Cost Savings Proposals – Paper Plants

Client : Writing & Printing Paper plant in Punjab

KUANTUM PAPERS LIMITED , SIALA KHURD

130 TPH , 110 KCSG , 545 Deg.C SH - CFBC

	W/OUT OB	WITH OB
PRESSURE , Kg/cm2	104.2	103.0
STEAM TEMPERATURE , Deg.C	538.0	537.8
STEAM ENTHALPY , Kcal/Kg	828.1	828.6
FEED WATER ENTHALPY , Kcal/kg	208.0	207.5

No of Days	Without Oxybooster	With Oxybooster
	16	7

FINAL CALCULATION DATE	25/12/2023

OXYBOOSTER TRIAL PROTOCOL RUN

SL NO	PARTICULARS	GCV PRE TRAIL	GCV DURING TRIAL	COST	STEAM GENERATION - PRE TRIAL PERIOD, TONS	STEAM GENERATION - DURING OXYBOOSTER TRIAL, TONS	BEFORE OB			AFTER OB		
							FUEL QTY , TONS	Weight %	HEAT INPUT	FUEL QTY , TONS		HEAT INPUT
1	Coal	3954.95	3917.22	7100	45330	16409.00	7096.00	75.86%		2428.00	76.0%	
2	Rice Husk						0	0.00%		0	0.0%	
3	Wood Dust	2333.85	2275.98	4000			473.00	5.06%		161.00	5.0%	
4	Khuddi (Vapsi)	3118.58	3205.83	4000			1349.00	14.42%		480.00	15.0%	
5	Straw Dust	3222.59	3151.66	3500			397.00	4.24%	34748196000	127.00	4.0%	11819186812
6	Others	2400.00		2000			39.00	0.42%		0.00	0.00%	
7	Oxybooster O2 Sync Gold	3800		0						0	0.00%	
8	Oxybooster O2 Shield	3800		0						0	0.0%	
9	Oxybooster O2 Swift	3800	3800	425000						0.707	0.02%	
10										0	0.00%	
							9354			3196.71		

	Without Oxybooster	With Oxybooster
HEAT INPUT IN KCAL PER KG OF STEAM - BEFORE OXYBOOSTER	766.56	
HEAT INPUT IN KCAL PER KG OF STEAM - WITH OXYBOOSTER	720.29	
SAVINGS IN HEAT INPUT IN KCAL PER KG OF STEAM	46.27	
Heat Input in Kcal	34748196000	11887251700
Heat Output in Kcal	28109133000	10191958080
Thermal Efficiency	80.89%	85.74%
DIFFERENCE IN THERMAL EFFICIENCY		4.84%

RESULTS SUMMARISED BY

SUPREME ENERGY SOLUTIONS

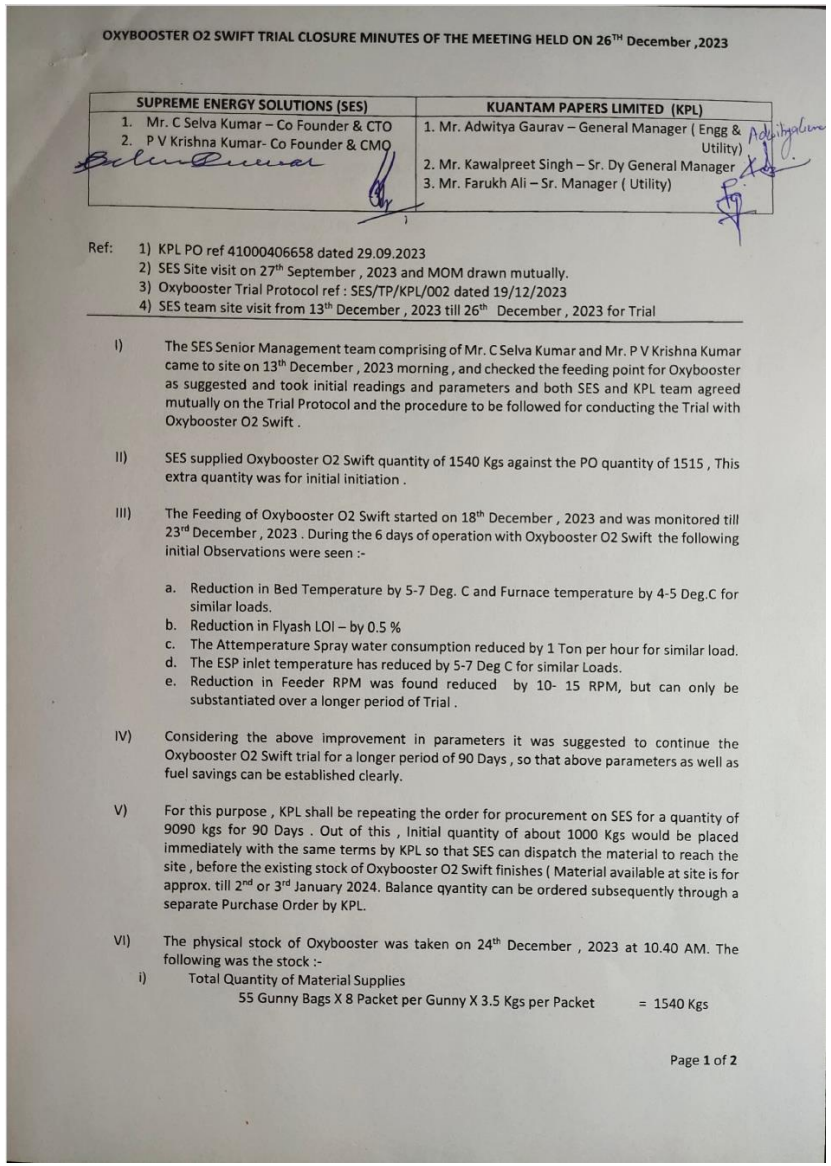
SUPREME ENERGY SOLUTIONS Trichy - 620 021

