



African Refining and Axens offering

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Axens

Axens



- **African Refining Industry – Long term analysis**
- **Axens offering**
 - **Feasibility studies for refinery expansion**
 - **A Complete Licensing Portfolio**

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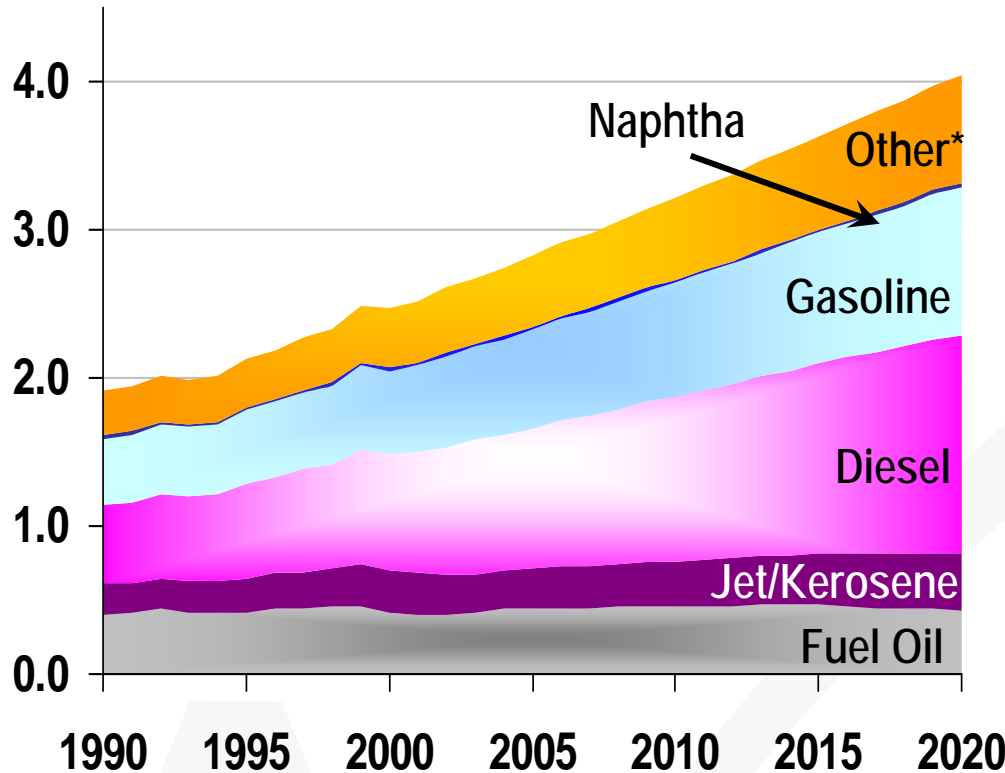
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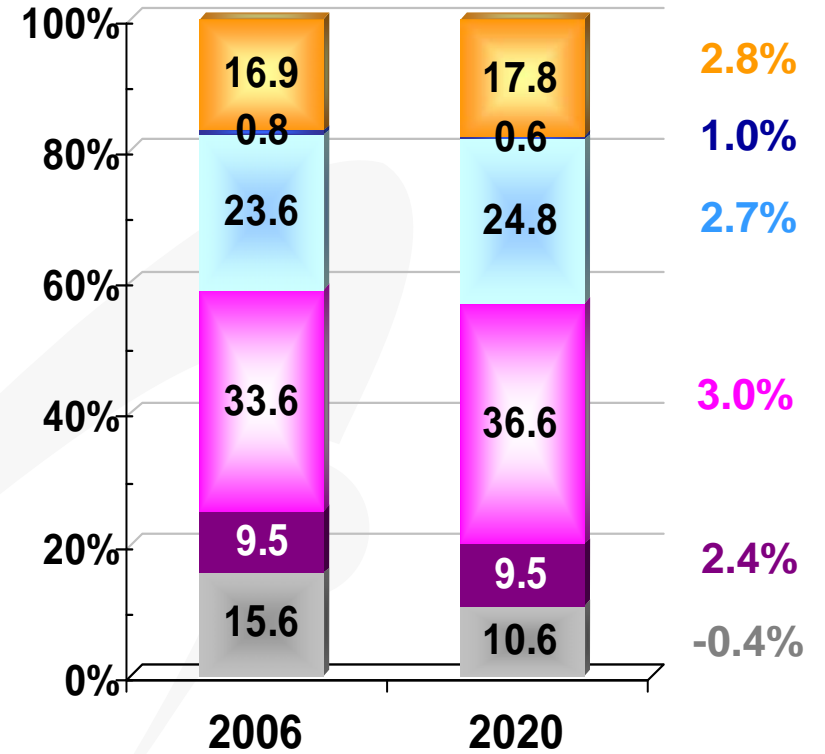
African Market Characteristics

