PACRA
Together. Creating Value.

Refineries

Sector Study

November 2022

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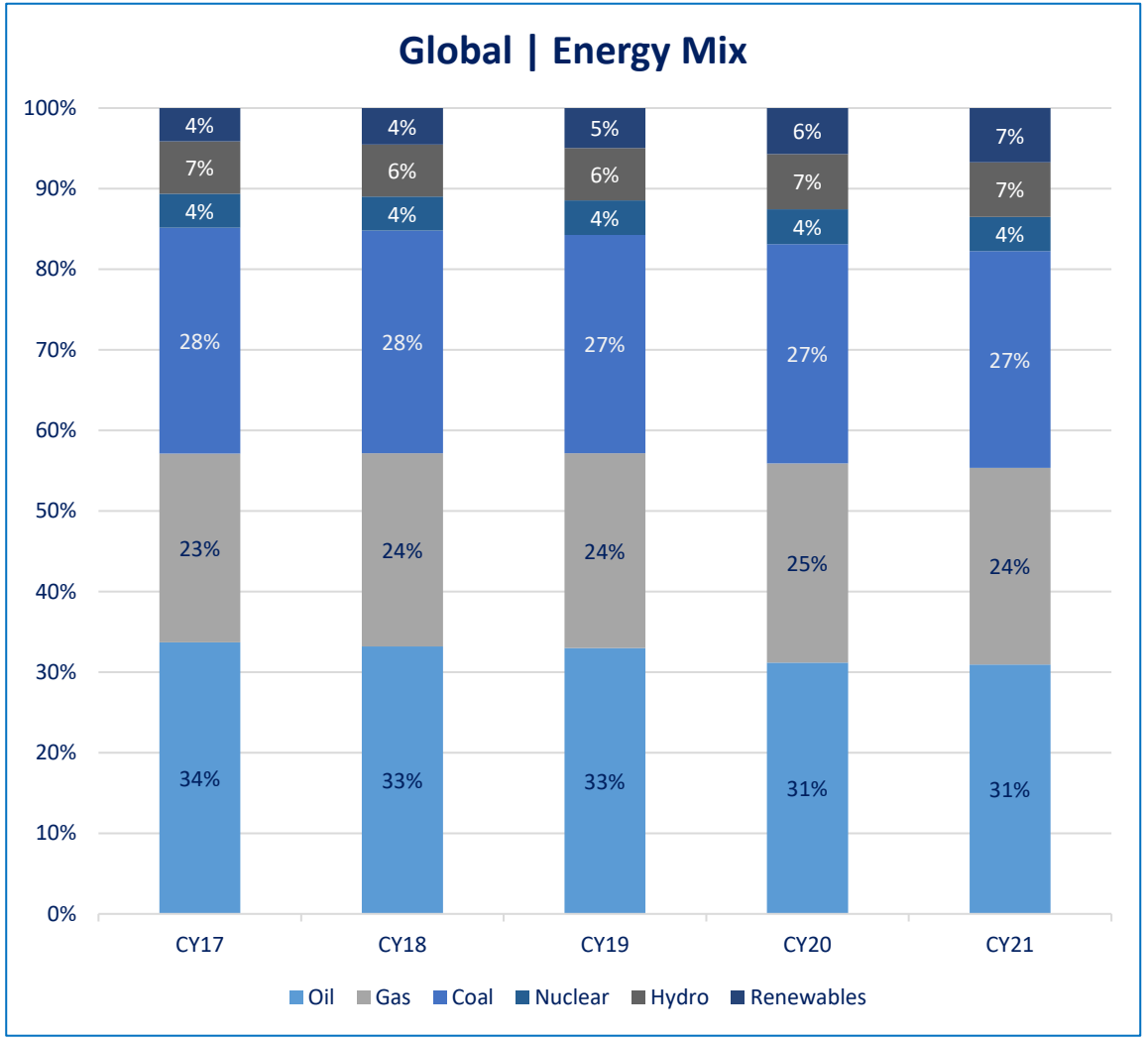
Global | Energy Mix

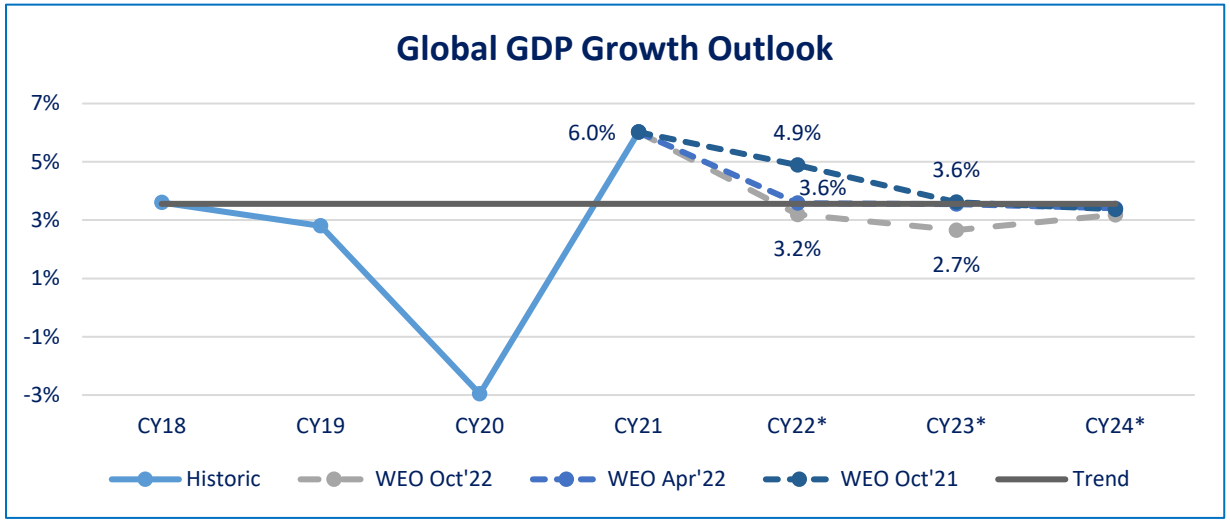
- The global energy mix is historically dominated by fossil fuels, with oil taking the lead among all fuels followed by coal and gas. Despite the growing demand for renewables and environment friendly energy, renewables still hold a very nominal portion in the global energy mix.
- According to BP Statistics, the world consumed energy amounting to ~97bln barrels of oil equivalent (CY20: ~91bln). Although there is a positive trend in the development of renewables, fossil fuels (Oil, Gas and Coal) comprised the lion's share in the global energy mix at ~82.3% of total (CY20: ~82.2%) with oil being the most dominant source of energy at ~31%.
- A gradual decrease in demand for fossil fuels is expected in the longer term following advances in renewable technology, improved efficiency of internal combustion engines, a more widespread use of EVs and international efforts for environmental sustainability.
- On the sidelines, the conflict in Eastern Europe that started in the beginning of CY22 has exposed major geopolitical risks in the fossil fuel supply chain. This may also act as the impetus for accelerated renewable technology adoption; as major developed economies sure up their energy security.

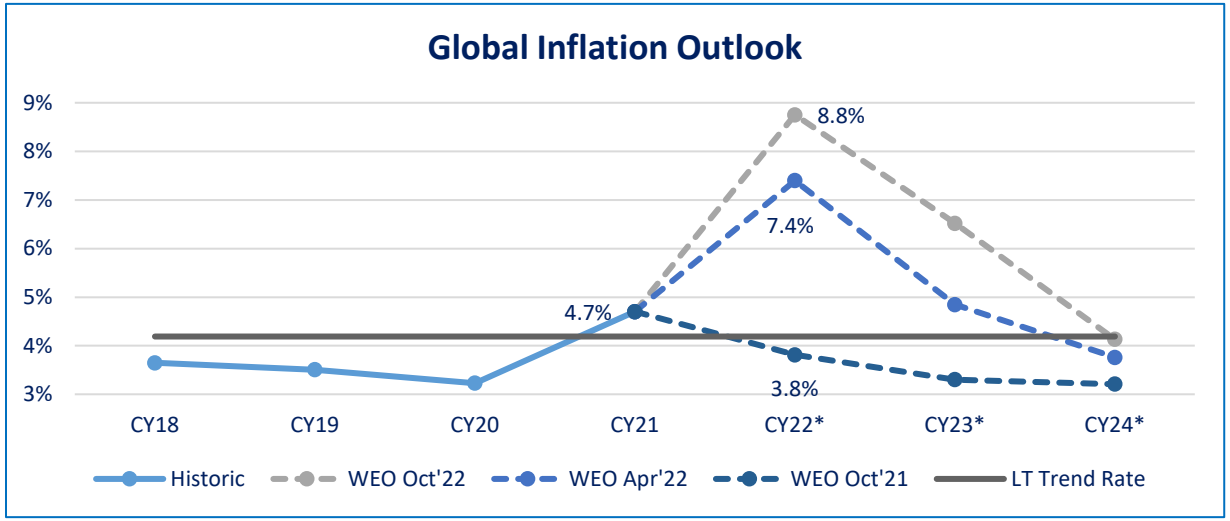


Source: BP Stats, Yale School of the Environment, McKinsey & Company

Global | Economic Outlook

- CY22 began with an expectation of normalization after the rapid global economic recovery of CY21, as IMF in its October'21 World Economic Outlook (WEO) forecasted the global GDP to grow at ~4.9% and then converge to its LT average rate of ~3.6% in CY23.
- However, with the conflict in Eastern Europe, and subsequent inflationary pressure and tightening monetary policy, expected global CY22 GDP forecast was revised down to 3.6%. It maintained convergence with the trend rate in CY23, in IMF's April'22 WEO.
- The inflation pressures have remained persistent, with high risks to energy security in developed economies. Fears of a looming recession have also become prevalent. IMF in its latest October'22 WEO, therefore, further revised its forecast GDP growth rate for CY22 to ~3.2% with subdued economic activity going into CY23 with its estimated GDP growth rate at ~2.7%.
- IMF in its latest (WEO) October'22 estimates global inflation for CY22 to clock in at ~8.8% (CY21: ~4.7%) and remain persistent through CY23 with convergence expected to LT trend in CY24.



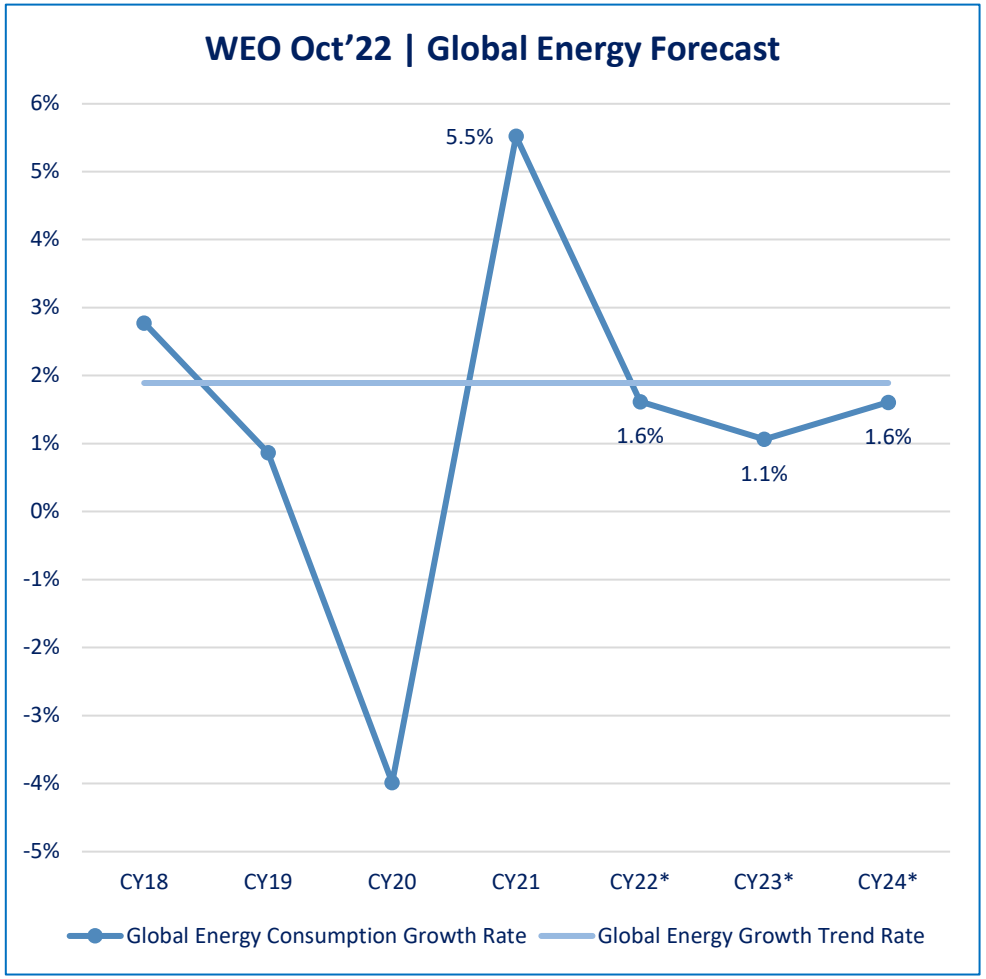


*Forecasted

Source: IMF

Global | Energy Consumption Outlook

- Global energy consumption growth is highly correlated with global GDP growth as the two have a long-term correlation coefficient of 0.91.
- Similar to global GDP, energy consumption also rebounded by ~5.5% in CY21.
- During CY20 slowdown, global energy consumption fell by ~4.0% while global carbon emissions dipped by ~5.9%, indicating high integration of fossil fuels in the modern economy.
- The current opportunity cost of reducing carbon emissions by ~1MT is USD~1,300.
- Energy commodity price changes, over a historic 30-year time period, have observed a high volatility of ~37%, compared to non-energy commodity price changes volatility of ~13%.
- The World Bank estimates energy and non-energy prices to decline by ~11% and ~8% in CY23.
- The Russia-Ukraine conflict which began in February 2022 set the pace for energy markets for the rest of the year, since Russia has been one of the largest energy exporters in the world, holding a global export share of ~12.8% in petroleum, ~19.8% in nature gas and ~17.9% in coal in CY21.