	PRE TRIAL	DURING TRIAL
S F RATIO	4.85	5.13

Client : Kuantam Paper Limited , Punjab

Heat Input per Kg of Steam achieved was 46 Kcal as against a guaranteed figure of 23 Kcal per Kg of Steam.

Kuantum Paper Management decided to go for 90 Days Further usage to establish the consistency in the result achieved



OXYBOOSTER O2 SWIFT TRIAL CLOSURE MINUTES OF THE MEETING HELD ON 26TH December ,2023

SUPREME ENERGY SOLUTIONS (SES)	KUANTAM PAPERS LIMITED (KPL)
1. Mr. C Selva Kumar – Co Founder & CTO 2. P V Krishna Kumar- Co Founder & CMO	1. Mr. Adwitya Gaurav – General Manager (Engg & Utility) 2. Mr. Kawalpreet Singh – Sr. Dy General Manager 3. Mr. Farukh Ali – Sr. Manager (Utility)

Ref:
1) KPL PO ref 41000406658 dated 29.09.2023
2) SES Site visit on 27th September , 2023 and MOM drawn mutually.
3) Oxybooster Trial Protocol ref : SES/TP/KPL/002 dated 19/12/2023
4) SES team site visit from 13th December , 2023 till 26th December , 2023 for Trial

I) The SES Senior Management team comprising of Mr. C Selva Kumar and Mr. P V Krishna Kumar came to site on 13th December , 2023 morning , and checked the feeding point for Oxybooster as suggested and took initial readings and parameters and both SES and KPL team agreed mutually on the Trial Protocol and the procedure to be followed for conducting the Trial with Oxybooster O2 Swift .

II) SES supplied Oxybooster O2 Swift quantity of 1540 Kgs against the PO quantity of 1515 , This extra quantity was for initial initiation .

III) The Feeding of Oxybooster O2 Swift started on 18th December , 2023 and was monitored till 23rd December , 2023 . During the 6 days of operation with Oxybooster O2 Swift the following initial Observations were seen :-

a. Reduction in Bed Temperature by 5-7 Deg. C and Furnace temperature by 4-5 Deg.C for similar loads.
b. Reduction in Flyash LOI – by 0.5 %
c. The Attemperature Spray water consumption reduced by 1 Ton per hour for similar load.
d. The ESP inlet temperature has reduced by 5-7 Deg C for similar Loads.
e. Reduction in Feeder RPM was found reduced by 10- 15 RPM, but can only be substantiated over a longer period of Trial .

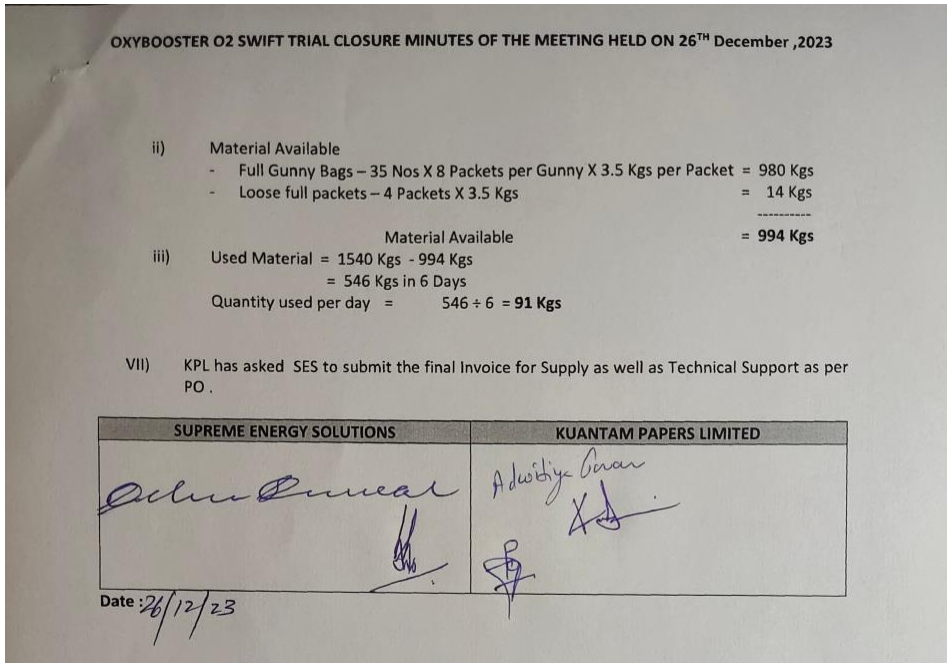
IV) Considering the above improvement in parameters it was suggested to continue the Oxybooster O2 Swift trial for a longer period of 90 Days , so that above parameters as well as fuel savings can be established clearly.