Market Demand, Mbdoe



Other* = LPG, asphalt, coke, lubricants, refinery fuel, fuel losses

Market Structure, %

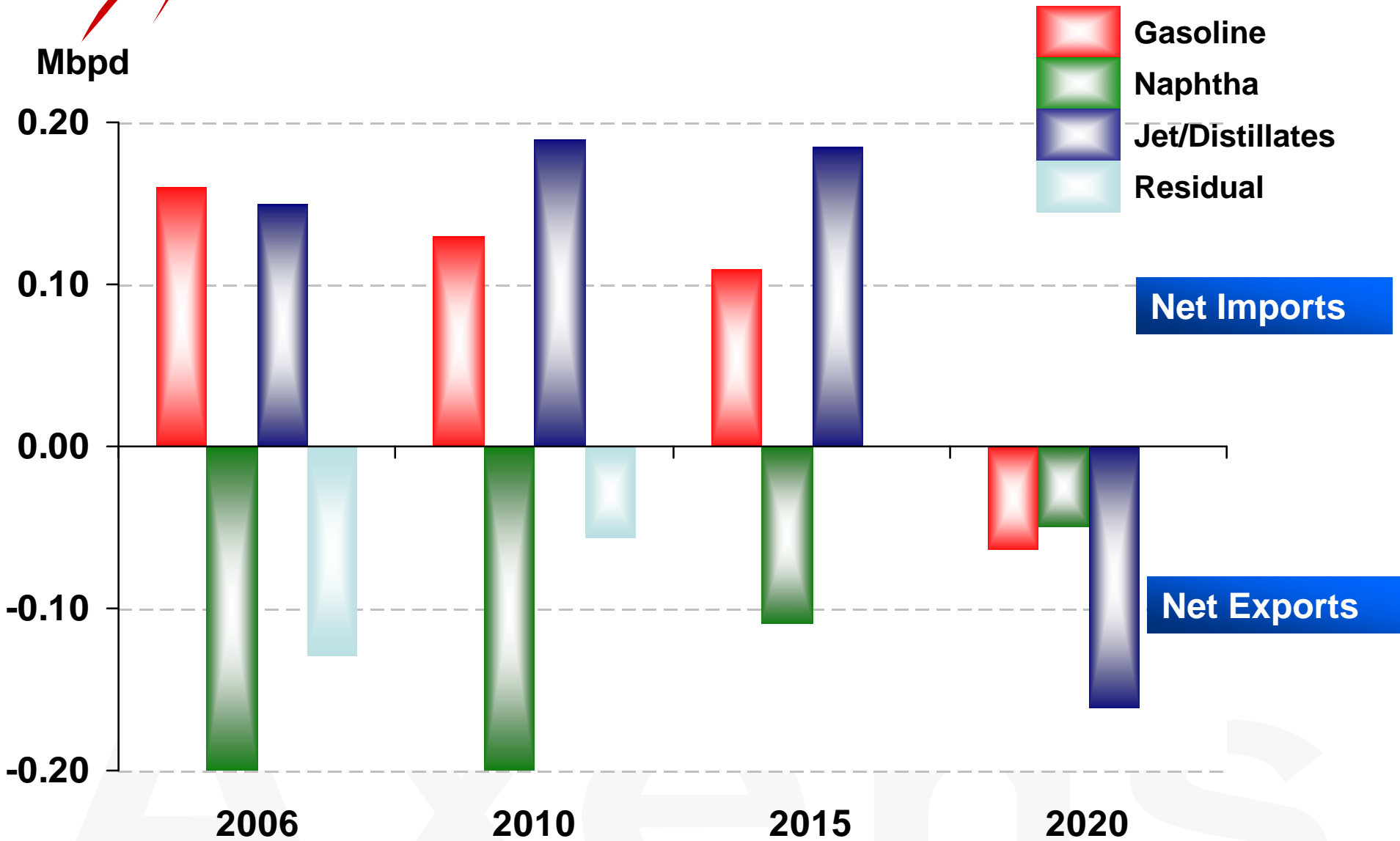


2.9 Mbpd

4.0 Mbpd

2.4%

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



- **15-20 % of the Demand in motor fuels is imported**
- **Strong demand in refined products in the future, with higher quality requirement**
- **Naphtha and Fuels Oils currently exported from Africa may have reduced outlets**
 - **More naphtha processing in African refineries for inclusion in gasoline pool?**
 - **Fuel oil conversion?**

