江南环保
JNG CHINA

JET
JNG US

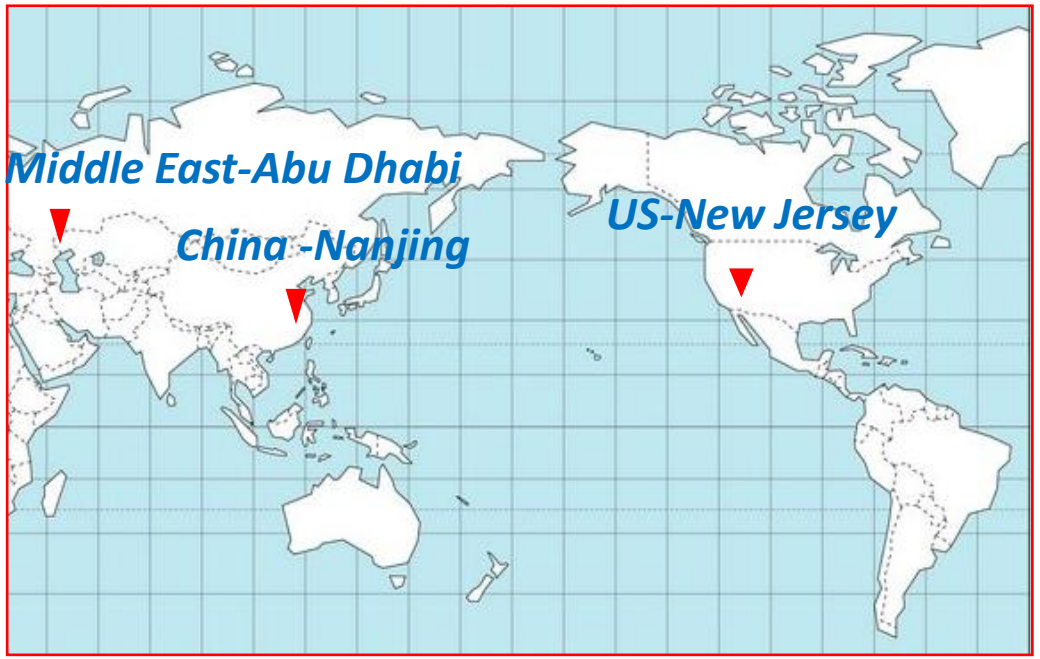
Introduction of Ammonia based FGD

August, 2019

Topics

1. Company Profile
2. Introduction of EADS Technology
3. Reference projects
4. CAPEX & OPEX

Company Profile



Jiangnan Environmental Protection Group Inc. (JNG) has three subsidiaries of JNG (China), JNG (US) and JNG (Petrochem), and JNG (Fertilizer) is under establishment.

JNG (China) known as JNEP, is responsible for Power & Refining sector in China and part of Asia markets.

JNG (US) known as JET, is responsible for Power in the U.S. and other international markets including INDIA.

JNG (Petrochem) is responsible for global refinery business.

JNG (Fertilizer) is responsible for global sulfur-containing compound fertilizer business.

