



Agenda



- Alfa Laval Packinox (Company overview)
- How to manufacture a Packinox
- How it works
- Case study
- Market overview
- Market in KSA
 - ✓ Packinox references & history
 - ✓ Possible targets (replacement of Texas tower in reforming units)

Key figures 2018

In MEUR



3 965
INVOICING



4 388
ORDER
INTAKE



ROCE as
%
22.4

665
Adjusted
EBITA

16.5
Adjusted EBITA as
% of sales

16 785

Average No. of
employees



We serve most industries



Biofuels

Biotech and pharmaceutical

Chemicals

Crude oil refinery

Engine and transport

Fluid power

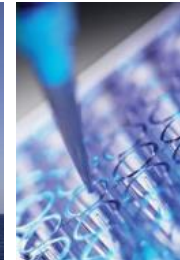
Food and beverages

HVAC

Industrial fermentation

Latex

Machinery



Marine and diesel

Metal working

Mining and mineral processing

Oil and gas

Power

Pulp and paper

Refrigeration and air-conditioning

Semiconductor systems

Steel and coke oven gas

Sugar

Wastewater treatment

Three business divisions



Energy

This area covers a wide range of industries such as HVAC, oil & gas, chemicals, biofuels – with a special focus on energy efficiency.



Food & Water

Offers products, solutions and systems in the areas of food processing and water treatment.



Marine

The company has supplied the marine industry since 1917 and has today a broad offering incl. environmental marine products.



- Subsidiary to Alfa Laval (100% owned)
- World leader in large, welded plate heat exchangers for the oil & gas industry
- Turnover: 60 millions EUR
- 150 employees
- International presence – offices worldwide
- Headquarter in Paris
- Production in Chalon sur Saône

Packinox history



The first
« Packinox »
exchanger is sold

1981

1985

The Packinox SA
company is created

1990



Framatome, the
french nuclear
company acquires
Packinox SA

1994

ISO 9001
certification.

First order for an
exchanger on a
Paraxylene unit.

2002



ISO 14001
certification

2005



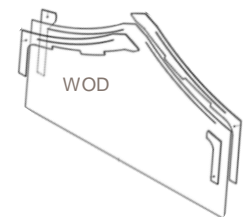
Alfa Laval is
acquiring Packinox
SAS

2009



A new forming pool
is put into service

2018



4th Generation with
new curved plate
design

Alfa Laval Packinox



Assembly line workshop

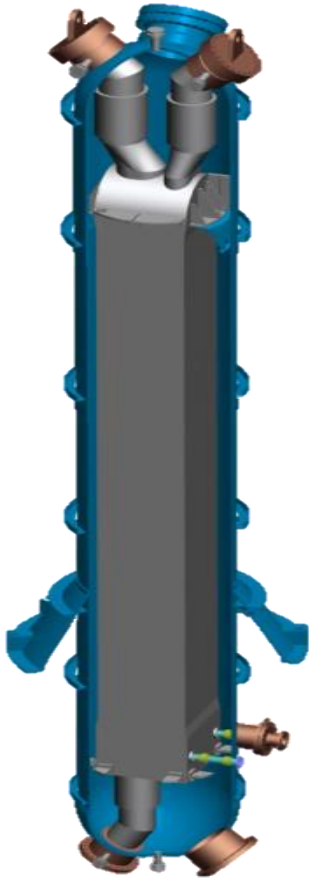


Forming facility

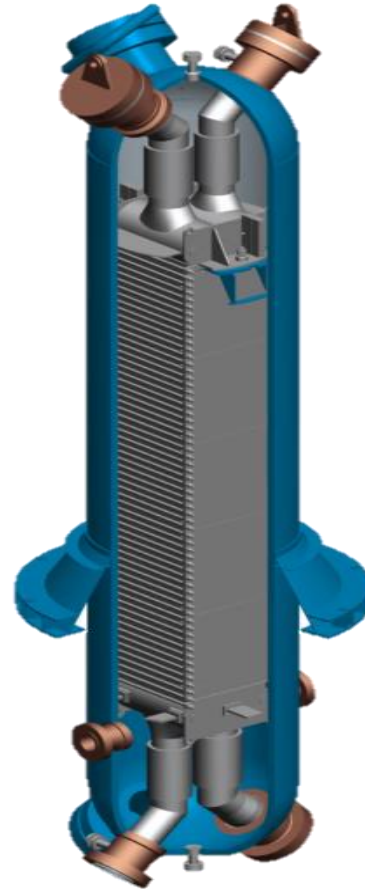
A photograph of a large industrial facility, likely a refinery or chemical plant. The scene is dominated by a complex network of blue-painted metal pipes and structural steel. In the background, several tall, dark smokestacks rise against a clear blue sky with a few wispy clouds. The foreground shows a dense arrangement of horizontal pipes, some wrapped in insulation. The overall impression is one of a large-scale, modern industrial operation.

