BRING CLEAN AIR TO YOUR LIFE
AIR QUALITY CONTROL SYSTEM (AQCS)
Doosan Heavy Industries & Construction is a global leader in the power and water business. We specialize in power generation engineering and power plant equipment manufacturing, such as nuclear reactors, boilers, turbines, and generators. We do major design and build seawater desalination and water treatment plants.

As for the power business, we possess the capacity to engineer and produce core equipment, such as boilers and turbines. We also provide EPC solutions for plant construction. Furthermore, we have source technology and world-class products by acquiring Babcock in 2006, Skoda Power in 2009, and Lentjes in 2011. These additions help us proactively respond to the various demands of our clients.
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THE ANSWER FOR GREENER & CLEANER LIFE

Doosan specializes in Air Quality Control System (AQCS) across the Power and Industrial sectors. Our AQCS technologies help clients all over the world to achieve their expected Greener & Cleaner Life.

FOR AQCS

Standard Provider
As a Standard AQCS Total Solution Provider, Doosan will set new boundaries for a Greener & Cleaner Life.

Reliable Innovator
Doosan is investing in innovational technology to provide our clients with the Optimum Solutions.

Best Companion
We are always finding new ways to meet demands from the ever-changing market to be the Best Partner in the business.
AIR QUALITY CONTROL SYSTEM (AQCS)

- Doosan is the optimal AQCS solutions provider providing our clients with the most economical and reliable environmental facilities.
- Our AQCS solutions have been developed in-house along side our own boiler fuel combustion technology.
- We offer various portfolios for FGD, SCR and ESP with respect to specific site conditions.
- Our clients will benefit from low O/M cost and longer lifetime through RAM (Reliability, Availability, Maintainability).

1. Flue Gas Desulphurization (FGD)
2. Gas Gas Heater (GGH)
3. Selective Catalytic Reduction (SCR)
4. Electrostatic Precipitator (ESP)
5. Ash Handling System (AHS)
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The purpose of Flue Gas Desulphurization (FGD) is to minimize SOx contents in Flue Gas. Doosan can provide various types of FGD.

► See page 8 for more information.

Rabigh6 FGD (Saudi Arabia)

Gas Gas Heater (GGH) is the core facility to achieve required temperature of Flue Gas to prevent white plume phenomenon and improve Desulfurization efficiency.

► See page 11 for more information.

Rabigh6 GGH (Saudi Arabia)

Selective Catalytic Reduction (SCR) is a method of controlling NOx amount in the flue gas.

► See page 12 for more information.

Mongduong2 SCR (Vietnam)

Selective Catalytic Reduction (SCR) is a method of controlling NOx amount in the flue gas.

► See page 12 for more information.

Electrostatic Precipitator (ESP) is used to remove particulates by electromagnetic force.

► See page 13 for more information.

Mongduong2 SCR (Vietnam)

Bottom Ash Handling System and Fly Ash Handling System are used to handle ash from Boiler and ESP.

► See page 14 for more information.

Rabigh6 GGH (Saudi Arabia)

Bottom Ash Handling System and Fly Ash Handling System are used to handle ash from Boiler and ESP.

► See page 14 for more information.

Taean ESP (Korea)

Bottom Ash Handling System and Fly Ash Handling System are used to handle ash from Boiler and ESP.

► See page 14 for more information.

Taean AHS (Korea)
WET LIMESTONE FGD
Low Emissions, High Efficiency, Environmentally friendly Technology

Doosan serves Wet limestone FGD through state of the art technology and it is a well-proven and cost-effective system. This system is composed of an absorber system, flue gas system, limestone preparation system, gypsum dewatering system and waste water treatment system. Doosan successfully installed diverse capacity wet-limestone FGD world wide and these experiences make Doosan your ideal partner to help meet your environmental standard.

- **BASIC PRINCIPLE FOR WET LIMESTONE FGD**
  Wet Limestone FGD system eliminate SOx in flue gas by using alkali absorbent such as limestone or lime as agent. As a result of this reaction, gypsum is produced as a by-product which can be further treated to commercial grade gypsum. Our optimized and advanced design minimizes utility consumption and maintenance of FGD facilities.