World Leader in Ammonia-based Desulfurization

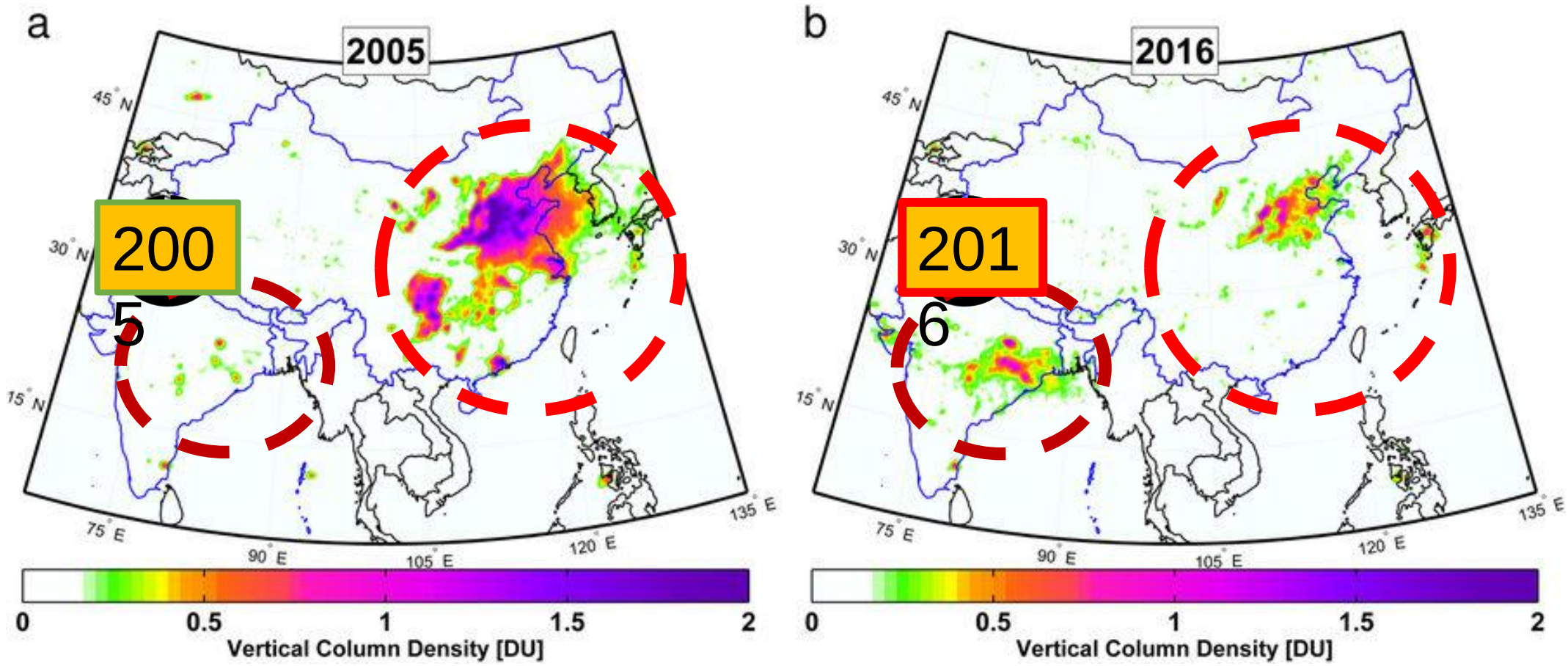
JET JNG US

- **150+** projects and approx. **300 installed units**
- **20+** installations with capacity > 300MW
- **80%** market share in ammonia desulfurization
- The primary author of **“China’s Technical Specifications for Ammonia-based FGD”**

Why FGD?

Satellite data reveal India overtakes China as world's top SO2 emitter

- Since 2007, emissions in China have declined by 75% while those in India have increased by 50%
  ~33 million people now live in areas with substantial SO_2 pollution



