

Advisory Outlook

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The Bottom-up Refining Revolution (4 of 4)



Olumide Adeosun

As Nigeria grapples with current economic realities, the market dynamics for refined products reinforces the country's potential to become West Africa's refining hub. The inherent opportunity for Nigeria's erstwhile dormant refining sector holds bright prospects for the future and a recognition of key drivers will accelerate the imminent refining revolution.



Ayodele Oluleye

In previous articles in this series we examined the supply / demand balance of refined petroleum products within Nigeria and West Africa, highlighting the near absence of domestic refining capacity. We then discussed three scenarios of possible impact to the refining sector up until 2030. Lastly, we set out the major event triggers for the strategic leaps necessary to catalyze the refining revolution. This last installment, highlights refining asset economics and structural commercial considerations for investors.

Considerations for Setup: The Investor's Guide

Refinery Options

Modular Refineries: These are usually available in capacities ranging from 1,000 to 30,000 barrels per day (bpd). Modular refineries provide flexibility and can be constructed in a phased manner. The relatively low

capital cost and flexibility for upgrades can make it a cost effective supply option for investors, especially if diesel is planned to be the lightest yield.

Conventional Refineries: These are usually larger refineries with capacities higher than 100,000 bpd. Conventional refineries are not as flexible as modular refineries and they require relatively high investment in resources and specialized labour to run, maintain and upgrade.

Sources: Cenam Energy partners, PwC Analysis

Modular Refineries		Conventional Refineries	
Pros	Cons	Pros	Cons
Flexible to meet demand (easy to add modules)	Fewer configuration options (usually topping or hydro skimming plant)	Multiple configuration options (topping, coking, cracking, hydro skimming etc.)	High initial capital outlay/long payout
Lower capital requirements/ Short payback period	Production mostly restricted to middle distillates, naphtha, and lights	Fewer staff per Effective Distillation Capacity (EDC)	One location for different markets
Minimal Space/Land requirements	More staff per Effective Distillation Capacity (EDC)	Production of higher value products	Significant space/land requirements
Quick and easy installation	Low production capacity	High Production Capacity	Increased storage requirements for a broader range of product yields that need to be stored separately
Greater control over the environment and work process during construction	Lower margins on products	Economies of scale leading to higher margins on products	Significant turnaround time for construction. Minimal control over environment during construction

Refining Economics

The economic viability of a refinery is dependent on the interaction of three elements: type of crude oil used, the complexity of the refining equipment (refinery configuration) and the desired type and quality of products produced.

Different types of crude oil yield a different mix of products depending on the crude oil's natural qualities. Crude oil types are typically differentiated by their density (light/sweet and heavy). Heavy crude tends to produce a larger yield of lower-value products (fuels oils) and also requires significant investment in the refining process. On the other hand, light, sweet produces large yield of higher-value products (transportation fuels) and requires less investment in the refining process. Nigeria currently produces light, sweet crude, meaning Nigerian refineries may be able to source and process crude at lower rates, increasing the viability of refining assets, particularly modular refineries which have lower feedstock requirements.

A key requirement for refining profitability is finding the sweet spot between cost of inputs and price of outputs in a highly volatile

environment influenced by global, regional, and local supply and demand fluctuations. Refineries have minimal influence over the price of input and outputs and, therefore, must ensure operational efficiency to improve profitability and gain competitive edge. This entails reducing operating costs such as labor, maintenance, energy (electricity and natural gas) etc. to the barest minimum. Efficiency is achieved through operational excellence, innovation, maintenance & upgrades and optimization to produce more output from fewer inputs.

Although refineries share certain similarities, each refining asset is a unique and complex industrial facility, with some flexibility in the crude slate it can process and the mix of product yields it can refine. Factors such as refinery configuration and complexity directly impact refinery end products while location and transportation infrastructure impact energy, labor and compliance costs.

