



---

## Oil Exploration & Production

---

### Research Team

**Saniya Tauseef** | Senior Manager Research  
**Sabeen Mirza** | Senior Research Analyst

© The Pakistan Credit Rating Agency Limited.



# Oil Exploration & Production

Contents	Page	Contents	Page	Contents	Page
Sector Introduction		Local Synopsis		E&P   Regulatory Framework	28
Oil Market Segments	1	Oil Value Chain	15	Natural Gas   Snapshot	30
Oil Value Chain	2	Industry Snapshot	16	Natural Gas   Proved Reserves	31
E&P Value Chain	3	Country's Total Crude Oil Reserves	17	Tight Gas Policy 2024	32
Oil Well Categories	4	Country's Energy Map	18	Seismic Acquisition Services   Overview	33
Types of Crude Oil	5	OGDCL Oil & Gas Reserves	19	Polaris Geo   Overview	34
<b>Global Synopsis</b>		PPL Ltd.   Oil & Gas Reserves	20	Seismic Acquisition Services   Business Risk	35
Energy Mix	7	POL Ltd. & MARI Petroleum   Oil & Gas Reserves	21	E&P   SWOT Analysis	36
Crude Oil Reserves	8	Province Wise Wells And E&P Activity   FY21	22	Rating Curve	37
Crude Oil Supply & Demand	9	Production   5 Years at a Glance	23	Outlook	38
Prices	10	Gross Sales   5 Years at a Glance	24	Bibliography	39
Spreads	11	E&P   Business Risk	25		
Crude Oil Trade	12	E&P   Financial Risk	26		
POL Products Trade	13				
Outlook	14				

# Introduction



# Oil Exploration & Production

## Oil Value Chain



- The oil value chain is divided into three segments, i.e., the **Upstream**, **Midstream**, and **Downstream** segments.
- The upstream segment encompasses the Exploration and Production (E&P) of oil.
- The midstream segment includes the transportation of oil from production sites to refineries via pipelines, trains, tankers, and trucks to produce refined products.
- The downstream segment comprises the marketing, storage & distribution of refined petroleum products.

# Oil Exploration & Production

## Value Chain

Crude oil is a mixture of hydrocarbons that exists in the 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.

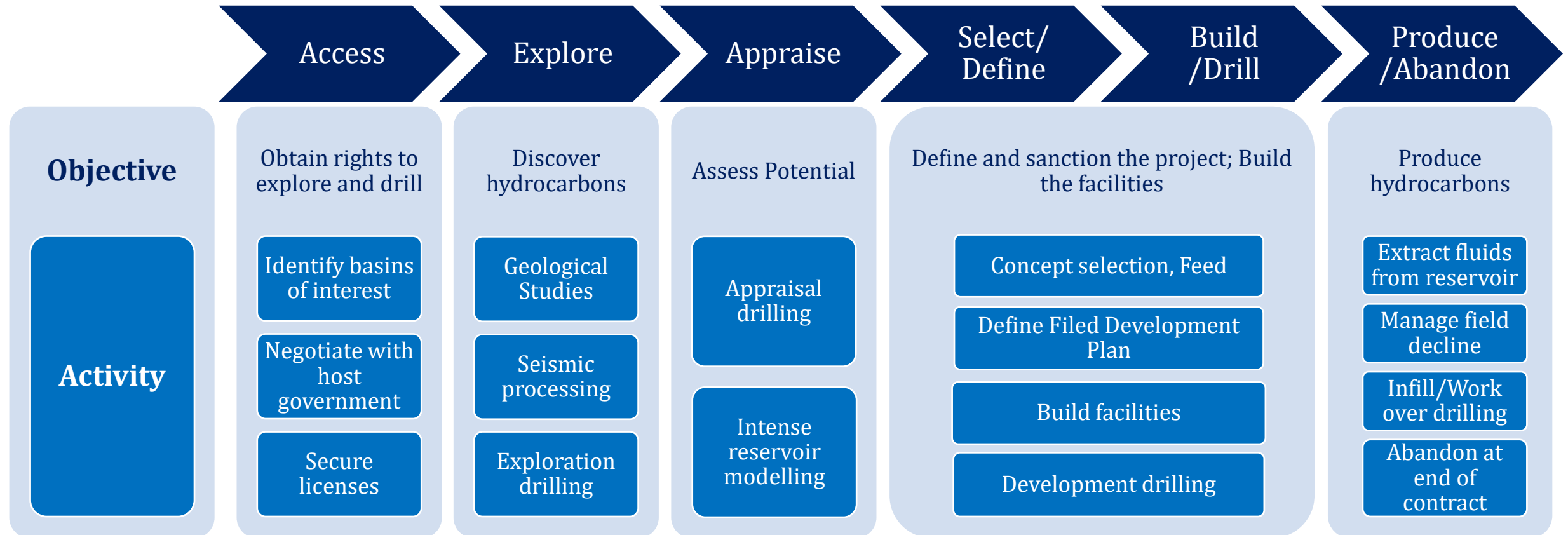
Refining breaks crude oil down into its various components, which are then selectively reconfigured into new products. All refineries have three basic steps: Separation, Conversion, and Treatment.