*Forecasted

Source: BP Stats, IMF, World Bank

Refineries

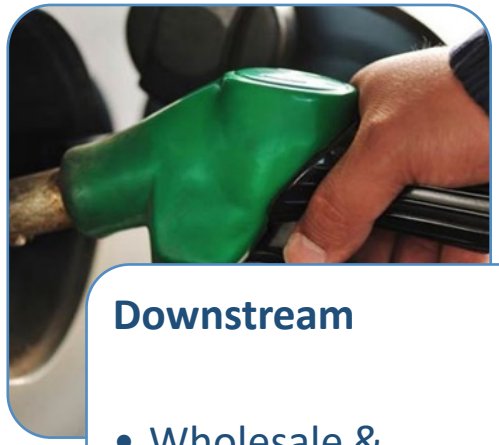
Oil Market Segments

Upstream

- Exploration
- Field Development
- Production Operations

Midstream

- Transportation
- Processing & Refining
- Storage & Distribution



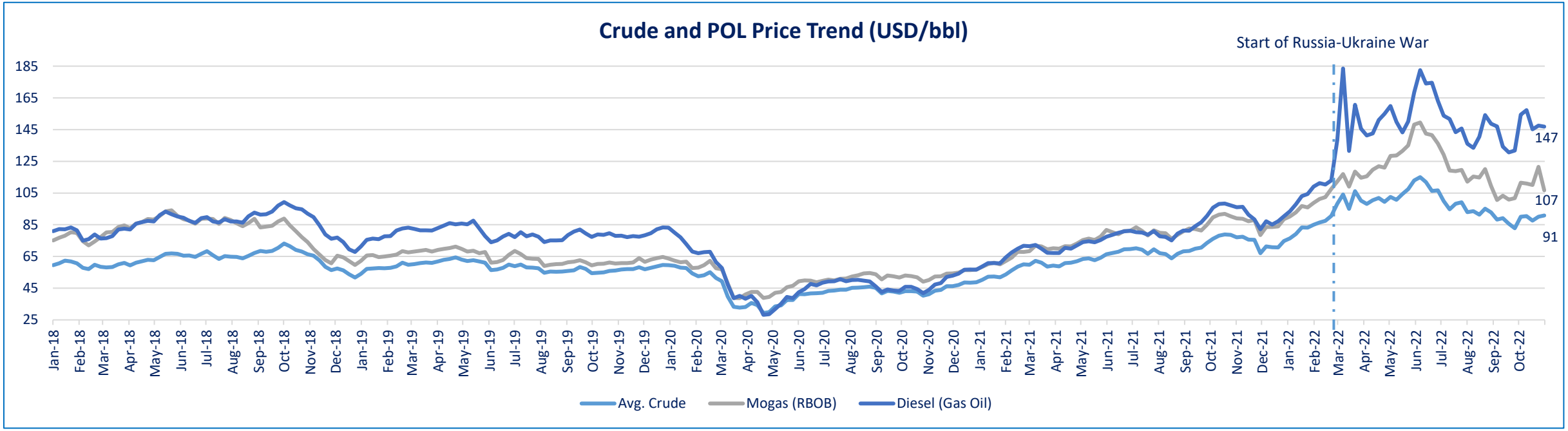
Downstream

- Wholesale & Marketing

- The oil sector is divided into **Upstream**, **Midstream** and **Downstream** segments.
- Upstream Sector encompasses Exploration and Production of oil.
- Midstream includes transporting oil from production sites to refineries via pipelines, trains, tankers, and trucks and production of refined products.
- Downstream comprises marketing & distribution of refined petroleum products.

Source: EIA, OPEC

Crude Oil & POL Products Prices



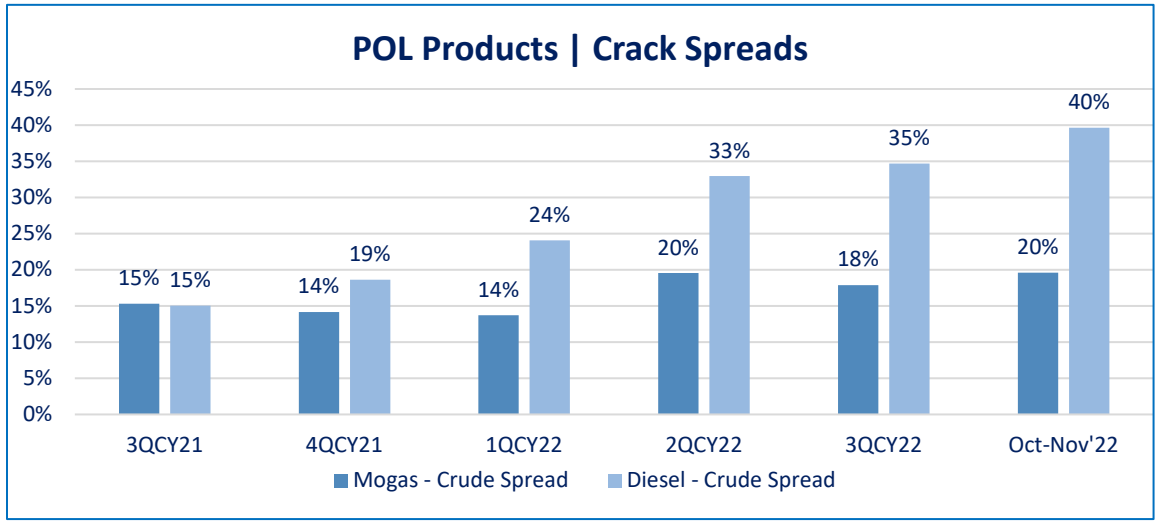
- Since the start of conflict in Eastern Europe, prices of crude oil and petroleum products have not only touched multidecade highs, but also have become more visibly volatile.
- Before the start of the conflict, 5-year average crude oil prices stood at USD~59/ bbl, while MOGAS and HSD prices stood at USD~69/ bbl and USD~74/ bbl respectively. Prices of crude oil, MOGAS and HSD, on average, increased by ~67.0%, ~72.6% and ~101.8% respectively, since the beginning of the geopolitical tensions.
- Furthermore, price volatility (measured in terms of standard deviation) of Crude oil, MOGAS and diesel has increased by ~89.1%, ~102.2% and ~324.0%, respectively.

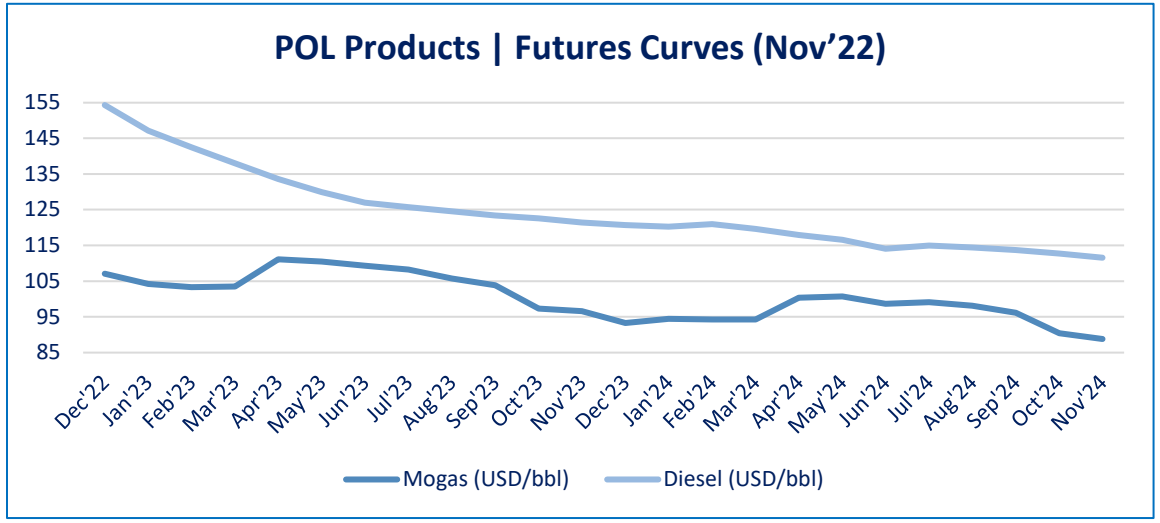
Source: Investing.com

Refineries

Crack Spreads

- Refined petroleum products trade at a premium above crude oil prices. This spread between prices is referred to as 'crack spread' and is indicative of mid-stream profitability margins.
- Prices of crude and refined products are independently subject to their own supply and demand dynamics, as well as regulatory, environmental and economic factors.
- Over the last five years, crack spreads of MOGAS and HSD have averaged around ~15% and ~20%, respectively.
- In CY21, global refining capacity reduced by ~0.4% with further expected capacity cuts up to ~1mln bbl/day. Refinery throughput also remained ~4.3% below pre-COVID levels and combination of sanctions on Russia have pushed the crack spreads of MOGAS and HSD to ~20% and ~40% respectively (Oct'22).
- Substitution of natural gas with Diesel (for heating and power generation) has kept the latter's market in backwardation. The market can reasonably be expected to remain tight and volatile going forward.





Source: Investing.com, BP Stats, Fitch, ifs.marketcenter.com

Refinery configurations

There are 4 major classifications of refineries based on the degree of complexity and the type of crude oil they can effectively refine.

- **Topping**
  These consist of a simple distillery that primarily separates crude oil into straight run distillates (i.e. gas oil, kerosene, Jet fuel and heating oil), naphtha, light gas, residual/heavy fuel oil. They lack the capacity to drive economically viable yields from low API gravity and high Sulphur crude oil (Heavy sour).

- **Hydro skimming**
  In addition to the distilleries, these include hydrotreating, catalytic reforming and blending infrastructure. These can handle crude oil with low to medium API gravity and Sulphur content (Light Sweet to Medium Sour). With additional infrastructure, they can reform naphtha to MOGAS up to specific octanes and desulphurize light products such as MOGAS and HSD to meet regulatory requirements.

- **Conversion/ Cracking**
  In addition to all the Hydro skimming infrastructure, these include facilities for hydro and/or catalytic cracking. These processes allow heavy fractions such as gas oil to be converted into lighter refinery streams, yielding MOGAS, jet fuel and other petrochemical feedstocks.

- **Deep Conversion/ Cocking**
  These are a special class of refineries that can convert the heaviest fraction i.e. residual oil into lighter streams which can then further be processed lighter petroleum products. These refineries can handle with economic viability; all classes of crude oil (Light Sweet to Heavy Sour).

