

A large white feather is positioned on the left side of the upper half of the page, set against a blue gradient background. To its right, three clear water droplets of varying sizes are arranged in a descending line. The overall aesthetic is clean and natural.

Certified  
Customized  
Compact

De-NOx SCR SYSTEM

**PaNOx**<sup>TM</sup> smart v2.0

ENGLISH

**PANASIA**

# Company Profiles

**PANASIA CO.,LTD.**

**Global Leader in Smart & Green Technology**

- Since 1989

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## Premises of Business and Production Infrastructure

**Built up robust infrastructure**

### Infrastructure For 1 Trillion KRW sales

Headquarter & 1 <sup>st</sup> Factory	2 <sup>nd</sup> Factory
	
- Location : Gangseo-gu, Busan - Establishment : Dec. 2014 - Land Area : 27,115 m <sup>2</sup> - Floor Area : 17,665 m <sup>2</sup> - Total Area : 35,606 m <sup>2</sup>	- Location : Gangseo-gu, Busan - Establishment : Jun. 2020 - Land Area : 12,918 m <sup>2</sup> - Floor Area : 9,837 m <sup>2</sup> - Total Area : 15,504 m <sup>2</sup>

PANASIA JAPAN Corp.	PANASIA CHINA Corp.	PANASIA EUROPE B.V.
		
- Location : NO.600, Osaka Ekimae Dai.3 Building 6F, 1-1-3, Umeda, Kita-ku Osaka, Japan	- Location : RM C 205, No.208D 5D, Lian hua Rd, Shanghai, China	- Location : Schorpioenstraat 286, 3067 KW, Rotterdam, Netherlands

# De-NOx SCR system

## PRODUCT LINE UP

De-NOx SCR SYSTEM

### PaNOx™

We, Panasia, have been supplying PaNOx SCR system to valuable customers in the world for overall industries like shipbuilding, power plant, chemical plant and so on since 1997. In addition, our SCR system has been being developed consistently such as combining components, optimized size of reactor and others. Through lots of track records or reference list and product optimization, PaNOx SCR system is nowadays one of the most competitive De-NOx SCR system.

De-NOx SCR SYSTEM

### PaNOx™ Marine smart v2.0

#### SHIPBUILDING

As one of the top tier companies in SCR market, Panasia has been supplying De-NOx SCR systems to global shipbuilders and ship owners. Based on the proven high technology, we have been consistently trying to optimize and develop our system more efficiently. Our SCR system complies IMO Tier III emission limits.



De-NOx SCR SYSTEM

### PaNOx™ smart v2.0



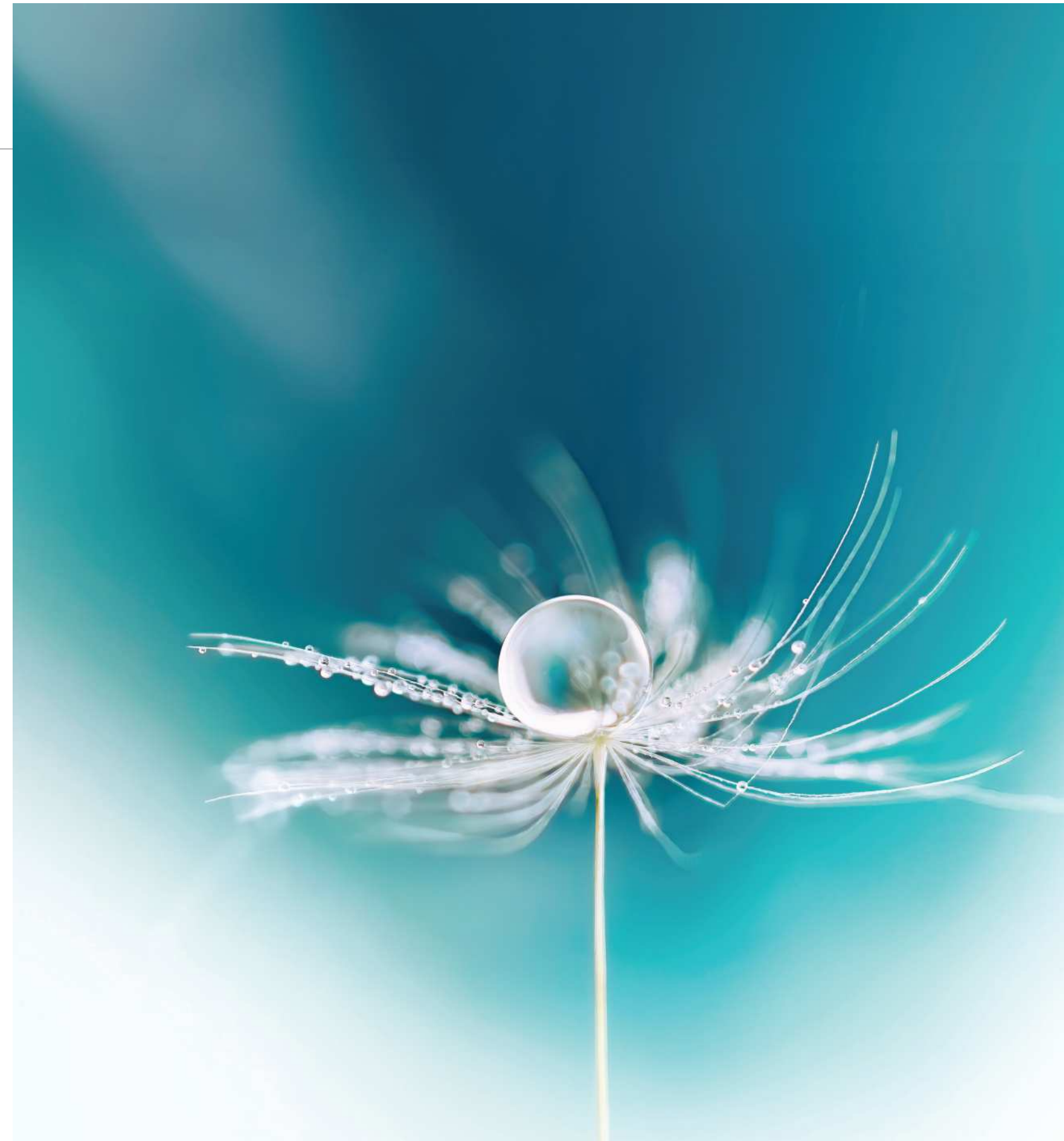
#### HRSG

We have successfully supplied SCR system to major HRSG manufacturers. Our SCR system can provide the service to apply local emission and environment requirement. Hundreds of catalyst modules are stacked in HRSG to reduce NOx in the exhaust gas comes from gas turbine. Yellow Plume Elimination System can be also provided upon client's request.



