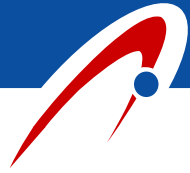


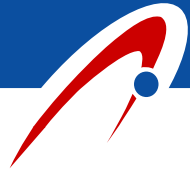
African Refining and Axens Technologies

Stéphane Wambergue

Axens



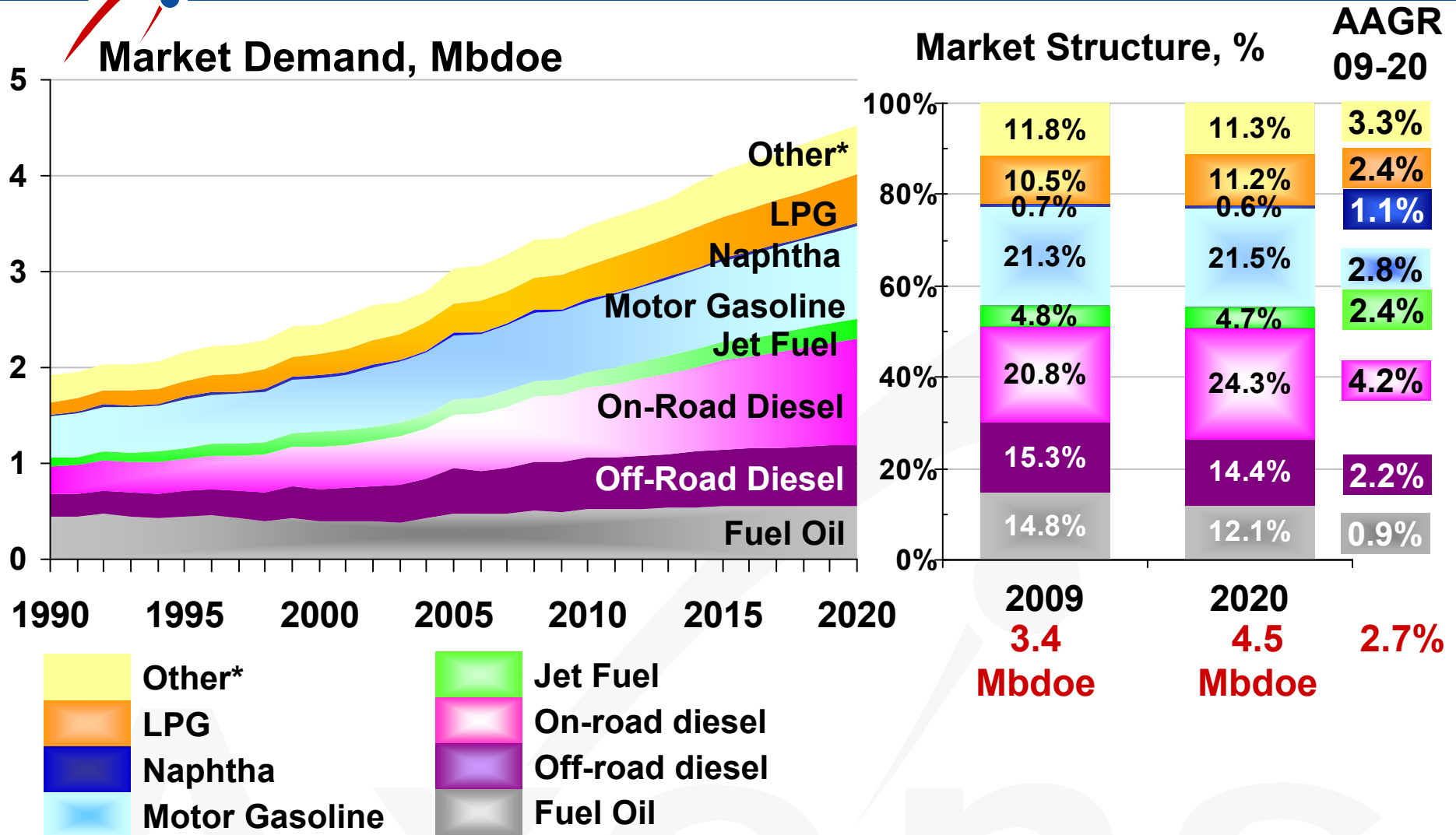
- **African Refining Industry - Long term analysis**
- **Technology offer**
 - **Feasibility studies for refinery expansion**
 - **A Complete Licensing Portfolio**