V) For this purpose , KPL shall be repeating the order for procurement on SES for a quantity of 9090 kgs for 90 Days . Out of this , Initial quantity of about 1000 Kgs would be placed immediately with the same terms by KPL so that SES can dispatch the material to reach the site , before the existing stock of Oxybooster O2 Swift finishes (Material available at site is for approx. till 2nd or 3rd January 2024. Balance qyantity can be ordered subsequently through a separate Purchase Order by KPL.

VI) The physical stock of Oxybooster was taken on 24th December , 2023 at 10.40 AM. The following was the stock :-

i) Total Quantity of Material Supplies
55 Gunny Bags X 8 Packet per Gunny X 3.5 Kgs per Packet = 1540 Kgs

Page 1 of 2



OXYBOOSTER O2 SWIFT TRIAL CLOSURE MINUTES OF THE MEETING HELD ON 26TH December ,2023

ii) Material Available
- Full Gunny Bags – 35 Nos X 8 Packets per Gunny X 3.5 Kgs per Packet = 980 Kgs
- Loose full packets – 4 Packets X 3.5 Kgs = 14 Kgs

Material Available = **994 Kgs**

iii) Used Material = 1540 Kgs - 994 Kgs
= 546 Kgs in 6 Days
Quantity used per day = 546 ÷ 6 = **91 Kgs**

VII) KPL has asked SES to submit the final Invoice for Supply as well as Technical Support as per PO .

SUPREME ENERGY SOLUTIONS	KUANTAM PAPERS LIMITED
	Adwitya Gaurav

Date : 26/12/23

Case Study - 130 TPH CFBC Boiler, 110 Kg/cm2 , 545 Deg.C

Client : Cement Factory in Chattisgarh

Power Plant	:	**30 MW**
Boiler Type	:	**CFBC**
Make	:	**IJT**
Capacity	:	**130 TPH**
Pressure	:	**110 Kg/cm2**
Temperature	:	**545 Deg.C**
Fuel Used	:	**Linkage Coal**
GCV range	:	**2700 to 3400 Kcal/Kg**

Savings Achieved at Cement Factory Due to Oxybooster O2 Swift Trial

Sl no	Particulars	Formula	UOM	Before Trial	During Trial
1	Number of days Considered		Days	11	11
2	Steam Generation	Cumulative steam for 11 days	Kgs	24750000	23248000
3	Average GCV of Coal	Average CV of 11 days Coal GCV	Kcal/kg	3025	3498
4	Enthalpy of Steam at 106 Kg/cm2 Pressure	Average	Kg/cm2	829.21	
5	Enthalpy of Feed water at 230 Deg.C	Average	Kcal/Kg	230	
6	Heat Input for 11 Days	= Coal GCV X Quantity of Coal	Kcal	17466874909.091	15480973104.167
7	Heat Input per Kg of Steam	= Total Heat Input for 11 Days ÷ Steam Generation	Kcal	705.732	665.906
8	Heat Input saved per kg of steam	= Heat input before trial – Heat input during trial	Kcal	-	39.827
9	Savings in Heat input per Kg of steam during trial period	= Savings in Heat input X Steam Generation during Trial	Kcal	-	925891860.946 ~ 925 Million Kcal
10	Savings in Coal for the Trial Period	= Total Heat input Saved ÷ GCV of Fuel	Kgs	-	306070.75
11	Savings in Coal Per day	= Total Savings ÷ No of days	Kgs	-	27824.614

SUMMARY OF UTILITY VALUES - BEFORE & DURING TRIAL

SL NO	PARTICULARS	BEFORE OXYBOOSTER TRIAL 11 DAYS 14th to 28th Feb 2023	DURING OXYBOOSTER TRIAL 11 DAYS 11th to 21st March 2023
1	Total power Generation , MW	5699.97	5348.83
2	Total Steam Generation , Tons	24725.00	23195.00
3	Total Feed Water in Ton	23829.36	22304.62
4	Total Attemperator Water , in Tons	1578.64	1365.89
5	Total Air consumption in Tons	34334.75	28591.00