Products and applications

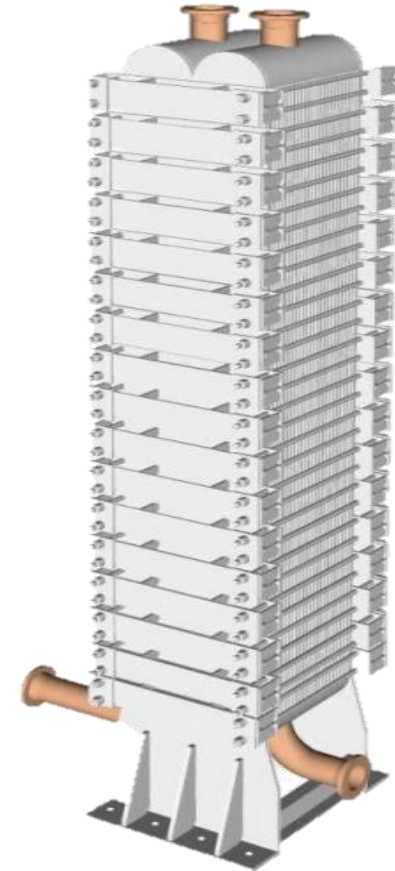
Standard products



CRU, aromatics,
LAB and methanol

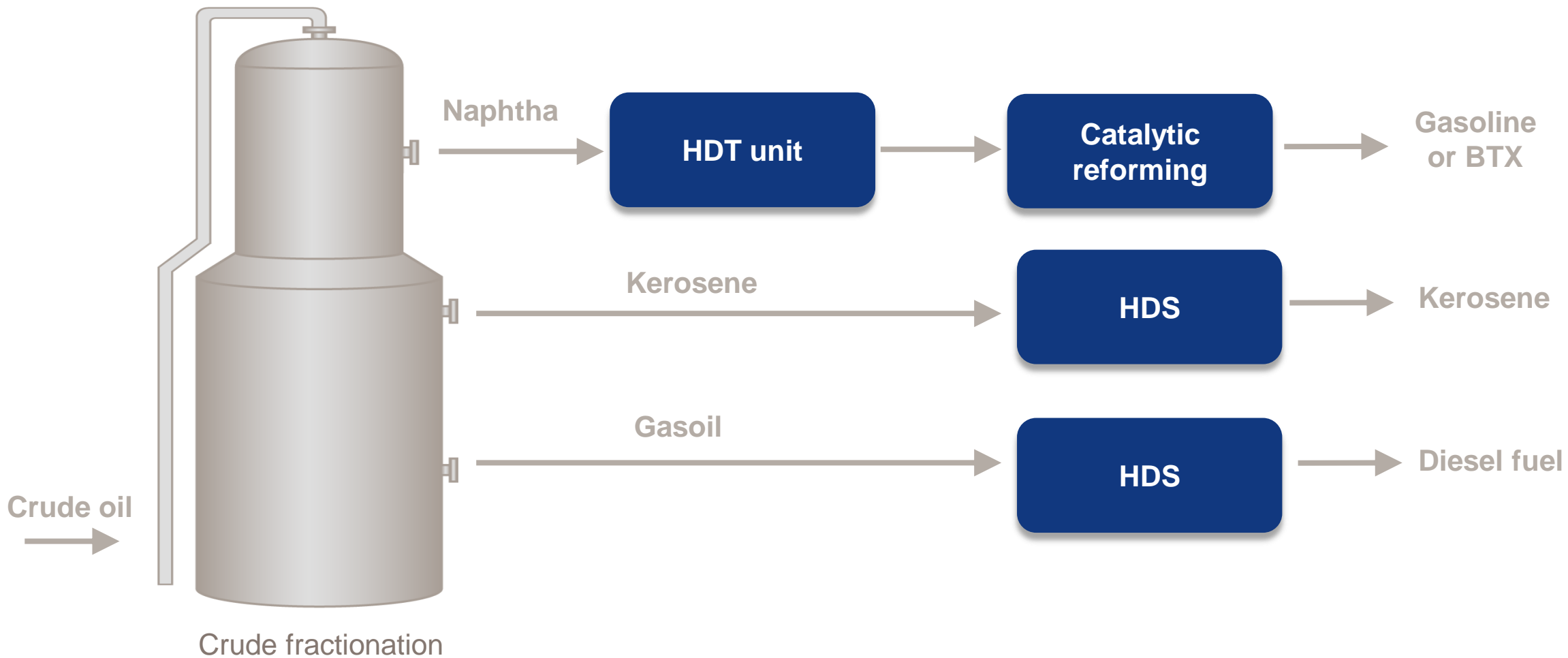


Hydrotreater

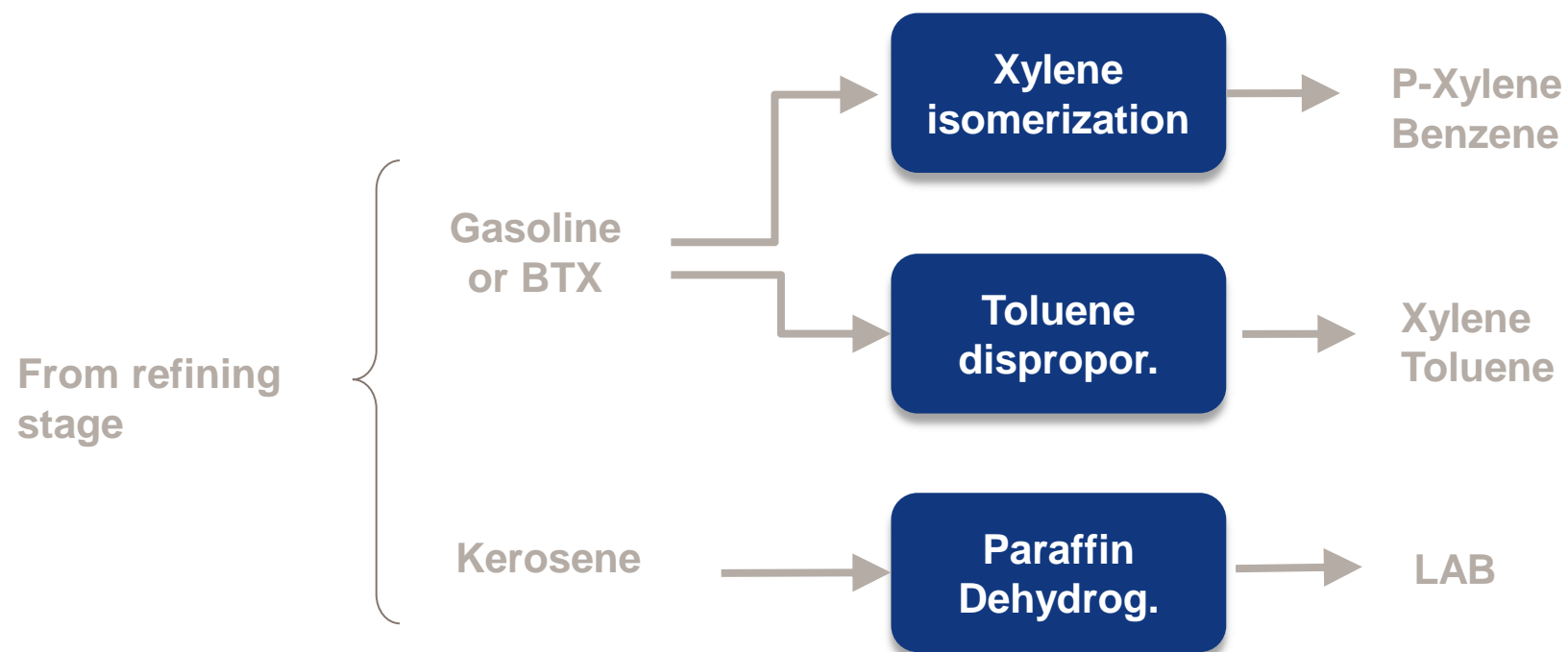


Feed/bottom stripper
liquid/liquid

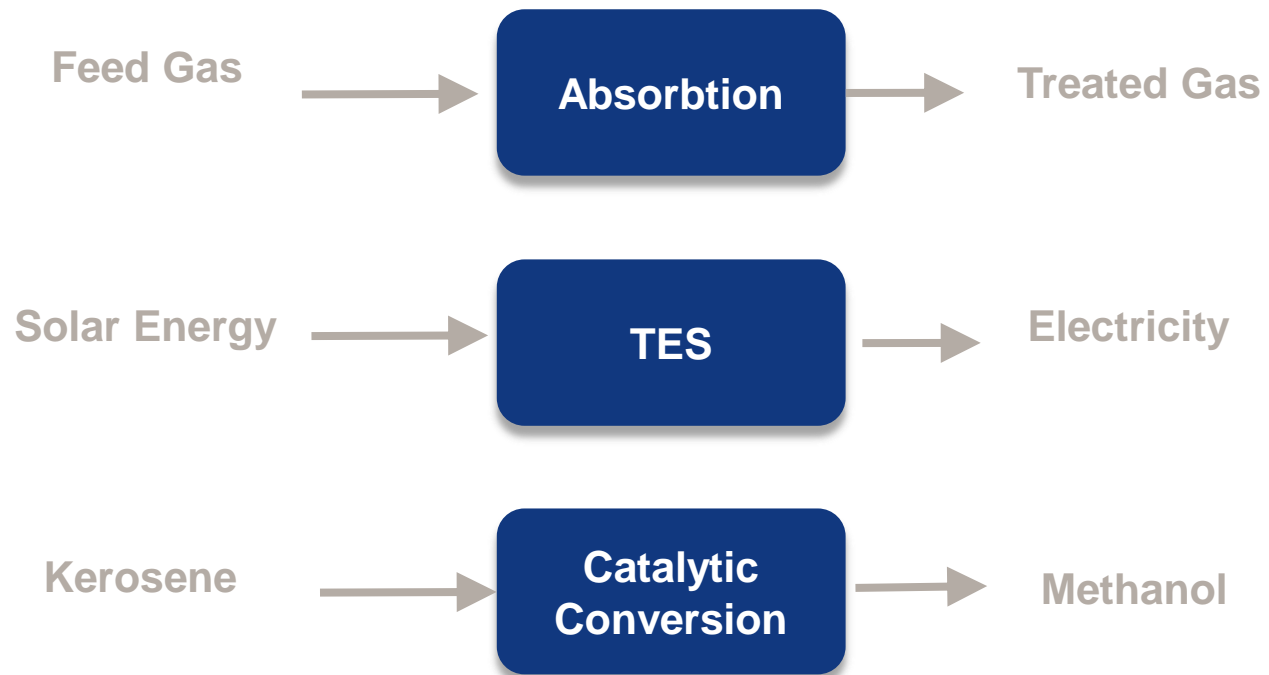
Refinery applications



Petrochemical applications



Other applications



Manufacturing steps



PLATE BUNDLE

Sheets

Explosion
forming

Stacking

Welding

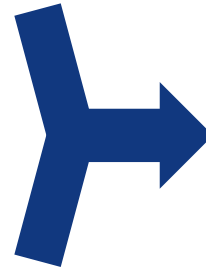
Plates

Rolling

Welding

Heat
treatment

PRESSURE VESSEL



Large size transport





Packinox Design

Alfa Laval Packinox

How it works

Highest Pressure Recycle gas contained into the vessel, maintaining plate bundle under positive pressure