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

# Oil Exploration & Production

## E&P Value Chain

- The upstream segment, also referred to as “Exploration and Production”, is concerned with discovering oil reserves, developing facilities to extract oil, and producing commercial quantities of oil from those sights. It is the most high-risk segment of the overall oil value chain and requires massive investments.





# Oil Exploration & Production

## Oil well categories (E&P asset types)

- Oil wells or upstream assets can be largely categorized into 3 types; conventional onshore (~53% share in global production), unconventional onshore including shale oil and gas (~18% share in global production), and offshore (~29% share in global production).
- On average 15-50% oil is recoverable from oil reservoirs.



### Conventional onshore

Hydrocarbons that have migrated from source rock, trapped by a seal

a) Project life: 18-40 years

b) Development cost/well: USD 6-7 mln



### Unconventional onshore

Hydrocarbons in an impermeable layer, unable to migrate

a) Project life: 5-12 years

b) Development cost/well: USD 5-10 mln



### Offshore

Hydrocarbons located under the seafloor

a) Project life: Up to 30 years

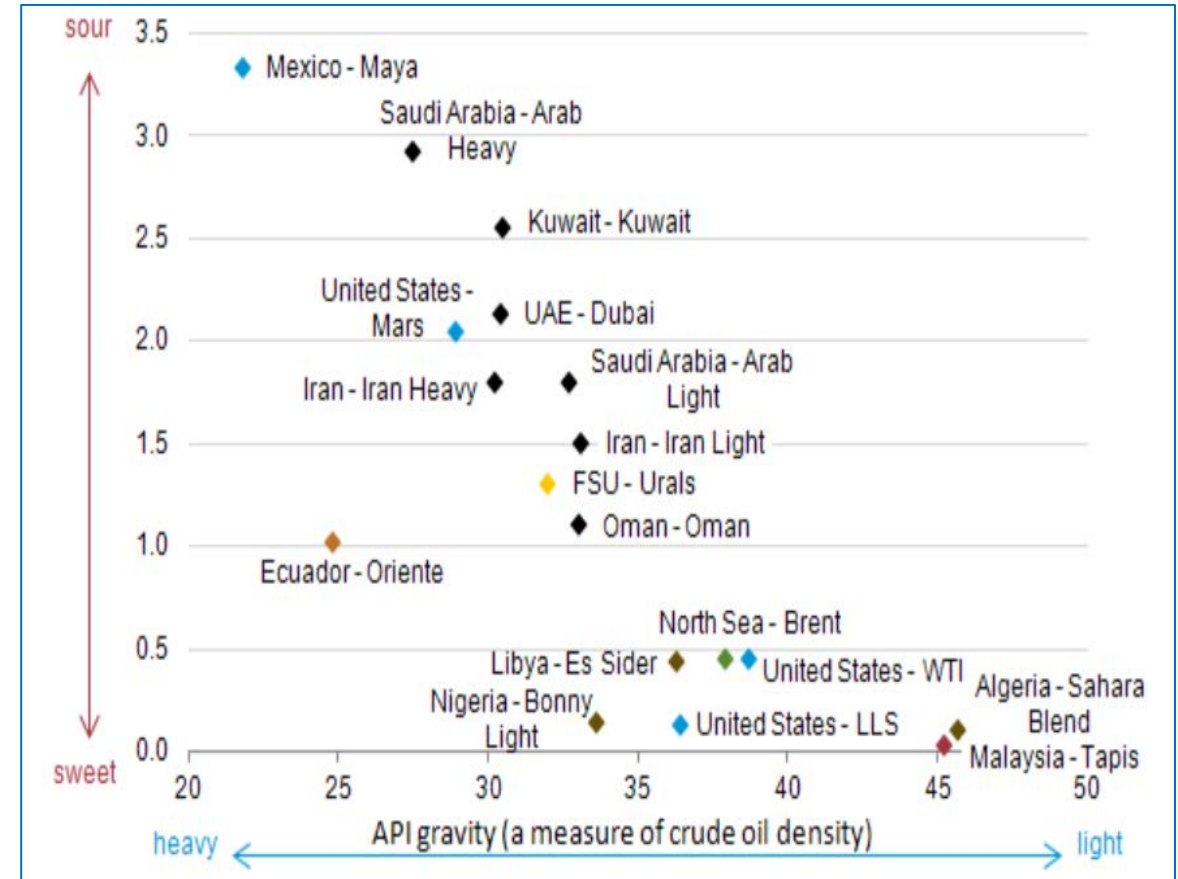
b) Development Cost/well  
 i) Shallow water: USD 30-50 mln  
 ii) Deepwater: USD 100-150 mln