PER MW CONSUMPTION IN TONS		
PARTICULARS	BEFORE OXYBOOSTER TRIAL	DURING TRIAL OF OXYBOOSTER
STEAM	4.34	4.33
AIR	6.02	5.35
FEED WATER	4.18	4.17
ATTEMPERATOR WATER	0.28	0.26

Savings Achieved at Cement Factory Due to Oxybooster O2 Swift Trial - MOM copy

MINUTES OF THE MEETING HELD AT NUVISTA , RISDA CEMENT WORKS FOR TRIAL OF COMBUSTION BIO CATALYST – OXYBOOSTER SWIFT ON 24.3.2023

NU VISTA LIMITED (NVL)	CHEAR INDIA PVT LTD (CIPL)
1. Mr. Sravan Kumar	1. Mr. C . Selva Kumar
2. Mr. Chandan Kumar Sharma	2. Mr. P V Krishna Kumar
3. Mr. Arunendu Kumar Singh	3. Mr. P T K Sunderavel
4. Mr. Y K Deepak	4. Mr. T. Balachandar.

Ref : i) NVL Purchase Order no 4900068176 dated 07.12.2022 for Trial of Oxybooster Swift for Coal consumption reduction in 130 TPH CFBC Boiler

ii) Trial Protocol dated 6th March , 2023 jointly signed by NVL and CIPL .

Iii) Pre trial dates - 14th February 2023 to 28th February 2023

Oxybooster Swift Trial - 11th March 2023 to 21st March , 2023

---

1) CIPL 's Oxybooster Swift trial team reached site on 2nd March to check and start pre-trial activities for provision of feeding Oxybooster into the furnace via the Lime stone bunker point.
2) As per protocol , the data for pre trial period (14th February , 2023 to 28th February , 2023) was collected and corelated in the approved format. The average GCV of Coal was 3044 Kcal/kg.
3) The Trial with Oxybooster Swift was started on 10th March ,2023 with single feeding 2 Kgs for every ½ hour , alternately in both feeders. Continuous feeding of Oxybooster Swift was undertaken from 12th March 2023 in both feeders , alternately.
4) The readings for computation for calculation purposes was taken upto 21st March , 2023 – 0001 Hrs , as per mutual consent between NVL & CIPL . The feeding of available Oxybooster Swift quantity will end on 24th March 2023
5) The Feeding quantity of Oxybooster Swift was done as follows

Sl no	Particulars	Date	Quantity
1	Pre Trial Quantity	6.3.2023	36 Kgs
2	Initiation quantity 104 Kgs per Day	10.3.2023 to 12.3.2023	312 Kgs
3	Regular feeding Quantity @ 96 Kgs per day	13.3.2023 to 24.3.2023	1152 Kgs
	Total Quantity		**1500 Kgs**

6) As per Purchase Order , a coal saving of 12 Tons per day was to be established over the Oxybooster Trial period . As per the Trial Completion Protocol , the following parameters are established :-

Sl no	Particulars	UOM	Pre Trial	During Trial
1	Number of Days considered	Day	11	11
2	Total Steam Generation	Tons	24750000	23248000
3	Coal Consumption	Tons	5774	4425.8
4	Average GCV of Coal	Kcal/kg	3025	3498
5	Total Heat Input for Trial period	Kcal	17466874909.091	15480973104.1667
6	Heat per Kg of Steam	Kcal	705.732	665.906

MINUTES OF THE MEETING HELD AT NUVISTA , RISDA CEMENT WORKS FOR TRIAL OF COMBUSTION BIO CATALYST – OXYBOOSTER SWIFT ON 24.3.2023

7	Savings in Heat per Kg of Steam	Kcal	-	39.827
8	Savings in Heat Input per Kg of Steam for Trial Period	Kcal	-	925891860.946
9	Savings in Coal for the trial period	Kgs	-	306070.75
10	Coal Saved per Day	Kgs	-	**27824**

7) Other noticeable changes observed during the trial of Oxybooster Swift was
   a. Reduction in Bed and Furnace Temperature .
   b. Δt between Furnace and Bed Temperature reduced and Thermal equiliburium established at combustion zone.
   c. Reduction in ESP inlet temperature
   d. Reduction in radiation losses in combustion zone.
   e. Reduction in Auxiliary power
   f. Reduction in Attemperator water consumption.
   g. Reduction in Total Air flow.

