



For a Clearer Sky

# Coroboth®

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Pulse Power System For ESP

**ELGIN SYSTEM INDIA PRIVATE LIMITED**



- ES IPL has the full fledged professional team to cater to the project implementation and services after sales.

## Corporates Brief

**Elgin System India Private Limited (ESIPL)** is incorporated by M/s Elgin System Inc., Canada in Raipur of Chhattisgarh State, India.

**Elgin System India Private Limited (ESIPL)** is engaged in the projects for pollution control of the Thermal Power Plant by adopting its core technology – COROBOTH<sup>®</sup> Pulse Power System for ESP Retrofit to reduce the particulates Emission .

## *Our Activities in Thermal Power Sector*

Globally more and more concerns have been expressed by the general public towards the control of the emission from the thermal power plants, that drives the need for the thermal power plants to restrain the emission as low as possible.

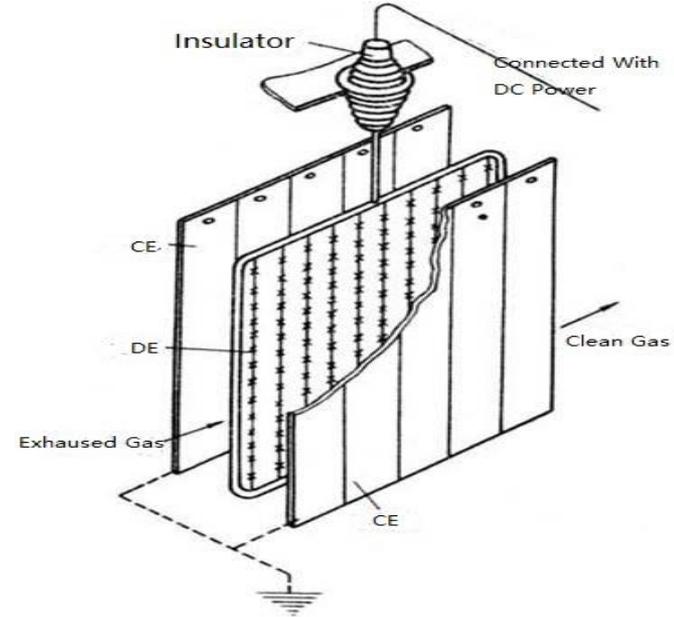
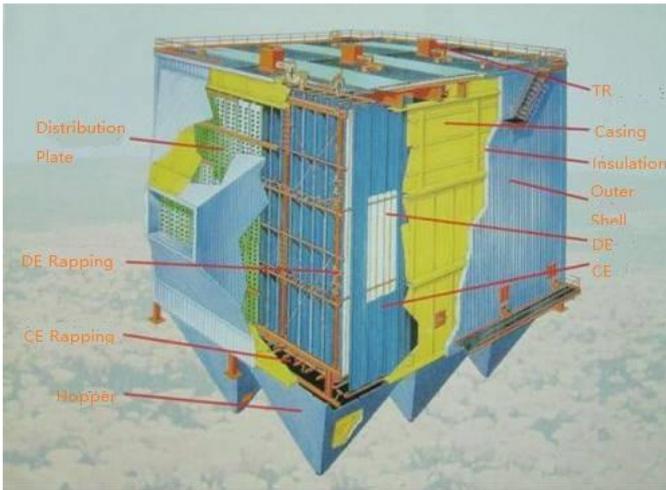
The governments gradually and steadily revise the emission policies to cater to the demands of the general public.

The thermal power plants, in deference to the call from the updated government rules/notifications as well as functioning its role with CSR, have to respond to the need.

We devote ourselves into the betterment of the performance of the ESP , a critical emission control equipment installed in the thermal power plant.

**What we do** is to utilize the advanced & matured technology developed by us to retrofit the installed ESP to improve its performance to satisfy the emission requirements.

## ESP PERFORMANCE PRINCIPLE



In ESP the flue gas stream is passed between two electrodes, across which a high potential difference is maintained. Out of the two electrodes, one is the discharging electrode and the other a collecting electrode. Because of high potential difference and the discharge system, a powerful ionizing system is formed. Gas ionization is the dissociation of gas molecules into free ions and potentials as high as 40-60kV are used. Consequently, ionization creates an active glow zone (blue electric discharge) called the corona or corona glow.

As the particulates in the carrier gas pass through this field, they get charged and migrate to the oppositely charged collecting electrode. The particles, once deposited on the collecting electrode, lose their charge and are removed mechanically by rapping or vibration to a hopper placed below.