Source: Journal of Energy Economics, Journal of Applied Energy

Refineries

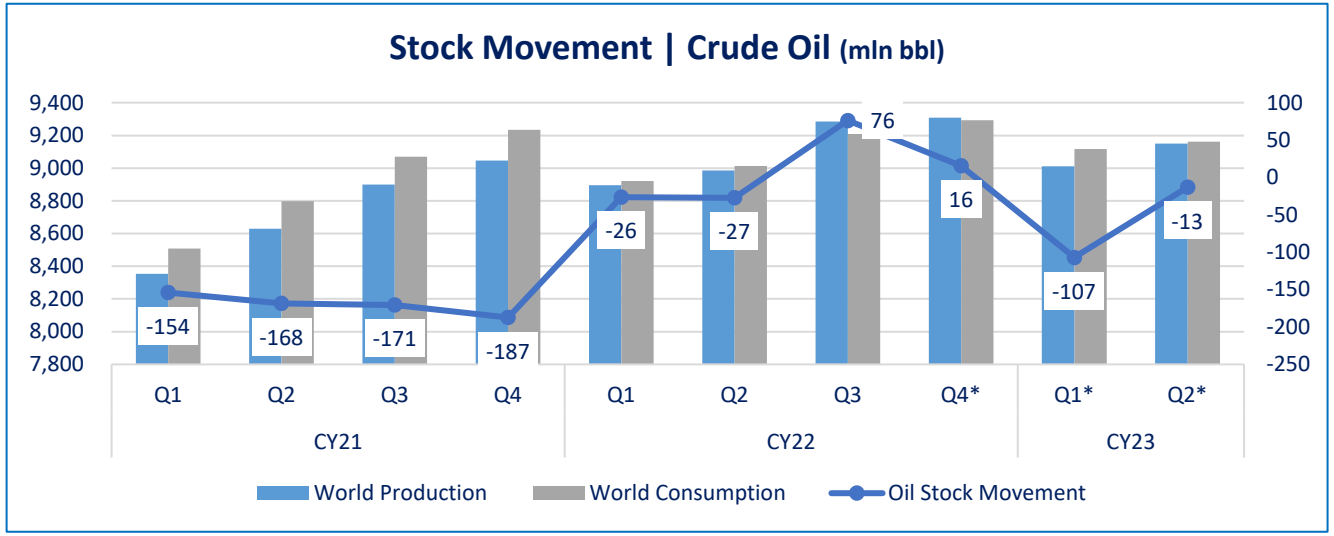
Oil Stock Analysis

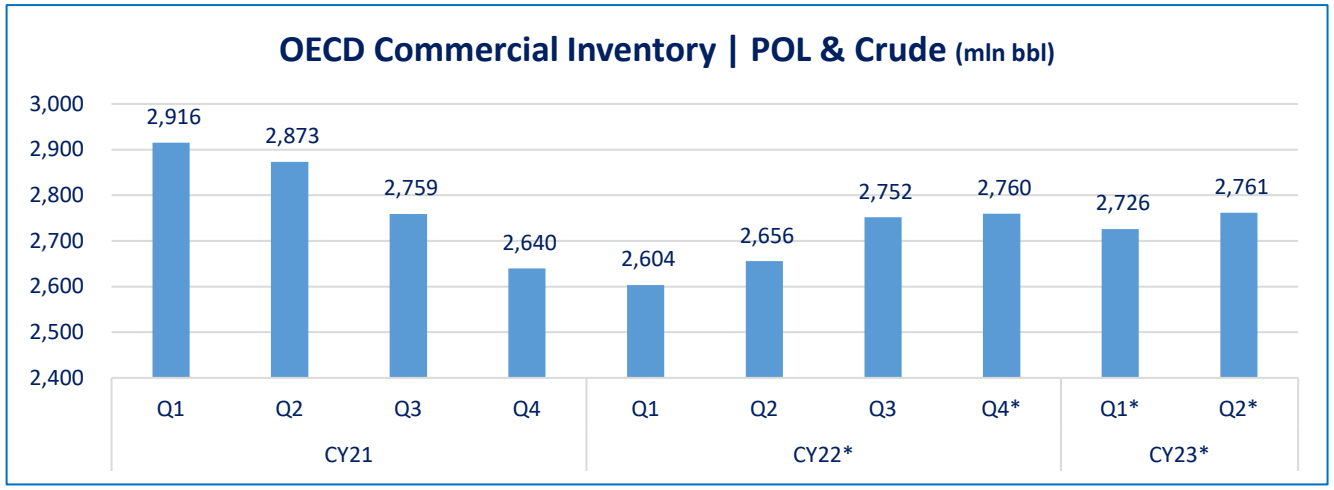
- Strong demand rebound in CY21 led to petroleum consumption outpacing its production levels, leading to total oil stock draws of ~1.3mln bbl/day. The largest draw was observed in the month of February, when Saudi Arabia imposed a production cut of 1bln bbl/day. This was coupled with a drop of ~1.3mln bbl/day from the USA due to severe temperature drops.

- OECD's commercial inventories, an important indicator of market stability conditions, dipped by ~9.3%, while USA's Strategic Petroleum Reserves dipped by ~10.1%.

- As petroleum production ramped up in CY22, draws on global petroleum inventories are expected to increase by ~0.5mln bbl/ day, with OCED's commercial inventories to increase by ~4.1% during CY22.

- However, productions cuts from OPEC and Russia are expected to come into effect, which may lead to inventory draws from Dec'22 onwards till 2QCY23 end.





*Forecasted**

Source: EIA, OPEC

Refineries

Oil Value Chain

Crude oil is a mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

Crude oil is transported to refineries to convert it into its derivatives.

Refining breaks crude oil down into its various components, which are then selectively reconfigured into new products. All refineries have three basic steps: Separation, Conversion, Treatment

Petroleum products include gasoline, distillates such as diesel fuel and heating oil, jet fuel, petrochemical feed stocks, waxes, lubricating oils, and asphalt.

Source: EIA

Global | Crude Oil Reserves Position

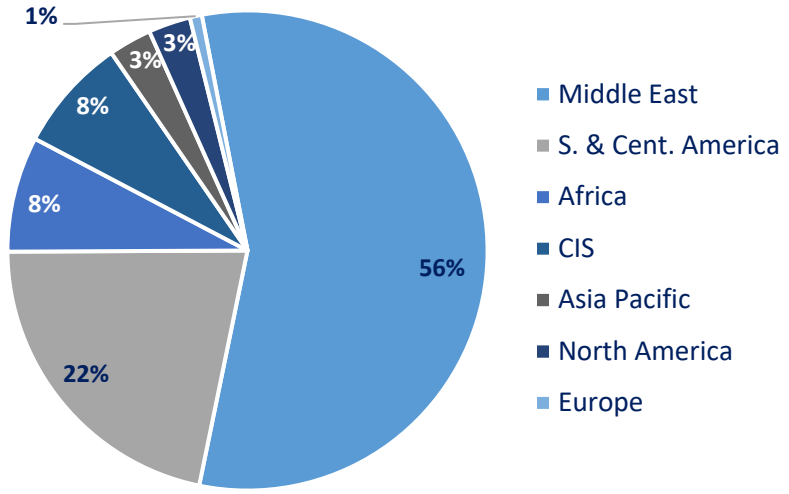
- World crude reserves stood around ~1,545bln barrels as at End-Dec'21.
- Reserves have been growing at a meagre CAGR of ~0.7% over the period of last five years (CY17-CY21). In CY21 alone, OPEC member countries added ~68.8bln barrels to their total proven crude oil reserves.
- According to current estimates, OPEC countries account for ~80.4% (~1,241.8bln barrels) of the world's proven crude oil reserves.
- Middle East makes up for the bulk of OPEC oil reserves, with ~62% of OPEC total.
- For CY21, Venezuela accounted for a total of ~303bln barrels (~24.4%) of crude oil reserves, followed closely by Saudi Arabia, with ~267.2bln barrels (~21.5%).

Global Crude Oil Reserves (bln barrels)

Period	CY16	CY17	CY18	CY19	CY20	CY21
Total World	1,489	1,491	1,495	1,554	1,545	1,545

Note: Oil Sands are not considered

Global Crude Reserves | Share (%) CY21



1 Barrel =0.1364 MT

Source: OPEC

Global | Crude Oil Production & Consumption Levels

- During CY21, global crude oil extraction as a percentage of global crude reserves was recorded at ~2.2%.
- Global crude oil consumption grew by ~5.9% but remained ~4.1% below pre-COVID levels during CY21.
- World crude oil extraction grew by ~1.2% in CY21, however, it remained ~5.7% below pre-COVID levels.
- In CY22, global crude oil extraction is expected to grow at ~4.4% reaching pre-COVID levels. However, following OPEC's agreement to cut production targets by ~2mln bbl/ day in the later half of CY22, coupled with ~16% decline in Russian oil production, crude extraction in CY23 is expected to grow by a meager ~0.7%.
- In CY22, global crude oil consumption is expected to grow by ~2.3%. The expected economic slowdown in CY23 may keep demand subdued, with crude consumption growth forecasts at ~1.2%.

Global | Crude Oil Extraction-mln MT

Period	CY17	CY18	CY19	CY20	CY21
World Production	**4,386**	**4,487**	**4,478**	**4,171**	**4,221**
Middle East	1,470	1,485	1,408	1,295	1,316
North America	920	1,029	1,108	1,059	1,075
CIS	702	715	720	661	674
Asia Pacific	369	361	361	353	348
Africa	386	393	397	331	345
S. & Cent. America	374	341	323	305	304
Europe	165	163	159	168	160

Global | Crude Oil Consumption-mln MT

Period	CY17	CY18	CY19	CY20	CY21
World Consumption	**4,362**	**4,421**	**4,429**	**4,019**	**4,246**
Asia Pacific	1,594	1,631	1,659	1,571	1,640
North America	1,012	1,033	1,025	890	958
Europe	705	704	700	608	638
Middle East	396	402	392	362	375
S. & Cent. America	282	273	270	238	261
CIS	188	193	197	184	194
Africa	185	187	187	166	180

*Estimated

Source: BP Stats, EIA

Refineries

Trade | Crude & Products

- In CY21, Saudi Arabia had the highest share of world crude exports (~16%), followed by Russia (~13%) and Canada (~10%). In products market, USA retained its position as the largest exporter (~20%), followed by Russia(~12%).
- A major portion of world crude and products import was dominated by Europe (~20%) and China(~19%). India is emerging as a net crude importer and product exporter on the globe with a share of ~10% in crude imports and ~6% in products export.
- In terms of exports of total petroleum liquids, Russia cemented itself as the global leader in CY21, outpacing USA by ~21mln MT and capturing over ~12% of the global market share.

Imports Share

No	Region/Country	CY20	CY21
		Crude & Product	Crude & Product
1	Europe	20%	20%
2	China	20%	19%
3	Other Asia Pacific	14%	14%
4	US	12%	13%
5	India	8%	8%
6	Japan	5%	5%
7	Singapore	4%	4%
8	S. & Cent. America	3%	4%
9	Mexico	2%	2%
10	Canada	2%	2%
11	ROW	9%	9%
	Total	100%	100%

Exports Share

No	Region/Country	CY20	CY21
		Crude & Product	Crude & Product
1	Russia	12%	12%
2	US	12%	12%
3	Saudi Arabia	12%	12%
4	UAE	6%	7%
5	Canada	7%	7%
6	West Africa	7%	6%
7	Iraq	6%	6%
8	Other Asia Pacific	5%	5%
9	Other Middle East	5%	5%
10	S. & Cent. America	5%	5%
11	ROW	23%	24%
	Total	100%	100%

Source: BP Stats

Refineries

POL Product Mix | Consumption

- In CY21, Mogas, among POL energy products, was the highest consumed product with a share of ~30% in POL consumption mix, followed closely by diesel with a share of ~29%.
- Mogas (or Motor Spirt, Gasoline, Petrol) is mainly used as transport fuel in light duty vehicles, with limited application in power generation and heating.
- While diesel (blend of middle distillates) is mainly an industrial fuel, it is known as the lifeblood of the global economy. It has numerous applications, such as for power heavy duty engines found in trucks, trains, ships, agricultural and construction machinery and military vehicles, along with power generation and heating.
- Jet Fuel regained some of its lost traction capturing a share of ~6%, as travel restrictions were eased in CY21.

Global | POL Consumption Mix					
Period	**CY17**	**CY18**	**CY19**	**CY20**	**CY21**
White Oils	**68%**	**69%**	**69%**	**66%**	**67%**
Mogas	31%	31%	31%	30%	30%
Diesel	29%	29%	29%	30%	29%
Jet fuel	8%	8%	9%	5%	6%
Kerosene	1%	1%	1%	1%	1%
Black Oils	**24%**	**24%**	**23%**	**26%**	**25%**
Other petroleum liquids	20%	20%	20%	22%	22%
Residual fuel oil	4%	4%	4%	4%	4%
Gases	**7%**	**8%**	**8%**	**8%**	**8%**
Liquefied Petroleum Gases	7%	8%	8%	8%	8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: EIA

Refineries

Global | Top players

- The top 10 global refineries, serving al three streams of oil industry, generated annual revenue to the tune of USD~2,157bln in CY21 (USD~1,444bln in CY20).
- Simultaneously, they contributed ~2.25% to world's GDP in CY21 (~1.70% in CY20).
- Most oil refineries are run by giant multinational corporations which are either state-owned or private entities.
- As of CY21, the top 10 oil refining companies held a ~34.4% share in global refining capacity of ~102mmbbl/d, while the top 3 oil refining capacity holding countries i.e. USA, China and Russia have ~ 41.0% of the global refining capacity.
- The top petroleum consumers followed a similar trend. USA, China and India had a cumulative ~41.0% share of global consumption.
- The industry has high barriers to entry and requires extensive capital investment.

Global | Refining Capacity

Sr.	Company	Origin	Capacity (mln MT)
1	**Sinopec**	China	280
2	**CNPC**	China	235
3	**Exxon Mobil**	USA	233
4	**Saudi Aramco**	KSA	174
5	**Marathon**	USA	159
6	**Rosneft**	Russia	156
7	**Shell**	Netherlands	148
8	**Valero Energy**	USA	138
9	**Phillips 66**	USA	113
10	**Petrobars**	Brazil	108
	Total		**1,745**

Source: Financial Statements, McKinsey Energy Insights

Refineries

Local | Industry Snapshot

- Pakistan relies significantly on imports to meet the demand of its energy products. During FY22, the country consumed ~23.1mln MT of petroleum products (FY21:~20.1mln MT) up ~14.9% YOY. Owing to declining local oil reserves amid low new discoveries, the dependence on imported POL products is increasing with each passing year.
- Currently, there are ~5 refineries operating in the country namely (i) Attock Refinery Limited (ATRL); (ii) Pakistan Refinery Limited (PRL); (iii) National Refinery Limited (NRL); (iv) Pak Arab Refinery Limited (PARCO); and (v) Byco Petroleum Pakistan Limited (BYCO).
- The sector is highly regulated with prices of two major products, i.e, MOGAS and Diesel, being determined by the Oil & Gas Regulatory Authority (OGRA) on fortnightly basis.
- Refineries generated an aggregate gross revenue of PKR~1,881bln in FY22 (FY21: PKR~1,214bln) with an annual GDP contribution of ~2.8% (FY21: 2.2%). The sector's revenue during FY22 registered a YOY growth of ~54.8% on account of increased consumption and all-time high petroleum products prices.