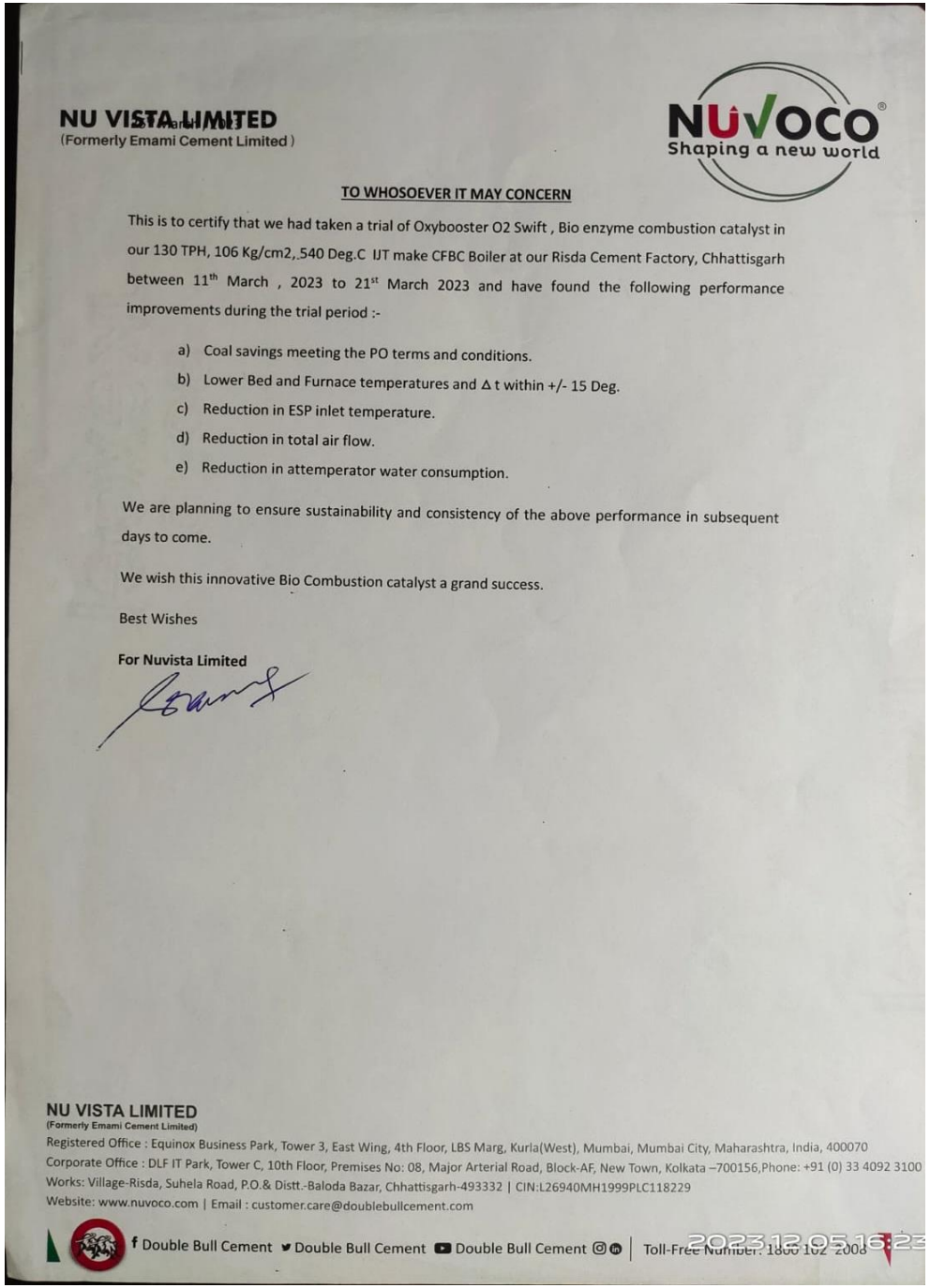
8) After the consent of NVL , CIPL to submit the final Invoices for Supply as well as for Travel as per the PO , within a weeks time.
9) CIPL requested NVL to close the PO and release the balance payment due to them and also issue them a Letter of Appreciation .

CIPL	NVL
C.SELVAKUMAR 24/3/23 P.V. KRISHNA KUMAR 24/3/23 P.T.K. SUNDARA VEL 24/03/2023 T. Balachandar 24/3/23	The above parameters are found in order, however NVL team will study the behaviour of the boiler after the trial I.e. from 25.3.2023 again to ascertain the findings and furtherance will be decided accordingly . The result is encouraging however we will again review the parameters & behaviour of pre & post trial. Chandan Sharma 24/3/23 Arunendu Kr Singh 24/3/23 24/03/2023

Date : 24.3.2023

OxyBooster Swift™ O2

Appreciation Letter of Our Client



NU VISTA LIMITED
(Formerly Emami Cement Limited)

NUVOCO Shaping a new world

TO WHOSOEVER IT MAY CONCERN

This is to certify that we had taken a trial of Oxybooster O2 Swift , Bio enzyme combustion catalyst in our 130 TPH, 106 Kg/cm2, 540 Deg.C IJT make CFBC Boiler at our Risda Cement Factory, Chhattisgarh between 11th March , 2023 to 21st March 2023 and have found the following performance improvements during the trial period :-

a) Coal savings meeting the PO terms and conditions.
b) Lower Bed and Furnace temperatures and Δ t within +/- 15 Deg.
c) Reduction in ESP inlet temperature.
d) Reduction in total air flow.
e) Reduction in attemperator water consumption.