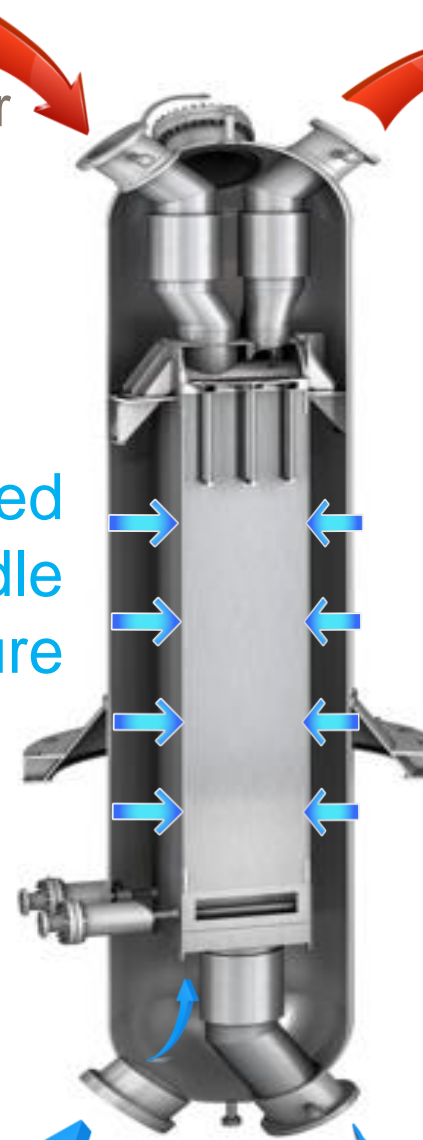
Liquid feed injection

Recycle gas

Hot Effluent inlet from reactor

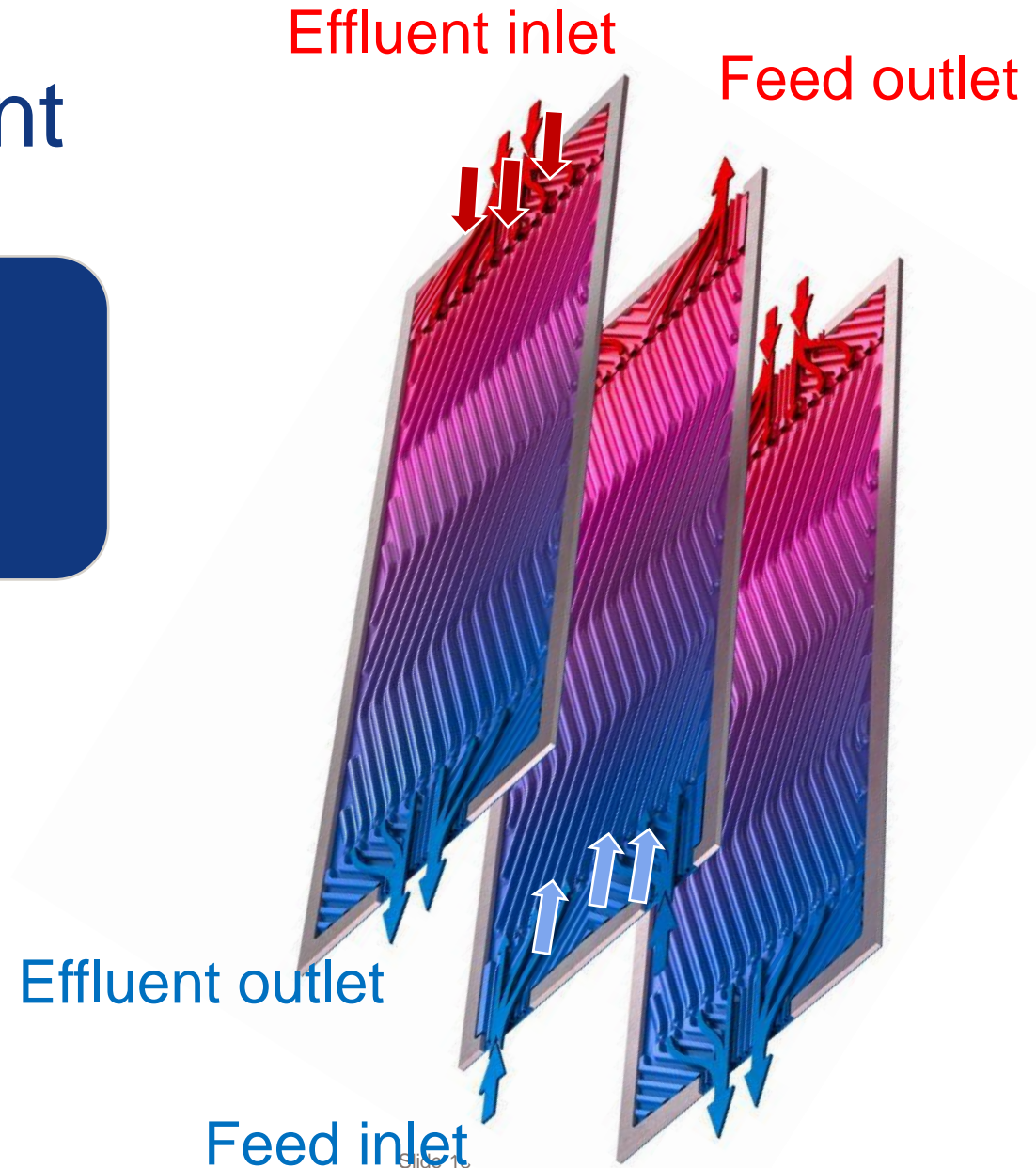
Hot Combined feed outlet To heater

Cold effluent outlet to coolers

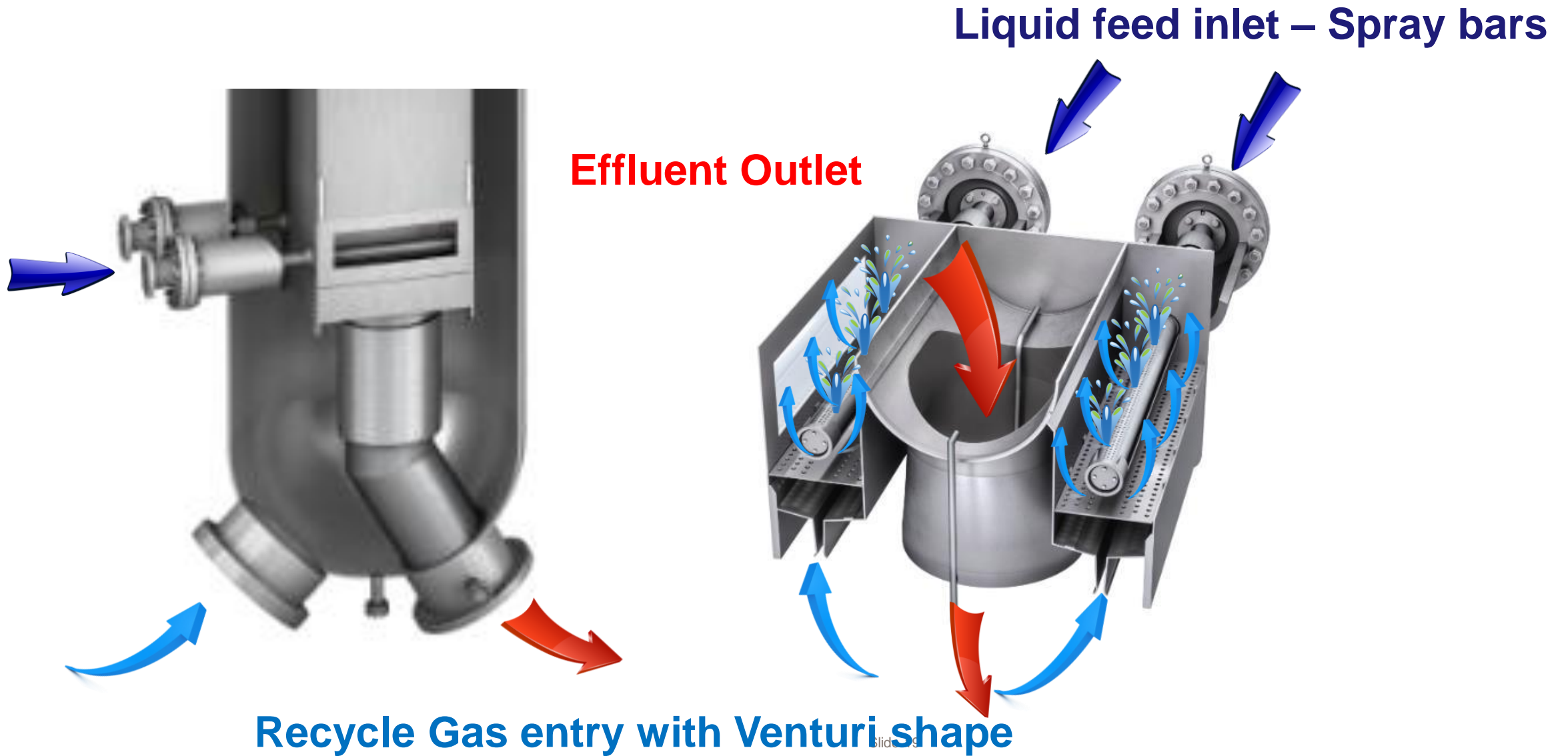


Alfa Laval Packinox Bundle plates arrangement

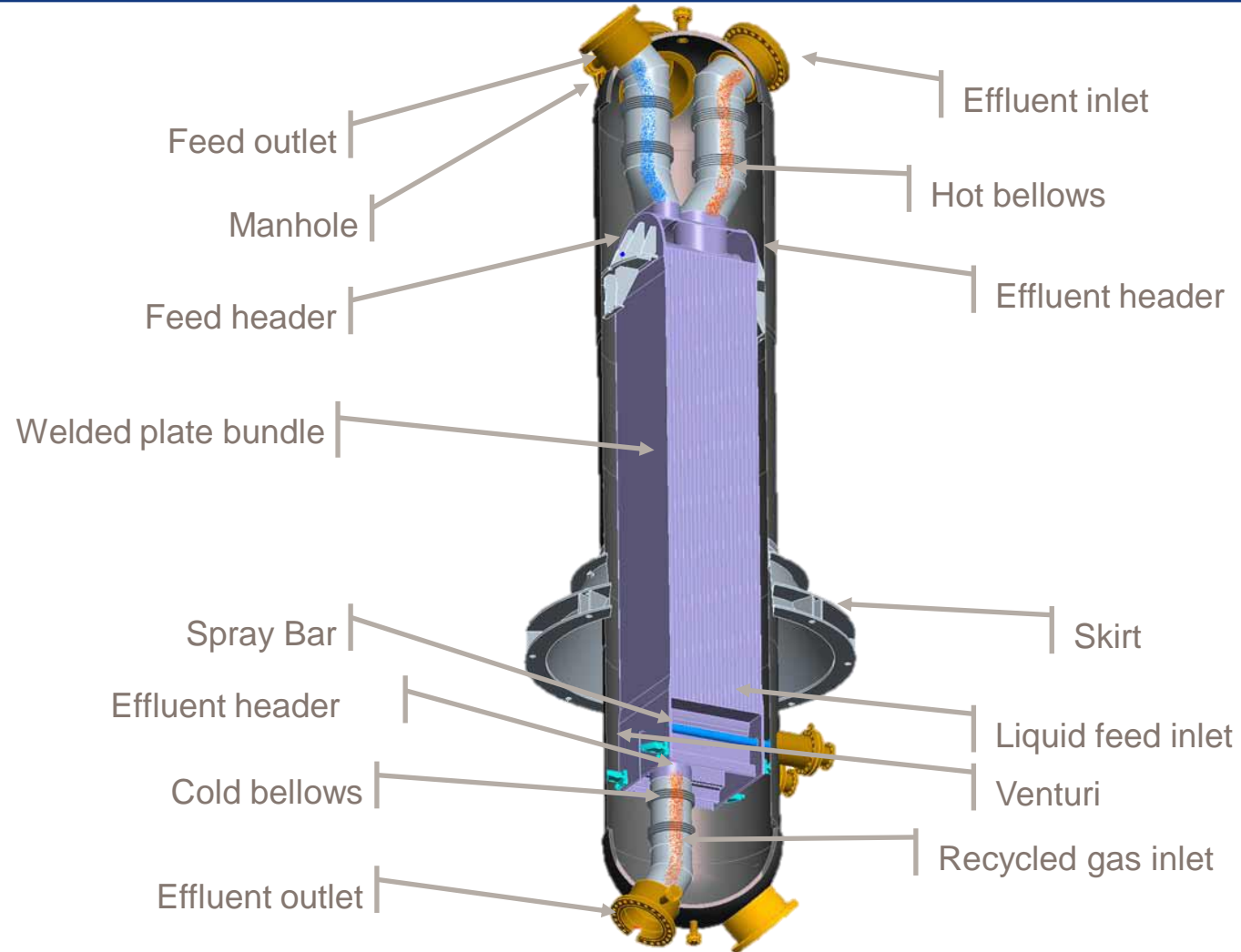
Turbulences created by the corrugated plates are the key
of the high thermal heat exchange
performances



Opened Detailed view of Bundle cold area (Bottom side)



Design



Reliable performance



The result is heat exchanger with:

- High capacity
- Outstanding heat recovery
- Compact size
- Minimal pressure drop
- Maximum yield
- High reliability