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Axens

African Oil Products Demand

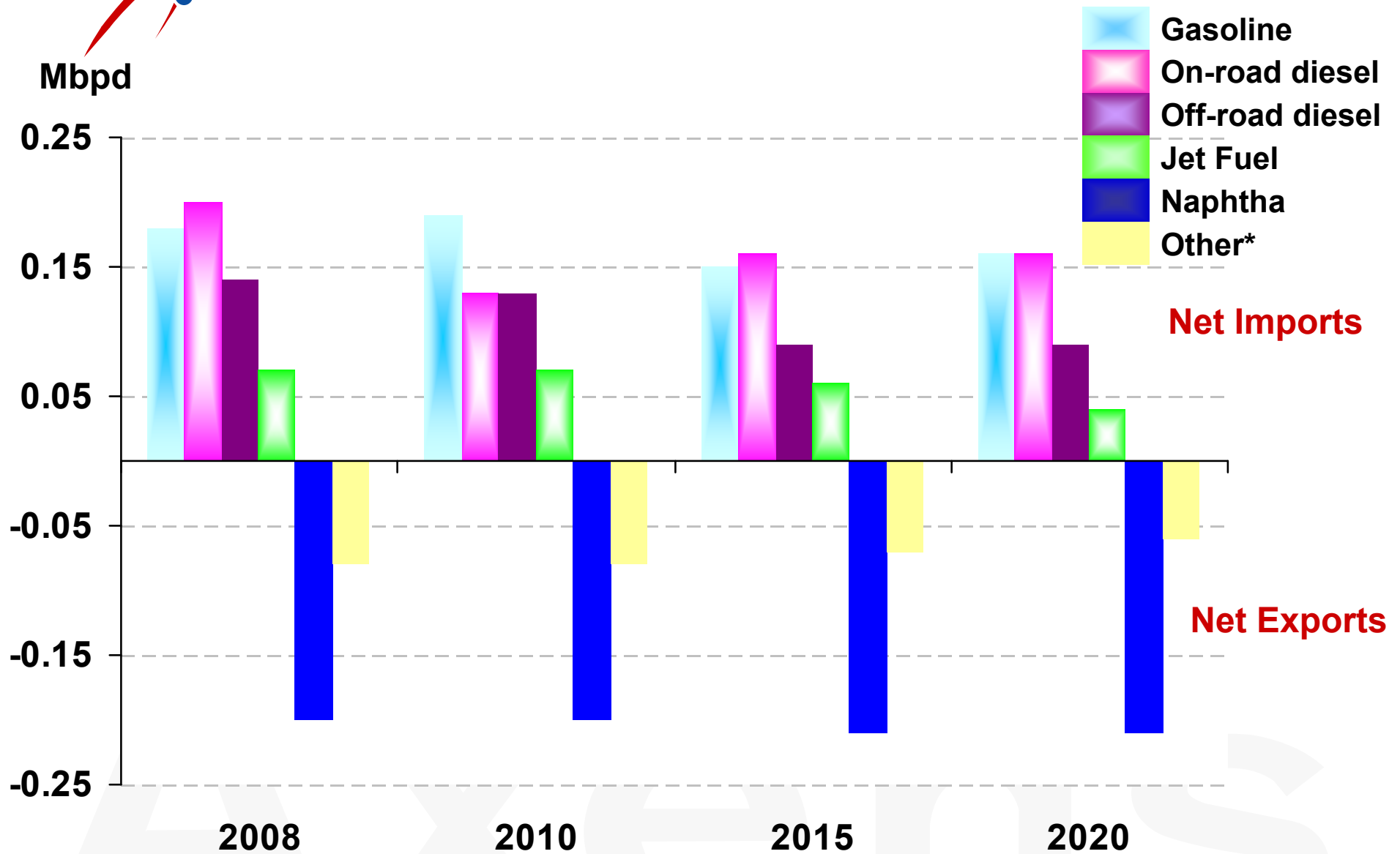
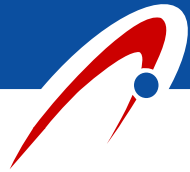