We are planning to ensure sustainability and consistency of the above performance in subsequent days to come.

We wish this innovative Bio Combustion catalyst a grand success.

Best Wishes

For Nuvista Limited

NU VISTA LIMITED
(Formerly Emami Cement Limited)
Registered Office : Equinox Business Park, Tower 3, East Wing, 4th Floor, LBS Marg, Kurla(West), Mumbai, Mumbai City, Maharashtra, India, 400070
Corporate Office : DLF IT Park, Tower C, 10th Floor, Premises No: 08, Major Arterial Road, Block-AF, New Town, Kolkata –700156,Phone: +91 (0) 33 4092 3100
Works: Village-Risda, Suhela Road, P.O.& Distt.-Baloda Bazar, Chhattisgarh-493332 | CIN:L26940MH1999PLC118229
Website: www.nuvoco.com | Email : customer.care@doublebullcement.com

f Double Bull Cement Double Bull Cement Double Bull Cement | Toll-Free Number: 1800 102 2008

2023.12.05 16:23

OxyBooster Swift™ O_2

Case Study - 25 TPH CVL FBC & 33 TPH FV Puls. Grate Boiler

Client : German Multinational Tyre manufacturer in Meerut , UP

- **Coal Savings & Reduction of Unburnt Carbon in Ash**
- **100% Biomass firing in 25 TPH FBC Boiler without any modifications**

Case Study - 25 TPH CVL FBC Boiler

Comparison of Operating Parameters

SL NO	PARTICULARS	DATE	30.12.2020	06.01.2021	29.12.2020	03.01.2021	03.01.2021	04.01.2021	30.12.2020	02.01.2021	05.01.2021	29.12.2020	30.12.2020	02.01.2021	02.01.2021	03.01.2021	29.12.2020	01.01.2021	01.01.2021	02.01.2021	29.12.2020	02.01.2021	01.01.2021	05.01.2021
		TIME	10.59.11 Hrs	13.02 Hrs	15.16.14 Hrs	16.02.21 Hrs A	13.33.07 Hrs	11.13 Hrs	11.30.42 Hrs	11.38.39 Hrs	15.05 Hrs	15.30.15 Hrs	09.18.11 Hrs	13.38.39 Hrs	16.34.22 Hrs	10.17.16 Hrs	18.51.41Hrs	10.17.04 Hrs	18.21 Hrs	9.07.13 Hrs	16.05.32 Hrs	12.59.48 Hrs	11.06.01 Hrs	16.11 Hrs
1	Steam Flow , T/Hr		15.1	15.1	14.3	14.3	14.1	14.4	12.6	12.6	12.5	11.7	11.6	11.6	11.6	11.8	10.6	10.6	10.7	10.8	9.3	9.5	9.1	9.8
2	Steam Pressure , Kg/cm2		21.1	21.4	21.5	21.2	21.3	21.3	20.9	21.7	21.8	21.9	21.1	21.5	21	21.9	22	21.8	21.8	21.7	22.1	22.4	22.2	21.6
3	Furnace Temperature, Deg.C		710.8	706	708.3	714.9	714.6	711	648.3	709.4	680	677.8	630.2	684.4	641.7	687.5	634.4	666.3	654.5	658.7	619.1	653.5	620.5	609
4	Flue Gas Exit Temperature , Dec. C		146.2	143	142.2	144.8	142.4	142	143.2	141	143	141.1	142.5	140.3	141.7	141.8	142	142.4	143.6	142.4	141	140.5	141.7	141
5	Feed Water (Inlet)Temperature , Deg. C																							
6	Feed Water (Outlet)Temperature , Deg. C																							
7	Compartment # 1 - Top Temperature , Deg. C		951.4	876	974	106.9	612.2	825	886.5	865.6	831	937.2	854.5	843.1	769.1	560.8	889.2	891	712.5	340.3	854.9	801.7	820.8	736
8	Compartment # 1 - Bottom Temperature , Deg. C		970.8	854	976.8	953.8	975.3	973	895.5	966.7	928	958.3	897.6	957.3	891.7	935.8	908	931.9	884.7	897.2	875	919.8	861.5	844
9	Compartment # 2 - Top Temperature , Deg. C		947.4	954	964.9	920.1	969.1	894	871.2	944.4	918	930.2	880.6	927.8	835.4	916.3	896.2	924.3	708.3	894.4	839.6	905.6	825.3	726
10	Compartment # 2 - Bottom Temperature , Deg. C		892	892	897.6	910.1	932.6	917	813.5	894.1	794	861.5	836.8	880.2	803.5	892.4	842.7	849.3	838.5	874.7	750.3	849	795.1	618
11	Compartment # 3 - Top Temperature , Deg. C		834.4	824	819.8	864.6	892.4	868	697.9	797.2	700	778.8	808.3	817.4	763.9	859.4	845.5	850.7	784	858.3	685.1	681.3	778.5	433
12	Compartment # 3 - Bottom Temperature , Deg. C		927.1	949	964.2	920.5	950.3	927	853.5	933.3	915	934.4	883	922.9	835.8	914.6	905.2	901.7	858.3	888.5	854.2	894.4	835.1	806
13	Coal Feeder # 1 RPM		750	350	500	400	400	300	600	200	300	300	400	200	200	200	300	200	250	200	300	200	200	200
14	Coal Feeder # 2 RPM		700	350	450	400	300	300	600	250	300	300	300	200	200	250	300	200	250	200	300	200	200	200
15	Coal Feeder # 3 RPM		750	350	500	400	400	300	600	200	300	300	400	200	200	250	300	200	250	200	300	200	200	200
16	Coal Feeder # 4 RPM		750	350	450	400	300	300	600	250	300	300	300	200	200	200	300	200	250	200	300	200	200	200
17	Coal Feeder # 5 RPM		500	350	500	400	400	300	500	200	300	300	400	200	200	200	300	200	250	200	300	200	200	200
18	Coal Feeder # 6 RPM		750	350	450	400	300	300	600	250	300	300	300	200	200	250	300	200	250	200	300	200	200	200
19	% Reduction in RPM of Feeder		100%	*47%*	100%	*89%*	*67%*	*67%*	100%	*42%*	*50%*	100%	100%	*67%*	*67%*	*83%*	100%	*67%*	*83%*	*67%*	100%	*67%*	*67%*	*67%*