Selection of FGD

Reagent - Consumption, Cost & Availability

By-Product - Revenue / Disposal

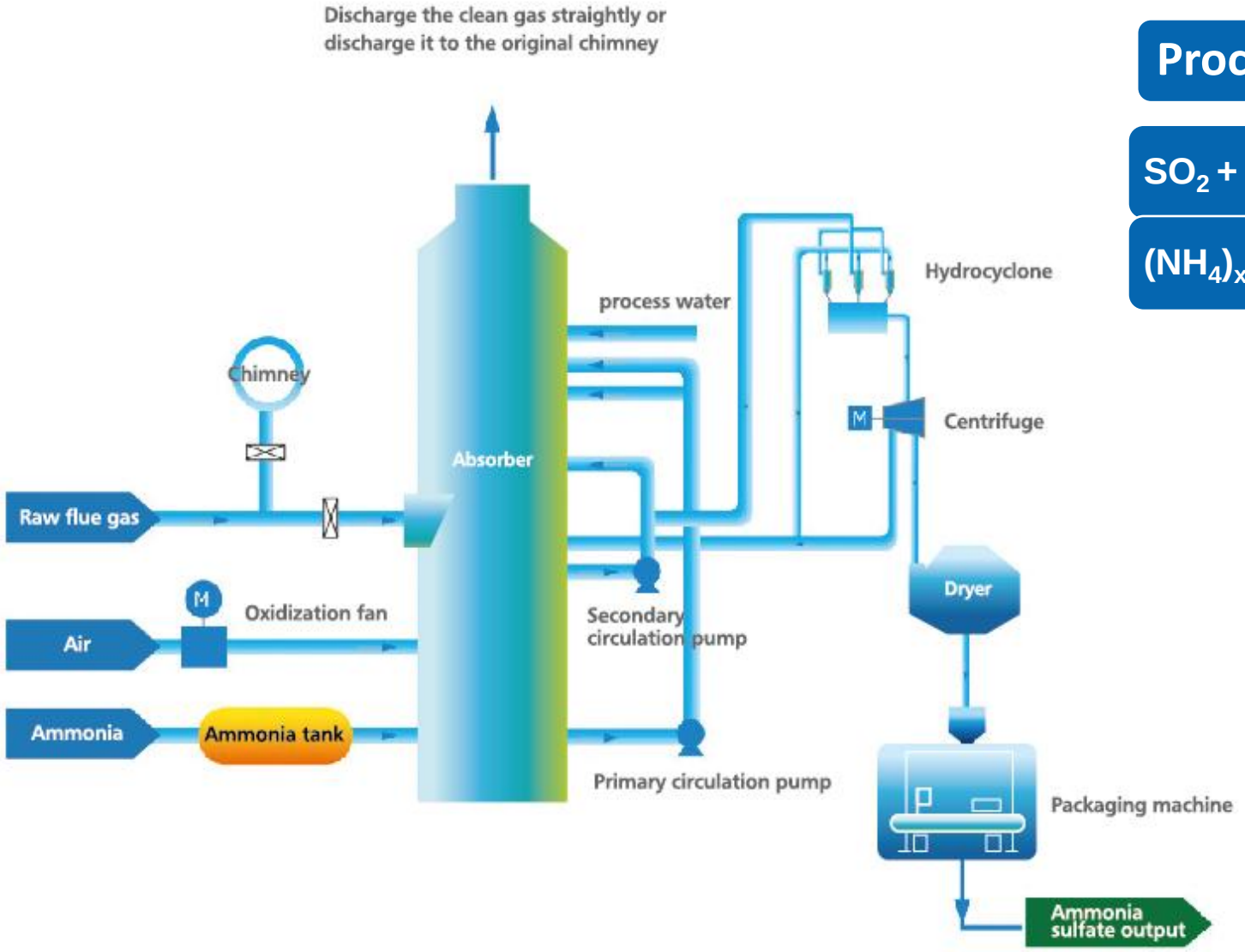
Emission Std
Current and Future

% SO2 in Flue Gas

Utility
Consumption

Plant Location/
Layout

EADS Technology: Process description



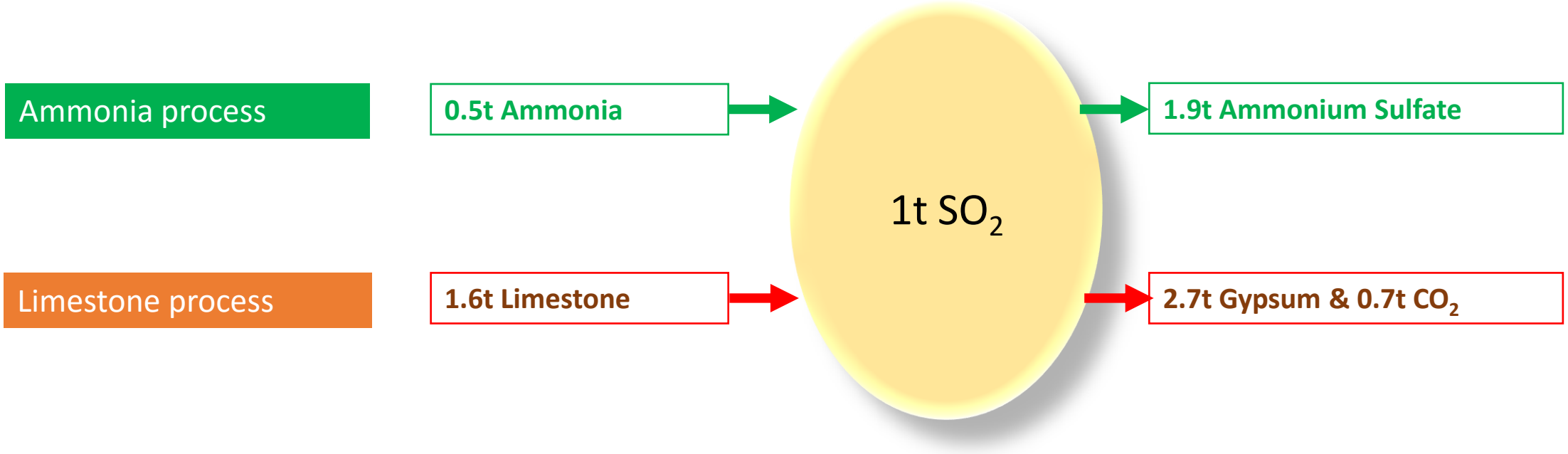
Process Mechanism

$$SO_2 + H_2O + x\ NH_3 \rightarrow (NH_4)_xH_{2-x}SO_3 \quad (1)$$

$$(NH_4)_xH_{2-x}SO_3 + \tfrac{1}{2}\ O_2 + (2-x)\ NH_3 \rightarrow (NH_4)_2SO_4 \quad (2)$$

Process Systems

- Flue gas system
- Absorption system
