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中国国电 CHINA GUODIAN

Plasma Ignition and Combustion Stabilizing System (PICS)

A Fuel Oil Saving Technology for Coal Fired Power Plant

By

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Associate Partner

S & S Water and Power Projects Pvt. Ltd.

Contents

China Guodian Group

- One of the "Top Five" power generation groups in China
- Total installed generation capacity 143 GW as of Dec. 2016 (more than 10% of China's total installed capacity).
- Wind power capacity 25.8 GW.
- Business includes power generation, coal mining and development of new Power related technology.
- Yantai Longuyan Headquarter located in Yantai, with 800 employees located in China & USA.

S&S Water and Power Projects Pvt. Ltd.

- S & S Water and Power projects Pvt. Ltd., is an ISO 9001:2015 certified company provides Technical support, in Operation& Maintenance, Design and Engineering Power Projects, supply of spares &spare development and skill development of Technical Man Power for carrying out various Engineering projects.
- The company is professionally operated by qualified Engineers, the directors of the company have over 35 years of experience in various engineering field like development of power sector, water management, Rural Electrification and other engineering assignments.
- S & S Water and Power Projects Pvt. Ltd.,(INDIA) a registered company under the Companies Act in India, and is carrying out business in India and Abroad.
- S & S Power has dedicated team experienced engineers which has worked in various Thermal power Plants in operation & maintenance, design & engineering and construction management of the Thermal & Hydro power stations. With vast experience in engineering projects in general and Thermal Power Projects in particular.

Plasma Ignition

- Research to establish Plasma Ignition Technology has been tried by many universities , power research institutes and boiler manufacturers in US, Russia and other countries since 1970's and achieved remarkable progresses but with no commercial success.

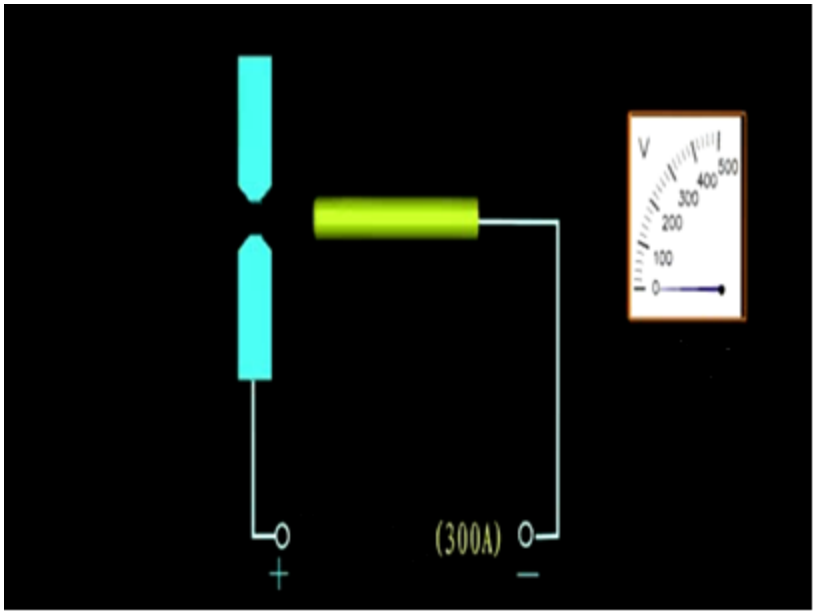
- Yantai Longyuan researched and experimented for several years, and developed the Plasma Ignition and Combustion Stabilization System (PICS). PICS was first successfully installed in a 50MW unit and achieved oil free startup in the year 2000.