Overview	FY21	FY22
Gross Revenue (PKR bln)	1,214.4	1,881.1
Gross Revenue %age Growth YoY	15.8%	54.9%
Sector Players	5	5
Local Crude Production (mln MT)	**3.7**	**3.7**
Imported Crude (mln MT)	8.8	9.3
Refinery Offtake (mln MT)	**11.8**	**12.1***
Crude Exports (mln MT)	0.3	0.4
Refinery Production (mln MT)	**11.5**	**11.7**
POL Product Import (mln MT)	10.1	13.1
Local POL Product Consumption (mln MT)	**20.6**	**23.4**
POL Product Export (mln MT)	0.2	0.3
Total Refining Capacity (mln MT)	**20.6**	**20.6**
Total Capacity Utilization	**57.5%**	**57.7%**
Structure	Oligopoly	
Regulator	OGRA	
Associations	OCAC	

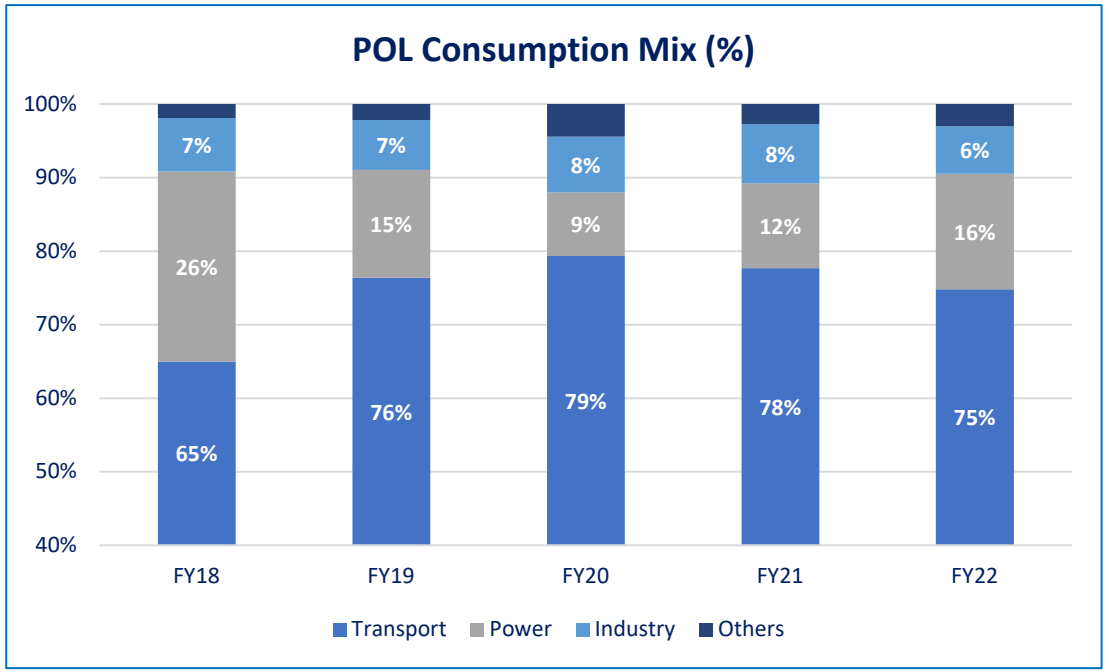
*Estimated
1 MT Crude = 7.454 bbl

Source: Pakistan Energy Year Book, OCAC, PACRA Internal Database

Refineries

Demand | Sector-wise POL Consumption

- Transport sector is the highest consumer of petroleum products, as it comprised ~75% of total POL products consumed in FY22 (~79% in FY21).
- POL consumption by industries is largely driven by LSM growth. The industrial consumption share remained almost stable at ~1.7% during FY22 (FY21: ~1.6%). Power sector's oil consumption reduced at a CAGR of ~22% from FY18-FY21 due to shift from RFO to cheaper and environment-friendly alternatives. However, it grew by ~1.3mln MT in FY22 to ~3.7mln MT.



POL Consumption (mln MT)					
Year	Transport	Power	Industry	Others	Total
FY18	16.1	6.4	1.8	0.47	**24.7**
FY19	14.6	2.8	1.3	0.41	**19.2**
FY20	14.0	1.5	1.3	0.8	**17.6**
FY21	15.9	2.4	1.6	0.6	**20.5**
FY22	17.5	3.7	1.5	0.7	**23.4**

Source: Pakistan Economic Survey

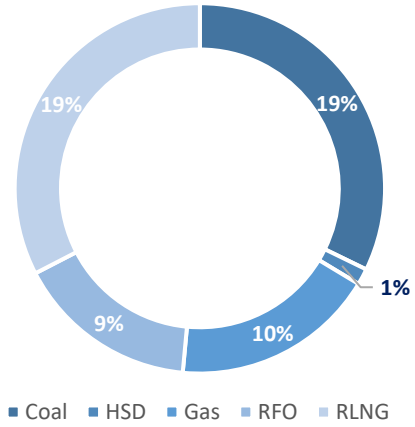
Demand | Power Generation Mix

- Thermal and hydro-energy are two major sources of electricity generation in Pakistan. During FY22, thermal electricity generation had a share of ~58% (FY21: ~58%) in total power generation mix followed by hydroelectric, which contributed ~25% to total electricity generation in the same period (FY21: ~31%).
- RFO-based power plants generated ~1,454 GWH electricity during FY22 (FY21: ~6,270.8 GWH) with a YoY decrease of ~77%, and at high fuel cost of PKR~36.2/ KWh. The share of RFO-based power plants in total thermal energy generation decreased to ~9% during FY22 (FY21: ~12%). This was likely due to low demand from state-run and private electricity producers.
- Going forward, the government is committed to increase the share of renewable energy sources in total power generation mix through Integrated Generation Capacity Expansion Plan (2021-2030).

Power Generation | Commercial Mix (%)

Source	FY18	FY19	FY20	FY21	FY22
Thermal	68%	67%	60%	58%	58%
Hydroelectric	21%	21%	29%	31%	25%
Nuclear	7%	8%	7%	7%	13%
Renewable	3%	4%	3%	3%	4%

Thermal Energy Mix (FY22)



Source: SBP EasyData

Refineries

Demand | Product Wise POL Consumption

- Pakistan's POL products demand is largely driven by the transportation sector and level of industrial activity in the country.
- MOGAS and HSD consumption grew by ~7% and ~14% YoY in FY22 respectively, signaling an uptick in auto sales and growth in agricultural sector.
- Total consumption of petroleum products during FY22 was recorded at ~23.4mln MT (FY21: ~20.1mln MT) with YoY growth of ~15%.
- The three major products, i.e., HSD, MOGAS and RFO account for ~95% of the total POL products consumption in the country. RFO consumption drastically declined at a CAGR of ~24% from CY17-CY21 mainly due to government's decision to reduce its use as a fuel for power sector plants.
- However, in FY22, FO sales (~32% YoY increase, compared to CAGR equivalent to ~-19%), due to high demand in power plants amidst non-availability of RLNG, along with low hydel generation.

POL Consumption (mln MT)

Period	FY18	FY19	FY20	FY21	FY22
White Oils	15.7	15.7	15.0	17.1	18.9
MOGAS	7.4	7.6	7.5	8.5	9.1
HSD	7.4	7.4	6.6	7.8	8.9
JP-1/ JP-8	0.8	0.6	0.7	0.5	0.7
Others	0.11	0.10	0.17	0.25	0.23
Black Oils	8.0	3.8	2.7	3.6	4.5
RFO	7.4	3.5	2.4	3.2	4.2
Others	0.6	0.3	0.3	0.4	0.3
Total	23.7	19.5	17.7	20.6	23.4

POL Consumption Mix (%)

Period	FY18	FY19	FY20	FY21	FY22
White Oils	66%	80%	85%	83%	81%
MOGAS	31%	39%	42%	41%	39%
HSD	31%	38%	37%	38%	38%
JP-1/ JP-8	3%	3%	4%	2%	3%
Kerosene	0.5%	0.5%	0.9%	1.%	1%
Black Oils	34%	20%	15%	17%	19%
RFO	31%	18%	14%	16%	18%
Others	3%	2%	2%	2%	1%
Total	100%	100%	100%	100%	100%

Source: PBS, OCAC

Refineries

Supply

- **Crude Oil:** Pakistan majorly relies on imports to meet its crude oil demand. Total crude oil consumption was recorded at ~12.1mln MT in FY22 (FY21: ~11.8mln MT) of which ~27% was locally produced ***(upstream oil sector)*** and ~73% was imported.

- **Petroleum Products:** Pakistan's consumption of Petroleum Products clocked in at ~23.4mln MT in FY22 (FY21: ~20.5mln MT), of which ~47.0% was produced locally and ~53.0% were imported. Locally, refined POL products are produced by the following refineries in the country:

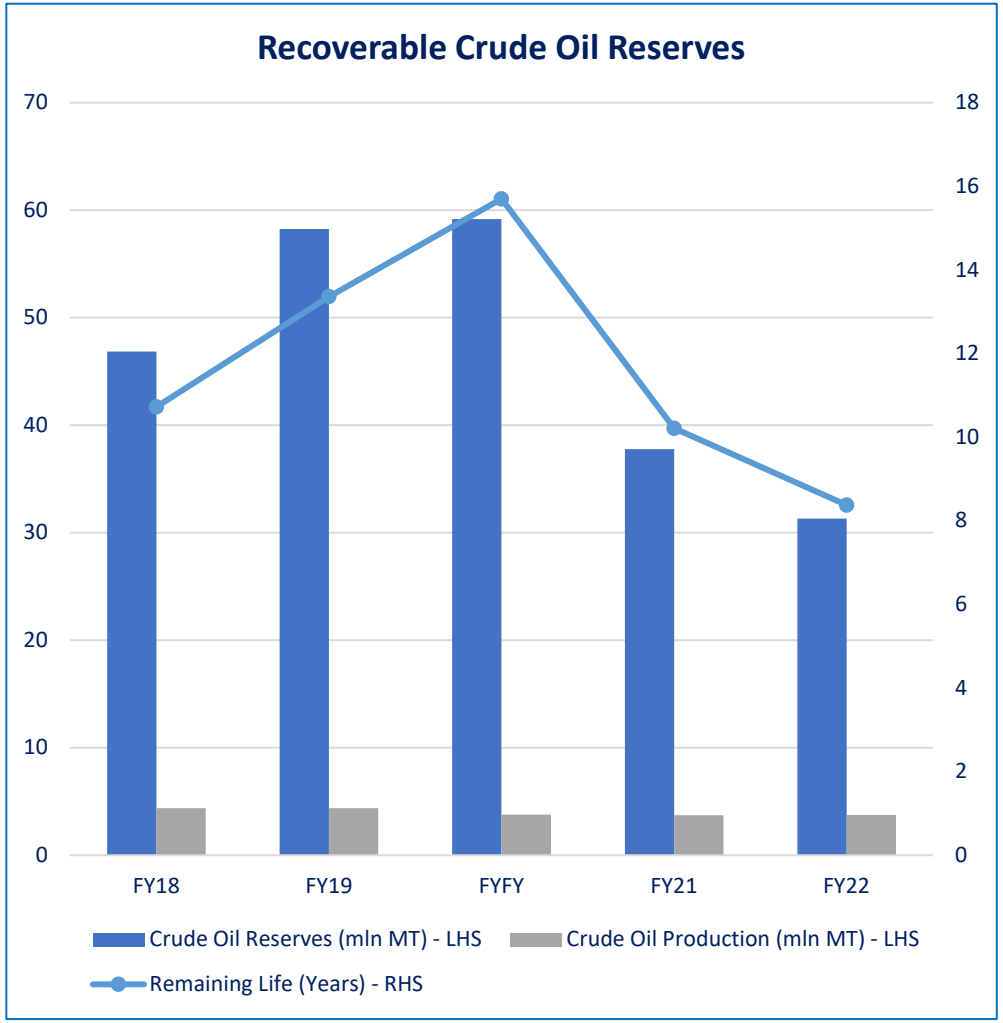
Cnergyico	PARCO	National Refinery Limited	ARL	PRL PAKISTAN REFINERY LIMITED
Note: Formerly Byco				
Incorporated in 1995	**Incorporated in 1974**	**Incorporated in 1963**	**Incorporated in 1978**	**Incorporated in 1960**

Refineries

Crude Oil Reserves

Recoverable Crude Oil Reserves & Extraction					
Period	FY18	FY19	FYFY	FY21	FY22
Crude Oil Reserves (mln MT)	46.8	58.2	59.2	37.8	31.3
Extraction of Crude Oil (mln MT)	4.4	4.4	3.8	3.7	3.7
Remaining Life (Years)	11	13	16	10	8

- Pakistan's recoverable crude oil reserves are estimated at ~31.3mln MT as at end June-2022 (June-2021: ~37.8mln barrels).
- Total recoverable crude oil reserves showed a significant decline in recent Reserves Evaluation Study, 2020 carried out by Degolyer and MacNaughton.
- Declining reserve life will significantly increase the reliance on imported fuel to meet local demand. Exploration of new wells and major discoveries are imperative to improve local supply of crude oil.