- Oxidation system
- Ammonium sulfate system


Ammonia process
0.5t Ammonia
1t SO_2
1.9t Ammonium Sulfate
Limestone process
1.6t Limestone
2.7t Gypsum & 0.7t CO_2

EADS Technology: Features and Advantages

High SO_2 removal efficiency: *99% or higher*

Environmental friendly: *no waste and water waste*

Favorable economics: *3.8 ton AS/ton NH3*

High flexible operating load: *30 – 110%*

Flexible and customized system designs

Absorbent; layout

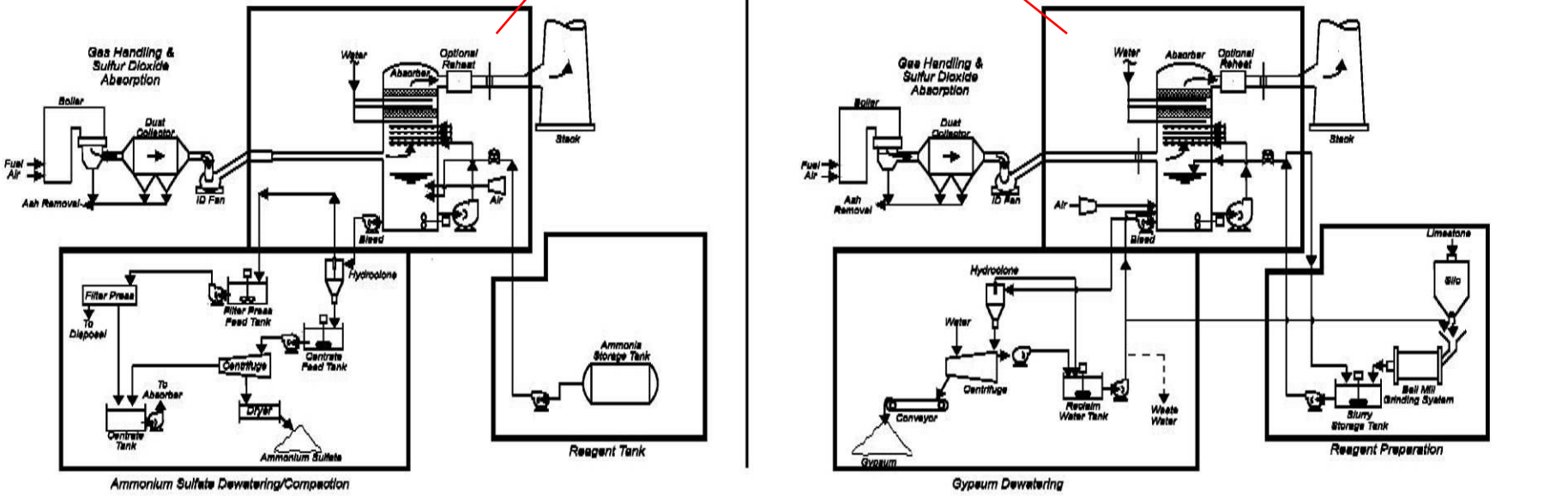
Comparison of Ammonia and Limestone Processes