Plasma Ignition

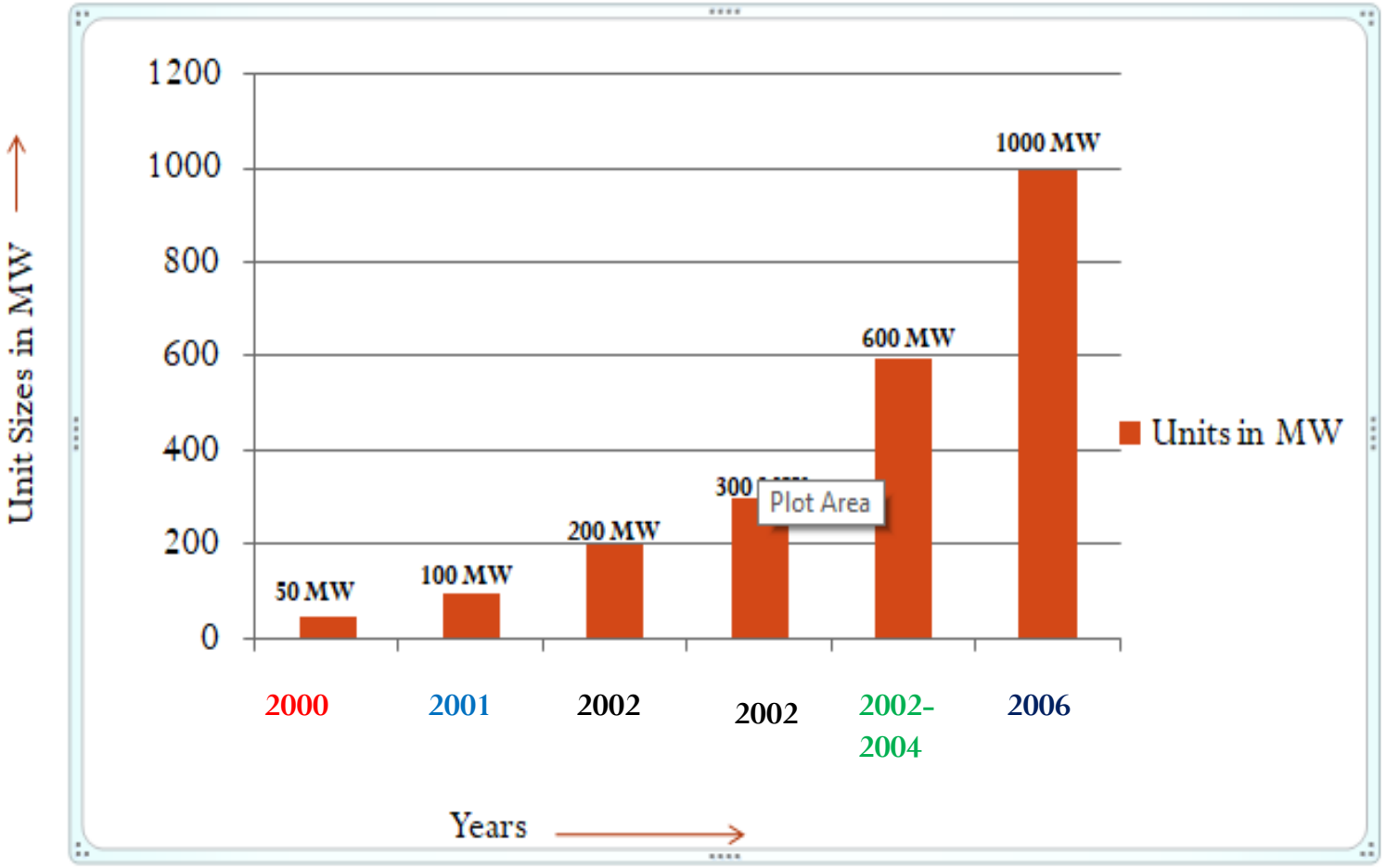
- Plasma is considered the 4th state of matter, where the particles always lie in ionised condition.

- When a certain portion of gas particles are ionized (a loss or gain of electrons of the molecules or atoms of the gas), the gas turns into a plasma, containing charged particles namely positive ions and negative electrons.

- High temperature of the order of 5,000°C is developed by the Plasma Technology.



Success Footprint of Plasma Ignition Technology



PICS Domestic Applications in China

As on Dec. 2016

NO.	Unit Capacity (MW)	No. of Units
1	1,000,1,036	41
2	600,660,670,680,800	307
3	300, 320, 330,350,360, 500	307
4	50 ~ 200	157
Total	352,198	812

- ✓PICS successfully ignites coal.
- ✓Adapted in tangentially fired and wall fired coal burners.
- ✓Adapted in different pulverizing systems: Indirect and direct fired systems.

PICS Overseas Projects

PICS has been successfully installed in the countries viz. Korea, Russia, China, Turkey, Tajikistan etc. Full list of PICS projects is as below:

Item	Name	Unit Capacity	Retrofit / New	Wall /Tangential	Coal Type	Plasma Burners Quantity per boiler
1	Korea Samchonpo	#1 560MW	Retrofit (2007)	T-fired	Bituminous	4
2	Korea Yonghung	#4 870MW	New	T-fired	Bituminous	4
3	Korea Hadong	#7、#8 500MW	New	T-fired	Bituminous	4
4	Russia Khabarovsk 3rd	#1 180MW	Retrofit	Side Wall opposite fired	Bituminous	8
5	China Taiwan Heping	#1, #2 600MW	Retrofit	T-fired	Bituminous	4