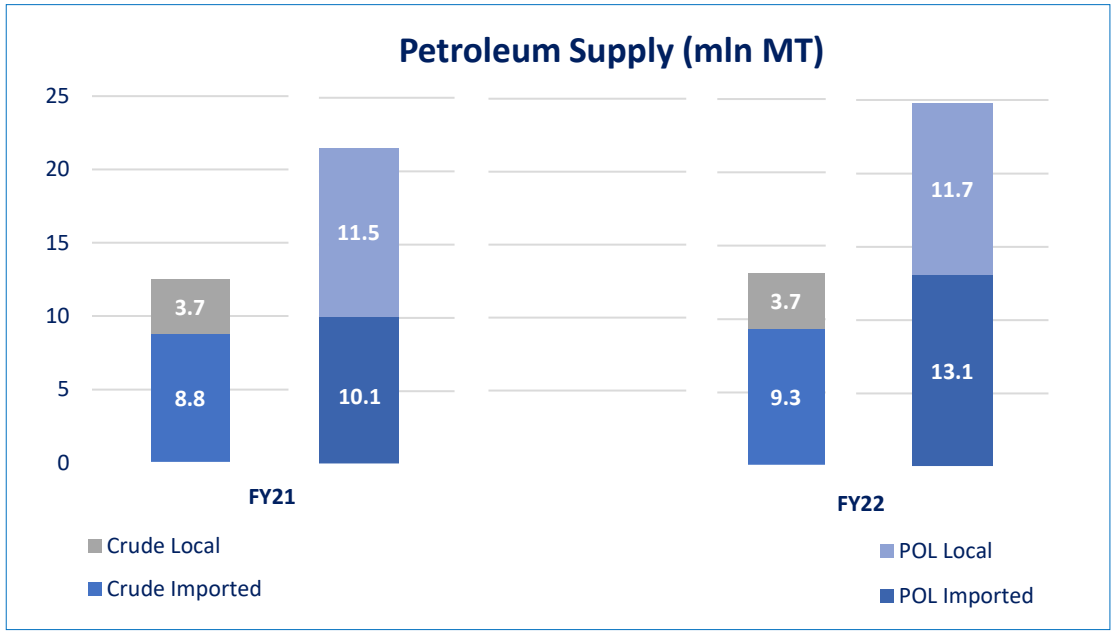


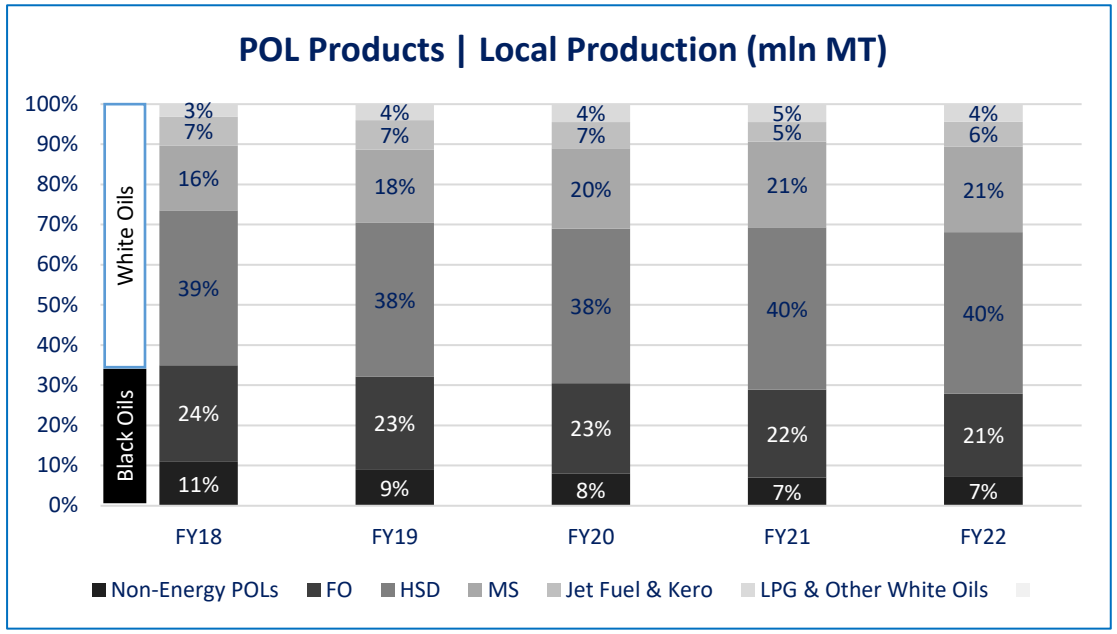
Source: OGDC

Refineries

Supply| Crude Oil & POL

- In FY22, local crude oil production is estimated to be ~3.7mln MT (FY21: ~3.7mln MT). However, as local refineries lack the capabilities to viably refine all grades of locally produced crude, their offtake averages at ~87%, while on average ~9% of locally produced crude (condensates) is exported.
- ~9.3mln MT of crude oil was imported in FY22 (FY21: ~8.8mln MT), of which, local refineries on average consumed ~98%.
- In FY22 ~11.7mln MT (FY21: ~11.5mln MT) of POL products were produced locally; local refineries on average yield ~97% of crude inputs into marketable POL products, while internal usage on average accounts for ~2% of the inputs.
- Imports of POL products in FY22 clocked in at ~13.1mln MTs (FY21: ~10.1mln MT).

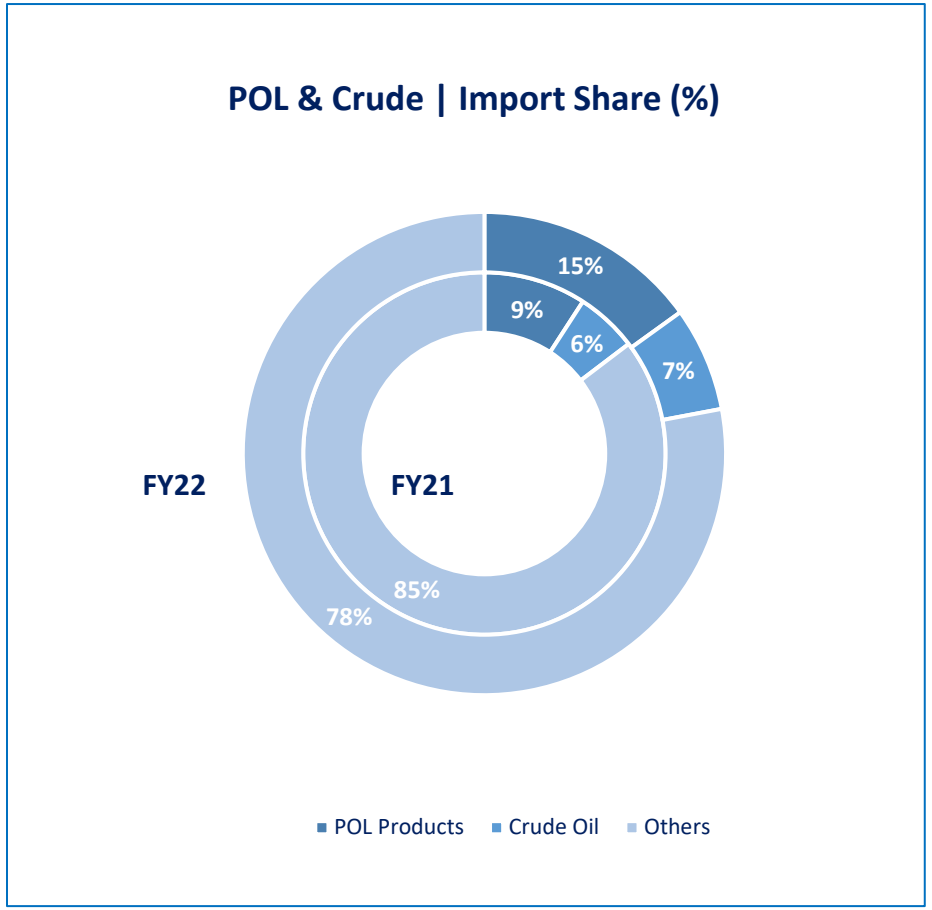




Refineries

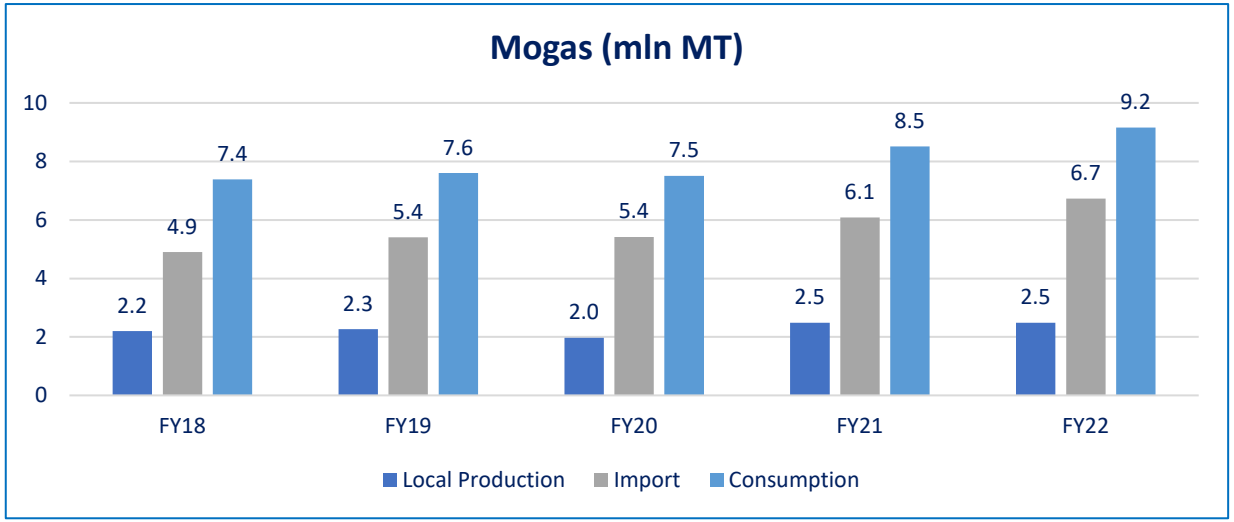
Supply | Crude Oil & POL Imports

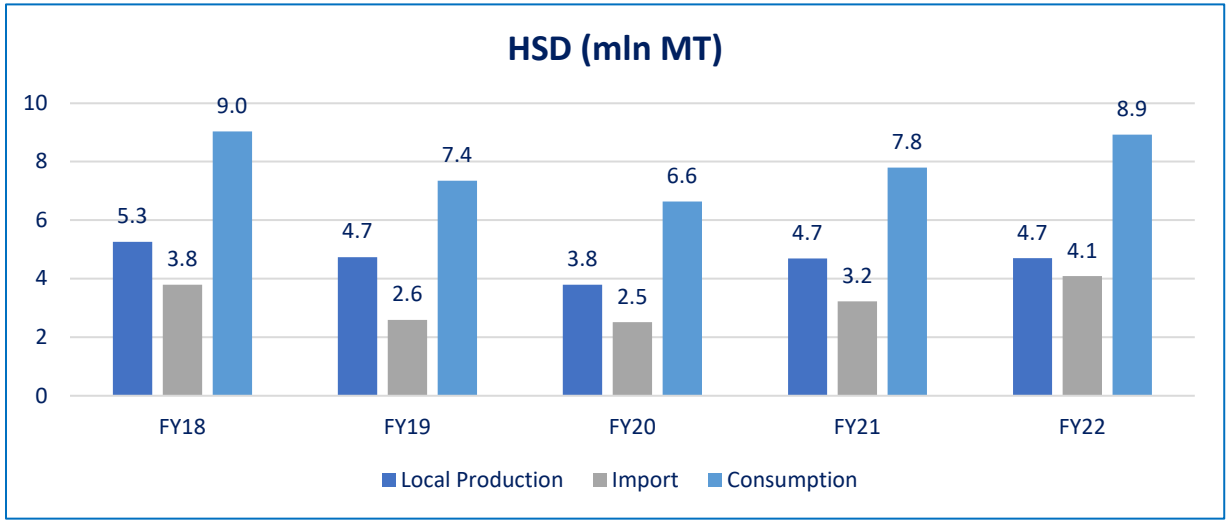
- Pakistan significantly relies on imports to meet its demand of crude oil. On average, around ~8.6mln MT of crude oil is imported every year.
- Total crude oil imports in FY22 amounted to USD~5.6bln (FY21: USD~3.1bln) representing ~7.1% of total import bill. While the volume imported increased by just ~0.5mln MT to ~9.3mln MT (FY21: ~8.8mln MT), value of imports increased most likely increased due to annual ~35% currency depreciation against USD.
- POL product imports for FY22 rose to ~13.1mln MT (FY21: ~10.1mln MT), an increase of 29.7% YoY.
- In FY22 POL product import bill amounted to USD~12.1bln (FY21: USD~5.2bln) representing ~15% (FY21: 9.1%) share in total imports. The hefty bill resulted due to a culmination of rupee depreciation, higher oil prices in international market and surge in demand.
- In 1QFY23, petroleum products' imports declined in quantity by ~31% YoY (~1.1ml MT), reflecting high pump prices and suppressed demand due to flash floods in the recent months.