#### BOILER

Even though the environment regulation in California, US is very strict such as NOx 9 ppm for 20MMBtu/hr to 75MMBtu/hr and NOx 5 ppm for 75MMBtu/hr, we have many of reference for boiler which means the technology of our SCR system is proven by the valuable customers in the world.



# Marine Application

De-NOx SCR SYSTEM

**PaNOx™** Marine smart v2.0

## IMO REGULATIONS

**January 1, 2016**

Tier III NOx **80% Reduced**

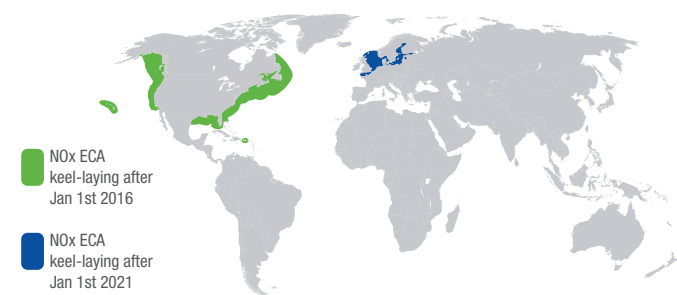


NOx pollution standards have been set on every type of motor vehicle and on stationary industrial units. For the marine sector, at a global level, the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) agreed a three-tier structure for new engines in 2008, which would set progressively tighter NOx emission standards depending on their date of installation. The NOx control requirements of Annex VI apply to installed marine diesel engines of over 130 kW output power.

Under the Tier III standard, NOx emission levels for an engine installed on a ship constructed on or after 1 January 2016 must be reduced to 3.4 g/kWh on any such ship operating in a designated Emission Control Area (ECA). Outside a designated Emission Control Area, Tier II limits apply. This represents an 80% reduction from Tier I (same NOx limit as EURO IV for diesel and petrol vehicles), and would require the use of Selective Catalytic Reduction (SCR) technology, or an alternative emissions control technology. In addition, special certification must be obtained that the engine system is compliant with the Tier III requirements.

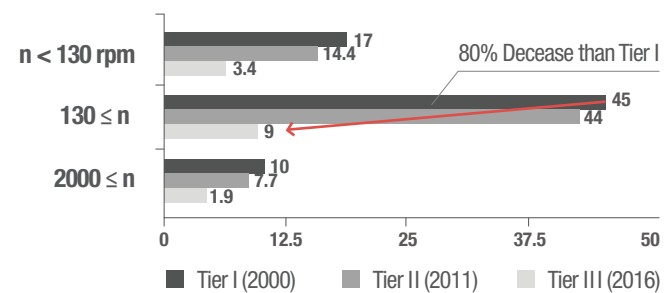
At present there are two effective NOx ECAs: the North American and the U.S. Caribbean Sea Areas (indicated in green on the map), as designated under regulation 13 of MARPOL Annex VI. The North Sea and Baltic Sea Area (indicated in blue) will become the third NOx ECA and will apply to ships with engines installed on or after January 1st 2021. Among the shipping community it is actively speculated that China is preparing its application for an ECA to be submitted to the IMO in 2019 or 2020. The scope and exact boundaries are not public knowledge yet but such a development will significantly help reduce dangerous NOx emissions and positively impact the lives of nearly a third of the Chinese population, who live near along the coast.

WORLD MAP ECA (Emission Control Area)