PICS Overseas Projects

Item	Name	Unit Capacity	Retrofit / New	Wall /Tangential	Coal	Plasma Burners Quantity per boiler
6	Indonesia Suralaya	#6 600MW	Retrofit	Wall-fired	High moisture bituminous	6
7	Korea Yonghung	#5, #6 870MW	New	Wall-fired	Bituminous	7
8	Turkey Eren	#1,#2,#3, #4 600MW	Retrofit	Wall-fired	Bituminous	4
9	Turkey Zetes (III)	2× 600MW	New	T-fired	Bituminous	4
10	Turkey Karabiga	2X 600MW	New	T-fired	Bituminous	8
11	Tajikistan Dushanbe Power Plant	2X 150MW	New	T-fired	Sub-Bituminous	4

Plasma Burner

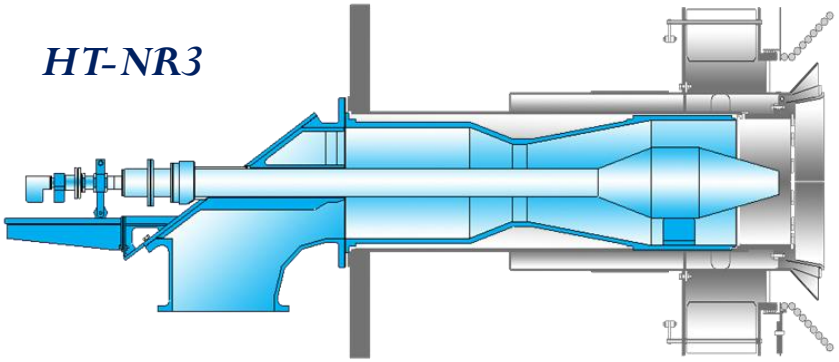
- **Plasma Burners have been successfully used during start up and low load operation of the coal fired Thermal Power Plants.**

- **Plasma Burner as Main Burner**
  - After the boiler startup and in its normal operation of the boiler, Plasma burner acts as the original coal burner with the same performance and the Plasma system is kept in shut down condition.