- **EXCELLENCE OF OUR TECHNOLOGY**
  - Diverse applications for all fuels and various capacities up to 1,000 MW and more
  - High removal efficiencies of Sulfuric Dioxide (SOx) over 99%
  - Low pressure loss by upward-downward spray nozzle
  - Performance optimization by ALRD* technology

* ALRD : Absorber Liquid Redistribution Device
The Seawater FGD has a less complicated process. We use seawater as an absorbent. The dissolved bicarbonates in the seawater serve as an agent and react with SOx in the flue gas. After absorption, effluent seawater is oxidized in aeration basin and neutralized seawater is discharged to sea. As a result of this less complicated process, Seawater FGD is the most cost-effective solution.

- **BASIC PRINCIPLE FOR SEAWATER FGD**
- **EXCELLENCE OF OUR TECHNOLOGY**
  - High SOx removal efficiency (Over 99%)
  - Low investment required (No limestone system, gypsum dewatering system, wastewater facilities)
  - Low operation & maintenance cost
  - Basin with highly efficient aeration membranes
CFB DRY FGD

High Removal Efficiency of Multi-pollutants

CFB Dry FGD process was developed as an alternative to the Wet Limestone FGD for lower capital cost and energy consumption. It has an advantage in regions with limited water resources. This flexible and economical technology can remove a wide range of pollutants such as SOx, Particulate Matter, Acid gas and Organic compound in flue gas from boiler.

BASIC PRINCIPLE FOR CFB DRY FGD

Hydrated lime is injected into the flue gas upstream of the fluidized bed reactor in which the absorption of sulfur occurs. After this reaction, the unreacted hydrated lime from the reactor is fed back to the fluidized bed and recirculated via FF or ESP. Due to intensive mass transfer and the high velocity in the absorber’s circulating fluidized bed, this system leaves a small footprint.

EXCELLENCE OF OUR TECHNOLOGY

- SO₂, SO₃, HCl, HF removal efficiency up to 99% and more
- Compact design and small footprint
- Low power and water consumption
- No waste water – dry particles only

* PCHC : Polychlorinated Hydrocarbons
The temperature of clean gas will be sufficiently higher thanks to a specialized tube which is designed by Doosan’s own technology. The tube is a main factor for performance of Non-Leakage GGH. Doosan’s Non-Leakage GGH with our specialized tube makes it possible to gain a competitive differential pressure value and minimize the ventilation cost.

- Achievement of minimum leakage, 0%
- Minimization of differential pressure
- Long lasting life time

The heat of flue gases is exchanged by counterflow in Ljungstrum GGH. Doosan’s Ljungstrum GGH with a compact design has a larger heating surface for efficient performance. Doosan has supplied the world largest GGH with experiences accumulated through various domestic & overseas projects.

- Outstanding track records for all types of fuel and various capacity
- Proven technology through World largest GGH (20.25m of rotor diameter, Shin-boryeong #1,2 / 1000MWx2)
- High efficiency of heat exchange with low CAPEX
SELECTIVE CATALYTIC REDUCTION (SCR)

Eco-friendly solution for Power Plant

Doosan has supplied high performance De-NOx systems to coal-fired and oil-fired power plants worldwide. Our technical expertise and experience in boiler design and manufacturing allow us to customize our SCR to the needs of our clients. Doosan guarantees market leading performance with stability to our clients.

- BASIC PRINCIPLE OF SCR
  Selective Catalytic Reduction (SCR) is a method of reducing the amount of Nitrogen Oxide (NO and NO₂) in the flue gas. (NOx Removal System)
  The SCR Process usually uses ammonia as reducing agent, to convert the NOx to Nitrogen(N₂) and water vapor at the catalyst surface.
  On the catalyst surface, the primary chemical reactions that occur are:
  
  $$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
  $$NO + NO_2 + 2NH_3 \rightarrow 2N_2 + 3H_2O$$

- EXCELLENCE OF OUR TECHNOLOGY
  - High Efficiency of NOx Removal (over 90%)
  - Applying wide range of Reducing Reagent
  - Outstanding fusion technology between Boiler and SCR
  - Optimized Ammonia Distribution Technology
**BASIC PRINCIPLE FOR ESP**

The ESP will be used for the removal of particulate matters in which the flue gas is discharged from boiler. The particles charged negatively at Discharge Electrode (DE) migrates to oppositely charged Collection Electrode (CE) and the particles adhere to it. Finally, the collected particles are removed by mechanical or electrical rapping system.