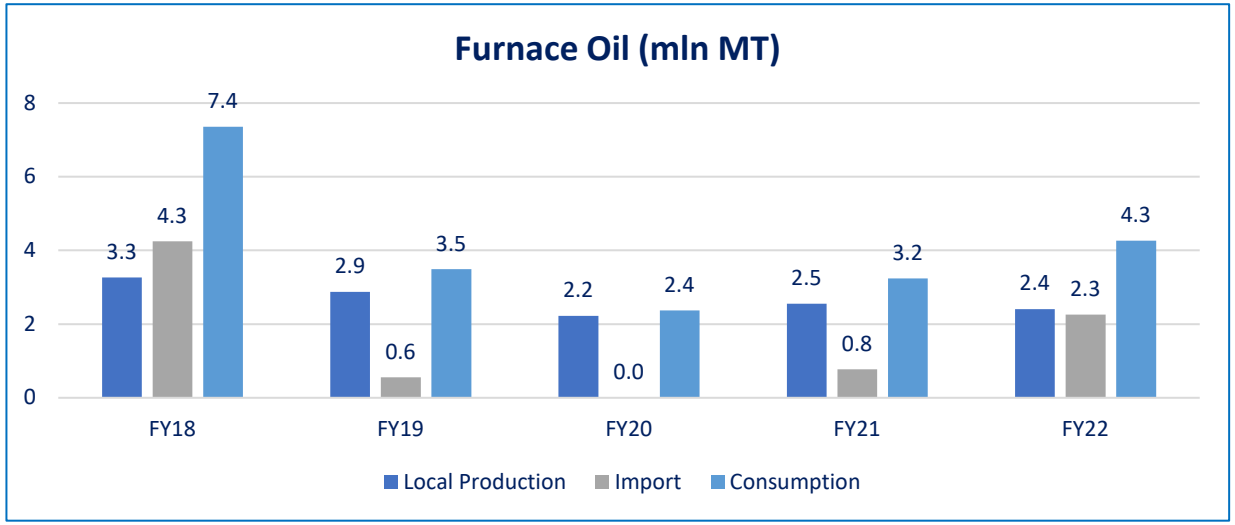


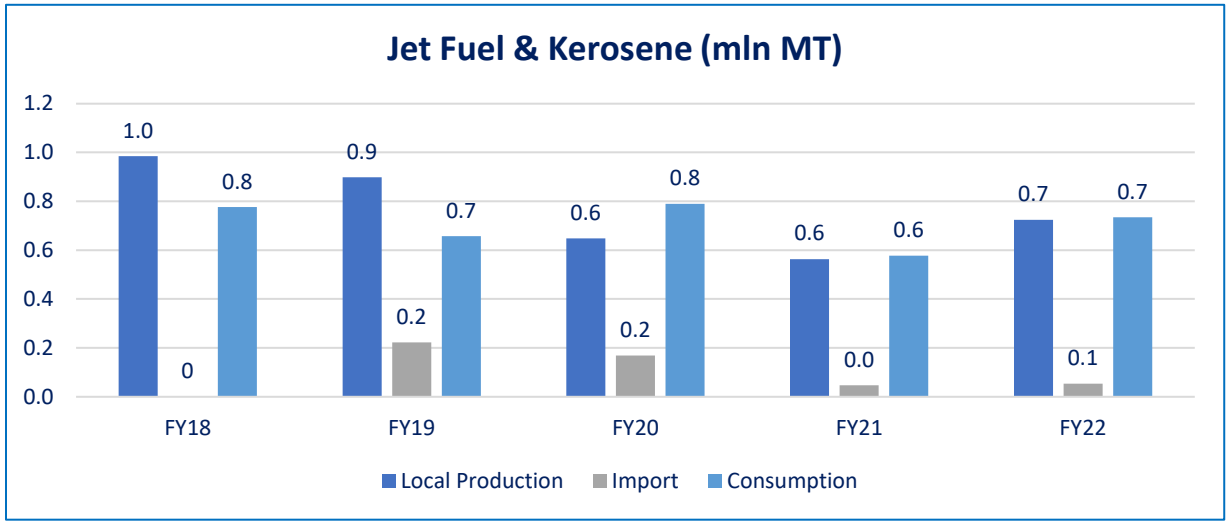
Refineries

Supply









Source: OCAC

Refineries

Capacity Utilization

- Pakistan's total refining capacity was recorded at ~20.6mln MT p.a during FY22 (FY21: ~19.6mln MT), an increase of ~0.05mln MT in FY22.
- All refineries are committed to upgradation of their refinery facilities. However, timing of that announcement is largely dependent on approval of the new refining policy that is under consideration.

Refineries	FY18		FY19		FY20		FY21		FY22	
	Capacity	Utilization	Capacity	Utilization	Capacity	Utilization	Capacity	Utilization	Capacity	Utilization
Cnergyico (formerly Byco)	7.6	35.6%	7.6	32.5%	7.6	30.8%	7.6	26.4%	7.6	16.3%
PARCO	5.3	101.2%	5.3	87.9%	5.3	57.0%	5.3	88.3%	5.3	103.0%
NRL	2.9	84.8%	2.9	76.9%	2.9	58.7%	3.1	63.3%	3.1	62.2%
ATRL	2.5	93.9%	2.5	93.5%	2.5	69.5%	2.5	77.0%	2.5	78.7%
PRL	2.1	79.4%	2.1	76.3%	2.1	59.3%	2.1	61.0%	2.1	62.7%
Total	**20.4**	**71.1%**	**20.4**	**65.0%**	**20.4**	**49.2%**	**20.6**	**57.5%**	**20.6**	**57.7%**

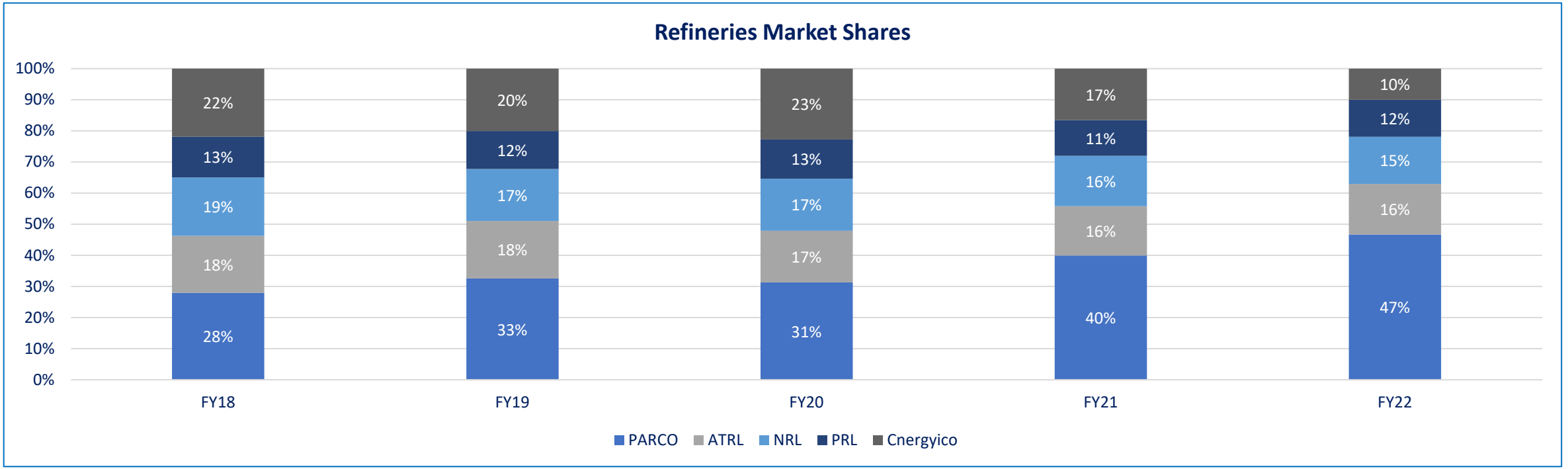
Source: Financial Statements

Refineries

Market Shares | Revenue-based

- PARCO carries the highest market share (~47%) in FY22 in terms of revenue, the share trend being in line with FY21. Among all refineries, ATRL and PARCO are based in North, while all other refineries are based in the South, i.e., Karachi, near port.

- ATRL mostly consumes local crude oil to meet its demand, whereas all other refineries are largely dependent on imported crude to meet demand.



Pricing Mechanism| How it Works

- The pricing structure of POL products (MOGAS & HSD) is a computation of six different price components (discussed in previous slide) embedded in a price formula.

- While OMC Margins and Dealer Commission are fixed, the Petroleum Levy, Sales Tax and IFEM are variable components, the former two depending on the GoP's discretion, and the latter computed through a freight pool mechanism.

- The start-up point for pricing mechanism is the **'Ex-Refinery Price'.** This price is determined by OGRA and was earlier determined based on PSO's weighted average costs of POL products in the preceding monthly and ~30 days International prices published in the Platt's Oilgram.

- Since September 01, 2021, the pricing mechanism has been shifted from monthly basis to fortnightly basis and the price benchmark based on PSO's oil imports has been shifted to Platt's Index. This development is expected to shield the Industry from Inventory losses.

- As per OGRA Rules, OMCs are required to build storage/ depots at different areas of the country in order to maintain a stock of at least 20 days so as not to end up with dry petrol stations. Ex-Refinery Price, PL, IFEM and OMC margin add up to Ex-Depot Price, while Dealer Commission is added on the next step. Sales Tax is applied to an aggregate of Ex-Depot Price and Dealer Commission.

Source: OCAC, OGRA

Refineries

Fuel Retail Price

- For FY22, OMC margins increased to PKR~3.3/liter, compared to PKR~2.9/liter. For MOGAS, share of OMC margins as % of average retail prices declined from ~2.7% in FY21 to ~2.3% in FY22. Similarly, in case of HSD, the share of OMC margins fell by ~0.3% YoY in FY22.

- Moreover, the ex-refinery price for MOGAS increased by more than 100% for both MOGAS and HSD in FY22, most likely due to the ~67% climb in international prices over the course of last two years (Approx. USD~22/ bbl to USD~66/ bbl in FY20 compared to USD~78/ bbl to USD~110/ bbl in FY22).

- Despite increasing global prices, petrol prices were fixed at Rs~150/ liter for a period of 2 months (Apr-May) [a subsidy to the tune of roughly PKR~30+ per liter). Simultaneously, the Sales Tax on all POL products was reduced to zero which cost FBR PKR~45 billion in April, hence average sales tax for FY22 recorded at PKR~4.6/ liter compared to PKR~15.5/ liter in FY21.

- However, following the overnight regime change in April of this year, the incumbent government rolled back the fuel subsidy in order to revive IMF's EFF program for the country and keeping the fiscal deficit in check.

MOGAS – Average Retail Price/ Liter (Composition)

Price Components	FY19	FY20	FY21	FY22	FY23		
					1QFY23	Oct'22	Nov'22*
Cost of Supply	71.9	61.5	60.5	131.3	184.7	172.0	164.5
IFEM Margin	3.3	3.4	3.6	4.0	4.1	2.3	(0.35)
OMC Margin	**2.6**	**2.8**	**2.9**	**3.3**	**3.7**	**3.7**	**3.7**
Dealer Commission	3.5	3.6	3.7	4.4	6.7	7	7
Petroleum Levy	15	19.8	20.3	5.4	30.3	39.8	50
Sales Tax	16.4	15.5	15.5	4.6	0.0	0.0	0.0
Max Ex-Depot Sales Price	112.7	106.6	106.6	145.1	229.5	224.8	224.8

HSD – Average Retail Price/ Liter (Composition)

Price Components	FY19	FY20	FY21	FY22
Cost of Supply	85.7	66.3	65.0	135.0
IFEM Margin	1.1	1.2	1.0	1.3
OMC Margin	**2.6**	**2.8**	**2.9**	**3.4**
Dealer Commission	2.9	3.1	3.2	3.8
Petroleum Levy	16.0	21.1	21.1	5.2
Sales Tax	18.4	16.0	15.8	6.9
Max Ex-Depot Sales Price	126.8	110.4	108.9	146.0

Source: OGRA, PSO

New Refinery Policy

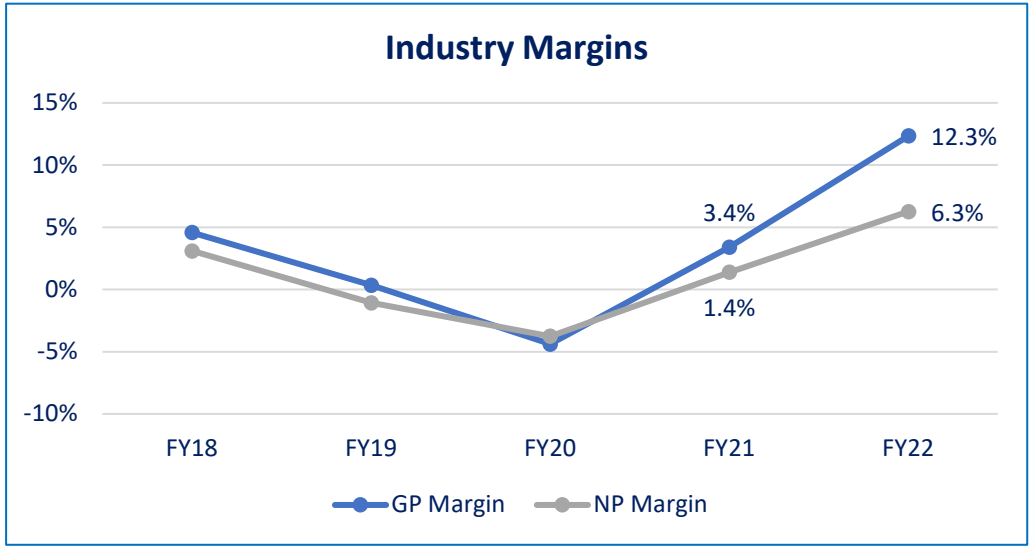
- There have been numerous developments towards the proverbial “New Refinery Policy”, aimed at resolving the prevailing shortcomings in refining capabilities (cracking and cocking) of market players.
- As per the latest development, the government is more inclined toward incentivizing greenfield refineries rather than the existing refineries.
- Following are the salient features of the upcoming refinery policy -
  - Duty protection in the form of 10% import duty on MS and diesel of all grades as well as imports of any other white product used for fuel of any kind of motor or engine. The protection will be effective from Jan’22 to Dec’27.
  - Government to limit its contribution in total investment to ~30% whereas ~70% to be fund by refineries.
  - A special reserve account for upgradation/ modernization/ expansion will be maintained by each refinery in a separate bank account to be opened in National Bank of Pakistan. The refineries will transfer any incremental revenue (net of taxes) based on the revised tariff structure to the special reserve account.
  - The refineries will be entitled to withdraw from the reserve account once the EPC contract has been awarded for the relevant project. The withdrawal from the reserve account will be on a proportionate basis
  - To be eligible for the incentives, the existing refineries would have to commit before 31st December 2021 and provide an undertaking to the PD with a proposed timeline along with potential size, configuration, product slate and all relevant information, ensuring production of Euro 5 MS and HSD. The refineries that do not provide such an understanding and do not have a waiver, will not be allowed to sell their products in Pakistan after 30th June 2022.