IMO MARPOL 73/78 ANNEX VI NTC 2008

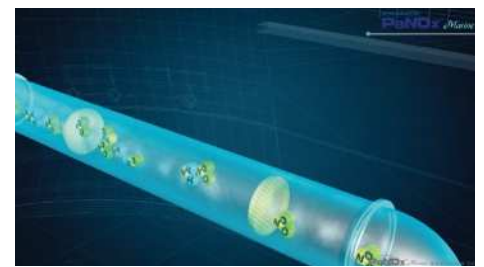
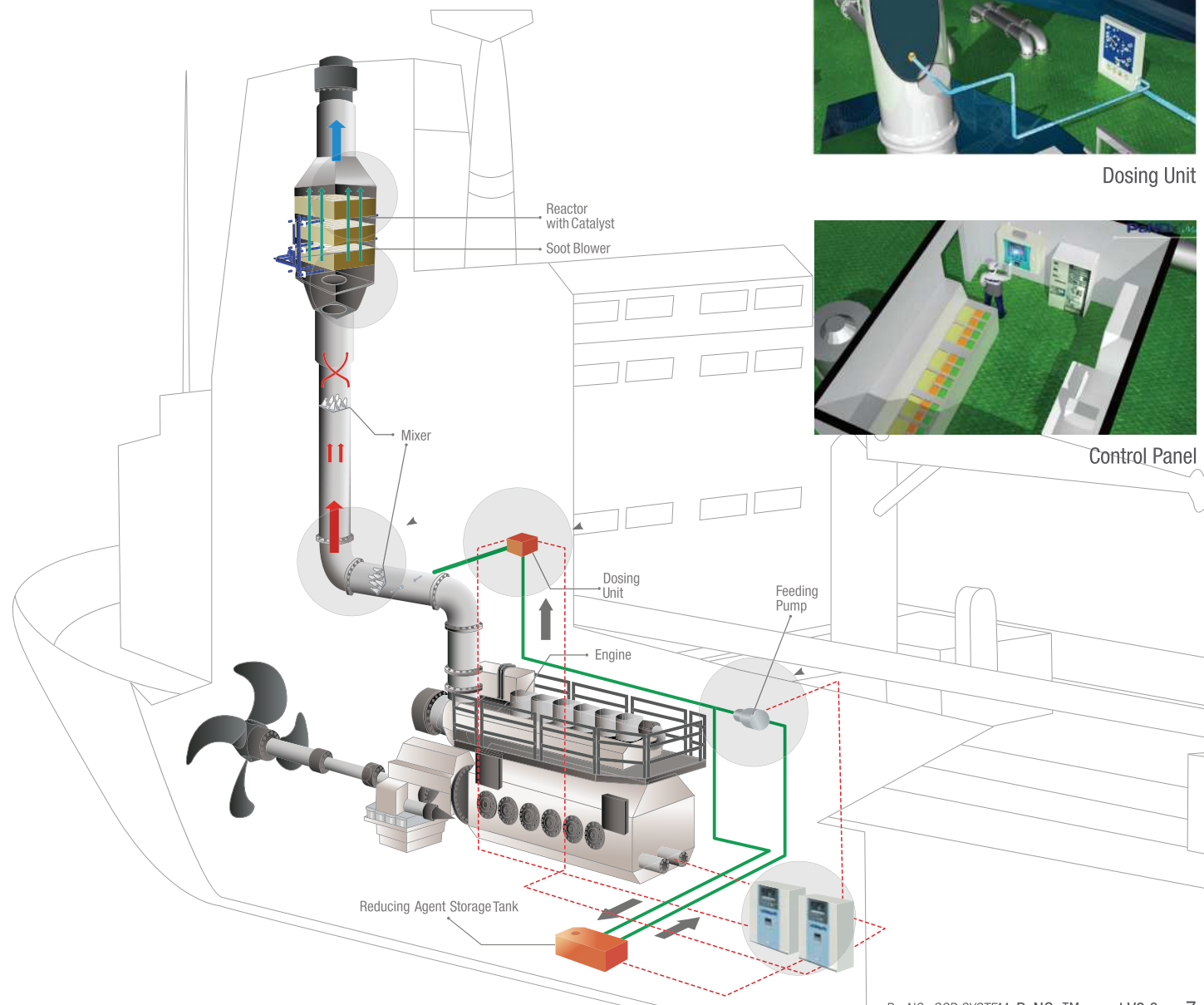
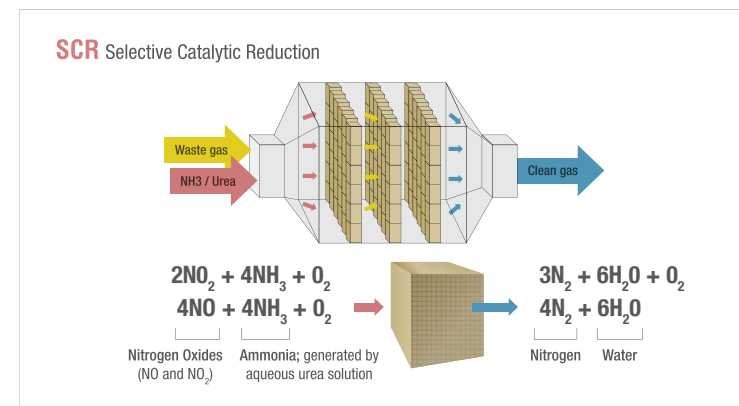
MARPOL Annex VI on Regulations for the Prevention of Air Pollution from Ships.



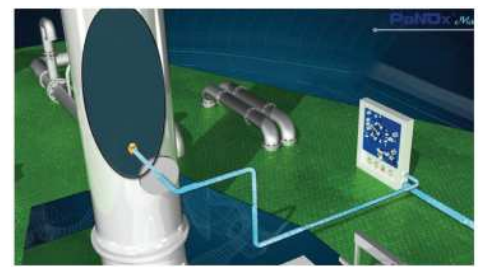
## COMPARISON BETWEEN SCHEME A AND B

Scheme A	Scheme B
Engine shop test (Tier II Engine + SCR)	Engine shop test (Without SCR)
(Tier III Pre-EIAPP Cert.)	Technical File Review
Onboard Test * Component ID Check * Performance Test	Tier II EIAPP Cert.
Tier III Engine Cert.	SCR shop test * Component ID Check
IAPP Cert.	Catalyst Scale Down Test * Performance Test
	(Tier III Pre-EIAPP Cert.)
	Onboard Test * Component ID Check * Performance Test
	Tier III EIAPP Cert.
	IAPP Cert.