**EXCELLENCE OF OUR TECHNOLOGY**

- High Dust Removal Efficiency (over 99%)
- Low Power Consumption by applying the High Efficiency Transformer-Rectifier
- High Erosion and Corrosion Resistance of internal components
- Durable Rapping System for CE & DE

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**ELECTROSTATIC PRECIPITATOR (ESP)**

**Highly Efficient Dust Collector**

For more than 30 years since 1979, Doosan has helped customers worldwide to meet the global environmental regulation with our ESP. Doosan will meet your expectations by offering tailored solutions to satisfy the necessary plant requirements.
ASH HANDLING SYSTEM (AHS)
A clean, efficient and dust free enclosed system with high reliability and minimum maintenance

The Ash Handling System is an essential system for power plants, and a customized solution that handles ash from boiler, economizer, air preheater and ESP. Doosan has many experience in various countries, and has maintained successful track records for more than 3 decades. Doosan has been satisfying clients by supplying various types of efficient ash handling system.

- Bottom Ash Handling System is categorized into 3 types: - Submerged Drag Chain Conveyor System - Dry Ash Extraction Conveyor System - Water Impounded Gravity Feed System

- Fly Ash Handling System is categorized according to mixing ratio of Ash and Air: - Dilute Phase - Medium Phase - Dense Phase

VARIOUS TYPES OF AHS

EXCELLENCE OF OUR TECHNOLOGY

- Diverse and numerous track record based on various capacities up to 1,000 MW and even more
- Easy field erection and Low installation cost with modular design
- Quick-and-Effective trouble shooting service
Doosan Lentjes is a leading global company in plant engineering. Ever since Lentjes was founded in 1927, it has been meeting the highest client requirements through its proven technologies in the areas of Circulating Fluidized Bed Boiler (CFB), Waste-to-Energy (WtE) and Air Pollution Control (APC).

In 2011, Doosan Lentjes has become a proud member of the Doosan family. With the support from Doosan Lentjes, Doosan Heavy Industries is now a global leading Air Quality Control System provider.
DOOSAN HEAVY INDUSTRIES VIETNAM (DOOSAN VINA)

Global Manufacturing Base

Doosan VINA is the only power plant equipment manufacturer in Vietnam. It was jointly established in February 2007 by Doosan Heavy Industries and Construction Inc. and Doosan Engineering & Construction in the Dung Quat Economic Zone on the central East coast of Vietnam. The site covers approximately one million square meters of land. So far 300 Million USD has been invested in this enterprise, which is comprised of several business divisions. Doosan VINA continues to grow and prosper on a daily basis.

Doosan VINA is committed to become one of the most respected companies in Vietnam through its sustained efforts for growth and development with support from the Multi Global Business Network of Doosan Heavy Industries and Construction.

Doosan Heavy Industries and Construction is able to provide AQCS to its customers with the best quality at a competitive price through Doosan Vina.
GLOBAL REFERENCES

1. Moneypoint
   - PJT: Moneypoint
   - Location: Ireland
   - Capacity: 3 x 305 MW
   - Fuel: Coal
   - FGD Type: CFB Dry
   - SOx Removal: Up to 96%

2. Rabigh6
   - PJT: Rabigh6
   - Location: Saudi Arabia
   - Capacity: 4 x 700 MW
   - Start-up year: 2014/2015
   - Fuel: Oil
   - FGD Type: Seawater
   - SOx Removal: Up to 97%
- **PJT:** Gheco-One
- **Location:** Thailand
- **Capacity:** 1 x 700 MW
- **Start-up year:** 2011
- **Fuel:** Coal
- **FGD Type:** Seawater
- **SOx Removal:** Up to 96%

- **PJT:** Sinboryeong#1,2
- **Location:** Korea
- **Capacity:** 2 x 1,000 MW
- **Start-up year:** Under Construction
- **Fuel:** Coal
- **FGD Type:** Wet limestone
- **SOx Removal:** Up to 95.5%

- **PJT:** Yonghung#3,4
- **Location:** Korea
- **Capacity:** 2 x 870 MW
- **Start-up year:** 2006
- **Fuel:** Coal
- **FGD Type:** Wet limestone
- **SOx Removal:** Up to 97%
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