0.5 ton Ammonia →1 ton SO_2 → ~1.9 ton Ammonium Sulfate	1.6 ton Limestone →1 ton SO_2 → 2.7 ton Gypsum

Ammonia process

Desulfurization absorber system

Limestone process



Ammonium sulfate system

Ammonia tank

Gypsum system

Limestone slurry preparation system

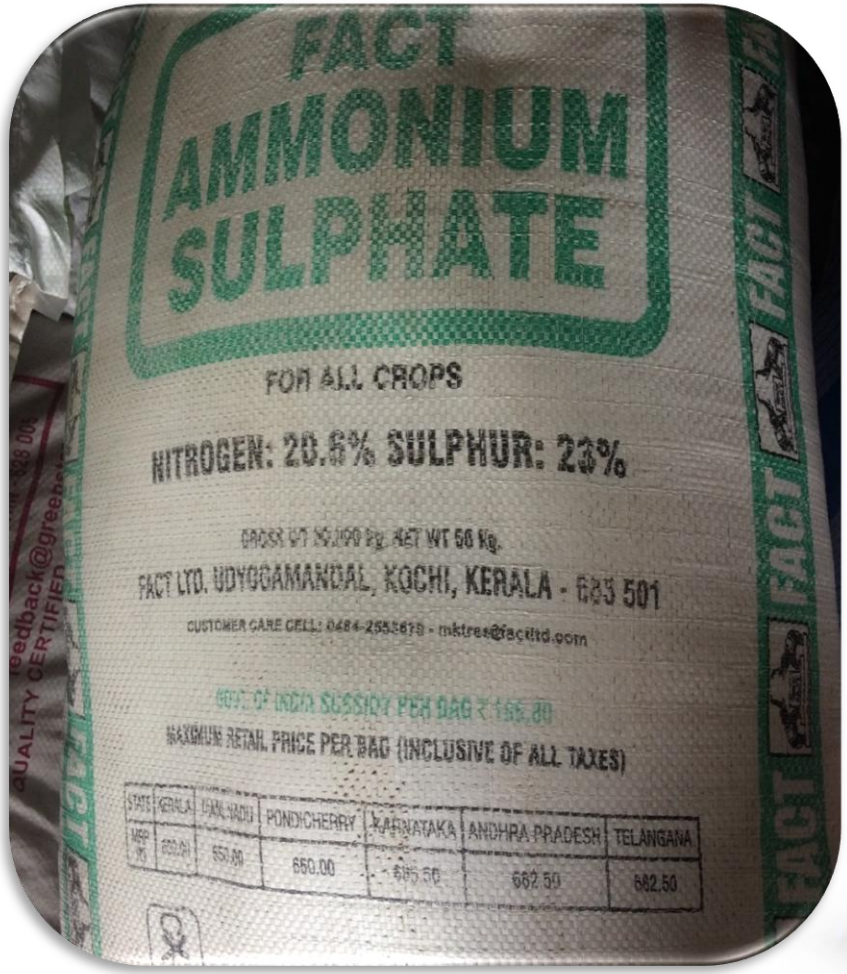
Advantages against Limestone FGD

	Limestone	EADS	Remarks
Process	Consume 1.6 t limestone & generate 0.7 t CO_2 per ton SO_2	Turn waste (SO_2) to a high vale byproduct	Limestone: Bigger environment impact EADS: **More environmentally friendly; More favorable economics**
Capital cost	Around 10 percentage lower for EADS		
Power consumption	1.2 -1.3 A	1A	EADS: **20-30% less power**
Operating cost	1.2-1.3 B	1B	EADS: **20-30% less operating cost**
Water consumption	More	less	EADS: **10 - 15 % less water consumption**
SO_2 reduction	97-98%	Up to 99.9%	EADS: **Easier to upgrade to meet lower SO2 emission in the future**
SO_2 emission	100 - 200 mg/Nm^3	As low as 30 mg/Nm^3	Limestone: Much higher cost to upgrade
Waste water generation	Yes	No	Limestone: More waste water needs to be treated
Solid waste generation	Yes	No	Limestone: Issues with Limestone sourcing and solid waste disposal
Synergy with de-NOx	No	Yes	EADS: Both de-SOx & de-NOx use ammonia; **More efficient process; lower overall cost**

Ammonium Sulphate Bags in India

3 Ways to Sell Ammonium Sulphate

Domestic Indian Market



Compound Fertilizer NPKS

Export Market mainly SEA

World Largest Ammonia FGD Project:
Shenhua Ningxia Coal Industry Group 10 x 200 MW Generation Sets

Client Name	Shenhua Ningxia Coal Industry Group CTL Project
Location	Yinchuan, Ningxia Province, China