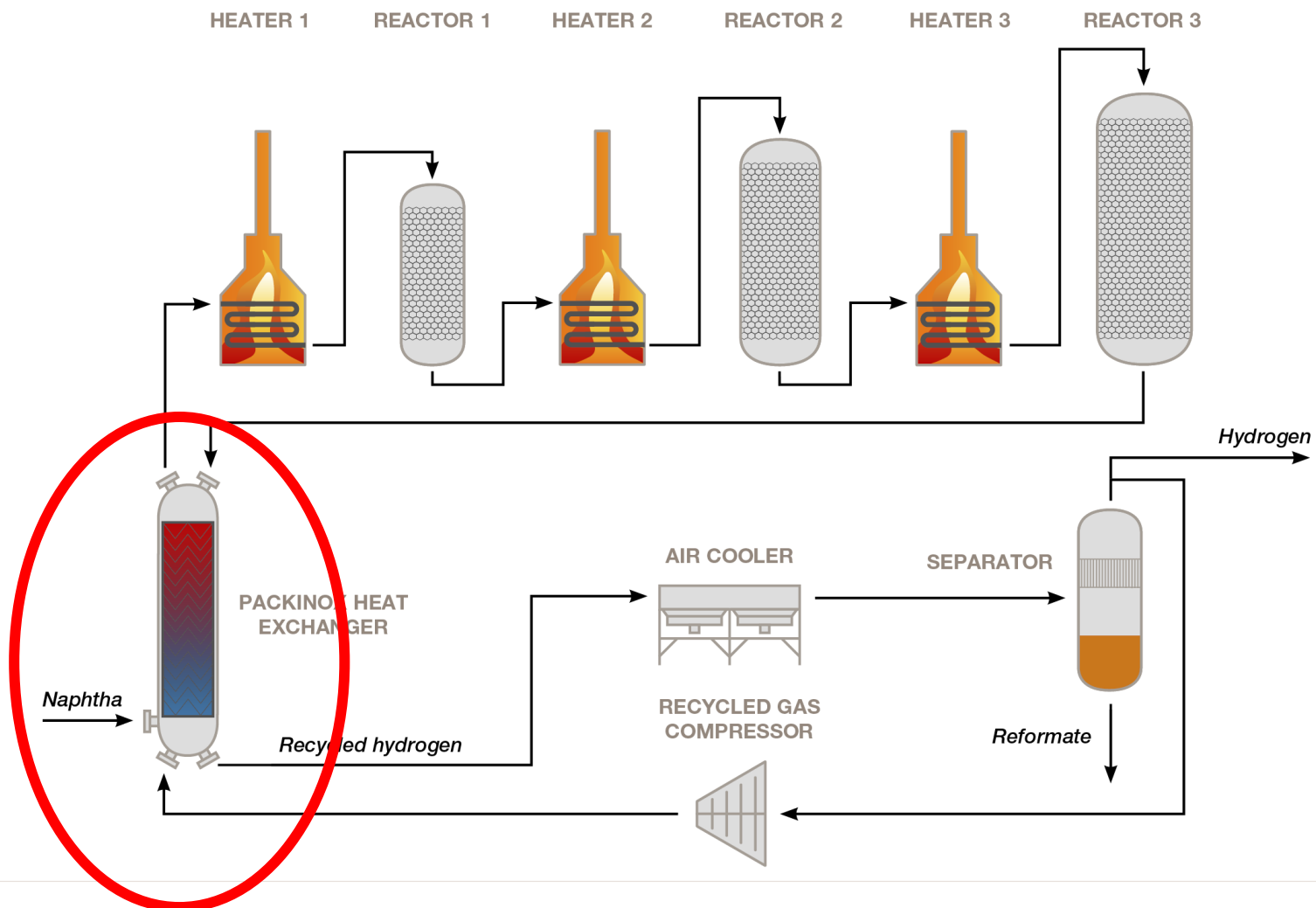




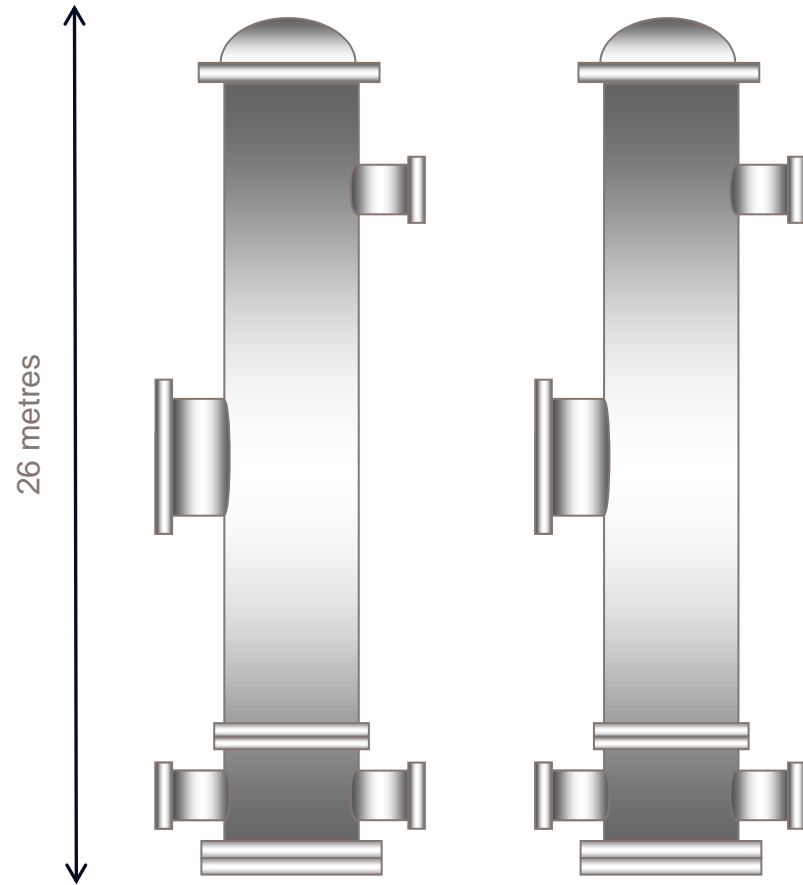
Case Study

Replacement of Vertical Shell-and-Tube HE by Packinox in CRU

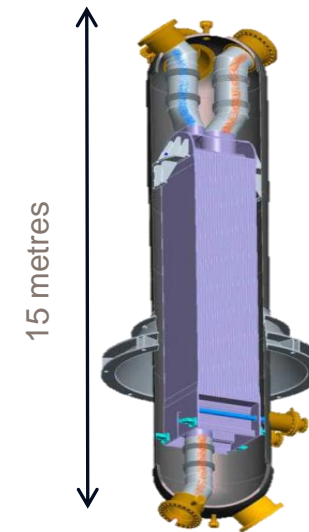
Process overview



Compact size



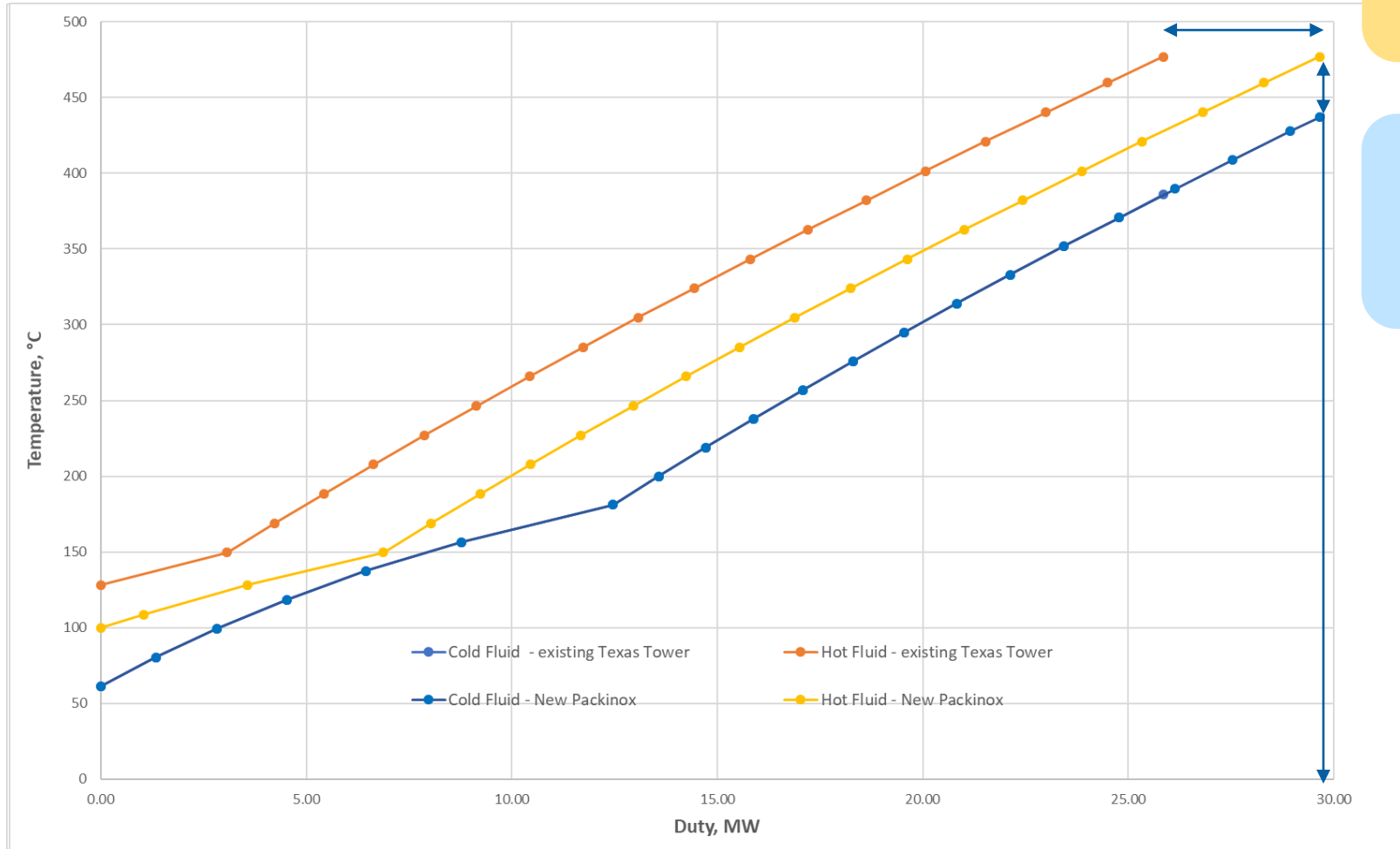
Two shell-and-tube HEX
Dry weight = 225 tonnes



One Packinox
Dry weight = 90 tonnes

Maximun Heat Recovery

- Recent exemple: CCR Platforming in Malaysia



Existing Texas Tower
HAT = 91°C
Duty = 25.8 MW

New Packinox
HAT = 40°C
Duty = 29.6 MW

Savings = 3.6 MW

Packinox vs. shell-and-tubes

Revamping of existing unit (30,000 BPSD CCR Reforming unit)

Replacement of existing Shell&Tube exchanger (Texas Tower)

	Packinox	Vertical S&T
Hot approach temperature (HAT)	35°C	65°C
Number of shells	1	2
Heat Duty	39.6 Gcal/h	36.04 Gcal/h
Additional heat recovery	3.56 Gcal/h	-
CAPEX		
Equipment cost	2,300,000 EUR	-
Installation cost	920,000 EUR	-
Total installed cost	3,220,000 EUR	-
SAVINGS		
Fuel savings per year (assumed fuel cost = US\$300/tonne)	1,748,900 EUR	-

Packinox vs. shell-and-tubes

Revamping of existing unit (30,000 BPSD CCR Reforming unit)

Replacement of existing Shell&Tube exchanger (Texas Tower)

In operation	Packinox	Vertical S&T
Thermal and Hydraulic Performances	Manufacturer Guarantees performance to spec	Difficulties in meeting performance spec.
Liquid Distribution system	Homogeneous mixing of the two phases Even distribution	Bad entrainment
Expansion Bellows	No contamination in case of failure	Contamination in case of failure
Vibrations	Physically impossible	Tube vibration and risk of mechanical failure
Fouling	Much lower than S&T	

Packinox vs. shell-and-tubes

Revamping of existing unit (30,000 BPSD CCR Reforming unit)

Replacement of existing Shell&Tube exchanger (Texas Tower)

Inspection and maintenance	Packinox	Vertical S&T
Access for bundle inspection	✓	✗
Inspection of pressure vessel internals	✓	✗
Repair of the bundle on site	✓	Tube plugging More extensive repairs
Cleaning	On-site cleaning	Hydroblasting after bundle removal



Convince Client to provide TT data for Technical and economic assessment



Information to be supplied to Alfa Laval Packinox

The following information are requested in order to evaluate / optimize the thermal and mechanical configuration of the proposed Alfa Laval Packinox Heat Exchanger in replacement of the existing heat exchanger.