- Other*
- LPG
- Naphtha
- Motor Gasoline
- Jet Fuel
- On-road diesel
- Off-road diesel
- Fuel Oil

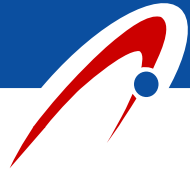
Other* = Kerosene (≠ Jet Fuel), Refinery Gas, Petroleum Coke, NGL, Lubricants, Bitumen, Paraffin Wax, Refinery Losses, ...

Source: Axens & other sources (2009)

African Refined Product Balance




AFRI Specifications



GASOLINE				
	AFRI-1	AFRI-2	AFRI-3	AFRI-4
Ron, min*	91	91	91	91
MON, min	81	81	81	81
Lead content**	Unleaded	Unleaded	Unleaded	Unleaded
Sulphur content, % mass, max	0.1	0.05	0.03	0.015
Benzene content, % vol, max	to be reported	to be reported	5	1
DIESEL				
	AFRI-1	AFRI-2	AFRI-3	AFRI-4
Sulphur content, % mass, max	0.8	0.35	0.05	0.005
Density at 15°C, kg/litre (min/max)	800/890	800/890	800/890	820/880
Cetane index (calculated), min	42	45	45	45
Lubricity (HFRR @ 60°C), micron, min	to be reported	to be reported	460	460

*A higher grade of gasoline may be marketed if required

**'Unleaded' means <0.013g of lead per litre

- 
- **More Crude processing to meet higher domestic demands → More naphtha & Fuel Oils produced by African refineries**
 - **Naphthas and Fuel Oils may have reduced worldwide export outlets**
 - **Demand in refined products in the future, with higher quality requirement**