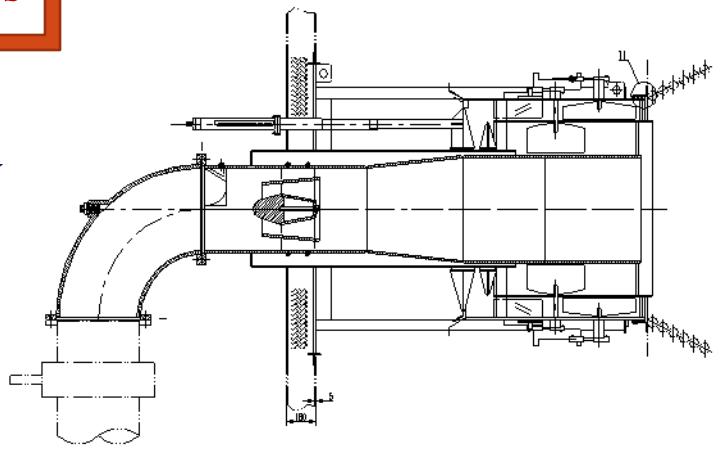
Plasma Burner

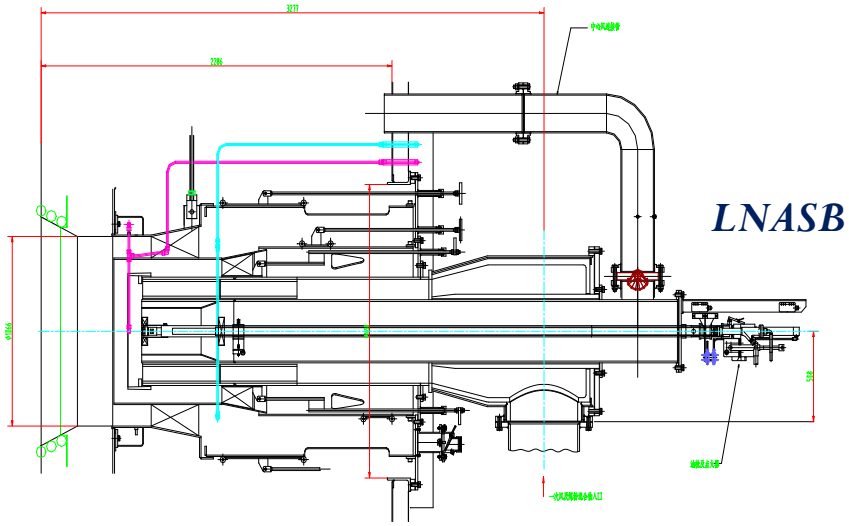
Swirl Burners

HT-NR3



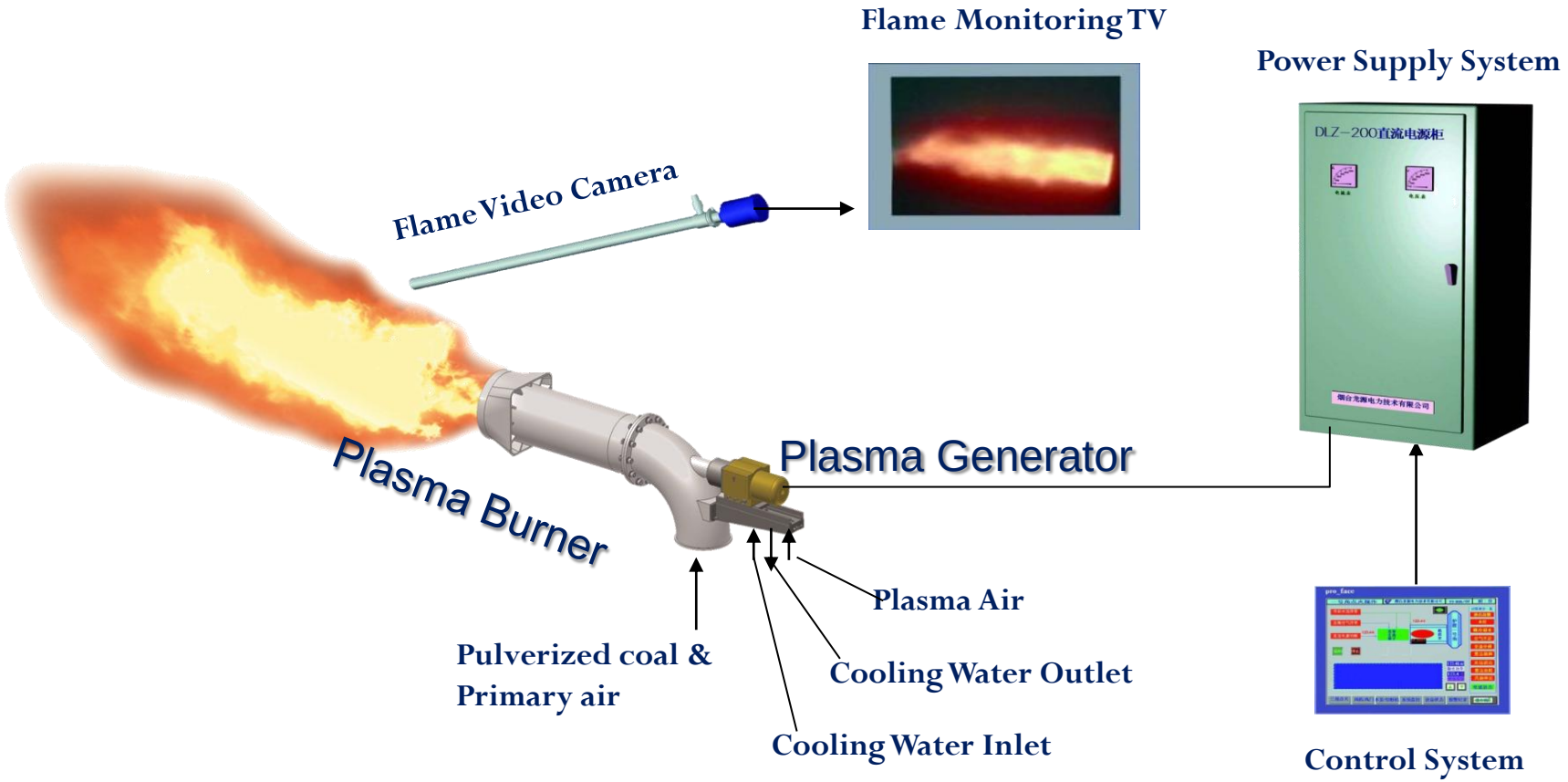
B&W DRB





LNASB

Plasma System Details

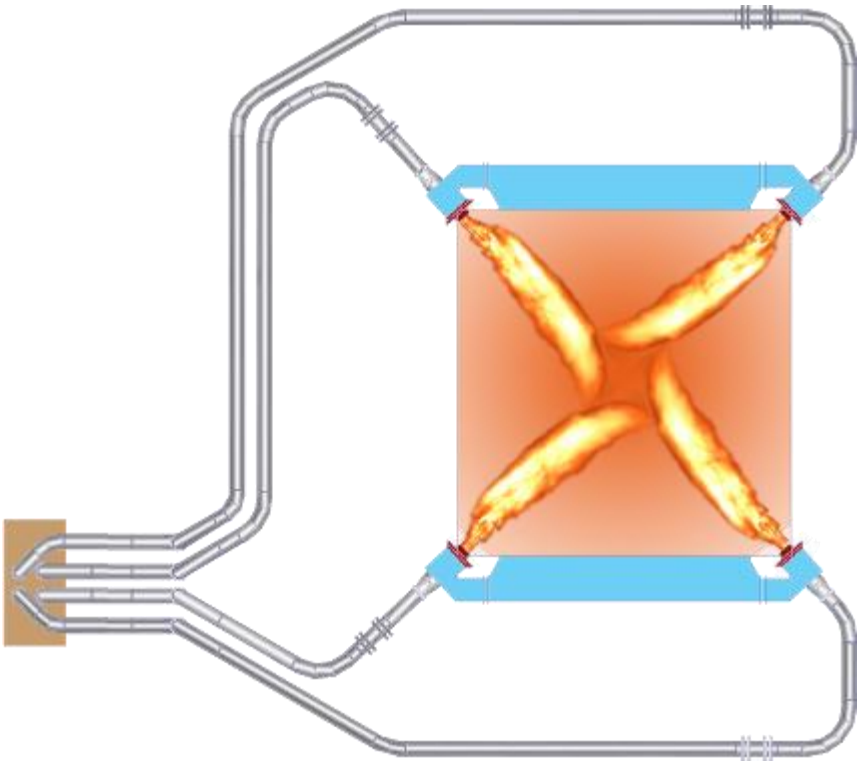