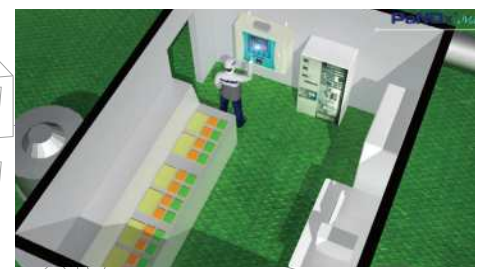
## SYSTEM CONFIGURATION



Mixer



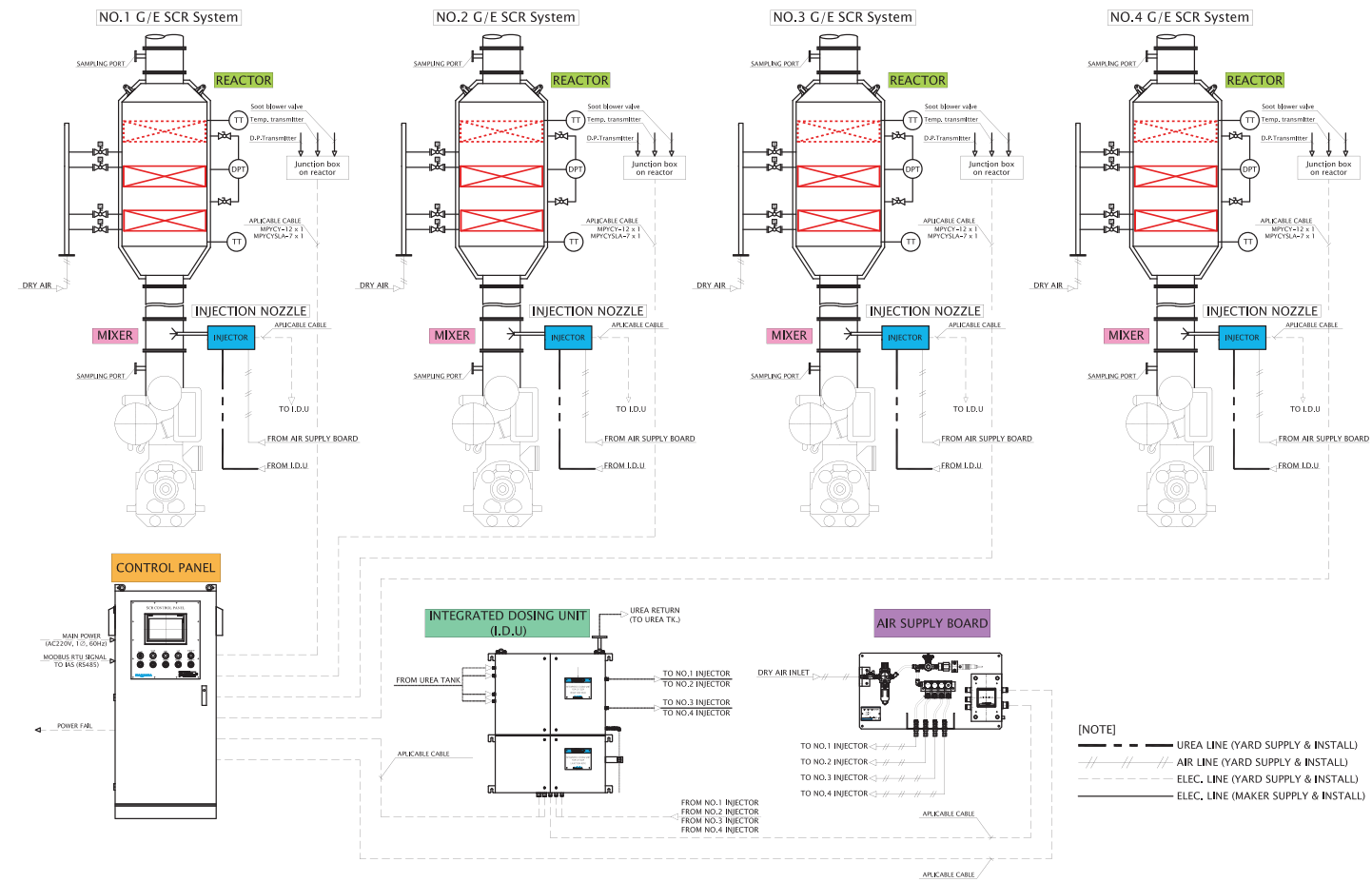
Dosing Unit



Control Panel

# Marine Application

## PIPING & INSTRUMENTATION DIAGRAM



## MAIN COMPONENTS



## CERTIFICATES



## COMPARISON BETWEEN ORIGINAL MODEL AND SMART VERSION 2 MODEL

De-NOx SCR SYSTEM

**PaNOx™ Marine**

6 pcs

- SCR Reactor
- Control Panel
- Dosing Unit
- Pump Skid
- Injection Nozzle
- Mixer

Improved  
In space &  
Power Consumption

De-NOx SCR SYSTEM

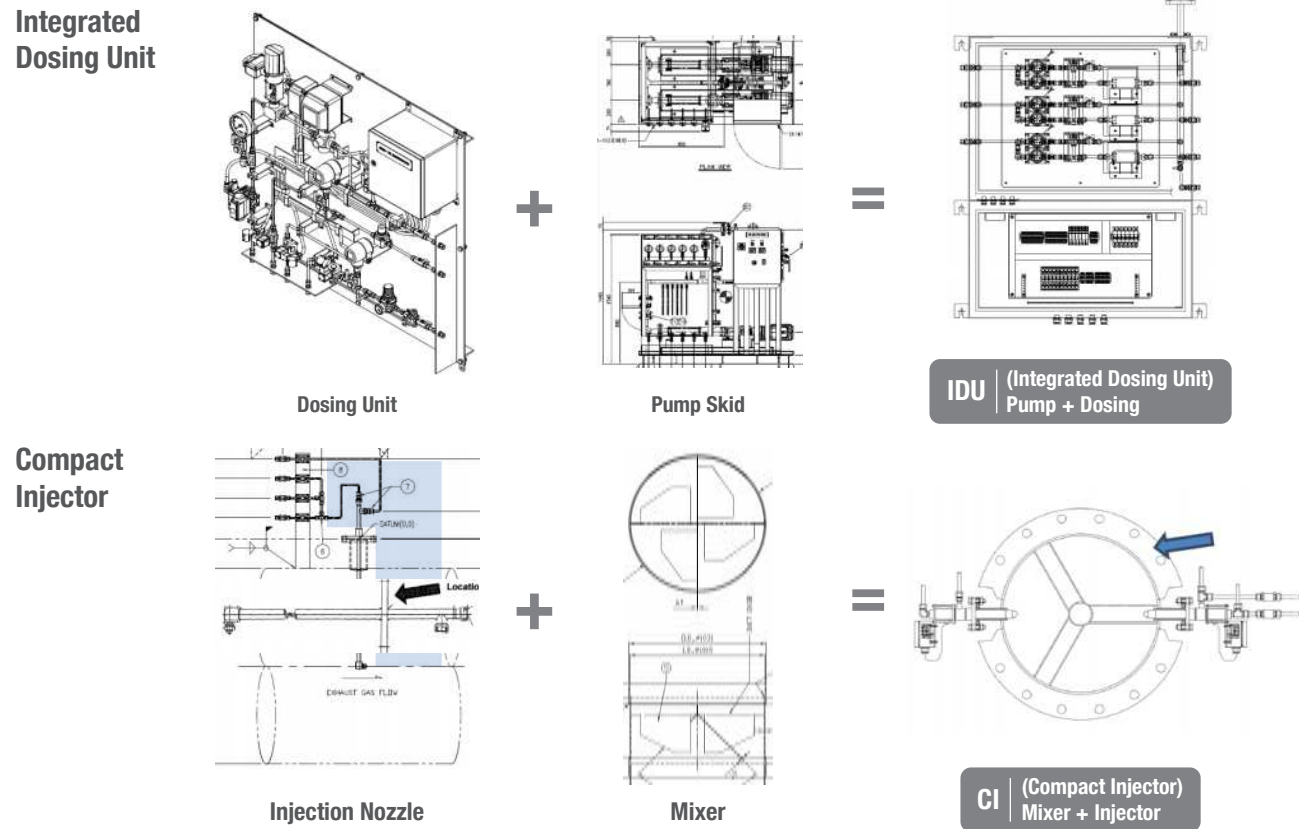
**PaNOx™ Marine smart v2.0**

4 pcs

- SCR Reactor
- Control Panel
- IDU(Integrated Dosing Unit)
- CI(Compact Injector)

