KARE-ENGINEERING

ENVIRONMENTAL SOLUTIONS

Environmental Solutions

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1- Air Pollution

- **Air pollutants mainly come from gases and particles emitted from**
  - industry,
  - motor vehicles,
  - domestic coal & wood burning
- **The most widespread pollutants are**
  - sulphur oxides (SOx),
  - carbon monoxide (CO),
  - nitrogen oxide (NOx),
  - volatile organic compounds (VOC),
  - hydrocarbons,
  - particles and heavy metals (leads etc.)

1- Air Pollution

- The main sources of
  - carbon monoxide,
  - nitrogen oxides, and
  - sulfur oxides
    - are combustion of fossil fuels. These are
      - coal
      - oil
      - petrol
      - gas

1- Air Pollution

- Although coal, within the fossil fuels group, releases
  - 20% more carbon per unit of energy than oil,
  - 40% more than natural gas (ignoring fugitive emissions), and
  - is currently, and is likely to remain, the dominant fuel (World Watch New Release 1999).

1- Air Pollution

- The control of these pollutants has become a significant issue on the agenda of governments worldwide resulting in national and regional initiatives to reduce emissions
- If the ‘prescribed level’ is exceeded people are at risk or part of the environment significantly changed
- This prescribed level should not be exceeded

2- Methods for air pollution control

- Cleaning up emissions by removing pollutants from exhaust gases
- Industry adopting cleaner technology
- Assisting dispersion through tall chimney
- Burning less polluting fuels
- Reducing exhaust pollutants from cars by keeping cars tuned and driving less

2- Methods for air pollution control

- **KARE Engineering** Co. Ltd. has engaged in a continuous effort to develop an improved DESULFURIZATION PROCESS, capable of achieving high levels of performance at the lowest possible lifecycle cost.

3- Flue Gas Desulfurization (FGD)

- Although FGD is one of the most commonly used technologies for air pollution control in industrialized countries, it does not create revenue by itself. So, it is not widely used in developing countries
- However, FGD systems have an important role of controlling air pollution.

3- Flue Gas Desulfurization (FGD)

- The application of best practice design, technology and energy can bring valuable benefits to a company
  - by reducing operating costs,
  - improving productivity and profitability, and
  - enhancing competitiveness

3- Flue Gas Desulfurization (FGD)

- Best practice means the current best combination eco-efficient techniques, methods, processes or technologies in use anywhere in the world
- So, **KARE Engineering** is an experienced manufacturer of FGD systems and brings/transfers best practice to the client business in all stages of the project including design, manufacturing, procurement, construction, commissioning, operation and maintenance

4- KARE Engineering Co. Ltd.

4.1- History

4.2- Wet FGD Technology

4.3- Seawater FGD Technology

4.4- Proposals for the Deployment of FGD Technology

4.5- Cost

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4.7- How to Contact Us (ANU Solutions Pty Ltd. & KARE Engineering Co. Ltd.)

4.1- History

- **KARE Engineering**, which represents 25 years knowledge and experience, is a leading company on flue gas, water/wastewater treatment and water reuse in Turkey with its highly qualified and specialized engineers on their subjects
- Kare is taking technical assistance from the Neft Academy of Azerbaijan, which has a reputable research and development center on the subject

4.1- History

- **KARE-Engineering** developed a multi-technology approach to solving the industries environmental needs, because design requirements and site-specific issues can vary widely around the world.

  Two principal control technologies are available:

1 – Wet FGD Technology

2 – Seawater FGD Technology

4.2- Wet FGD Technology

- FGD processes is to remove undesirable characteristics like
  - dust,
  - soot,
  - odor,
  - pollutants like SO_x, CO, H_2S from stack gas, resulting from combustion, in an environmentally friendly manner

4.2- Wet FGD Technology

- Preferred method is
  - packed or
  - unpacked wet type scrubber
    - depending on
  - the size of the plant; and
  - the chemicals used

4.2- Wet FGD Technology

- Our systems accept using a wide variety of alkaline, especially wastewater, that will have the following three way benefits
  - Acid is not added to wastewater to lower pH
    - the acid produced during gas treatment will neutralize the wastewater
  - Operational impacts of reagents of alkaline, which are used in conventional methods, are lowered
  - There will not be any solid waste production

At Siirt Electric Power Plant, a KARE-Engineering Wet FGD is used to convert this 57,5 MW station into Clean Air Act compliance.