	Before Using Oxybooster
	During Trials of Oxybooster

- ✓ **ΔT between top and bottom bed temperature reduced**
- ✓ **Furnace temperature dropped for similar loads**
- ✓ **Coal feeder RPM dropped between 40% to 70%**

Case Study - 25 TPH CVL FBC Boiler

Reduction in Unburnt Carbon & Fuel Savings

Before use of Oxybooster

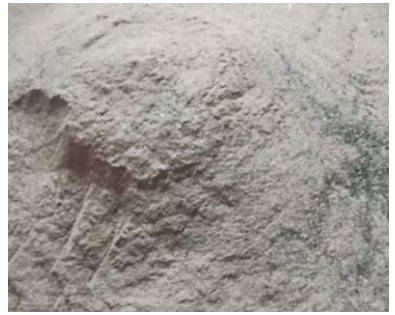
Unburnt Carbon 18 -19% With Imported Coal

APH bottom Ash

Bank Zone Ash

MDC Bottom Ash

During usage of Oxybooster



Unburnt Carbon Reduced to 6 -7% While using Oxybooster

Case Study - 33 TPH FV Pulsating Grate Boiler

Reduction in Unburnt Carbon & Fuel Savings

Before use of Oxybooster

Within 48 Hour of using Oxybooster

Bed Ash

Fly Ash

OxyBooster Swift™ O_2

Case Study - 25 TPH CVL FBC Boiler

100% Biomass firing without any modifications

Challenge Faced by the Tyre Plant

- Banning of Coal firing in Delhi NCR Region , forcing use Biomass in FBC Boiler
- FBC Boiler designed on 100% Coal , not suitable for Biomass firing
- Different Quality of Biomass Pallets of different size distribution - 6 mm to 20 mm