# Exploration & Production

## Types of Crude Oil

- Crude Oil is usually a black liquid, extracted from underground geological formations; It is formed from dead organisms buried under immense pressure and heat (hence called a fossil fuel). It is rich in hydrocarbons (long and short) and also contains small amounts of substances such as sulfur, nitrogen, oxygen, and some heavy metals.
- The Grade of Crude oil extracted from different locations vary, depending upon the specific mix of hydrocarbons and other substances present in it. Two of the most widely accepted parameters, for classifying the grade of crude oil are; its density measured via its American Petroleum Institute (API) Gravity, and its sweetness measured via its sulfur content.
- Density:** The more dense the crude oil, the heavier it is, the lower its API gravity and heavier the yielded refined product (i.e., residuals). Conversely, the lower the density of crude, the higher the API gravity and the lighter the yielded product (i.e., Gasoline blend).
- Sweetness:** The sweetness or sourness of crude oil is dependent upon its sulfur content. Crude oil with well below 1.0% sulfur is considered sweet and the yielded product requires less treating; while products driven from crude oil with higher sulfur content (i.e., sour) require more treating to meet emissions/safety standards.

Density & Sulfur Content of Select Crude Oil



A variety of crude oils are traded on the market, and these are usually labeled according to the region of origin. Three of the most well-known regional crude oils used for benchmarking are; WTI (produced in the USA), Brent (produced in the UK), OPEC (Basket of oils from 7 countries)



# Exploration & Production

## Types of Crude Oil – By Density & By Sweetness

### By Density

API Gravity Range	Avg. Sulfur Content	Avg. Fraction Volume (%)						
		Butane and Lighter IBP - 60F	Light Naphtha C5 - 165F	Heavy Naphtha 165 - 330F	Kerosene 330 - 480F	Diesel 480 - 650F	Vacuum Gas Oil 650 - 1000F	Vacuum Residue 1000F+
> 20 and ≤ 25	2.18%	0.70%	4.35%	6.68%	9.27%	16.13%	34.93%	27.93%
> 25 and ≤ 30	0.80%	1.38%	3.92%	12.46%	13.85%	17.76%	31.24%	19.39%
> 30 and ≤ 35	0.64%	1.67%	4.85%	14.08%	14.04%	18.99%	30.46%	15.91%
> 35 and ≤ 40	0.35%	2.28%	7.01%	18.82%	16.37%	18.96%	26.41%	10.15%
> 40 and ≤ 45	0.16%	2.43%	8.48%	20.90%	17.78%	19.85%	24.08%	6.43%
> 45 and ≤ 50	0.12%	3.47%	17.13%	29.30%	15.27%	13.43%	16.17%	5.20%
> 50 and ≤ 55	0.05%	3.17%	19.30%	39.63%	16.97%	11.67%	7.97%	1.37%
> 55	0.01%	2.55%	35.85%	42.53%	9.93%	5.25%	3.60%	0.33%

### By Sweetness

Fractional Cuts	Avg. API Gravity	Sulfur Content Range		
		>0.0% & ≤0.6%	>0.6% & <2.0%	>2.0% & ≤4.0%
		Sweet	Sour	
<b>Butane and Lighter IBP - 60F</b>	121.4	0.00%	0.00%	0.00%
<b>Light Naphtha C5 - 165F</b>	83.6	0.00%	0.00%	0.01%
<b>Heavy Naphtha 165 - 330F</b>	55.1	0.01%	0.02%	0.05%
<b>Kerosene 330 - 480F</b>	42.0	0.03%	0.11%	0.41%
<b>Diesel 480 - 650F</b>	33.1	0.14%	0.56%	1.81%
<b>Vacuum Gas Oil 650 - 1000F</b>	24.0	0.34%	1.32%	3.60%
<b>Vacuum Residue 1000F+</b>	10.9	0.71%	2.58%	6.56%

