MICRO OIL IGNITION SYSTEM (MOIS) &
COMBUSTION STABILIZING TECHNOLOGY

A Fuel Oil Saving Technology for
Pulverized Coal Fired Power Plant

AHT Corporation
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Contents

- Principle of MOIS Technology
- Application of MOIS Technology
- Thermal Power Plants with MOIS
- Benefit Analysis
New Coal Burner

Mini-oil Ignition System

- Mini-oil ignition coal burners be installed and replace the present coal burners at lowest elevation (A level) associated to mill A.
- The coal nozzles and inlet bend of coal burners to be replaced with Mini-oil ignition coal burners together with its dedicated inlet bends.
- The tip area of Mini-oil ignition coal burner is the same as that of original burner.
- Existing LDO/HFO burners will remain unchanged and be kept as standby ignition measure.
New Coal Burner
New Coal Pipe Elbow
MOIS Gun
Arrangement in Corner

cooling air for flame video camera
compressed air for oil-atomizing
compressed air for scavenging
light diesel oil
combustion air for mini-oil gun
primary air & pulverized coal
manual shutoff valve
manual shutoff valve
manual shutoff valve
manual shutoff valve
igniter/spark
filter
safety shutoff valve
logic protection system
oil flame scanner
to control room TV
flame video camera
driving device
thermocouple
MOIS Gun
Arrangement in Corner
New Coal Burner and Elbow Assembly
The application of Enhanced Oil Firing Technology which uses small quantity of fuel oil, high compressed air for atomization & gasification of oil releasing sufficient high heat flame (1600~1800 °C).
**Principle of MOIS**

**Ignition Principle**
The MOIS applies enhanced oil firing technology, combines atomization with gasification and realizes sufficient combustion of LDO. A strong and stable oil torch with high temperature of 1600~1800 deg C can be obtained by burning a small quantity of fuel oil only. The pulverized coal goes through the oil flame and quickly absorbs the heat, releasing volatile matters which quickly burst the coal particles and ignite. In combination with specially designed coal burner, sufficient combustion of coal particles can be realized, and thus startups the boiler and supports furnace combustion during boiler’s low load operation.
Enhanced Oil Firing Technology
Mini-oil gun applies the combination of medium atomization and gasification. Initially, a small quantity of fuel oil is atomized into oil mist by compressed air and ignited by dedicated spark ignitor in an extremely short time. The wall temperature of oil combustor will be increased rapidly due to its heat-resisting and heat-storage materials and is higher than enough for the rapid gasification of oil mist, thus accelerate oil firing and produce high temperature oil flame in the center of coal burners.
Oil Burner & Oil Gun Assembly
Function of MOIS Burner

➢ For ignition and combustion support

- In the process of boiler start-up and shutdown, directly burning of pulverized coal particles by MOIS under cold state can provide stable coal flame to ensure the safety operation of above process.
- In the process of boiler low load operation, fast restart of MOIS guns can provide stable coal flame to support combustion in the furnace which can replace fuel oil/natural gas burners.

➢ As main burner

- After boiler’s load rising above minimum stable load, MOIS burner acts as the original coal burner with the same performance.
Relative Advantages over conventional Light-up

- Extremely small quantity of oil is required for startup (Boiler light-up upto 40% BMCR load)
- Greater than 80% oil saving achieved as compared to conventional light up method.
- Startup can be controlled smoothly matching the boiler temp & pressure ramp-up curves
- Less maintenance as compared to conventional oil guns due to simple micro oil gun construction
- Clear chimney conditions during cold start-ups
- Very consistent, stable & concentrated oil flame enabling coal combustion during start-up
- Long time (several hours) can not be synchronized, due to the turbine or other equipment problems, will not significantly impact the SOC KPI.
Simulation & Experiment

Numerical Simulation

Lab Facility
In Oct 2003, MOIS firstly used on a **50MW** bituminous coal-fired unit in Kashi Power Plant.

In Nov 2007, MOIS firstly used on a **600MW** lean coal-fired unit in Huaneng Qinbei Power Plant.

In Dec 2009, MOIS firstly used on **2x1000MW units** in SDIC Beijiang Power Plant, the first application of mini-oil ignition system to 1000MW in China.

In May 2011, MOIS firstly used on a **600MW** unit in Huaneng Hanfeng Power Plant, its first application on **W-shape boiler** in China.

As of July, 2018, domestic application of MOIS is **over 400 boilers**.
<table>
<thead>
<tr>
<th>Name of Power Plant</th>
<th>Unit Capacity</th>
<th>Retrofit/New</th>
<th>Corner(T)-/wall-fired</th>
<th>Coal</th>
<th>Status Quo</th>
</tr>
</thead>
<tbody>
<tr>
<td>India, Jhajjar CLP</td>
<td>2x600MW</td>
<td>New</td>
<td>T-fired</td>
<td>High-ash coal</td>
<td>Finished</td>
</tr>
<tr>
<td>Cambodia, Sihanouk Port</td>
<td>3x135MW</td>
<td>New</td>
<td>Corner-fired</td>
<td>High-moisture coal</td>
<td>Finished</td>
</tr>
<tr>
<td>Indonesia, Jeneponto</td>
<td>2x125MW</td>
<td>New</td>
<td>Corner-fired</td>
<td>High-moisture coal</td>
<td>Finished</td>
</tr>
<tr>
<td>Indonesia, (CFK) East Kalimantan</td>
<td>1x60MW</td>
<td>New</td>
<td>Corner-fired</td>
<td>High-moisture coal</td>
<td>Finished</td>
</tr>
<tr>
<td>Tajikistan, Dushanbe</td>
<td>2x50MW</td>
<td>New</td>
<td>Corner-fired</td>
<td>Bituminous</td>
<td>Finished</td>
</tr>
<tr>
<td>India, Adani Power Group</td>
<td>12x660MW</td>
<td>Retrofit</td>
<td>Corner-fired</td>
<td>High-ash coal</td>
<td>Finished</td>
</tr>
<tr>
<td>Pakistan, Qadirabad</td>
<td>2x660MW</td>
<td>New</td>
<td>Corner-fired</td>
<td>Bituminous coal</td>
<td>Finished</td>
</tr>
</tbody>
</table>
Monitoring System