Technical Requirements of a Plasma Ignition System

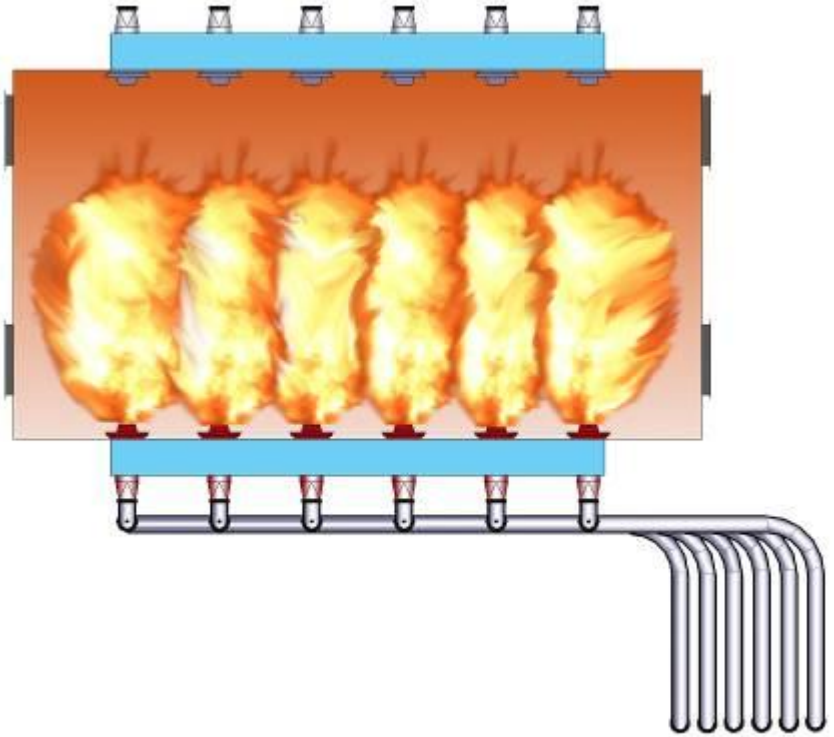
- Plasma burner guns
- Control system
- Power supply system
- Plasma carrier air system
- Cooling water system for the Plasma Gun
- Primary air heating system for boiler cold startup