Required information	Supplied
1. Flow rates (in kg/h): <ul style="list-style-type: none">On Feed side: Naphtha Flow rate H2 recycle flow rateOn Effluent side: Last reactor effluent rate (normally equal to the sum of naphtha and recycle gas)	
2. Composition of Naphtha Feed, Hydrogen Recycle Gas (in wt or mol%) using the breakdown given in page 2 here after. If not available for Naphtha feed, please provide the following information: <ul style="list-style-type: none">For Naphtha Feed:<ul style="list-style-type: none">PIONA per carbon number as presented in the Crude assay (in wt%).specific gravity,ASTM D86	
3. For reactor effluent: <ul style="list-style-type: none">RON of ReformateC5+ yield (in wt% of the Naphtha Feed)Aromatic content in Reformate (in wt%)H2 yield (in wt% of the Naphtha Feed)	
4. Inlet and Outlet temperatures on both Feed and Effluent side (on Feed side, please provide temperature of both naphtha and Hydrogen recycle gas)	
5. Pressures at: <ul style="list-style-type: none">Feed side inlet (Hydrogen recycle gas inlet)Effluent side inlet	
6. Datasheet (mechanical and process datasheets) of existing Heat Exchanger showing: <ul style="list-style-type: none">Dimensions (diameter, Length between tangent lines, Weights,),Material of construction,Design temperature and Design Pressure (on both side)Piping connections (and diameters).	
7. Existing configuration in order to estimate maximum acceptable diameter of the new HE: <ul style="list-style-type: none">If available, please provide lay-out / general arrangement / detailed information about the structure.Please provide, if available, the following elements:<ul style="list-style-type: none">Maximum load of the existing structureWhat are the loading conditions: wind, earthquake, nozzles loads, others?	



Composition Breakdown to be used for Naphtha, Hydrogen Recycle Gas and reactor Effluent

In wt% or in mol%	Naphtha Feed	Hydrogen recycle gas
H2		
METHANE		
ETHANE		
PROPANE		
nBUTANE		
isobUTANE		
nP5		
iP5		
N5		
nP6		
iP6 (in Methyl-P5)		
iP6 (in DiMethyl-P4)		
N6 (cyclo5)		
N6 (cyclo6)		
A6		
nP7		
iP7 (in Methyl-P6 and Ethyl-P5)		
iP7 (other)		
N7 (cyclo5)		
N7 (cyclo6)		
A7		
nP8		
iP8 (in Methyl-P7 and Ethyl-P6)		
iP8 (other)		
N8 (cyclo5)		
N8 (cyclo6)		
A8		
nP9		
iP9		
N9 (cyclo5)		
N9 (cyclo6)		
A9		
nP10		
iP10		
N10 (cyclo5)		
N10 (cyclo6)		
A10		
nP11		
iP11		
N11 (cyclo5)		
N11 (cyclo6)		
A11		