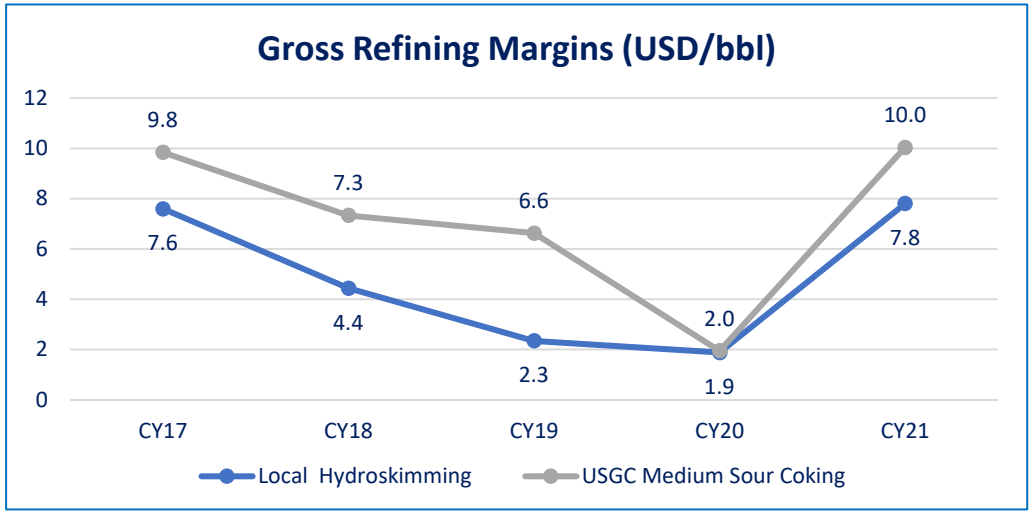
Source: Taurus Securities

Refineries

Business Risk

- In FY22 a number of factors contributed positively in driving local Refineries performance. As the GDP grew by ~6.2% (FY21: ~6.4%), local POL product consumption grew by ~14.3% YoY (FY21: ~16.2%) while tight international markets pushed crack spreads to multi-year highs.
- Although local POL product production in FY22 only grew by ~0.3% YoY (FY21: ~18.0%), Gross Revenue per MT of refined products grew by ~54.5% YoY (FY22: PKR~161,244). Duties, Levies and Taxes decreased by ~42.8% YoY (FY22: PKR~18,476), pushing Net Revenue per MT of POL product up by ~98.0% (PKR ~142,768), while COGS per MT of POL Product grew by ~79.7% (PKR~125,146).
- Increased pricing power in FY22 led to multi-year high gross profit margins of ~12.3% (FY21: ~3.4%). Better cost controls led to Operating Profit margins of ~11.0% (FY21: ~2.8%), while interest and tax expenses increased ~1.5x and ~3.0x respectively. However, improved pricing also enabled multi-year high Net Profit margins of ~6.3% (FY21: ~1.4%).
- Although the industry showed robust performance in FY22, faces several structural issues which in times adverse market conditions disallow high margins.
- As all refineries operate hydro-skimming technology, their refining margins are, on average, ~31% lower than refineries with more advanced deep-conversion capabilities (i.e. Cracking & Coking).

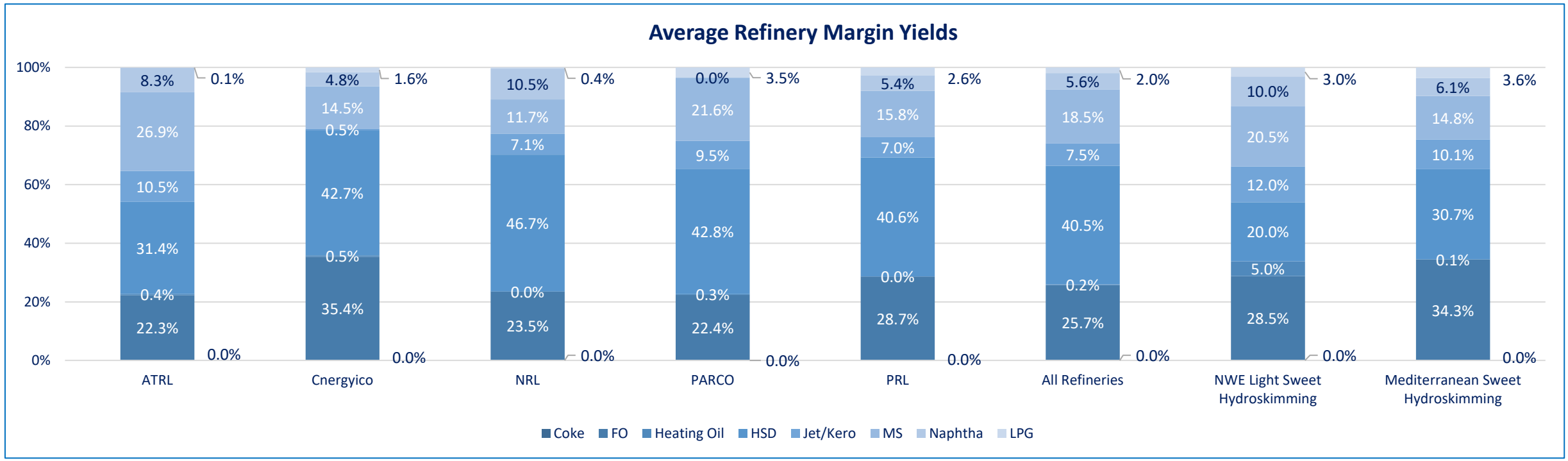




Source: Financial Statements, BP Stats, PACRA Internal Database

Business Risk | Local Refinery Configuration

- All local Refinery yields are consistent with "IEA Global Indicator Refinery Margin Yields and Cost Parameters 2022" classification of standard Sweet Hydroskimming North West Europe and Mediterranean yields.
- Hydroskimming refineries outputs are dependent upon the straight run yields of the grade of crude oil used, thus light and sweet crude oils are preferable to derive economically viable yields.
- Light and Sweet crudes are more expensive and high yields of less economically-viable FO from the Hydroskimming process in tandem led to lower refining margins.

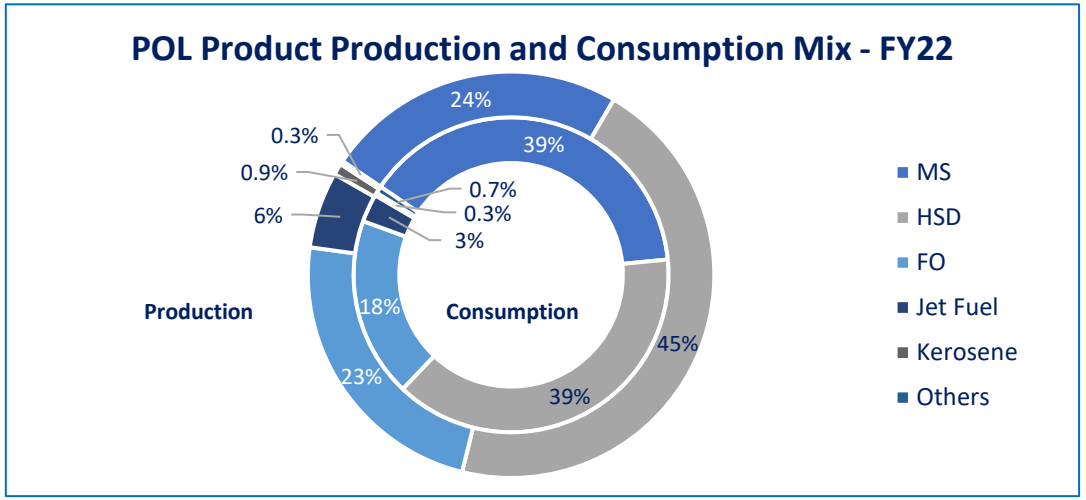


Source: Pakistan Energy Year Book, IEA, Valero, World Bank

Refineries

Business Risk | Local Petroleum Storage

- Lack of both conversion and deep-conversion capabilities at local refineries leads to a mismatch between the national POL product production and consumption mix.
- Higher production levels and slower offtake of FO has a tendency to cause bottlenecks in the production process, as FO storage capacity with Refineries can only store ~7.6% of its annual average yield.
- Pakistan maintains low stocks of crude oil, as total national crude oil storage capacity only accounts for ~7.8% of the annual average crude offtake.



Gross National Petroleum Storage Capacity ('000 MT) - FY21

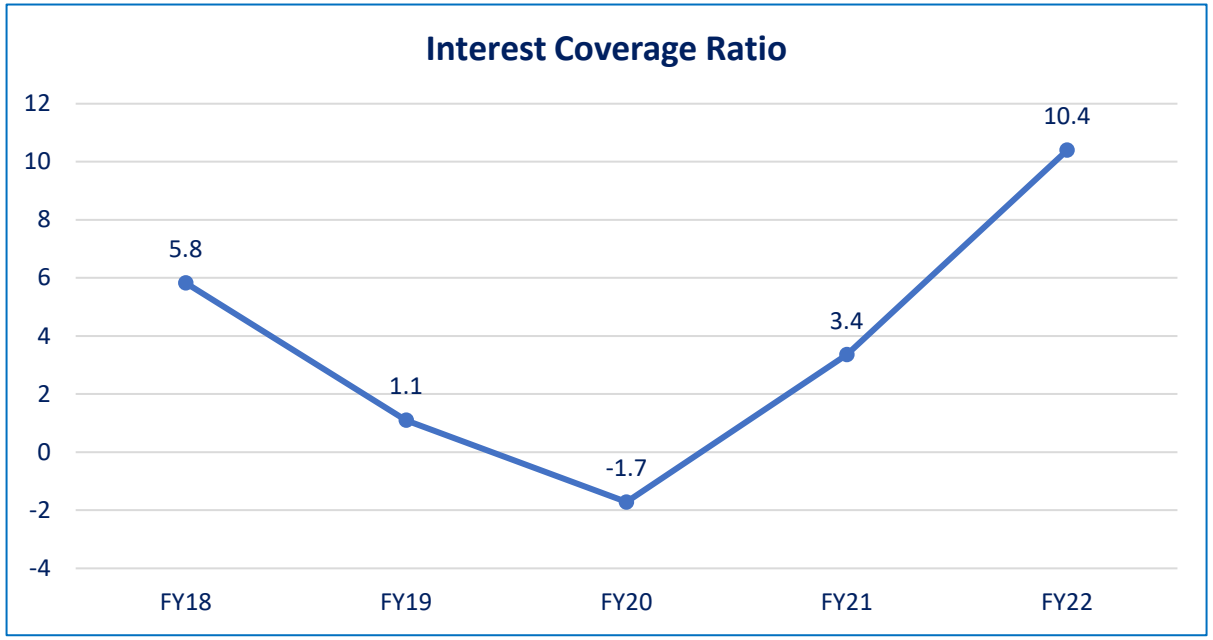
	OMCs Port Installations	OMCs Up Country	ATRL	Cnergyico	NRL	PRL	PARCO	Total OMCs	Total Refineries	Total Country
Crude	16	-	94	128	155	187	372	16	936	952
HSD	330	649	21	62	32	20	86	979	221	1,200
MS	444	354	22	33	16	8	25	798	105	903
FO	324	103	49	36	34	28	56	427	204	631
Jet Fuel	28	10	14	0.5	8	5	19	38	46	84
Kerosene	0.3	14	7	1	0.6	2	6	15	18	32
Naphtha	-	-	20	-	19	21	-	-	60	60
Others	38	14	1	0.6	-	-	12	52	14	66
Total	**1,181**	**1,144**	**228**	**262**	**265**	**271**	**577**	**2,325**	**1,603**	**3,928**

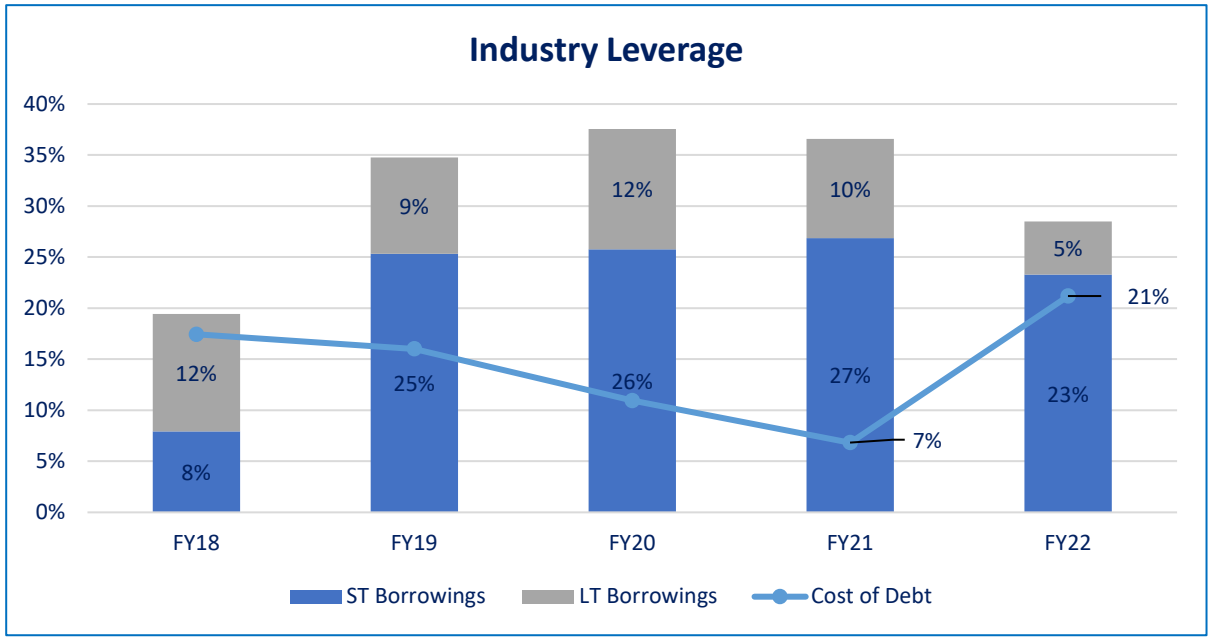
Source: OCAC

Refineries

Financial Risk | Capacity to Pay and Borrowings

- SBP in perusing its hawkish stance hiked its policy rates from 7% in FY21 to 13.5% by FY22-end and resultantly the effective cost of debt for the Refinery industry reached ~21% in FY22 (FY21: ~7%).
- However increased pricing power and high margins enabled the industry to maintain interest coverage ratio of ~10.4x in FY22 (FY21: 3.4x). despite high borrowing rates.
- By FY22-end, the industry reduced its long-term borrowings by ~27.1%; short-term borrowings grew by 17.6%; while increased profitability and income retention lead to a ~53% growth in equity; as a result the industry leverage declined to ~28.5% (FY21: ~36.6%).