4.2.1- Advantages

- There is not any obligation to use softened water. Hard or waste water can be used
- Water consumption is low. Water used is recycled, only a small quantity of evaporated water needs to be added
- Chemical consumption is low
- The head losses are avoided due to our special scrubber design, resulting in no necessity for fans
  - reduces electricity consumption

4.2.1- Advantages

- The specially designed spiral-jet nozzles are chosen to prevent clogging
- Nozzles are cleaned, checked and replaced without stopping the system
- The system is so designed that variable emission levels, from 1.700 mg/Nm^3 even to 150 mg/Nm^3, can be attained
- Our system has less initial cost, compared with the equivalent systems
- By-pass stack is not necessary
- The systems are based on our own technology

4.2.2- Chemicals Used

Market Name	Chemical Formula
Caustic Soda	NaOH
Soda Ash	Na_2CO_3
Lime	$Ca(OH)_2$
Limestone	$CaCO_3$

4.3- Seawater FGD Technology

- Naturally abundant seawater sulphate was subsequently converted to sulphides which were deposited in the organic material. In this way sulphur became a constituent of fossil fuels
- The Seawater Process absorbs sulphur dioxide (SO_2) from flue gas in seawater and oxidizes it prior to discharge; in other words returning sulphur to the sea in the way it originally appeared - as dissolved sulphate.

4.3.1- Process Description

- The treating process covers the cooling of the exhaust gases, removal of SOx, soot and particulates from the gas and emitting the clean gas to open atmosphere
- The hot flue gas coming from the motor is quenched before entering the scrubber. The scrubber is a wet type, without packing. Seawater is alkaline and is sprayed in the scrubber by nozzles to absorb SOx molocules

4.3.1- Process Description

- The effluent from the scrubber contains the sulphite and sulphate ions. The effluent is treated to oxidize the sulphite ions to convert to sulphate ions, which are made harmless by aeration
- An air blower combined with air diffusers are used for the aeration process. The harmless effluent is discharged to sea after the oxidation process.

4.3.2- Advantages

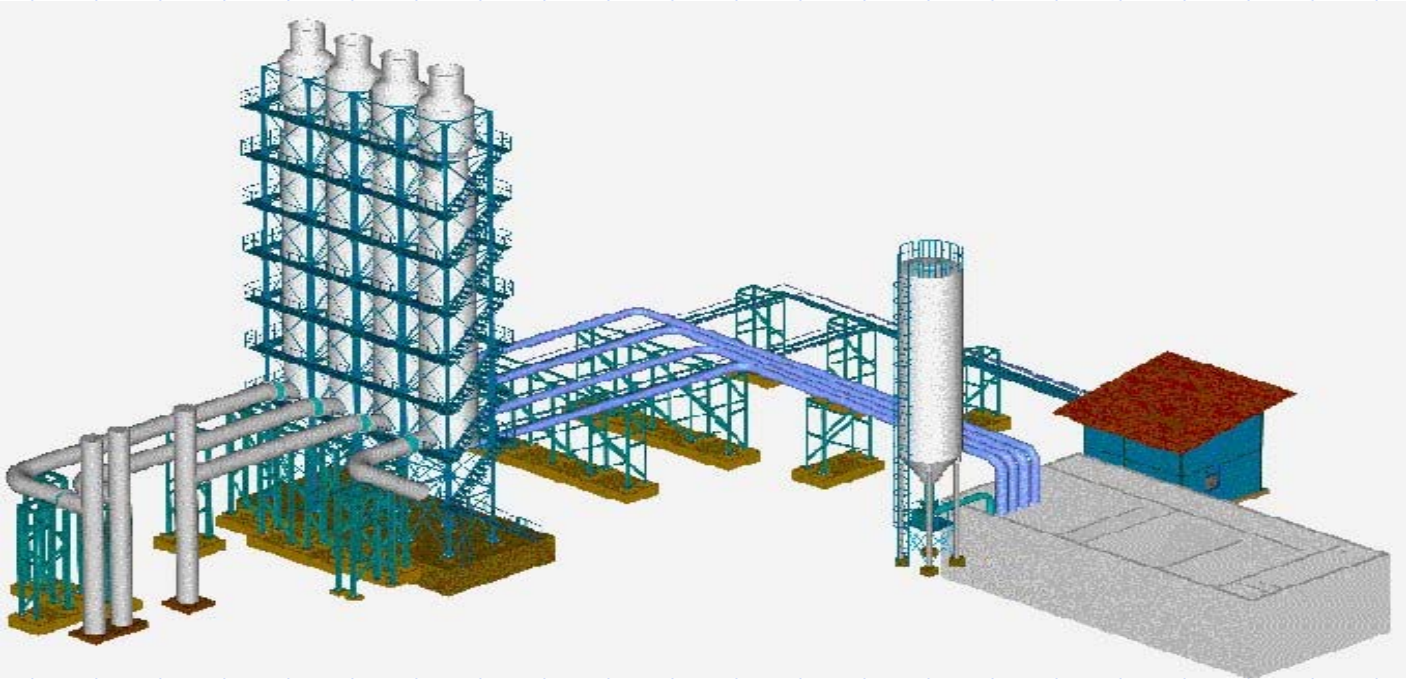
- No waste is formed, so no waste handling is required
- Requires only seawater and air
- No additional chemicals
- Has lower capital and operational costs than do other kinds of wet FGD systems.
- The absorbed SO_2 is oxidized to harmless sulphate ion, a natural constituent of seawater
- The scrubber are not subject to clogging
- High reliability