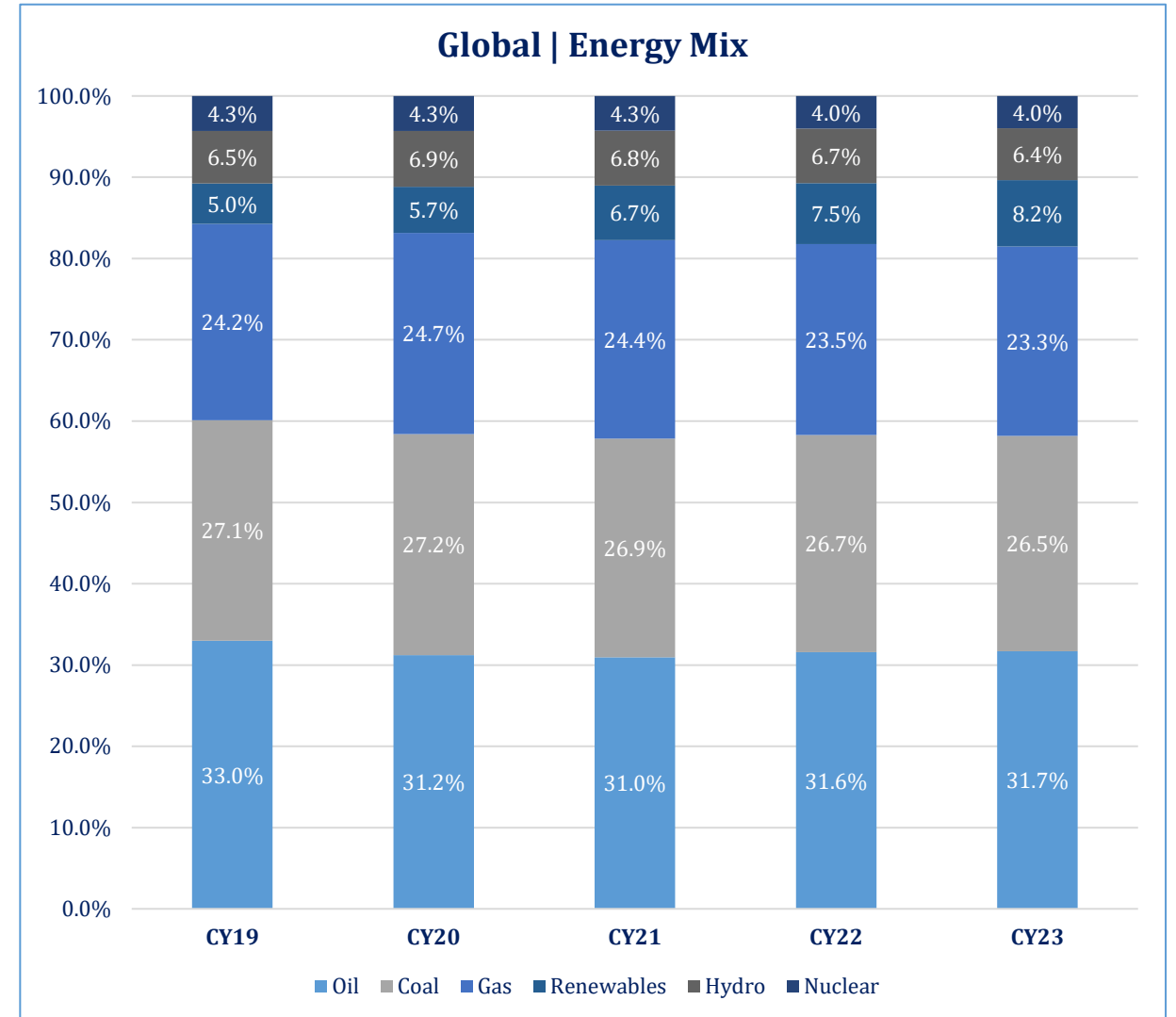
# GLOBAL SYNOPSIS



# Exploration & Production

## Global | Energy Mix

- The global energy mix has, over the years (CY19-23), been dominated by fossil fuels, with oil being the major contributor, followed by coal and gas. These comprised the lion's share in the global energy mix at ~81.5% of the total in CY23 (SPLY: ~82.0%).
- Oil demand is expected to peak by CY30, however, natural gas and oil are forecast to remain a core part of the global energy mix. Factors leading to this decline include improved engine efficiency, continued electrification of road transport, and international efforts for environmental sustainability.
- LNG imports are expected to contribute to the growing use of natural gas in developing economies, accounting for ~65-75% of the increase in Asia by CY30, and reflecting increasing usage in power and industrial sectors in this region.
- Renewable energy sources are forecast to provide ~40-50% to global power generation by CY30 and ~85% by CY50. The growth in installed wind and solar capacity by CY30 is forecast to be dominated by China and the developed world, each accounting for ~30-40% of the overall increase in capacity. However, the renewable build-out faces challenges such as supply chain issues and slow permitting.