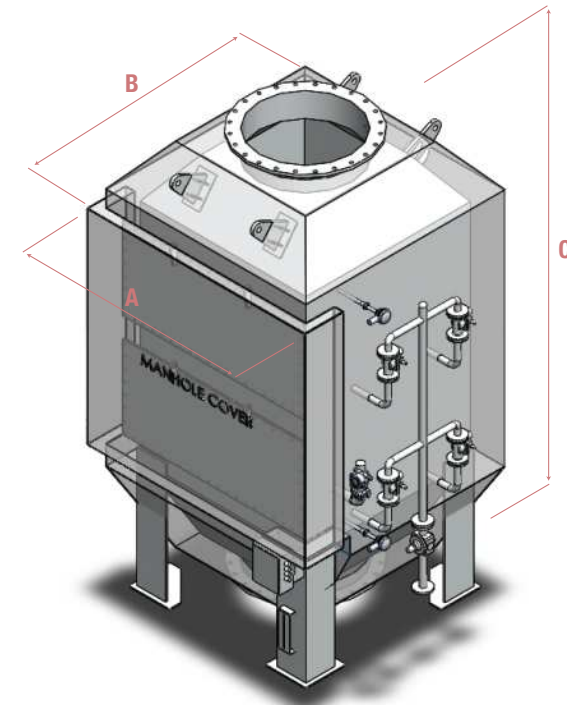
# Marine Application

## MAIN COMPONENTS ANALYSIS



## STANDARD SIZE OF REACTOR BY ENGINE POWER

Num	Model	Engine Power kW	Reactor dimension			Weight Reactor + Catalyst
			A	B	C	
1	PNX-N0048	≤480	850	850	2,200	1,400
2	PNX-N0075	≤750	850	850	2,200	1,460
3	PNX-N0120	≤1,200	1,170	1,170	2,200	1,940
4	PNX-N0160	≤1,600	1,170	1,170	2,600	2,030
5	PNX-N0220	≤2,200	1,500	1,500	2,600	2,500
6	PNX-N0300	≤3,000	1,500	1,500	2,740	2,680
7	PNX-N0470	≤4,700	1,820	1,820	2,740	2,680
8	PNX-N0520	≤5,200	2,140	2,140	2,740	3,570
9	PNX-N0650	≤6,500	2,140	2,140	3,200	4,340
10	PNX-N0780	≤7,800	2,470	2,470	3,200	4,700
11	PNX-N0890	≤8,900	2,470	2,470	3,200	5,230
12	PNX-N1150	≤11,500	2,790	2,790	3,200	6,220
13	PNX-N1200	≤12,000	3,110	3,110	3,200	6,780



DESIGN BASE : Temperature (after T/C) : 250 ~ 500°C

## SCR Reactor

Capacity	PaNOx smart V1.0			PaNOx smart V2.0			Reduced by
	Length	Height	Width	Length	Height	Width	
1000kw	970	970	2750	953	947	2680	6.52%
3000kw	1293	1284	3240	1189	1181	3240	15.42%
4000kw	1613	1601	3240	1425	1415	3240	21.92%
4500kw	1923	1605	3362	1661	1649	3240	14.48%
8000kw	-	-	-	2133	2121	3240	-



Volume Down  
**14.6%**

## I.D.U

Component	Length	Width	Height	Surface Area(m <sup>2</sup> )	Reduced by
PaNOx smart V1.0	Pump Skid	1630	900	1516	
	Dosing Unit	1200	320	1150	4.26
PaNOx smart V2.0	IDU	1070	500	1360	5.34
Reduced by					64.06%



Volume Down  
**64.1%**

## HYBRID SYSTEM FOR SCR AND SILENCER



# Marine Application

## PROJECT INFORMATION

### New Building



Application	LNGC
Ship Owner	Gaslog
Capacity	3,650kw x 2sets / 2,750kw x 2sets



Application	LNGC
Ship Owner	Cardiff
Capacity	3,650kw x 2sets / 2,750kw x 2sets



Application	LNGC
Ship Owner	NYK
Capacity	3,840kw x 2sets / 2,880kw x 2sets



Application	Crude Oil Tanker
Ship Owner	NAT
Capacity	1,150kw x 2sets



Application	1,500ton maritime probe
Ship Owner	NIFS
Capacity	430kw x 2sets



Application	Container
Ship Owner	Evergreen
Capacity	4,000kw x 4sets



Application	Drill Ship
Ship Owner	Seadrill
Capacity	8,000kw x 6sets



Application	Floating Storage Unit
Ship Owner	Statoil
Capacity	4,600kw x 4sets / 1,500kw x 1set