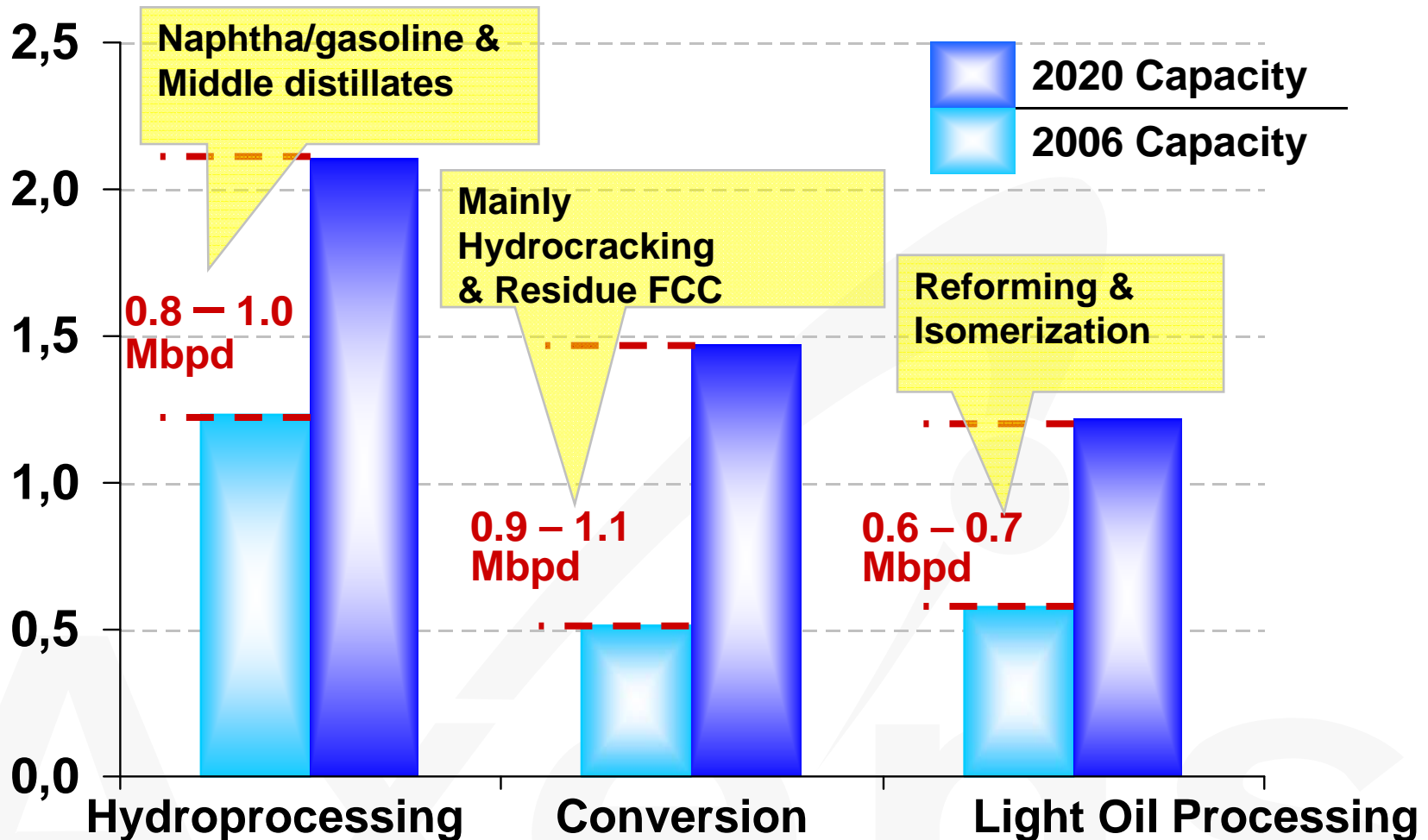
Potential investments in

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

African Refining Capacity Expansion 2006-2020



Capacity Mbpd
(Million Barrel Per Day)





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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