Refinery Configuration Analysis	Conventional	Modular Refinery (with PMS)	Modular Refinery (Diesel)
Capacity (bpd)	200,000	30,000	20,000
Investment (USD)	7 billion	187 million	92 million
Revenue (USD)	4.7 billion	650 million	459 million
Payback (Years)	12	5	1.4
Margins	13%	6%	15%

Sources: Cenam Energy partners, EIA, Vfuels

Modular Refinery Analysis (Diesel)

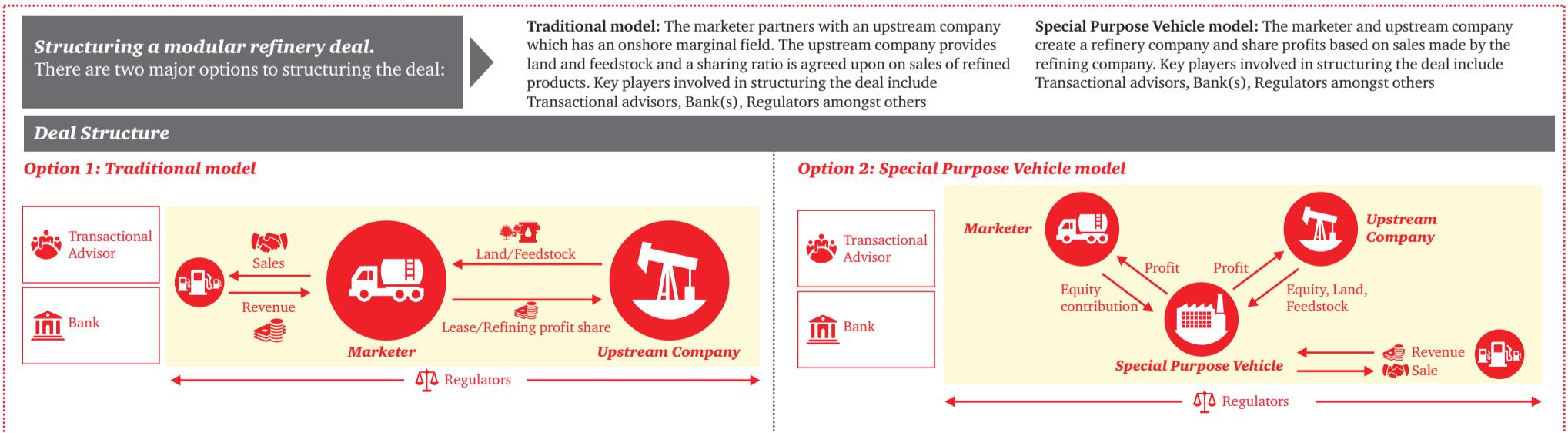
Capacity	Cost (USD)	NPV (USD)	IRR	Payback (Years)
20,000	92 million	95.6 million	67%	1.4
10,000	55 million	38.8 million	54%	1.6
7,000	44 million	21.8 million	45%	1.9
5,000	38 million	8.9 million	34%	2.3
3,000	29 million	(956,000)	21%	2.9

Assumptions

- Modular refineries are co-located with existing refineries or marginal onshore fields
- Modular Refineries- Bonny light as feedstock
- Conventional refineries- Brent as feedstock
- Crude Oil price - USD 54
- Weighted Average Cost of Capital (WACC) - 23%

Capacity	PMS	Kerosene	AGO	Residual Fuel	Naphtha
20,000	-	154 million	395 million	384 million	154 million
10,000	-	77 million	197 million	192 million	77 million
7,000	-	54 million	138 million	134 million	54 million
5,000	-	38 million	99 million	96 million	38 million
3,000	-	23 million	59 million	58 million	23 million

Capacity in bpd, Annual Product volumes in Litres



Conclusion

Investors are constantly faced with tough decisions on refinery setup options which will yield the highest returns. Our analysis reveals that the modular refinery, an off-the-shelf solution, is a cost effective supply option for investors especially when diesel is the lightest yield. The relatively low capital cost, flexibility and short payback period make it distinctly attractive.

For the independent producer, participating in a modular refining project improves cashflow, ensures crude oil production is sufficiently optimized and delivers value beyond the traditional oil production business model. For downstream marketers seeking to hedge against foreign exchange exposure, domesticating fuel supply and building local capacity - modular refineries is a winning strategy.

About the authors

Olumide Adeosun is an Associate Director & Head, Capital Projects and Infrastructure Advisory practice at PwC Nigeria. His industry experience is from over 10 years in a variety of finance & commercial roles with oil and gas supermajor, BP. He can be reached at olumide.adeosun@pwc.com

Ayodele is a consultant with PwC Nigeria's advisory practice. He can be reached at ayodele.oluleye@pwc.com

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