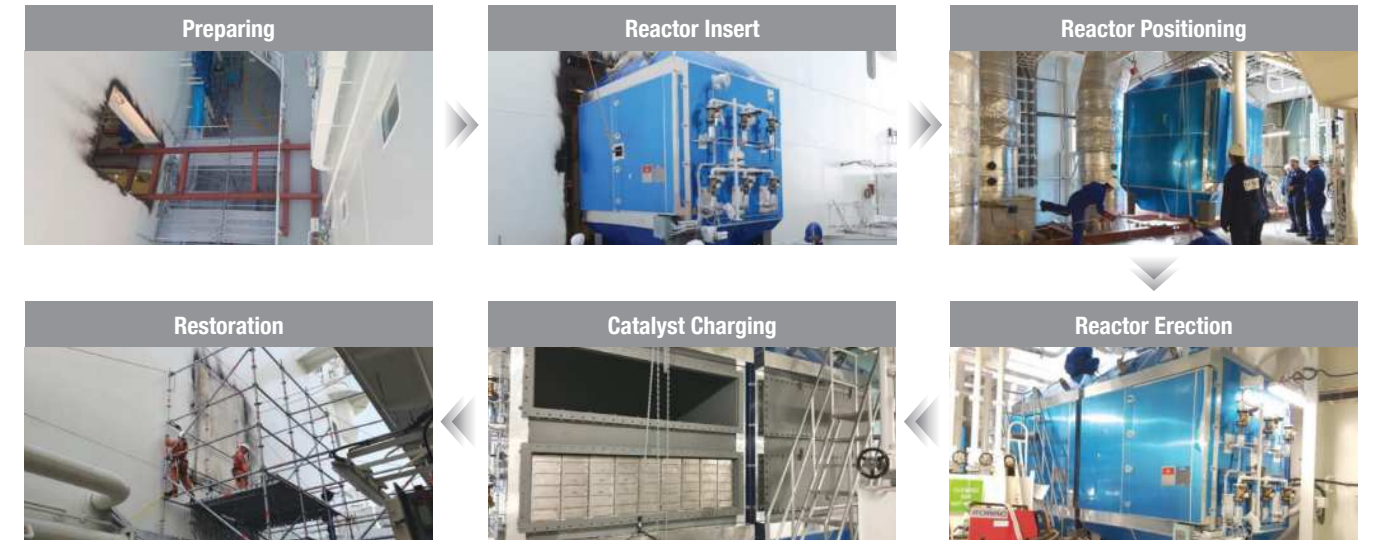


Application	4,900ton Platform Supply Vessel
Ship Owner	ShiCo
Capacity	1,900kw x 4sets

### Retrofit



Ship Name	Hoegh Galleon
Ship Owner	Hoegh LNG
Capacity	7,800kw x 4sets
Reductant	Urea (40%)



1. SCR Installation 2. MARPOL Test 3. EIAPP Certificate Issue  
 \* All works have been done during voyage.

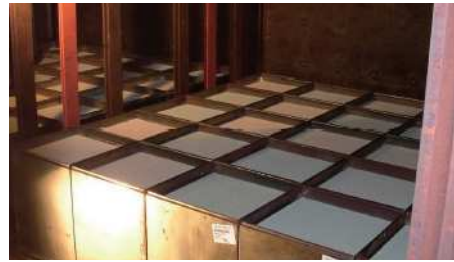


# Stationary Plant Application

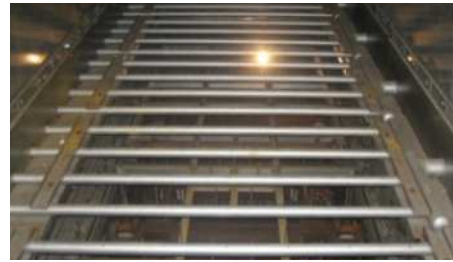
De-NOx SCR SYSTEM

## PaNOx™ smart v2.0

### MAIN COMPONENTS (POWER PLANT)



Catalyst



Ammonia Injection Grid



Dilution Air Fan



Local Control Panel

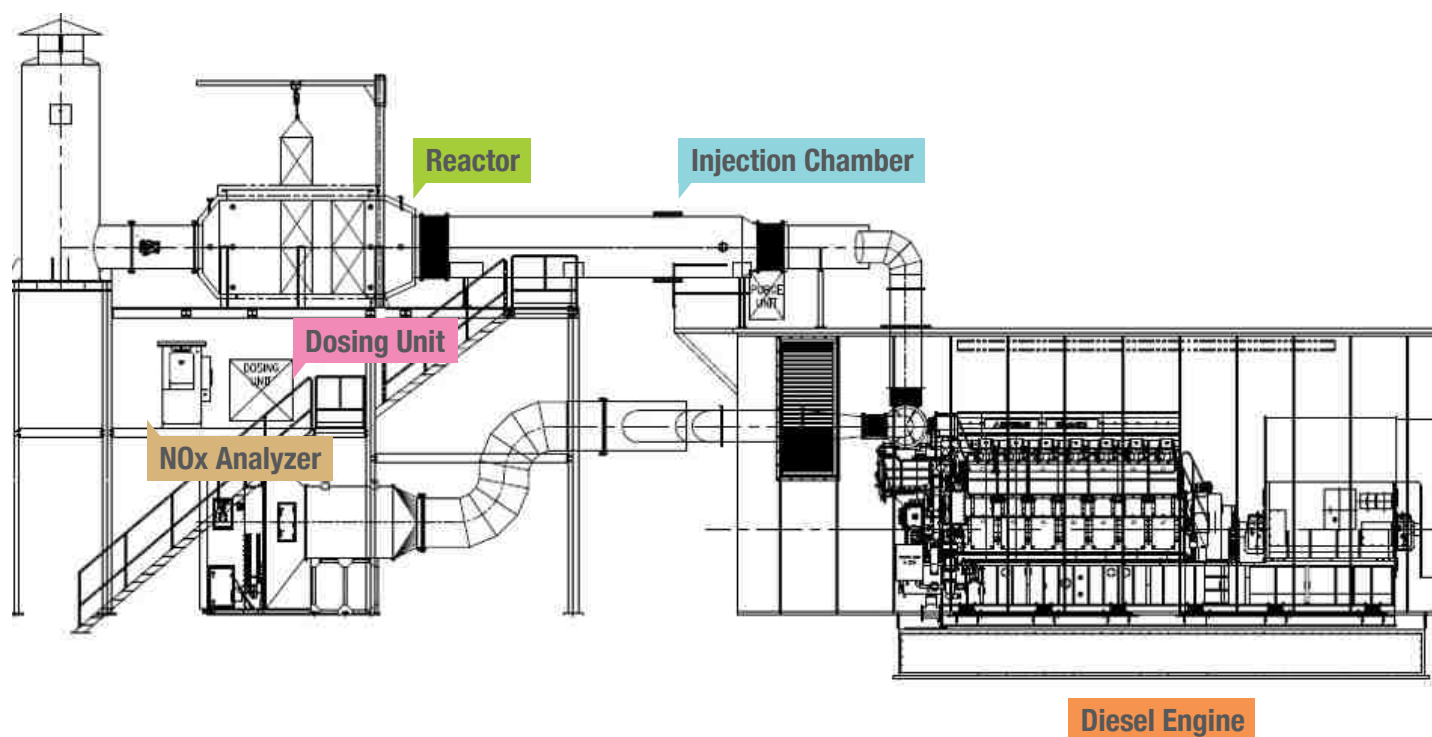


Elec. Heater & Vaporizer



Distribution Manifold

### MAIN COMPONENTS (STATIONARY PLANT)



### PROJECT INFORMATION (KOREA)



#### Incheon

- Application : Bio Gas Turbine
- Engine Capacity : 5MW x 1 Unit
- Reductive Agent : Aq. NH<sub>3</sub>(25%)