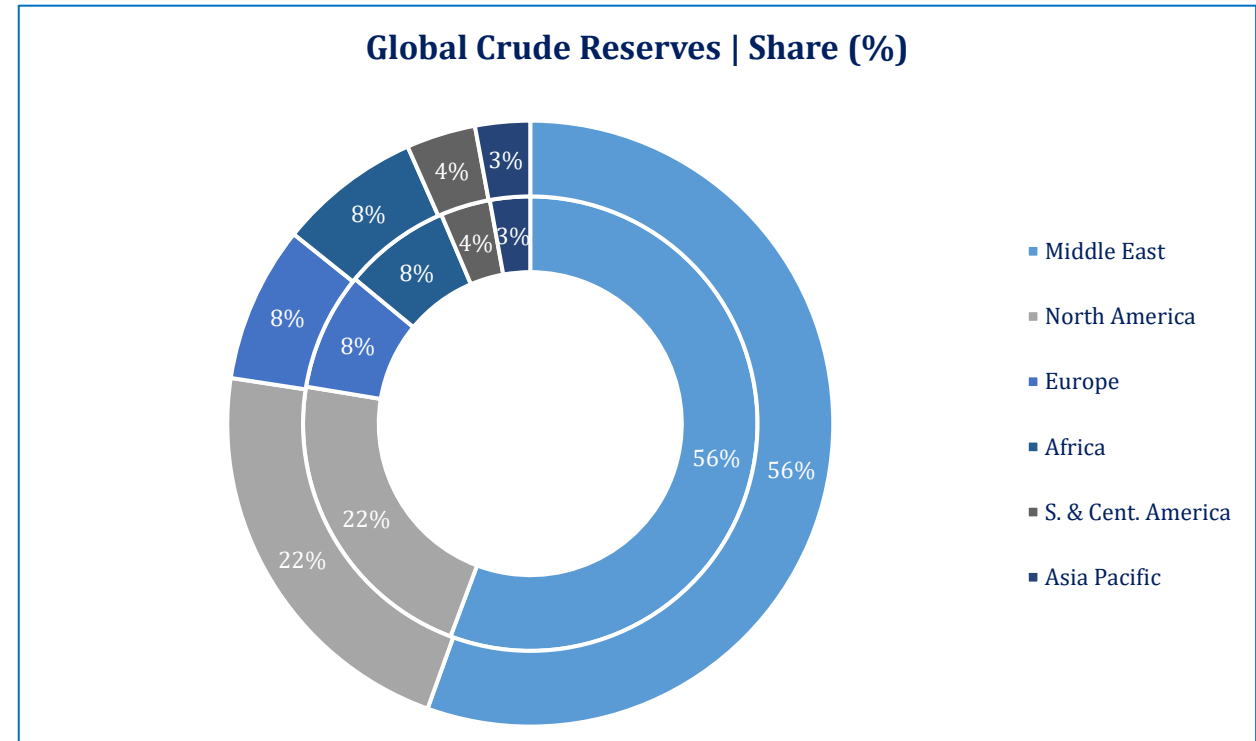
# Exploration & Production

## Global | Crude Oil Reserves

- During CY23, global crude reserves stood at ~1,570bln barrels (CY22: ~1,564bln barrels), up ~0.4%. The largest reserves registered were in the Middle East (~55.5% in CY23; SPLY: ~55.7%).
- A further breakdown with respect to Middle Eastern countries reveals that Saudi Arabia formed ~17.0% of the global reserves (SPLY: ~17.1%), while Iran comprised ~13.3% (SPLY: ~13.3%).
- North American countries together accounted for ~21.5% (SPLY: ~21.5%) of the total crude reserves. Meanwhile, Venezuela alone formed ~19.3% (SPLY: ~19.4%) of the global crude reserves.
- Asia Pacific region accounted for ~2.9% (SPLY: ~2.9%) of the global crude reserves.
- Europe accounted for ~8.3% of the global crude reserves. Russia's crude reserves formed ~5.1% (SPLY: ~5.1%) of the world total. Meanwhile, Africa accounted for ~7.6% (SPLY: ~7.6%) of the world's total reserves during the year.

*Note: Oil Sands not considered*

Global Crude Oil Reserves (bln barrels)					
Time Period	CY19	CY20	CY21	CY22	CY23
World Total	1,554	1,545	1,545	1,564	1,570



# Exploration & Production

## Global | Crude Oil Supply and Demand

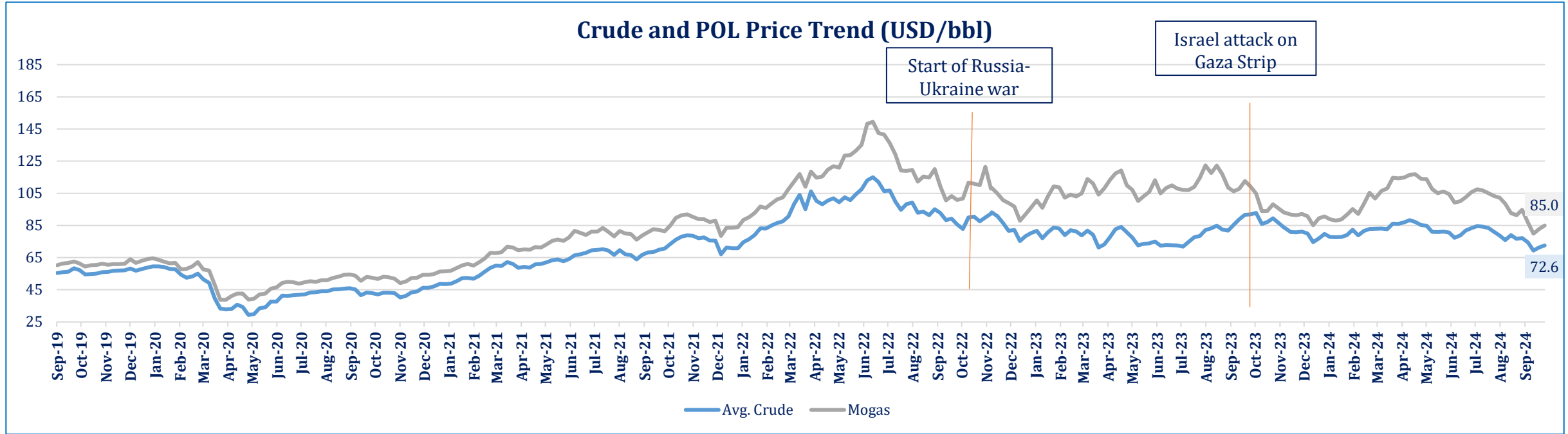