## Most Probable reasons stated for under performance of ESP

### **Fundamental Problems**

- High Resistivity particles
- Re-entrainment of collected particles
- Poor gas flow
- Gas velocity too high

### **Mechanical Problems**

- Poor electrode alignment
- Vibrating or swinging corona wires
- Distorted collecting plates
- Excessive dust deposits on collecting electrodes and corona electrodes
- Air leakage into hopper, shells or gas ducts
- Formation of dust mountain in ESP inlet and outlet ducts

### **Operational problems**

- Full or overflow hoppers
- Shorted corona sections
- ESP overloaded by excessive gas flow
- Process upsets ( poor combustion, steam leaks, etc.)
- Rectifier sets or controls poorly adjusted
- Poor adjustment of rapper intensity/frequency

## The root factor for ESP performance

IS THE PROBLEM OF OVERHAULING & OPERATIONS?  
**OSTENSIBLY YES, BUT MATERIALLY NO.**

It is a known fact that all the mechanical and operation problems can be rectified/improved through the overhauling of the ESP and better operation practices.

It is also a known that even if after the correct overhauling of the ESP or betterment of the operation practices, the performance of ESP could not be at desired level. The reason is the high specific resistivity of the flying ash.

Mr. Pradip Kumar Mandal, NTPC, New Delhi and Mr. Tanuj Kumar, M.G. R. Educational & Research Institute, Chennai published their paper << ESP Performance in India Pulverized Coal Based Thermal Power Stations – Problems and Solutions>> in the year of 2006, which have pointed out clearly that:

“Due to presence of low sulphur and alkalis and consequently having very high ash resistivity ( $10^{12}\Omega\cdot\text{cm}$ — $10^{14}\Omega\cdot\text{cm}$ ) it is difficult to achieve good ESP performance.”

## IS THE PROBLEM OF HIGH ASH RESISTIVITY? OSTENSIBLY YES, BUT MATERIALLY NO.

The existing R & D also shows that :

1. It is easy for ESP to collect the flying ash with the specific resistivity between  $10^4\Omega\cdot\text{cm}$ -- $10^{10}\Omega\cdot\text{cm}$ .
2. It is not easy for ESP to collect the flying ash with the specific resistivity between  $10^{10}\Omega\cdot\text{cm}$ -- $10^{11}\Omega\cdot\text{cm}$  because the spark rate will increase whereas the voltage will decrease to affect the efficiency of the ESP.
3. It is hard or impossible for the ESP, under the conventional electric power supply system equipped, to collect the flying ash with the specific resistivity higher than  $10^{11}\Omega\cdot\text{cm}$  because there is the incurrance of the back corona and dramatically reduce the efficiency of the ESP.

## Our R & D shows

1. For the fly ash with the specific resistivity between  $10^4\Omega\cdot\text{cm}$ -- $10^{10}\Omega\cdot\text{cm}$  the collecting efficiency can be improved by increasing the density of the secondary current. **BUT the power consumption has to be increased.** Due to that large portion of the current is wasted in the fields.
2. For the flying ash with specific resistivity above  $10^{11}\Omega\cdot\text{cm}$ , the more particulates can be charged by increasing the secondary output. **BUT this results in the incurrence of the back corona** which decreases the collecting efficiency.
3. For DC power supply to ESP the back corona could be avoided through the intermittent power supply or Charge Ratio power supply, BUT the average voltage dramatically reduces whereas the peak voltage has no improvement. This can not substantially increase the collecting efficiency of ESP.

## *The dilemma:*

Once there is the severe incurrence of back corona, for the SCR power system, the only way to increase the collecting efficiency is to increase the field voltage of the ESP. But once the field voltage is increased the back corona will occur which again decreases the collecting efficiency.