#### Hanam

- Application : HRSG
- GT Power : 425MW x 1 Unit
- Reductive Agent : NH<sub>3</sub>(25%)
- YPES + SCR Hybrid system



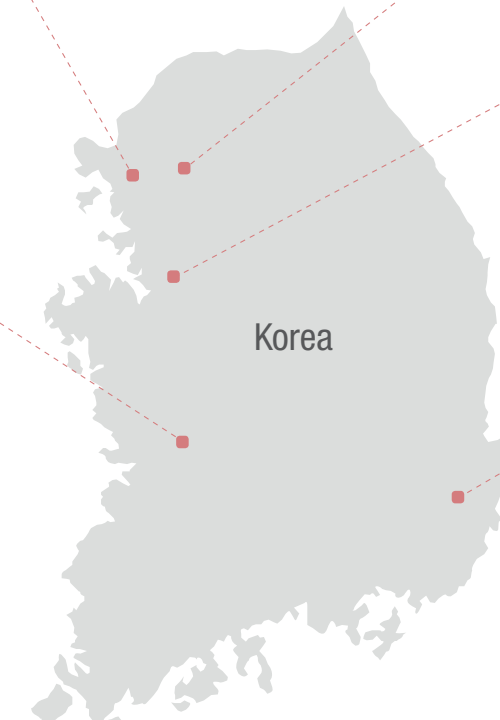
#### Iksan

- Application : Bio Gas Engine
- Engine Capacity : 350kW x 1 Unit
- Reductive Agent : Aq. Urea(40%)



#### Pyeongtaek

- Application : HRSG
- GT Power : 475MW x 2 Unit
- Reductive Agent : Anhydrous NH<sub>3</sub>



#### Ulsan

- Application : HRSG
- GT Power : 425MW x 2 Unit
- Reductive Agent : Anhydrous NH<sub>3</sub>



#### KCES

- Application : Incinerator
- Capacity : 33,800 Nm<sup>3</sup>/hr x 1 Unit
- Reductive Agent : Aq. Urea(40%)



#### Jeju

- Application: HRSG + YPAS
- GT Power : 120MW x 2 Unit
- Reductive Agent : Aq. Urea(40%)



# Stationary Plant Application

## PROJECT INFORMATION (IRAN)



### Tombak

- Application : Diesel Engine
- Capacity : 7MW x 2 Unit
- Reductive Agent : Aq. Urea (40%)
- Delivered : December 2011



## PROJECT INFORMATION (SAUDI)



### Yanbu

- Application : HFO Boiler
- Capacity : 117 ton
- Reductive Agent : Aq. Urea (40%)
- Delivered : August 2012



## PROJECT INFORMATION (USA)



### Fresno WWTP

- Application : 2-HRSG retrofit (004)
- Capacity : 3MW (126,000 lb/hr)
- Reductive Agent : NH3 Gas
- Supply Items : Catalyst/Reactor/AFCU
- Delivered : October 2011



### Diamond Pet Foods

- Application : 2-Industrial Boiler (002)
- Capacity : 12MMBtu/hr (350HP)
- Reductive Agent : Anhydrous NH3 Gas
- Supply Items : Catalyst/Reactor/AFCU
- Delivered : July 2011



### CO-OP City PP-New York

- Application : OTSG
- Capacity : 350 HP
- GT Power : 12MW x 2 Unit
- Reductive Agent : Aq. NH3 (19%)
- Supply Items : AFCU, ADM, AIG, Control Panel
- Delivered : January 2007



### Hawaii

- Application : OTSG
- GT Power : 24MW x 2 Unit
- Reductive Agent : Aq. Urea (40%)
- Supply Items : AFCU, ADM, AIG, Control Panel
- Delivered : August 2008



### Corn Products

- Application : 1-Solar Turbine/Deltak HRSG (003)
- Capacity : 3MW
- Supply Item : Catalyst/Reactor/AFCU
- Reductive Agent : NH3(19%)
- Delivered : Jan. 2011



### Univ of California-Riverside

- Application : Industrial Boiler (009)
- Capacity : 1000 HP \* 3 Unit
- Supply items : SCR systems
- Reduction Agent : NH3 Gas
- Delivery : Mar. 2013
- \*\*5ppm NOx & NH3 Slip



### ConAgra Foods-Helm

- Application : Industrial Boiler (005)
- Capacity : 100,000 lbs/hr steam \* 2 Unit
- Reduction Agent : NH3 Gas
- Supply Items : SCR SYSTEMS
- Delivery : Feb. 2012



### VA-Long Beach

- Application : Industrial Boiler (010)
- Capacity : 1000 HP \* 2 Unit
- Reduction Agent : NH3 Gas
- Supply Items : SCR systems
- Delivery : 2014
- \*\*5ppm NOx & NH3 Slip