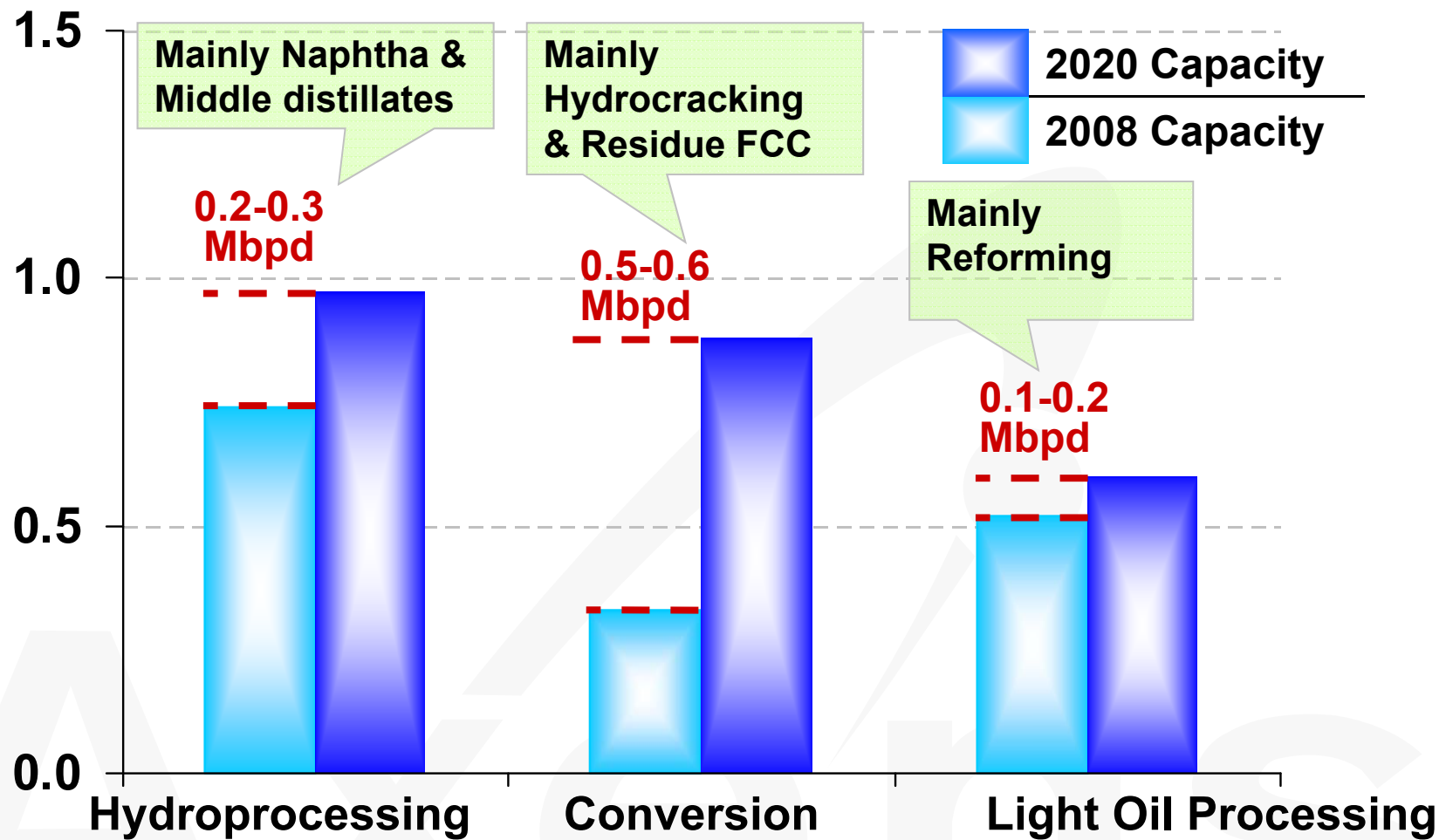
Potential investments in Africa

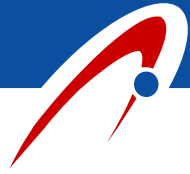
- **Naphtha processing for octane improvement: isomerisation and reforming**
- **VGO & Residue conversion**
- **Distillate HDS units**

African Refining Capacity Expansion 2008-2020



Capacity Mbpd
(Million Barrel Per Day)





- African Refining Industry - Long term analysis
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Feasibility Studies for Refinery Expansions

Customized expertise

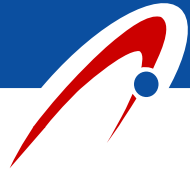
- Feasibility studies for refinery modernization and expansion programs
- Projects to meet future product specifications

Benefits

- Anticipate future market demands
- Focus on required modifications at minimum cost
- Ensure maximum refining margin