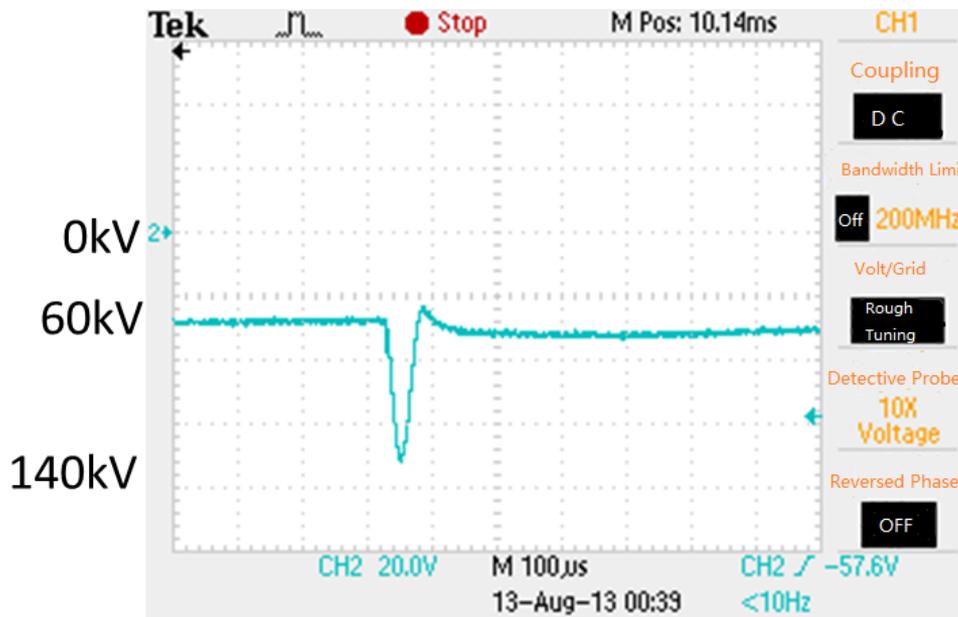
Hence for SCR power system for ESP there has to be a compromise, i.e. to select a relatively low average working voltage to restrain the back corona and then achieve the ideal collecting efficiency.

**WE HAVE THE SOLUTION - COROBOTH<sup>®</sup> SYSTEM**

## WHAT IS COROBOTH®?

Since 2008 we initiated the R & D for the power supply for the ESP to tackle the problem of poor performance and the dilemma as mentioned before. We officially launched the COROBOTH® system in the year of 2013.

COROBOTH® is High Frequency Fundamental Wave Superimposed DC power Supply. It outputs MW level energy periodically.



Equivalent Output Energy --- 16 MW

Pulse width --- < 50  $\mu$ s

Working Frequency --- 100 PPS

The field voltage can be increased to 90 kV to 140kV in transient time

## What are the silent features of COROBOTH®?

### 1. Capturing capacity & capability on the different particle size

Relationship between the particle size and particulate charge		Relationship of carrying capacities among different particulate sizes under different power supplies	
size ( $\mu\text{m}$ )	Carrying principle	Conventional DC Power	<b>COROBOTH®</b>
0.5-1.5	Diffusion Charge	1	<b>26 times</b>
10	Diffusion Charge	1	<b>20 times</b>
10-20	Both diffusion charge and electrical field charge	1	<b>17 times</b>
> 20	Electrical field charge	1	<b>0.95 times</b>

## What are the silent features of COROBOTH®?

2. Comparison of  $V_{ai}$  and  $V_p$  among different Power supply systems for ESP

Vai & Vp values comparison			
	SCR	HF	<b>COROBOTH®</b>
Vai	45kV	60kV	<b>60kV</b>
Vp	63kV	62kV	<b>140kV</b>
Vai × Vp	2835kV <sup>2</sup>	3720kV <sup>2</sup>	<b>8400kV<sup>2</sup></b>
Increased times of $\omega$	1	1.3	<b>3</b>

Coroboth® the effect on particle is 3 times of SCR type power supply and 2.3 times of HF power supply.

$\omega$  is the migration velocity.  $V_{ai}$  is the average voltage.  $V_p$  is the peak voltage.

## What are the silent features of COROBOTH®?

### 3. Comparison on other aspects for ESP efficiency

Description	Properties & Response	Collecting Efficiency under DC Power Supply	Collecting Efficiency under COROBOTH®
SiO <sub>2</sub>	Occupies majority portion of the flying ash with high specific resistivity above 10 <sup>11</sup> Ω·cm	Low	High
Al <sub>2</sub> O <sub>3</sub>			
Alkali (CaO, K <sub>2</sub> O)	Neutralization with SO <sub>3</sub> , Surface conduction reduces and resistance increases	High	High
Na <sub>2</sub> O	The more ratio and less resistance	High	Normal
SO <sub>3</sub>	The more ratio, surface conduction increases and resistance reduces	High	Normal
Un-burnt carbon	Specific resistivity of 10 <sup>2</sup> Ω·cm to 10 <sup>3</sup> Ω·cm	High	Normal
Temperature	At 150 degree Celsius the resistance reaches peak point, lower than this resistance reduces	At low temp.--- High	Normal