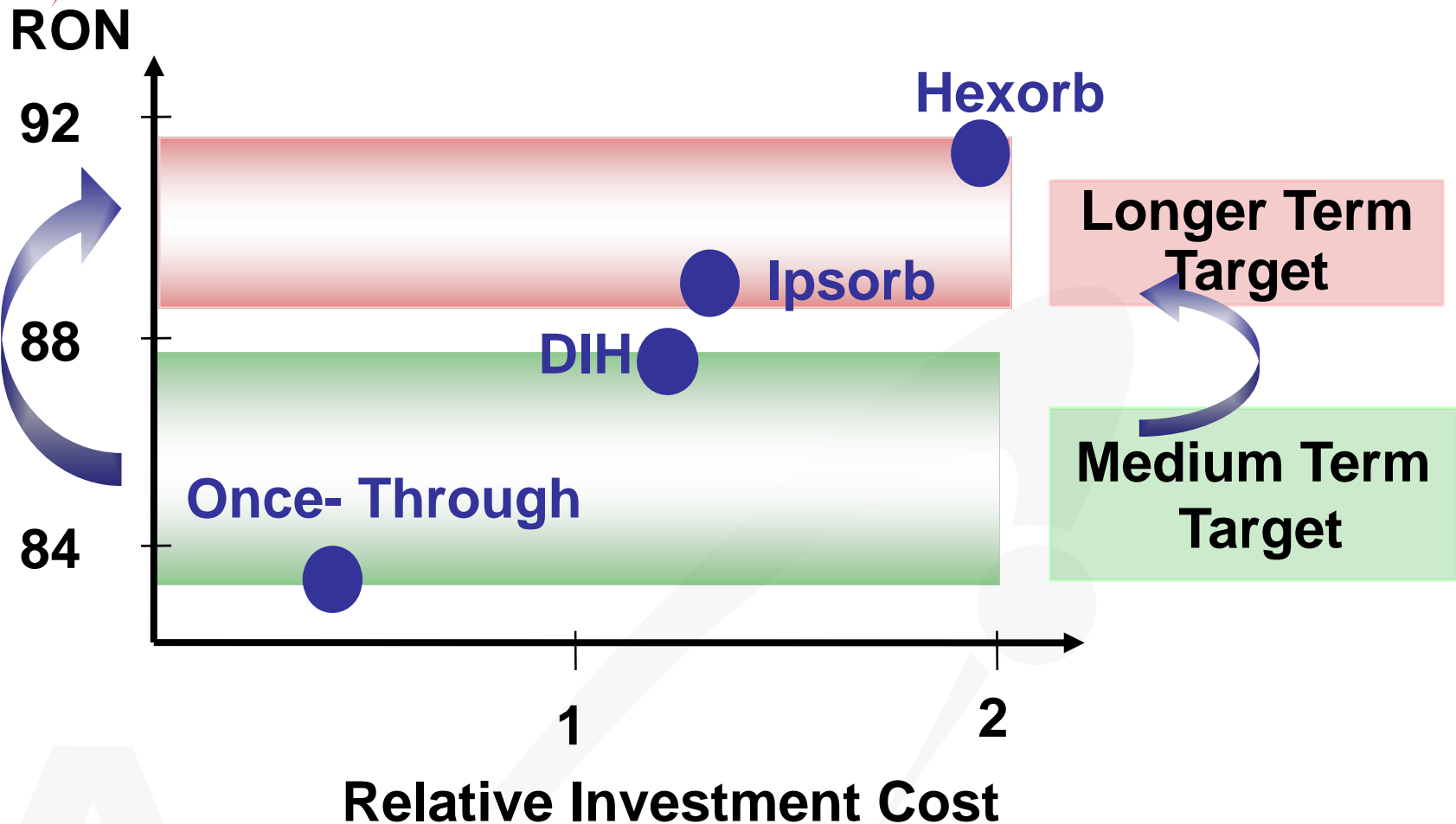




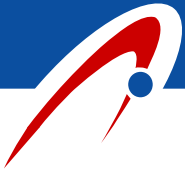
- **> 120 reforming units designed**
 - **50 Semi-regenerative**
 - **> 75 CCR Reformers** (more than 35 in operation)

- **25 CCR licenses awarded since January 2005**
 - **11 in 2005**: 8 in Middle East, 2 in Asia, **1 in Africa**
 - **6 in 2006**: 4 in Middle East, 1 in Europe, 1 in Asia
 - **8 in 2007**: 2 in Middle East, **1 in Africa**, 3 in Asia, 2 in S-America
 - Another CCR sold **in Africa** in 2008
 - + one semi regenerative reformer sold in 2007

A Complete Isom Technology Portfolio



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



- **> 90 units designed for Ultra Low Sulfur Diesels (less than 50 ppm sulfur)**
- **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**



- **Atmospheric Residue FCC for low to medium Concarbon content residues**
 - One single unit for the conversion of the whole atmospheric residue: the best way to reach the 'critical size'
 - 90% conversion of the Atm Residue to LPG, gasoline and LCO
 - LCO post treated to meet sulfur and cetane requirements in mixture with Straight Run diesel
 - R2R technology by far the n°1 technology for Residue cracking
- **VGO Hydrocracking**
 - Up to 90% conversion of the VGO in once through mode
 - High yield in middle distillate with very high quality: no sulfur, high cetane

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- **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**