Arrangements of plasma burners

T-fired Boiler



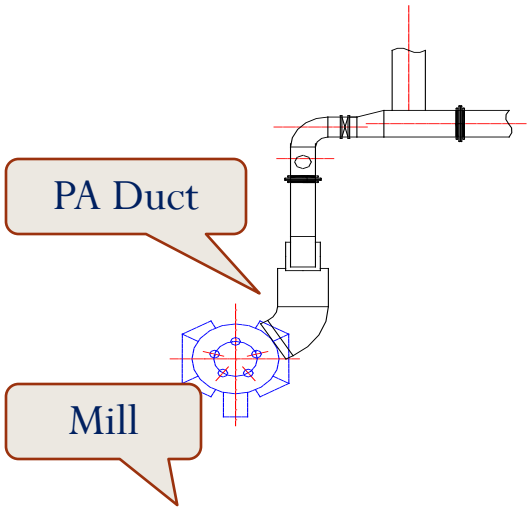
Wall-fired Boiler



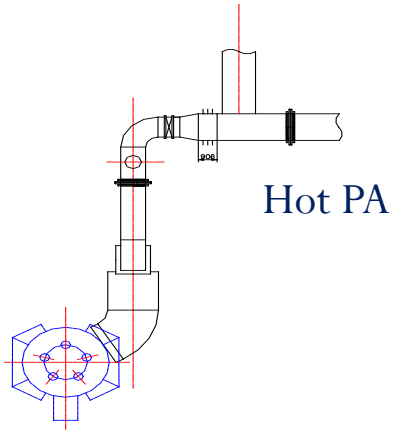
Plasma guns are installed in lowest or the lowermost one/two levels of coal burner guns.

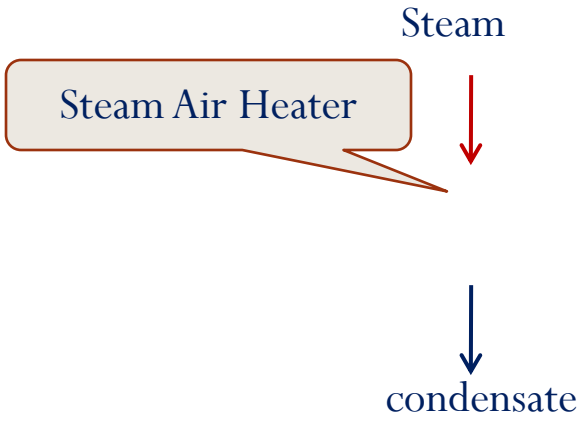
Primary air heating system

Steam Air Heater is required to provide hot air to make the mill startup possible in cold state of the boiler and is provided as a part of the Plasma Ignition System.



Original Pulverizing System



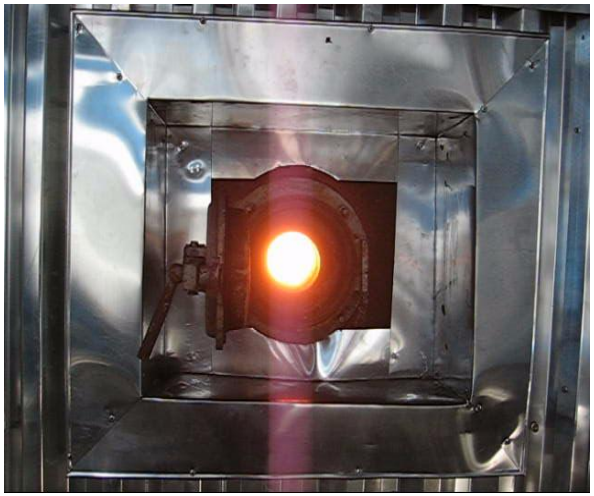


Modified Pulverizing System

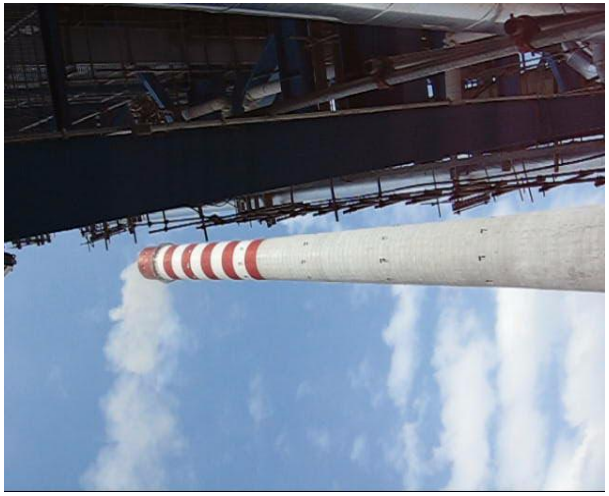
Plasma Ignition Process (Shantou 600MW)