4.4- Proposals for the Deployment of FGD Technology

- Design
- Manufacturing
- Procurement
- Construction / Erection
- Commissioning
- Operation
- Maintenance

4.4- Proposals for the Deployment of FGD Technology

- **Design** options differ depending on
  - the type of fuel used, (the sulfur content of fuel)
  - the size of the plant,
  - limestone quality,
  - utility water,
  - requirements of byproduct gypsum,
  - allowable wastewater quality and quantity
- State-of-the-art CAD capabilities allow KARE's engineers to electronically create a fully-integrated design based upon standard "building blocks"



KARE -Engineering has very capable engineers to digitally create a fully –integrated design based upon standard building blocks.

4.4- Proposals for the Deployment of FGD Technology

- **Manufacturing**
  - FGD components (uses special materials like high grade stainless steel) such as
    - Scrubber (the non-plug nozzles, the final washing water unit and the mist eliminator),
    - Oxidation, Sedimentation, Thickening and Circulation Tank,
    - Ducts
    - Steel structures (such as Limestone silo) are manufactured in Turkey.

4.4- Proposals for the Deployment of FGD Technology

- **Procurement**
  - Certain components of FGD systems are exposed to severe erosive and corrosive conditions, so attention is paid to the selection of
    - Pumps such as sludge (immersible) pumps, circulation pumps, final wash pump, drainage pump
    - Valves, and
    - Agitators

4.4- Proposals for the Deployment of FGD Technology

- **Construction / Erection** work for a new FGD system is basically easier than that of a steam generator or turbine, and
- would be supervised by experienced personnel employed by KARE-Engineering.

4.4- Proposals for the Deployment of FGD Technology

- **Commissioning**
  - System start-up
  - Flue gas analysis (SO_2, particulate, etc.) and chemical analysis of limestone, gypsum, absorber slurry and wastewater are made to confirm the performance
  - Preparing using and maintenance manuals

4.4- Proposals for the Deployment of FGD Technology

- **Operation**
  - Where appropriate
    - operation and maintenance manuals are provided during the commissioning stage,
    - onsite training (1 week training for plant personnel) is provided based on manuals
    - 3 months performance test to guarantee the facility will consistently meet the applicable environmental regulations (operation and maintenance by Owner during this period).

4.4- Proposals for the Deployment of FGD Technology

- **Maintenance**
  - Appropriate maintenance is required to maximize the reliability and availability of the installed equipment/plant

4.5- Cost

- The cost of FGD systems vary considerably depending first of all on whether the system is
  - new or retrofit
  - Note that retrofit systems can cost from 50 to 100 percent more than a new system
- The difference primarily is in the
  - additional duct work,
  - removal of existing equipment and
  - engineering required to fit the large FGD system into a existing plant site.

4.5- Cost of the New System

- Services included in the price
  - Design and manufacturing
  - Supply of materials and necessary equipments (procurement)
  - Loading, transport and unloading
  - Construction
  - Start-up and commissioning (including operator training)
  - Achieving the operating permit from the Ministry of Environment
  - 3 month performance test

4.5- Cost of the New System

- Services not included in the price
  - Duty and fees for the contract
  - Emission measurement fee
  - Emission Permission Certificate fee
  - Value Added Tax (VAT)
- Total Cost
  - Depends on the plant size and other requirements

4.6- References

- You can view three of our references below. For more references and information, please visit our web site.
- www.kare-engineering.com

Karadeniz Energy	Silopi / Turkey	Power Plant, 150 MW, Desulfurization, particles removal
Idil-2	Idil / Turkey	Power Plant, 57.5 MW, Desulfurization, particles removal
RASA A.S.	Mardin / Turkey	Power Plant, 70 MW, Desulfurization, particles removal.

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