- In CY23, global crude oil production as a share of total available reserves stood at ~2.1% (SPLY: ~2.0%). Saudi Arabia accounted for ~11.8% of world crude produced (SPLY: ~13.0%), clocking in at ~531.7mln MT (or ~11.4mbpd) (SPLY: ~574.2mln MT or ~12.2mbpd).
- Meanwhile, the USA made up ~18.3% of global crude produced (SPLY: ~17.2%), with ~8.5% YoY increase to ~827.1mln MT or ~17.8mbpd (SPLY: ~16.7mbpd). Overall, the Middle East and North America comprised ~31.3% and ~26.7%, respectively, of the global crude produced in CY23 (SPLY: ~32.5%, ~25.6%, respectively), while the 'Other CIS' region contributed ~15.0% (SPLY: ~15.4%), with Russia's share in global output recording at ~12.0% (SPLY: ~12.4%)
- Global crude consumption was up ~2.5% YoY in CY23, clocking in at ~4,530.5mln MT or ~82.8mbpd (SPLY: ~81.4mbpd). Asia Pacific formed ~38.5% of global crude consumption, recording at ~1,744.3mln MT (or ~100.2mbpd).
- China remained the top consumer, making up ~17.0% of the global crude consumption and recording at ~768.6mln MT (or ~16.6mbpd). On the other hand, the USA formed ~18.0% of the global crude consumption, recording at ~815.6mln MT (or ~19.0mbpd).