Start ignition

1 minute after ignition

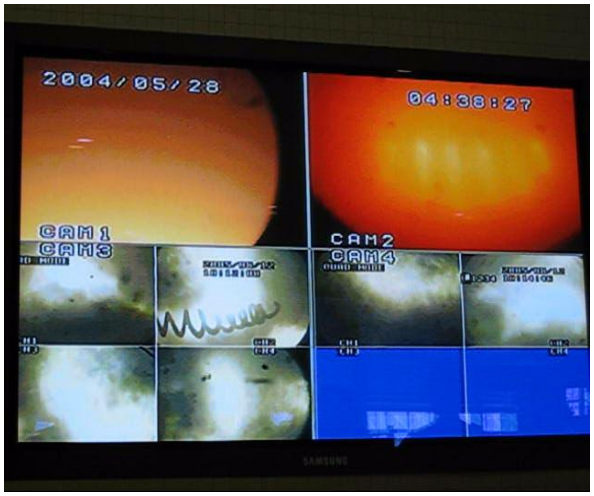


10 minute after ignition



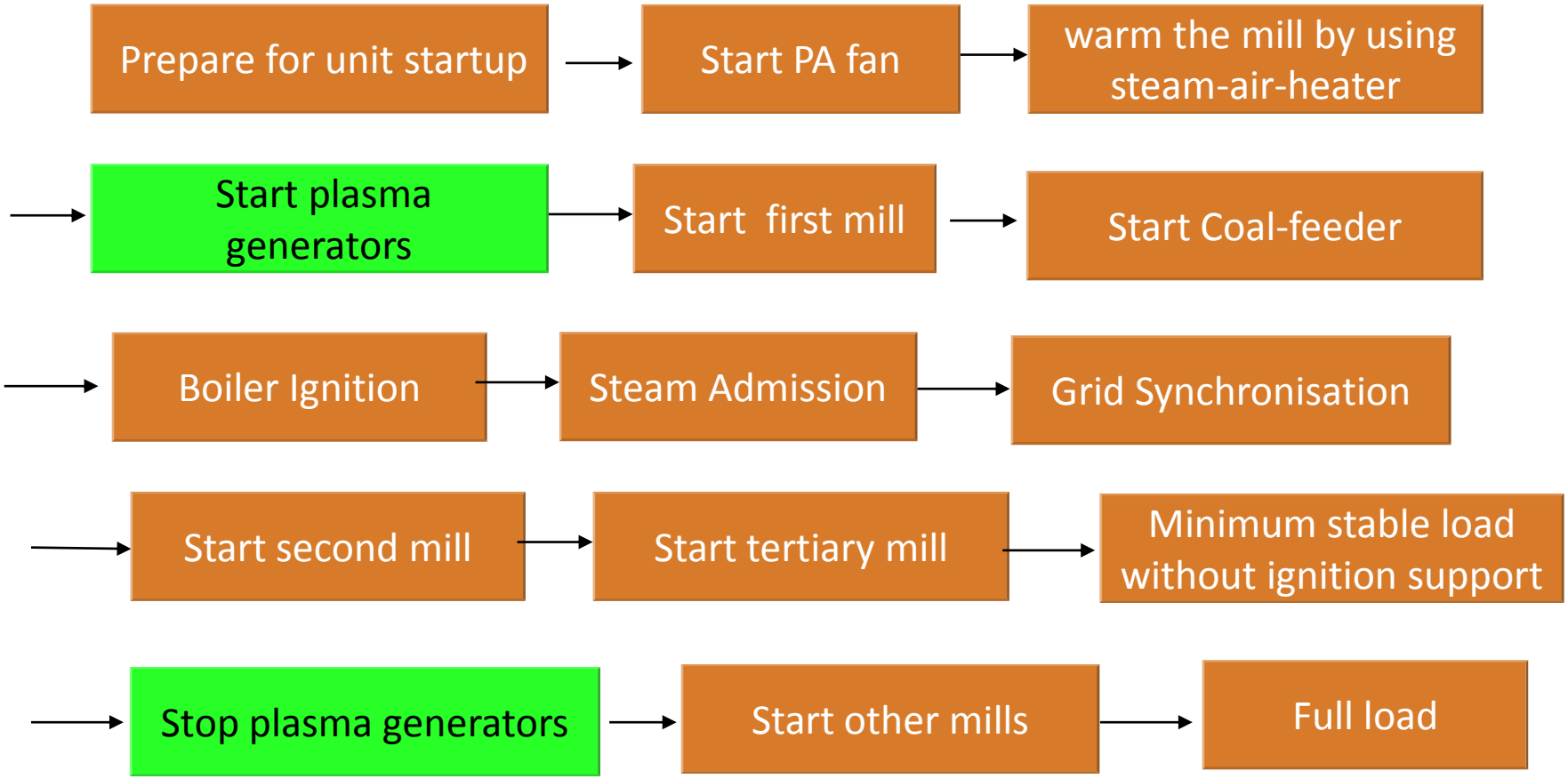
12 minute after ignition

15 minute after ignition



30 minute after ignition

Typical Startup Procedure with PICS

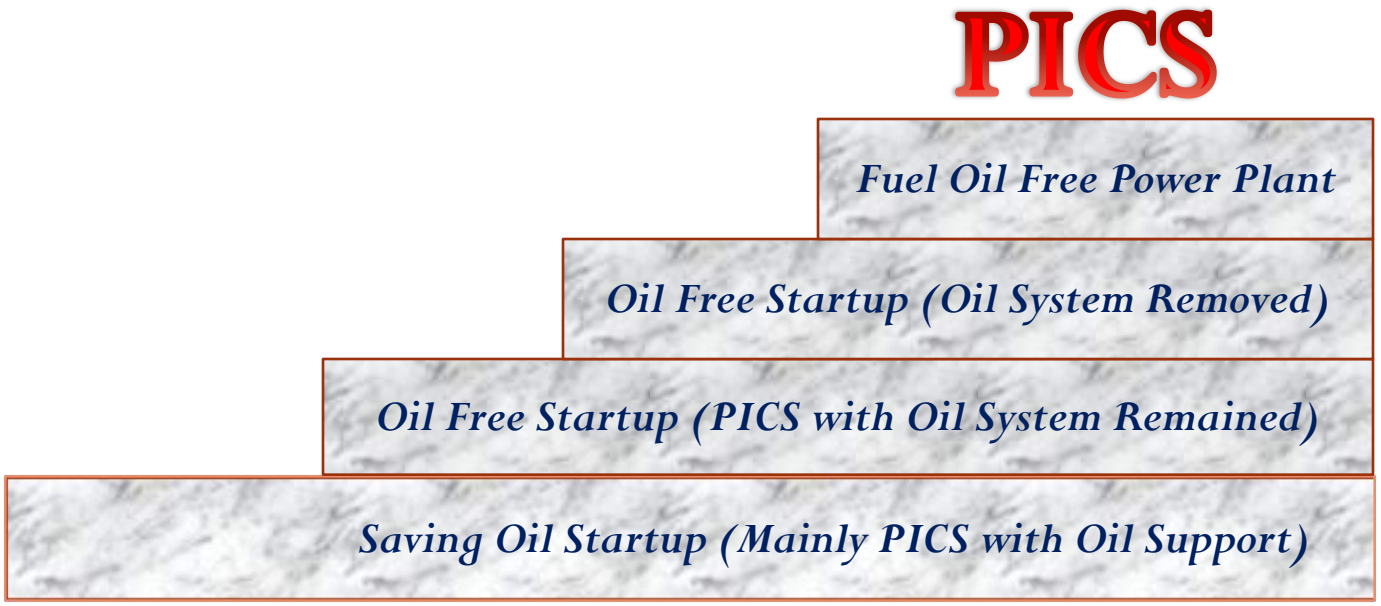


Plasma Ignition Process (Yuhuan 1000MW)

- *1000MW*
- *Ultra-supercritical*
- *Double T-fired*
- *Single furnace*
- *Low NOx PM burners*

In 2006, the first PICS project on a 1000MW unit in Yuhuan TPP

PICS Development Steps



Fuel Oil Free Power Plant

Dongsheng Power Plant
Kangping Power Plant
Fukang Power Plant
Liupanshan Power Plant
Yanji Power Plant
Jiangnan Power Plant
Fugu Power Plant
Hami Power Plant
Beitang Power Plant
Pengali Power Plant

By the end of 2016, total 44 fuel oil free power plants with 90 units are in operation.
More an d more fuel oil fire power plants are under construction.

Patents


特許証
特許第3934554号
ПАТЕНТ
№ 2260135
The United States of America
The Director of the United States Patent and Trademark Office