Note: P means Paraffins
N means Naphthenes
A means Aromatics



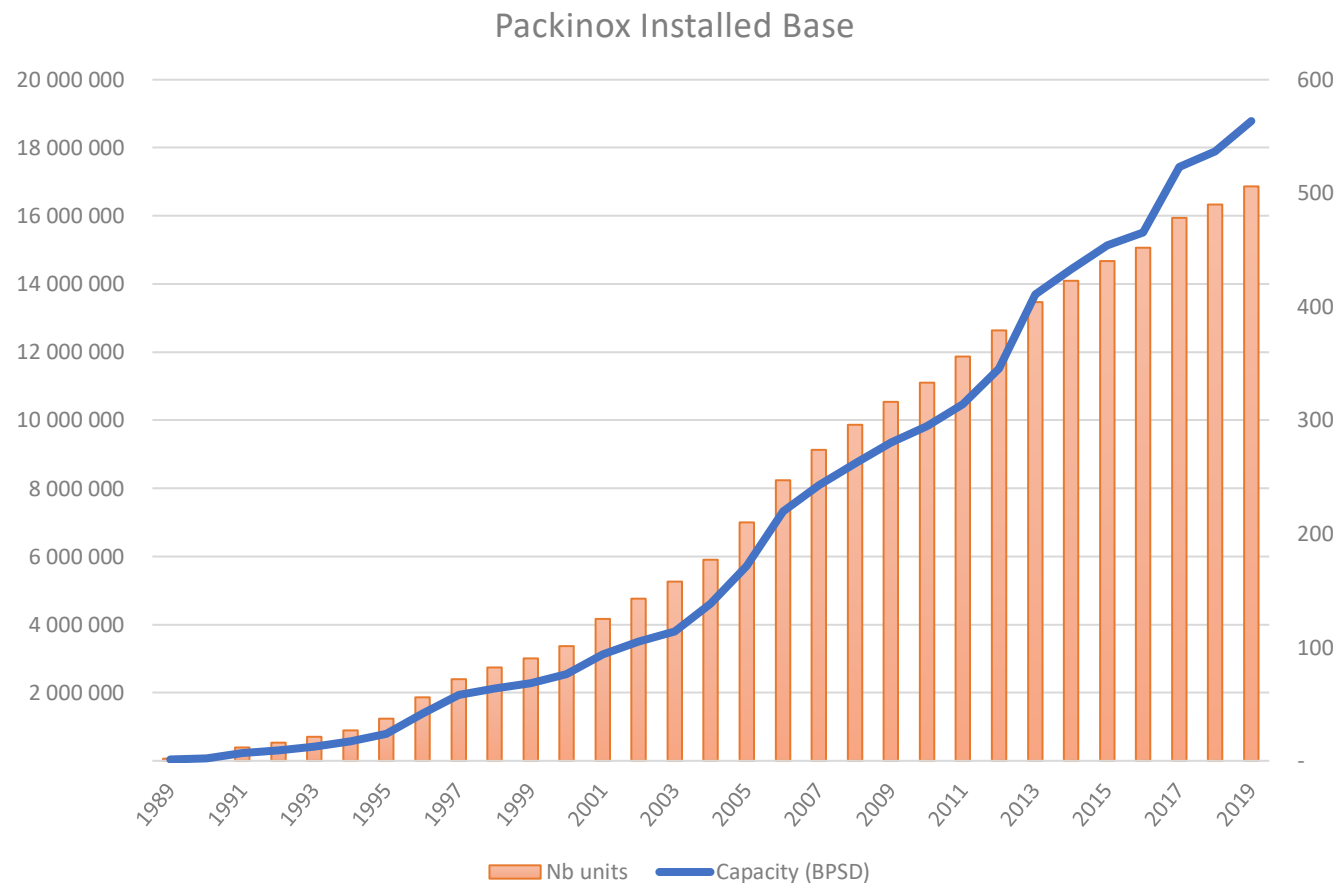
Packinox References and Market Share

Market Share



AL Packinox installed base is growing continuously being the first choice for our customer and being supported by every licensors for reforming and Aromatic units.

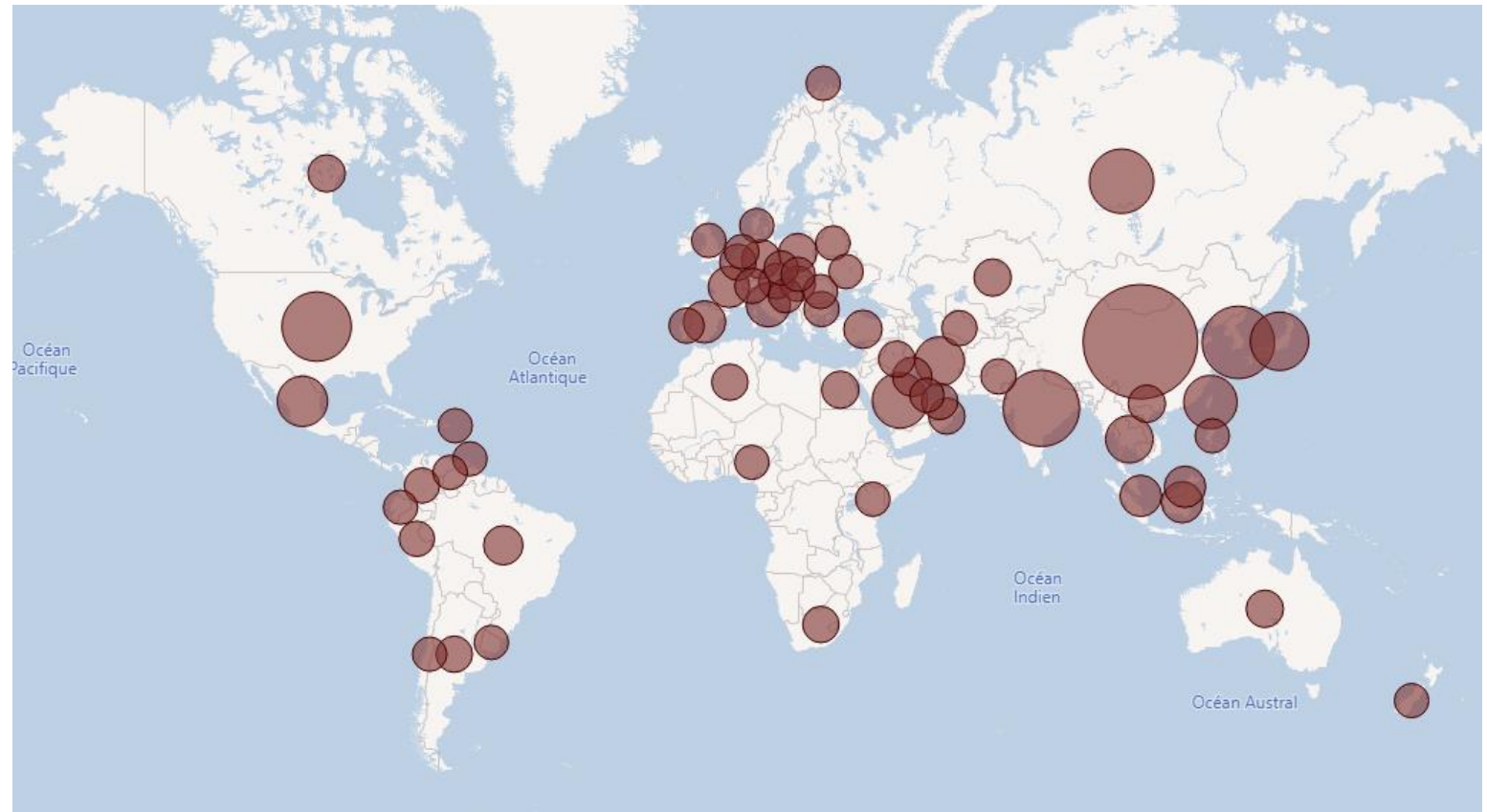
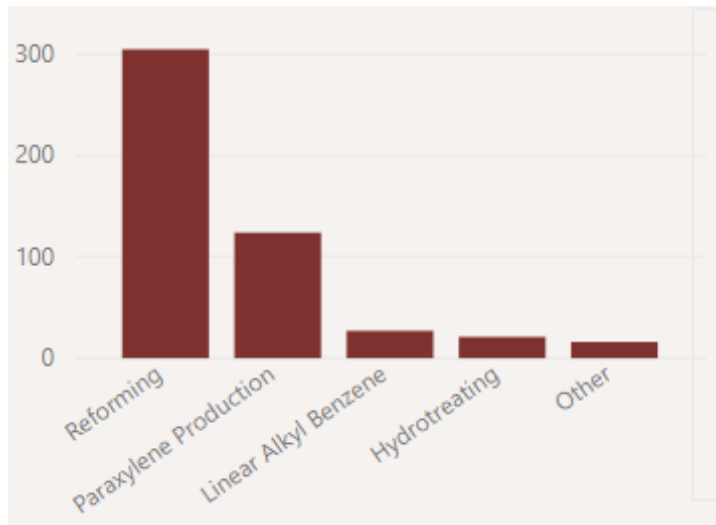
We have nowadays more than **500** exchangers in operation for more than **18 M BPSD** processed around the world and **2,5 million** cumulative working days of experience.