Capacity	10×200 MW units
EADS Generation	Currently 3rd generation, being upgrading to the 4th generation
Absorber Configuration	1 absorber for 1 unit, total 10 absorbers
Stack Configuration	Two concrete stacks with metal liner
Absorbent	99.6% anhydrous ammonia
Byproduct	Ammonium sulfate in bags

EADS Technology with Ultrasonic PM Control: Wanhua Chemical Inc. Project

Project Type: Ultra-low emission

Date of completion: May, 2015

Inlet PM content ≥ 20 mg/Nm^3

Outlet PM content ≤ 5 mg/Nm^3

Outlet SO_2 emission ≤ 35 mg/Nm^3 (12 ppmv)

PM removal efficiency ≥ 75%

Ammonia recovery **≥ 99%**

CAPEX published by CEA

EADS Ammonia FGD

CAPEX:

The cost estimation given below is only indicative in nature and discovered through open competitive bidding for the projects already awarded:

CAPACITY GROUP (MW)	LAKH PER MW #
210	40.5
250	
300	39.15
500	36.45
525	
600	33.3
660	
800	27
830	

NORMS FOR INSTALLATION OF FGD
for
NEW ENVIRONMENTAL REGULATIONS - 7th December-2015
(For Ammonia & Sea Water based FGD)

(FROM 20th March, 2019 ONWARDS)

Limestone FGD

CAPEX:

The cost estimation given below is only indicative in nature and discovered through open competitive bidding for the projects already awarded:

CAPACITY GROUP (MW)	LAKH PER MW #
210	45
250	
300	43.5
500	40.5
525	
600	37
660	
800	30
830	

The above CAPEX is "**Base Cost**" only, this base cost is with new chimney and without GGH and does not include Taxes-Duties and Opportunity Cost for interconnection.

NORMS FOR INSTALLATION OF FGD
for
NEW ENVIRONMENTAL REGULATIONS - 7th December-2015

(FROM 21st Februry, 2019 ONWARDS)

From harmful Flue Gas to useful Fertilizer

Thank You….Any Questions?