United States Patent
STANDARD PATENT


世界知识产权组织
WORLD INTELLECTUAL PROPERTY ORGANIZATION
AWARD FOR OUTSTANDING CHINESE PATENTED INVENTION
The WIPO - SIPO Award is bestowed upon
Wang Aisheng Tang Hong Wang Yupeng Ji Shuxin Tian Dong
Wang Gonglin Ren Weiwu Zhang Xiaoyong Shao Ruihu Ma Shuang
For his / her invention of
One kind of plasma ignition devices which used to ignite pulverized coal burners in utility boilers
Chinese Patent No. ZL02203117.0
COMMISSIONER
STATE INTELLECTUAL PROPERTY OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA
DIRECTOR GENERAL
WORLD INTELLECTUAL PROPERTY ORGANIZATION
Issued in Beijing on January 2008
中华人民共和国国家知识产权局
STATE INTELLECTUAL PROPERTY OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA
中国专利金奖
名称 一种直接点燃煤粉锅炉的等离子体点火装置
专利号 ZL02203117.0
发明人（设计人） 王爱生 唐 宏 王雨蓬 纪书信 田 东 王公林 任伟武 张晓勇 邵瑞虎 马 双
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北京 2008年 1月

Prizes Received

1st Prize of "China Science & Technology Award for Power Industry"

2nd Prize of "China National Science & Technology Development Award"


Thank you