Market Share

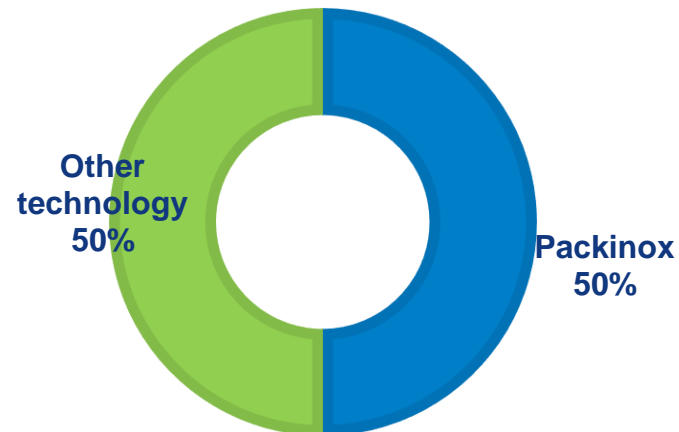


- We have our exchangers installed in more than 60 countries, mainly on reforming and aromatic units.

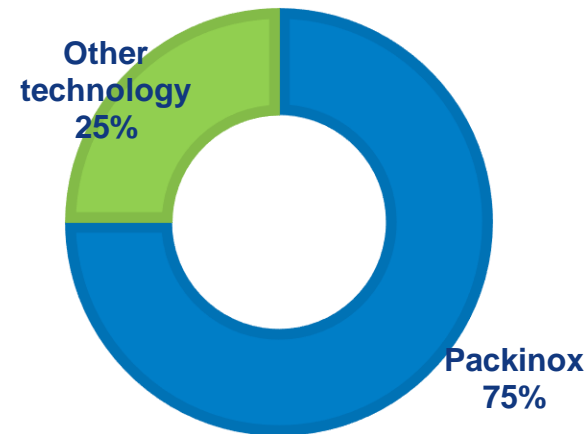


- AL Packinox equip more than 50% of Reforming units around the world for capacity higher than 10 000 BPSD.
- For unit above 30 000 BPSD, where the thermal efficiency is even more beneficial to our customers, our market share is higher than **75%**.

REFORMING 10 000+ BPSD



REFORMING 30 000+ BPSD



Pckinx ID	EndUser	Location	Licensors	NatureAffaire	Start-up Date	Status	TypeProcede
9P/E601	Arabian Industrial Fibers	Yanbu	UOP	New unit	August-99	In operation	Xylene Isomerisation
9P/E602	Arabian Industrial Fibers	Yanbu	UOP	New unit	August-99	In operation	Toluen Transalkylation
PE0319	ARAMCO	Riyad	Axens	New unit	September-06	In operation	Gasoil HDS
PE0316	ARAMCO	Yanbu	Axens	New unit	October-06	In operation	Gasoil HDS Stripper
PE0317	ARAMCO	Yanbu	Axens	New unit	October-06	In operation	Gasoil HDS
PE0729	ARAMCO	Ras Tanura	Axens	New unit	February-11	In operation	Gasoil HDS
PE0730	ARAMCO	Ras Tanura	Axens	New unit	February-11	In operation	Gasoil HDS
PE1309	ARAMCO	Jazan	Axens	New unit	Delivered 2015	Delivered	CCR Reforming
PE1310	ARAMCO	Jazan	Axens	New unit	Delivered 2015	Delivered	Xylene Isomerisation
PE1319	ARAMCO	Jazan	Axens	New unit	Delivered 2015	Delivered	Gasoil HDS
PE1320	ARAMCO	Jazan	Axens	New unit	Delivered 2015	Delivered	Gasoil HDS
PE1723	ARAMCO	Ras Tanura	Axens	New unit	Delivered 2019	Delivered	CCR Reforming
PE0420	Farabi PC	Yanbu	UOP	Revamping	May-06	In operation	Linear Alkyl Benzene Unit
PE1001	Farabi PC	Yanbu	UOP	New unit	March-12	In operation	Linear Alkyl Benzene Unit
PE1617	Farabi PC	Yanbu	UOP	New unit	September-20	In operation	Linear Alkyl Benzene Unit
PE0919	JERP	Al-Jubail	Axens	New unit	October-13	In operation	CCR Reforming
PE0920	JERP	Al-Jubail	Axens	New unit	January-14	In operation	Xylene Isomerisation
PE1219	Petro Rabigh	Rabigh	Axens	New unit	January-19	In operation	CCR Reforming
PE1220	Petro Rabigh	Rabigh	Axens	New unit	January-19	In operation	Xylene Isomerisation
PE1221	Petro Rabigh	Rabigh	Axens	New unit	January-19	In operation	Toluen Transalkylation
PE1914	Yansab	Yanbu	Scientific Design	New unit	February-21	In operation	Other Process
PE1018	YERP	Yanbu	UOP	New unit	January-15	In operation	CCR Reforming

- 17 Packinox currently in operation
- 5 Packinox to be started-up by 2021/2022
- Process:
 - 5 Packinox on CCR Reforming
 - 7 Packinox on HDS unit
 - 6 Packinox on Aromatic (PX) complex
 - 3 Packinox on LAB
 - 1 Packinox on Ethylene Oxyde
- Bad history with Aramco:
 - In 2013: Serious issue on Riyadh HDS unit – meetings with Aramco at high level
 - In 2014, Aramco has decided to stop Packinox installation on HDS unit (However, for Jazan, Packinox is maintained...)
 - Since that time, all Packinox have good performances in Aramco.

- Market share on Reforming: 30% only
- Reforming units non-equipped with Packinox:

End User	Refinery Name	Unit Name	Location	Unit Capacity	HE Type
ARAMCO	SASREF Al Jubail Refinery	Continuous Catalytic Reformer	Jubail	19000	tubular
ARAMCO	Riyadh Refinery	Catalytic Reformer Unit	Riyadh	30000	tubular
ARAMCO	Ras Tanura Refinery	Reformer 2 (488)	Dhahran	25000	tubular
ARAMCO	Ras Tanura Refinery	Reformer 1 (493)	Dhahran	25000	tubular
ARAMCO	Ras Tanura Refinery	Reformer 3 (J-24)	Dhahran	57000	tubular
ARAMCO	Yanbu Refinery	Continuous Catalytic Reformer	Jeddah	40000	tubular
Saudi Aramco Mobil Refinery Ltd	Yanbu SAMREF Refinery	Reformer Unit	Yambu	46000	tubular

- This units are key targets for Packinox:
 - Collect Operating data of Tubular HE (using ALP questionnaire)
 - Assess Packinox performances (technical and economic comparison)