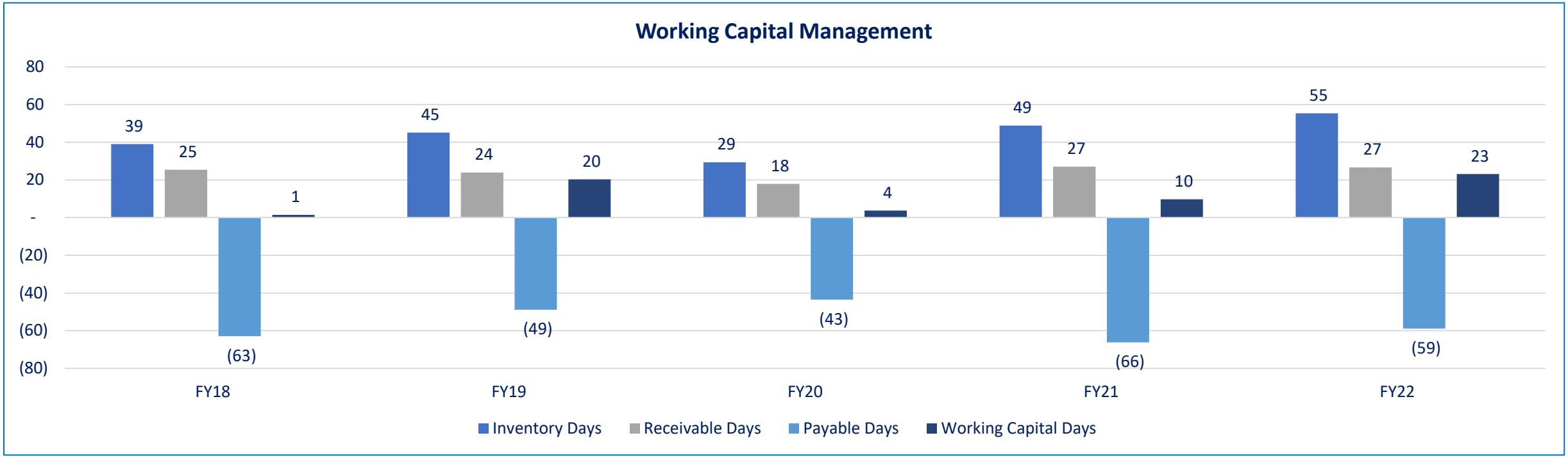


Source: Financial Statements, SBP

Refineries

Financial Risk | Working Capital

- In FY22, the Industry's average inventory days stood at ~55 days (FY21: ~49 days) with a YoY increase of ~6 days. Average receivable days of the industry during FY22 were recorded at ~27 days (FY20: ~27 days). Moreover, payable days in FY22 stood at ~59 days (FY20: ~66 days); pushing the working capital days to ~23 days (FY21: ~10 days) with a YoY increase of ~13 days.

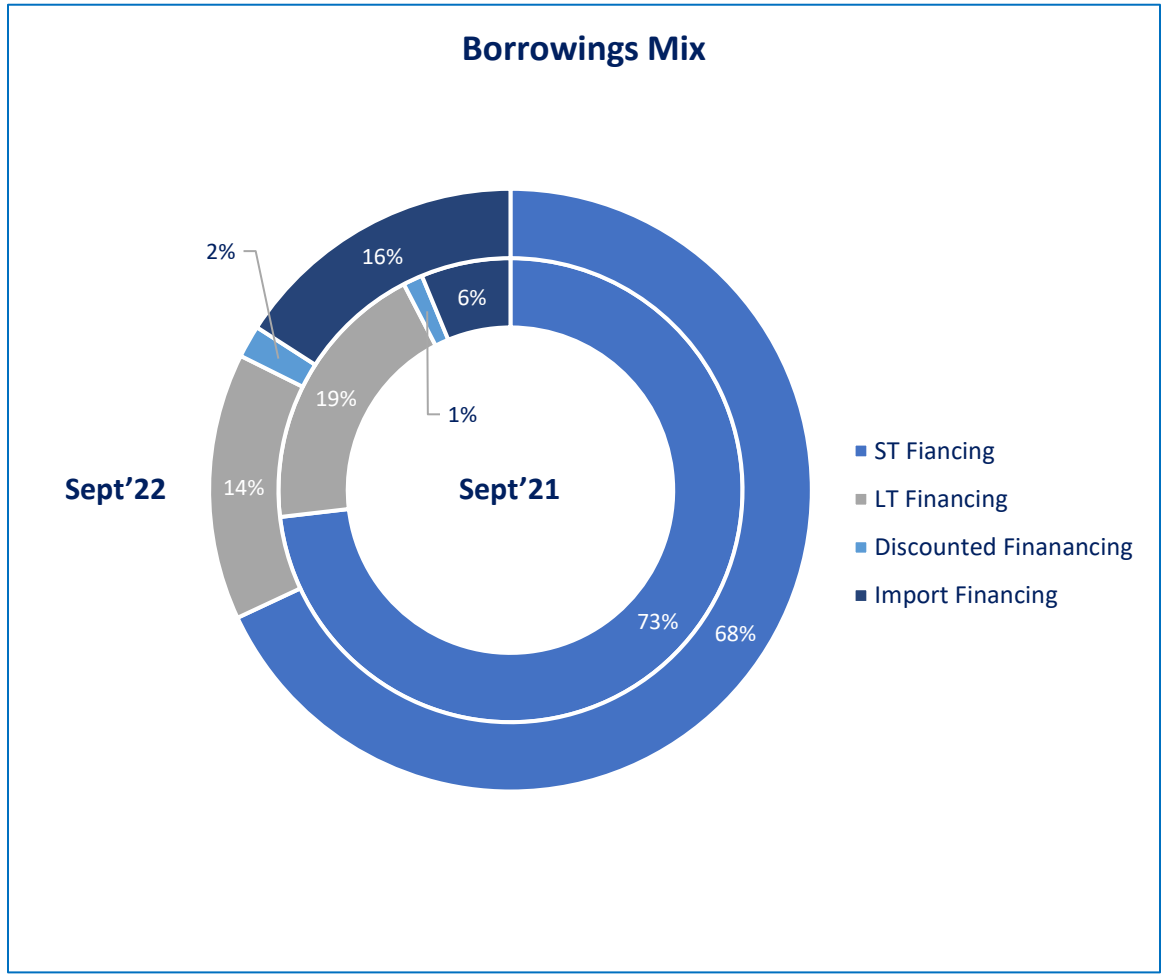


Source: Financial Statements

Refineries

Financial Risk | Borrowing Mix

- As per SBP data in Sept'22 industry borrowings stood at PKR ~147,109bln (Sept'21: PKR~129,829) increasing by ~13.3% YoY.
- Short Term financing held a ~68% (Sept'21: ~73%) share in the total borrowings mix and grew by ~5.4% YoY.
- Long Term financing held a ~14% (Sept'21: ~19%) share in total borrowings; decreasing by ~15.7% YoY.
- Discounted borrowings in terms of EFS and LTFF & TERF held a share of ~2% (Sept'21: ~1%) and grew by ~44.2% YoY.
- Amidst high input costs (i.e., crude oil prices) import financing grew by ~1.9x YoY and captured a share of ~16% (Sept'21: ~6%) in the industry's borrowing mix.
- Increased borrowings during peaking interest rates are reasonably expected to adversely impact the industry's bottom line going forward.

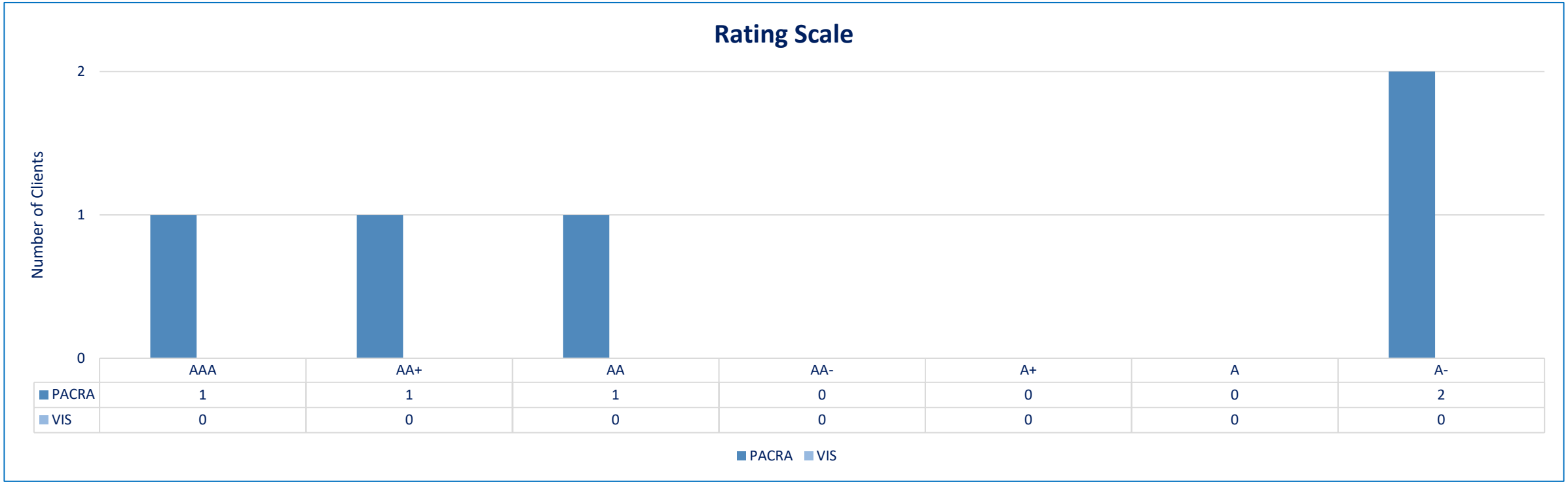


Source: SBP

Refineries

Rating Curve

PACRA rates all five refineries currently operative in Pakistan, in the bandwidth of A- to AAA.



Refineries

SWOT Analysis

- Highly capital-intensive business.
- Government relations.
- Strategic importance.
- Robust local demand.

- Under-utilization of refining capacity.
- High proportion of low-value product (FO) in total product mix.
- Exposure to exchange rate and international oil price movement.
- Technological lags.

- Attention/ focus of government towards solving issues of refineries.
- Upcoming refinery policy.
- All companies are moving towards upgradation of Bottom-of-Barrel (BOB) to produce value-added products.
- Improving crack spread.

- Non-approval of refinery policy.
- Abrupt reduction in petrol prices.
- Depleting local oil reserves.

Refineries

Outlook: Stable

- Although the industry depicted robust performance in FY22, political instability earlier this year, coupled with local and global macroeconomic vulnerabilities in last quarter of same period and devastating floods in the beginning of FY23 have, in conjunction, been highly detrimental to the economy.
- Inflation levels hit ~23.2% in Sept'22 and PKR depreciated by ~31.2% against the USD for the same period; the SBP, adopting a hawkish stance, has maintained its policy rate at 15% since July'22. Similarly, the QIM index, after peaking in Mar'22, fell by ~25.1% in Sept'22. Going forward, the economy as a whole is also expected to slow down in FY23 with GDP growth rate forecast at ~2%.
- Overall POL product consumption in 1QFY23 has declined by ~23% YoY; while among major products, Mogas consumption fell by ~21% YoY and HSD consumption fell by ~32% YoY following massive damage to agriculture and transport infrastructure in from the floods.
- Share of FO in the July – Aug'22 power generation mix has fallen to ~6.7% (July – Aug'21: ~10.2%); as power generation from it declined by ~41% YoY in the same period and FO offtake in 1QFY23 also decreased by ~16% YoY.
- The southern side of the country was disproportionality affected by the floods as that's where most of the damage occurred; resultantly 1QFY23 average Gross Profit margins of refineries in Karachi fell to ~-1.6% (1QFY22: ~3.4%); Operating Margins fell to ~-2.0% (1QFY22: ~2.4%) and Net Margins fell to ~-5.1% (1QFY22: ~-0.4%).
- Refineries in the upcountry maintained robust performance in 1QFY23; as their Gross Profit margins grew to ~15.4% (1QFY22: ~6.3%); Operating Profit margins grew to ~12.1% (1QFY22: ~7.2%) and Net Profit Margins grew to ~8.1% (1QFY22: ~5.0%).
- The industry as a whole also maintained stable performance as 1QFY23; as their Gross Profit margins grew to ~9.2% (1QFY22: ~5.2%); Operating Profit margins grew to ~8.6% (1QFY22: ~3.1%) and Net Profit Margins grew to ~5.0% (1QFY22: ~1.5%).
- Subdued demand in tandem with structural deficiencies, in terms of technology obsolesce and low storage capacities is expected to keep capacity utilization under check; while improved pricing is reasonably expected to support financial performance, however it is subject to crude and POL product price movements in the international market.

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- OPEC
- Pakistan Bureau of Statistics (PBS)
- Business Recorder
- State Bank of Pakistan (SBP)
- Pakistan Stock Exchange (PSX)
- Investing.com
- Financial Statements
- PACRA in-house Database

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