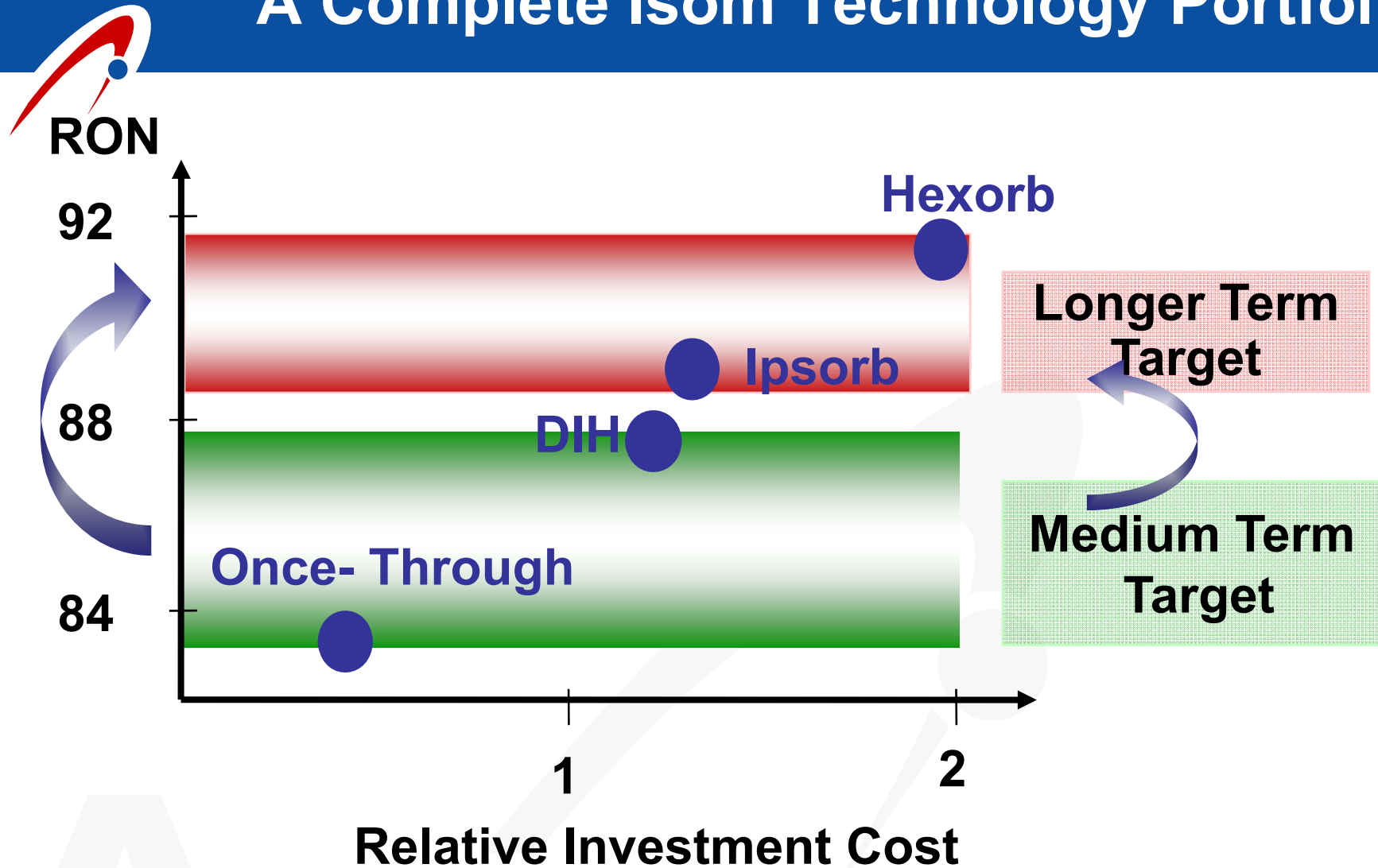


Our Industrial References in Naphtha Reforming

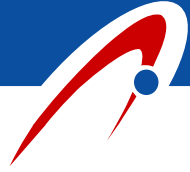


- **> 130 reforming units designed**
 - **50 Semi-regenerative**
 - **> 80 CCR Reformers** (more than 35 in operation)
- **More than 30 CCR licenses awarded since January 2005**