- Flame Video Camera
- TV
- MOIS Control Cabinet
- Combustion air for mini-oil gun
- Mini-oil gun
- Mini-oil ignition coal burner
- Cold state PA Warming system
- Pulverizing System
- Oil piping system & compressed air system
- Control System
Adaptation

**Combustion System**
- Corner-fired
- Wall-/opposed-fired
- W-shape boiler

**Pulverizing System**
- direct type with fan mill, medium speed mill and double ended mill
- storage type with ball mill

**Types of Coal**
- Bituminous coal
- Sub-bituminous
- Lignite
- Lean coal
Adaptation
Case Study - Qinbei Power Plant

Unit Overview:
◆ Unit Capacity: 4 x 600MW New boilers
◆ Boiler Supplier: Dongfang Boiler Company (DBC), wall-fired, HT-NR3 LNB
◆ Type of coal: Lean coal with Vad ≈ 12%
◆ 4 mini-oil ignition coal burners were installed at the lowest level

Application Results:
◆ Avg. total oil consumption per unit during the commissioning: **179 tons**
◆ Traditional oil burners were not used during the commissioning.
◆ The first application of mini-oil ignition system (MOIS) on lean coal-fired boiler in China.
Case Study- Adani Power, Mundra Plant, India

Unit Overview:
- Unit Capacity : 5 x 660MW (Unit #5/#6/#7/#8/#9)
- Boiler Supplier : Harbin Boiler Company, Corner-fired boiler
- Type of coal : High Moisture Indonesian Coal
  - Var≈ 22%, Aar ≈ 16%, M ≈ 25%, HHV ≈ 4000 kcal/kg
- C/O date : 2008 / 2010

Application Results:
- All the units retrofitted from July 2014 to July 2016, oil saving rate from 85% to 93.2%.
- All the 5 units MOIS modifications were finished successfully.
Project Certification & Appreciation Letters in Mundra Plant

Appreciation Letter

Expect services provided by Mr. Yu Jianhui for erection, commissioning and operation of Micro Oil Gun System (MOGS) in Mundra Power Limited, Mundra Gujarat, India in Unit #5, 6, 8 & 9.

- Mr. Yu Jianhui has provided services for erection, commissioning and operation of Micro Oil Gun System (MOGS) in Mundra Power Limited, Mundra Gujarat, India in Unit #5, 6, 8 & 9.
- Mr. Yu Jianhui has helped MPL engineers during erection commissioning and operation of MOGS. He has provided quick response to all the problems faced during erection and commissioning of systems.
- Mr. Yu Jianhui has positive attitude and commitment to his work.
- Mr. Yu Jianhui is very time punctual and he never left the site during emergency and has provided basic possible solution to problems.
- Mr. Yu Jianhui shared his knowledge during commissioning and operation of MOGS.
- Mr. Yu Jianhui timely communicated instruction to avoid any delay in erection and commissioning.
- Mr. Yu Jianhui has provided his service 2014 on cell phone also.

MPL appreciates the work of Mr. Yu Jianhui for successfully completion of Micro Oil Gun System in MPL #5, 6, 8 & 9.

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## Economic Benefit for a 660MW new unit

<table>
<thead>
<tr>
<th>Conventional Oil Ignition System</th>
<th>Mini-oil Ignition System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. oil consumption during the commissioning</td>
<td>4000 tons</td>
</tr>
<tr>
<td>Cost of light diesel oil in China</td>
<td>USD 1000 /tons</td>
</tr>
<tr>
<td>Total operating cost</td>
<td><strong>USD 4.0 million</strong></td>
</tr>
<tr>
<td>Cost of coal</td>
<td>USD 100 / ton</td>
</tr>
<tr>
<td>Electricity consumption of pulverizing system</td>
<td>20 kWh/ton</td>
</tr>
<tr>
<td>Total operating cost</td>
<td><strong>USD 1.2 million</strong></td>
</tr>
</tbody>
</table>

Saving in operating cost during the commissioning: **USD 2.8 million (70% saved)**
## Economic Benefit for a 600MW retrofit unit

<table>
<thead>
<tr>
<th>Conventional Oil Ignition System</th>
<th>Mini-oil Ignition System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil consumption for one boiler startup</td>
<td>150 tons</td>
</tr>
<tr>
<td>Price of light diesel oil in China</td>
<td>USD 1000 /tons</td>
</tr>
<tr>
<td>Operating cost for one startup</td>
<td>USD 150,000</td>
</tr>
<tr>
<td>Price of coal</td>
<td>USD 100 / tons</td>
</tr>
<tr>
<td>Electricity consumption of pulverizing system</td>
<td>20 kWh/t</td>
</tr>
<tr>
<td>Total operating cost</td>
<td>(4000+33000+264)=USD37,264</td>
</tr>
</tbody>
</table>

Operating cost lowered in percentage: \((150,000-37,264)/150,000=75\%\)
Environmental Benefit

- Avoiding black smoke during unit startup, keeping a blue sky
- Improving ESP performance

*ESP de-energized during the startup of boiler with oil ignition*

*ESP energized during the startup of boiler with MOIS*
Oil Flame Before Mill Starting

Thanks

Authorized distributor of YTLY in the Philippines

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