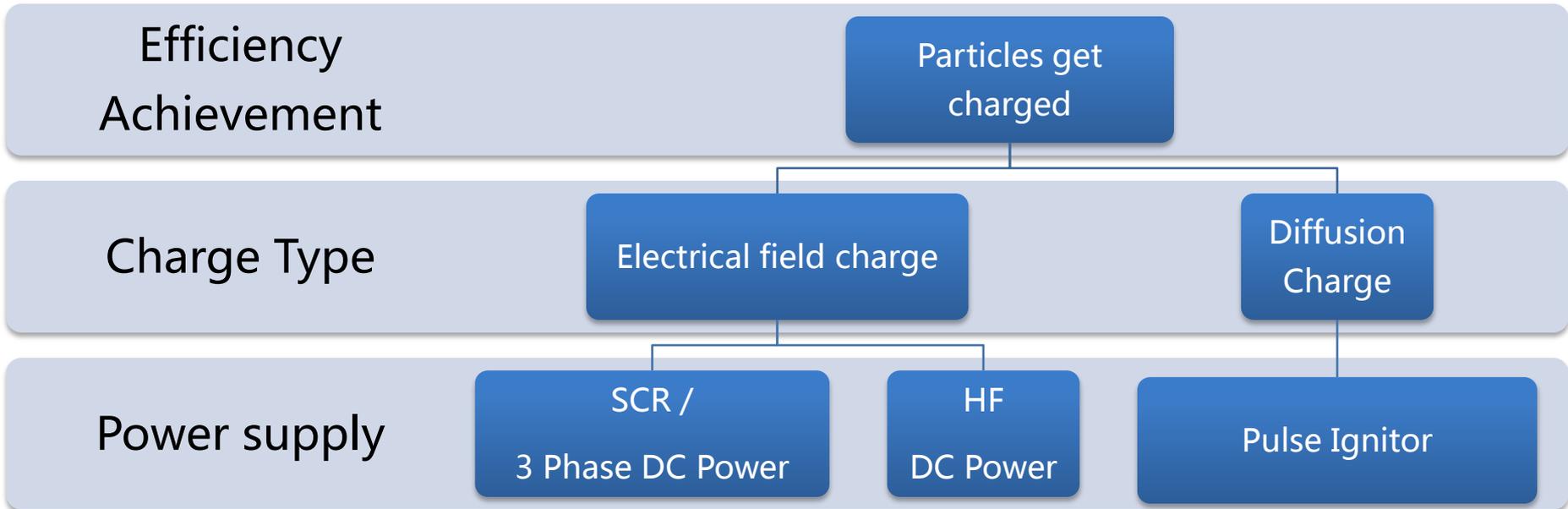
## What are the silent features of COROBOTH®?

### 4. Comparison on other aspects for ESP efficiency

Description	Properties & Response	Collecting Efficiency under DC Power Supply	Collecting Efficiency under COROBOTH®
NH3	<ul style="list-style-type: none"> <li>➤ Small portion reacts with Sox to form sticky and soft subjects which reduces the specific resistivity a little bit</li> <li>➤ When larger portion of NH3 counters the high resistivity ash to form more sticky subjects and difficulty to fall down which increases the resistance and incurs the back corona</li> </ul>	<p>Small portion --- High</p> <p>Large portion --- Chock</p> <p>Large portion --- Corrosion</p>	<b>Normal</b>
Moisture	Moisture in the flue gas and the SO3 can together affect the surface conduction of the ash, the more moisture the less resistance	High	<b>Normal</b>

What are the Silent features of COROBOTH®?

5. Electrical Field Charge & Diffusion charge



## What are the silent features of COROBOTH®?

### 6. Power Consumption - Comparison

Comparison of Input power of different power system under same collecting efficiency

Description	Unit	SCR	HF	COROBOTH®	Remark
DC Base voltage	kV	50	58	39	DC voltage Max. 60kV
Pulse voltage	kV			50	CE spacing of 400mm
PRF	Hz			100	
I Corona	mA	700	810	350	DC current Max. 1200mA
P Field consumption	kW	35	47	15	
P input	kW	55	52	18	

Coroboth® input power calculation formula:  $DC\ Base \times I\ Corona + V_{ps} \times I_{ps} \times 50 \times PRF \times 10^{-6}$

At the same emission level, Coroboth® Power consumption is over 67% less than SCR power.