A Complete Isom Technology Portfolio

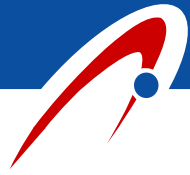


43 references: 18 Once-through, 23 DIH recycle, 2 Ipsorb

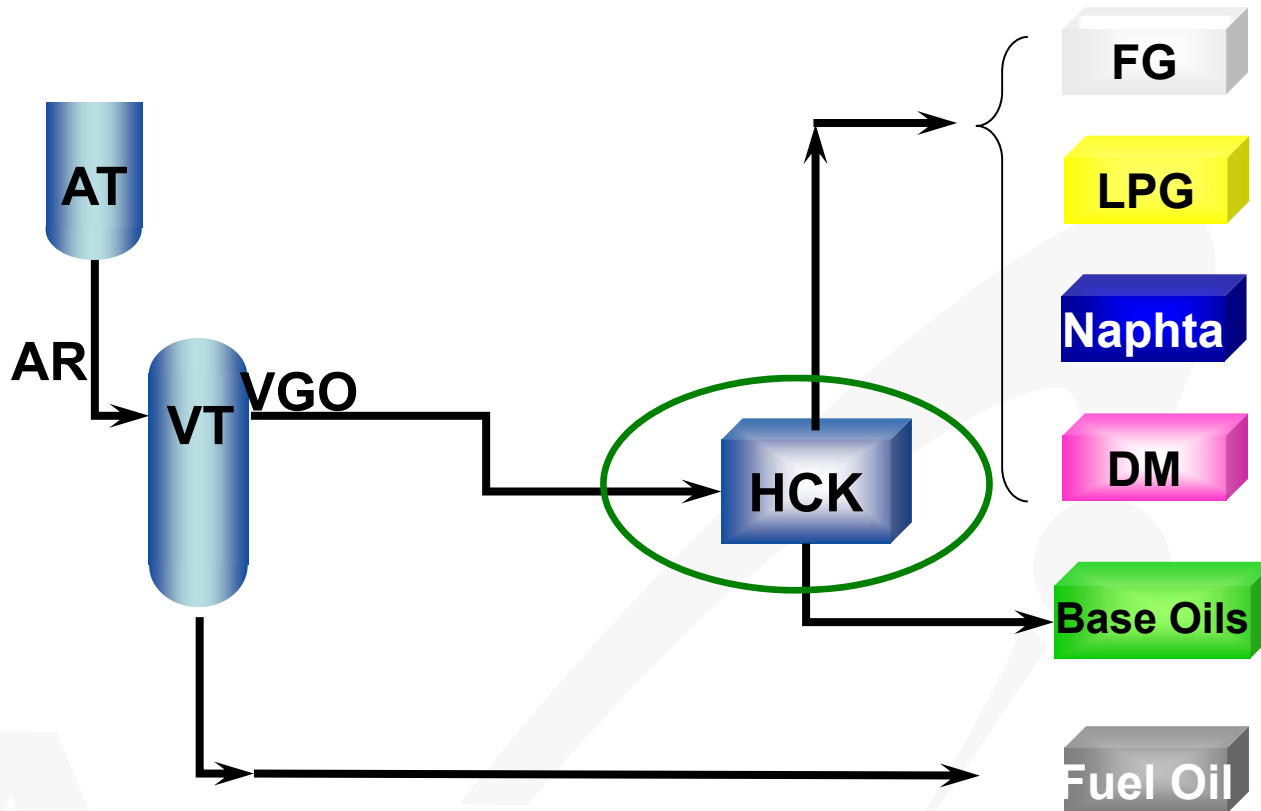


Our Industrial References in Ultra Low Sulfur Diesel

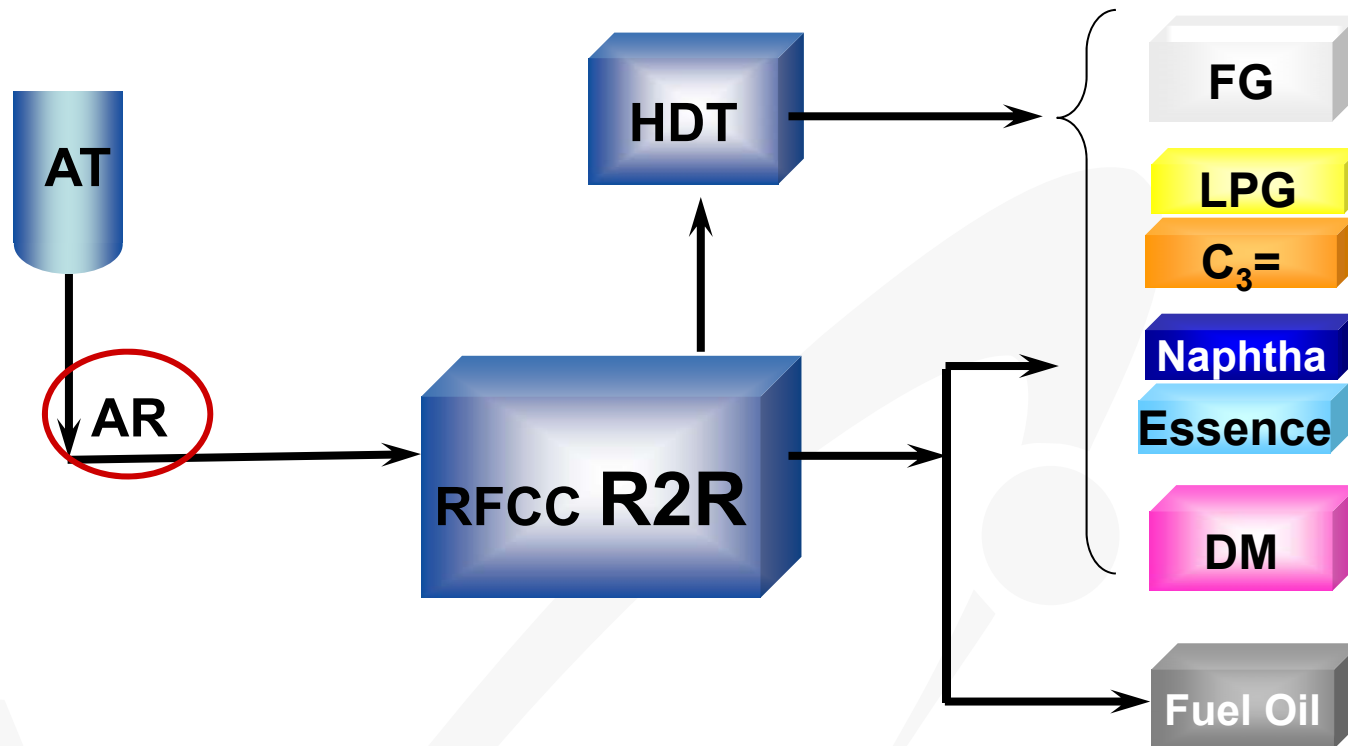
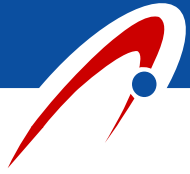
- **> 110 units designed for Ultra Low Sulfur Diesels (less than 50 ppm sulfur), including three in Africa over the past three years**
- **Based on the use of high activity catalysts**
 - **HR 500 series**
 - **the new HR 626 CoMo catalyst**
- **EquiFlow™ Reactor internals for near ideal distribution of the liquid and the vapor phase at the inlet of the catalytic beds**

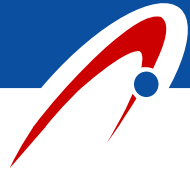


Hydrocracking for conversion of VGOs to Diesel

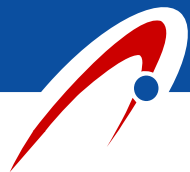


Atmospheric Resid Conversion - RFCC





- **African refining sector will have to meet**
 - **Growing demand in motor fuels**
 - **Higher quality gasoline and diesel pools**
 - **Decreasing Fuel Oil Demand: threats on the current heavy fuel oil export markets**
- **Axens well positioned to accompany this evolution, as a leading licensor in**
 - **Naphtha processing for gasoline production**
 - **Middle Distillates Hydrotreating**
 - **VGO and Residue Conversion**



African Refining and Axens Offer