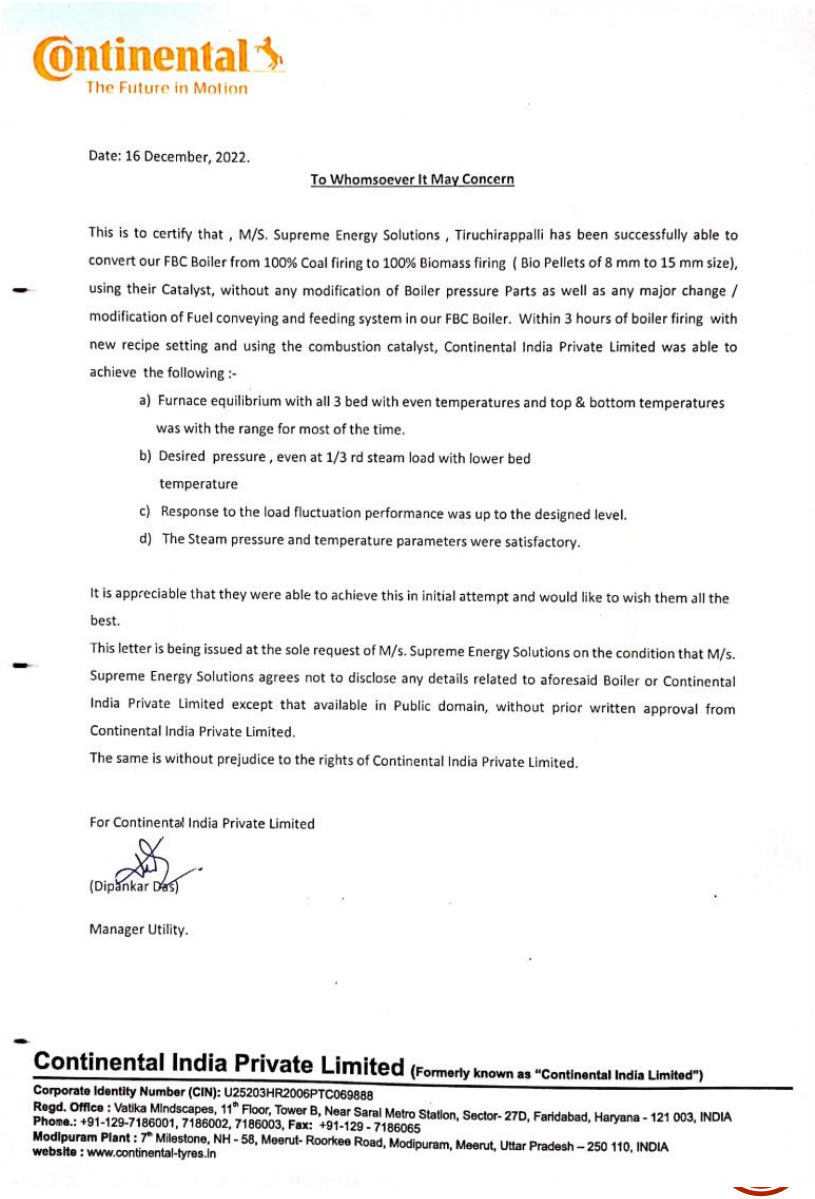
OxyBooster Swift™ O_2

Case Study - 25 TPH CVL FBC Boiler

100% Biomass firing without any modifications

Solution by Supreme Energy Solutions

- **Achieved 100% Biomass firing with pallet size 6 mm to 15 mm , using underbed feeding without changing the PA line , Mixing Nozzles or any of the pressure parts etc.**
- **Boiler Parameters stabilized within 3 Hours of firing**
- **Quick response to varying pressure drawl by plant and Dry saturated steam - reducing steam consumption**
- **Have recommended to go in for higher size PA lines and Fuel & Air nozzles as well as seperate fuel feeding arrangement for contineous full load operations.**



Continental
The Future in Motion

Date: 16 December, 2022.

To Whomsoever It May Concern

This is to certify that , M/S. Supreme Energy Solutions , Tiruchirappalli has been successfully able to convert our FBC Boiler from 100% Coal firing to 100% Biomass firing (Bio Pellets of 8 mm to 15 mm size), using their Catalyst, without any modification of Boiler pressure Parts as well as any major change / modification of Fuel conveying and feeding system in our FBC Boiler. Within 3 hours of boiler firing with new recipe setting and using the combustion catalyst, Continental India Private Limited was able to achieve the following :-

a) Furnace equilibrium with all 3 bed with even temperatures and top & bottom temperatures was with the range for most of the time.
b) Desired pressure , even at 1/3 rd steam load with lower bed temperature
c) Response to the load fluctuation performance was up to the designed level.
d) The Steam pressure and temperature parameters were satisfactory.

It is appreciable that they were able to achieve this in initial attempt and would like to wish them all the best.

This letter is being issued at the sole request of M/s. Supreme Energy Solutions on the condition that M/s. Supreme Energy Solutions agrees not to disclose any details related to aforesaid Boiler or Continental India Private Limited except that available in Public domain, without prior written approval from Continental India Private Limited.

The same is without prejudice to the rights of Continental India Private Limited.

For Continental India Private Limited

(Dipankar Das)

Manager Utility.

Continental India Private Limited (Formerly known as "Continental India Limited")
Corporate Identity Number (CIN): U25203HR2006PTC069888
Regd. Office : Vatika Mindscapes, 11th Floor, Tower B, Near Saral Metro Station, Sector- 27D, Faridabad, Haryana - 121 003, INDIA
Phone.: +91-129-7186001, 7186002, 7186003, Fax: +91-129 - 7186065
Modipuram Plant : 7th Milestone, NH - 58, Meerut- Roorkee Road, Modipuram, Meerut, Uttar Pradesh – 250 110, INDIA
website : www.continental-tyres.in

CONCLUSION

1. Multi fuel firing in boilers to control Energy cost is inevitable – so are the challenges in boiler operations due to the heterogeneous nature of fuel .

2. The Use of Oxybooster O2 Swift - Bio Combustion catalyst can Reduce Energy cost , instantly , which is achieved by improving the combustion efficiency and reducing other losses.

   Gross Saving Potential - 3X (X – cost of Oxybooster O2 Swift)

3. Use of Oxybooster O2 Swift helps bring Sustainability by reducing consumption of Oxygen and Improving Environmental impact .

   It also helps reduce the Carbon Footprints and is eligible for Carbon Credit.

Thank You . . . .