Crude Oil Production (mln MT)						Crude Oil Consumption (mln MT)					
Period	CY19	CY20	CY21	CY22	CY23	Period	CY19	CY20	CY21	CY22	CY23
<b>Crude Extraction</b>	<b>4,487.4</b>	<b>4,188.2</b>	<b>4,237.9</b>	<b>4,424.1</b>	<b>4,514.1</b>	<b>Crude Consumption</b>	<b>4,451.5</b>	<b>4,051.2</b>	<b>4,277.6</b>	<b>4,422.1</b>	<b>4,530.5</b>
<b>Middle East</b>	1,411.4	1,300.3	1,314.7	1,442.1	1,413.9	<b>Asia Pacific</b>	1,661.7	1,574.2	1,613.0	1,656.6	1,744.3
<b>North America</b>	1,109.4	1,060.4	1,079.0	1,133.6	1,207.5	<b>North America</b>	1,031.5	900.8	983.4	1,000.3	1,005.1
<b>CIS</b>	718.5	659.1	673.2	679.2	675.2	<b>Europe</b>	700.3	609.3	639.1	660.5	653.6
<b>Asia Pacific</b>	361.5	353.1	348.2	344.5	345.7	<b>Middle East</b>	390.9	362.5	382.9	411.6	421.4
<b>S. &amp; Cent. America</b>	329.5	313.0	313.5	339.7	378.1	<b>S. &amp; Cent. America</b>	279.2	242.8	271.1	291.1	301.2
<b>Africa</b>	397.2	333.9	348.4	333.6	341.5	<b>CIS</b>	198.3	191.9	202.8	207.0	210.1
<b>Europe</b>	160.0	168.4	160.9	151.4	152.1	<b>Africa</b>	189.6	169.7	185.1	195.0	194.8