## *What are the silent features of COROBOTH®?*

### 7. Capacity & Capability to Capture High Specific Resistivity Ash

**COROBOTH®** Pulse Power System has the capacity and capability to capture tiny and high specific resistivity ash.



## **Coroboth® Pulse Power System**

**Capacity & Capability ---- more than ten times**

**Pulse power TR temp. rising less than 10 °C**

Adopting special magnetic material and special architect design to ensure the temp. rising less than 10 °C.

**Isolation protection technology**

- All the DI, DO signals are isolated through optoelectronic system
- IGBT is driven by fiber.
- The driven power is dually isolated by isolated TR and switch power.

**Fault Protection technology**

- Dual watch dog (hardware & software)
- IGBT drive board has double over-current protection, both open circuit and short circuit protected.

**Advance insulation material and processing**

- The most international advanced insulation material and the insulation design are adopted.
- The acetylene emission is zero.

**Outdoor protection class and complete fault protection**

- The case adopts the industrial ABS with rigid construction.
- The protection class is IP55.
- Complete Fault protections are available.

**Upto 60°C working environmental temp.**

- The recycling air cooling technology adopted can blow away the heat generated by the equipment.
- Tested that it works even when the ambient temp. reaches 60 °C

## **Stable & Reliable**

### **SS and Anti-corrosion design**

- The control box, HV outlet flange, even small fixing bolts and nuts are of SS material.
- The base is Salt spray treated which ensures the reliable operation in the plant located at sea shore or in tropic area.

### **Highest level of screening of components**

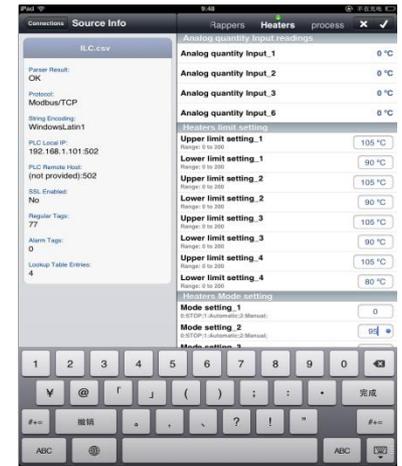
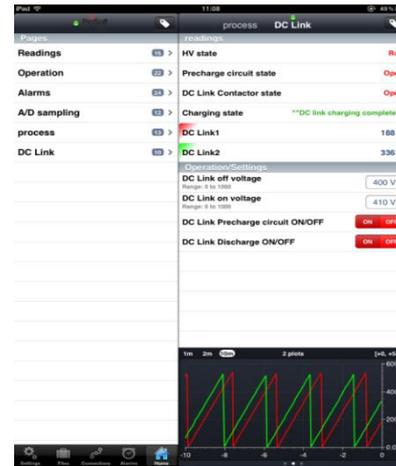
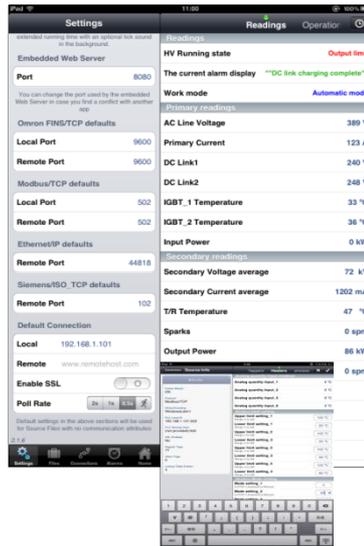
Coroboth® adopts the makes of the components of:  
ABB, SCHNEIDER, MIT LV electric components, INFINEON IGBT, TI chip, PHOENIX terminal, APPLE IPAD RTU, complex busbar, aviation sealing fitting, MOXA communication unit, IFIX configuration software

### **Severe thunderstorm stable operation**

The linear isolation and fiber transmission are adopted for the signals. All passed the thunderstorm test. COROBOTH® can safely be in operation under the thunderstorm weather condition.

# Wireless Operation System

To achieve the all weather on- site operation, the IPAD wireless RTU is developed to facilitate the operation.



# Summary of Coroboth<sup>®</sup> Pulse Power System

- > High efficiency for capturing particle less than PM10
- > High efficiency for capturing high specific ash resistivity particle
- > Improve ESP efficiency and substantially reduce emission
- > Reduce power consumption

## *COROBOTH<sup>®</sup> --- Service After Sales*



The project office at **Raipur, Chhattisgarh** for 24 X 7 quick response to the services as requested by the client.

*Once again*

The perfect solution for ESP efficiency improvement

**Coroboth®**

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