### UC-Irvine Med Center

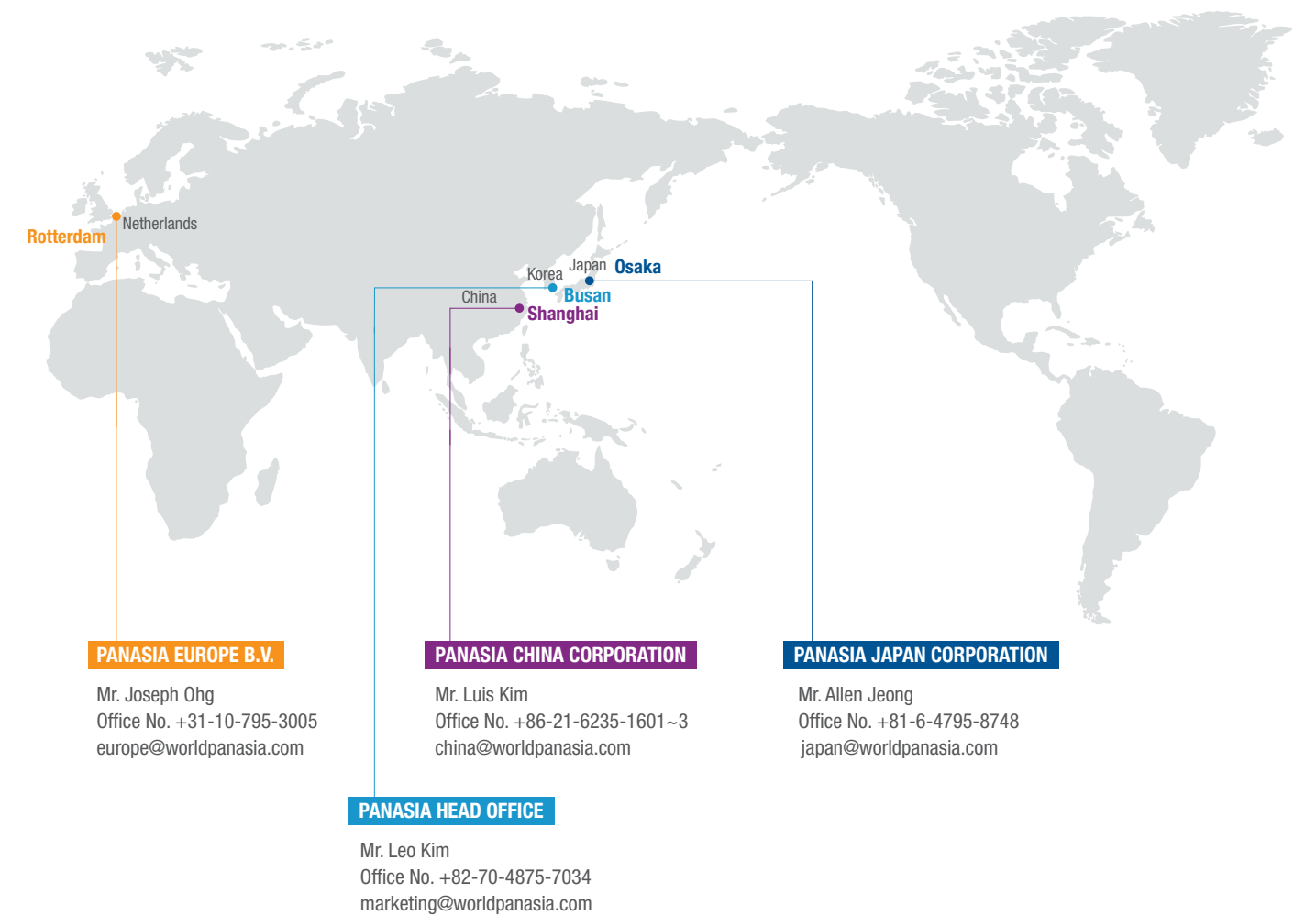
- Application : 2-Industrial Boiler (007)
- Capacity : 750 HP \* 2 Unit
- Reductive Agent : NH3 Gas
- Supply Item : Catalyst/Reactor/AFCU
- Delivered : Feb. 2012

# Track Record

NO.	Application	Project Name	Customer	Country	Capacity	Reductant	Q'ty	Year	Remark
1	Power Plant (HRSG)	ULSAN Chemical Plant	SK corp.	KOREA	8MW	NH3 Gas	1	2002	Steam Generator
2		CO-OP CITY PP	IST, KEPCO ENC	USA(New York)	12MW	NH3(19%)	2	2007	OTSG
3		HELCO KEAHOLE	IST, KEPCO ENC	USA(Hawaii)	24MW	Urea(40%)	2	2008	OTSG
4		003	Corn Products	USA (California)	3MW	NH3(19%)	1	2011	Solar Turbine/Deltak HRSG
5		004	City of Fresno	USA (California)	3MW	NH3 gas	2	2011	Allison Turbine/Deltak HRSG
6		PYEONGTAEK CCPP	Western Power	KOREA	475MW	NH3(99.9%)	2	2013	
7		ULSAN CCPP	East Western Power	KOREA	475MW	NH3(99.9%)	2	2013	
8		INCHEON CCPP	East Western Power	KOREA	5MW	NH3(25%)	1	2013	BIO GAS
9		HANAM CHPP	Doosan Construction	KOREA	425MW	NH3(25%)	1	2013	SCR & YPES
10		JEJU CCPP	GE POWER SYSTEMS KOREA	KOREA	225MW	NH3(25%)	2	2016	SCR & YPAS
11	Boiler	CS IB SCR	California Sheets	USA(California)	600 HP	NH3 Gas	1	2010	
12		DP IB SCR	Diamond Pet Foods	USA(California)	350 HP	NH3 Gas	2	2010	
13		CFH IB SCR	ConAgra Foods-Helm	USA(California)	100,000 lbs/hr steam	NH3 Gas	2	2012	
14		CFO IB SCR	ConAgra Foods-Oakdale	USA(California)	150,000 lbs/hr steam	NH3 Gas	3	2012	
15		UC MC IB SCR	UC-Irvine Med Center	USA(California)	750 HP	NH3 Gas	2	2012	
16		Yanbu II Power Plant	DKME	SAUDI(Yanbu)	117 Ton Boiler	Urea(40%)	1	2012	HFO Boiler
17		CF02 IB SCR	ConAgra Foods-Oakdale	USA(California)	150,000 lbs/hr steam	NH3 Gas	1	2013	
18		UCR IB SCR	Univ of California-Riverside	USA(California)	1000 HP	NH3 Gas	3	2013	5ppm NOx & NH3 Slip
19		CF03 IB SCR	ConAgra Foods-Oakdale	USA(California)	150,000 lbs/hr steam	NH3 Gas	1	2013	
20		VALB1 IR SCR	VA-Long Beach	USA(California)	1000 HP	NH3 Gas	2	2014	5ppm NOx & NH3 Slip
21		VALB2 IR SCR	VA-Long Beach	USA(California)	1000 HP	NH3 Gas	1	2015	5ppm NOx & NH3 Slip
22		UCI IR SCR	Univ of California-Irvine	USA(California)	1000 HP	NH3 Gas	1	2016	5ppm NOx & NH3 Slip
23		VAWLA IB SCR	VA-West Los Angeles	USA(California)	1000 HP	NH3 Gas	3	2016	5ppm NOx & NH3 Slip
24		UCL2 IR SCR	UC-Irvine	USA(California)	1000 HP	NH3 Gas	1	2016	5ppm NOx & NH3 Slip
25	Incinerator	National development project	KCES Co.,Ltd.	KOREA	33,800 Nm3/hr,wet	Urea(40%)	1	2004	

# Worldwide Service Network

Effective Follow-up Service, Prompt Action for Spare Parts



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