# Exploration & Production

## Global | Prices

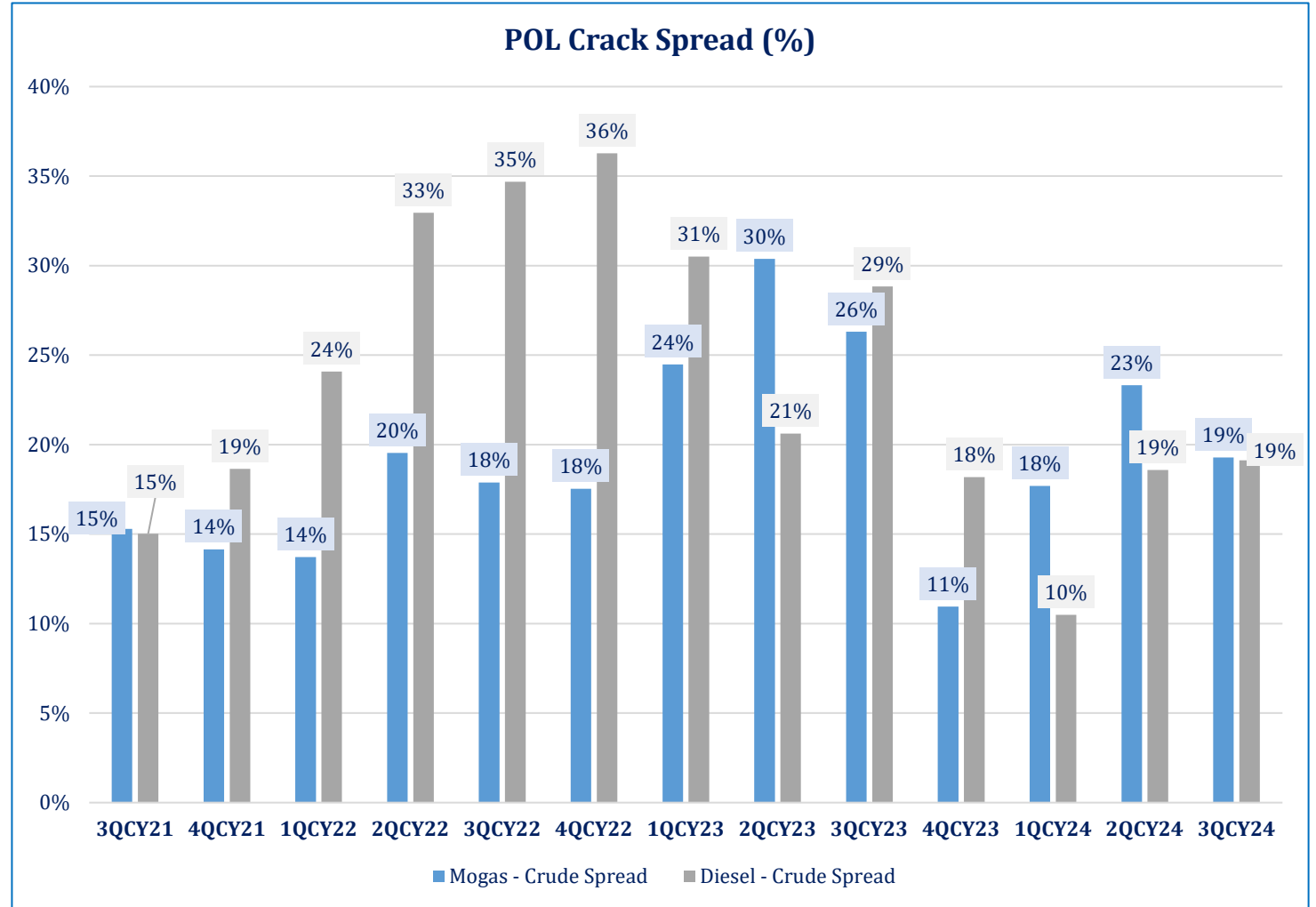


- Global POL product prices (MOGAS and HSD) tend to move in tandem with global crude oil prices. During Jan'19-22, average global Brent prices remained at USD~59.8/bbl, registering ~8.1% CAGR during this period.
- Following the Russia-Ukraine conflict (started Feb'22), average Brent prices averaged at USD~98.4/bbl in CY22 on account of global supply chain disruptions (Russia was the second-largest exporter of crude oil in CY21).
- In CY23, average crude prices averaged USD~71.3/bbl, down ~31.0% YoY, on account of slower growth in China (top crude importer in CY22, with ~23.8% share in global imports). During 8MCY24, crude prices displayed a mixed trend due to factors like low demand from China, excess supply, the Israel-Gaza conflict, loose FED monetary policy e.t.c. Average crude prices as at End-Sep'24, stood at USD~72.6/bbl.

# Exploration & Production

## 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.
- Meanwhile, prices of crude oil and refined products are subject to their respective supply and demand dynamics, as well as regulatory, environmental, and economic factors.
- In CY23, total global refining capacity increased by ~2.1% YoY (clocking in at ~103mbpd), whereas oil refinery throughput was up ~1.6% YoY (recording at ~83.0mbpd).
- During the year CY23, MOGAS and HSD spreads against the crude averaged respectively at ~23.0% and ~25.0%
- During 3QCY24, both MOGAS and HSD respective spreads against the crude averaged ~19.0% each.



# Exploration & Production

## Trade | Crude Oil Trade

- Crude Exports:** In CY23, major crude exporters included Saudi Arabia, Russia, and Canada, with these forming ~37.4% of the total crude exported. International crude traded stood at ~2.1bln MT (or ~68.1mbpd). For Saudi Arabia, the largest export destinations were other Asia Pacific countries (~26.7%, SPLY: ~25.2%), China (~24.6%, SPLY: ~24.0%) and Japan (~14.7%, SPLY: ~14.4%). Of Russia's total crude exports, ~13.5% went to Europe (SPLY: ~44.2%), while ~44.4% was imported by China (SPLY: ~32.5%). Meanwhile, the USA exported ~43.5% of its total crude exported to Europe (SPLY: ~44.9%).
- Crude Imports:** The top three global importers of crude formed ~62.2% of the total crude imported globally in CY23 (SPLY: ~75.5%). China remained the largest crude importer, with ~11.0% YoY higher imports signaling economic recovery. Meanwhile, Europe imported ~10.7% YoY lower crude (SPLY: ~11.3% YoY growth), with Russia forming ~4.3% of its total crude imports (SPLY: ~10.0%) and the USA accounting for ~15.2% during the year (SPLY: ~20.3%), reflecting the region's lower dependency on Russia's crude.

Country	Exports   mln MT (CY23)	Share, Global Exports (%)	YoY Δ	Country	Imports   mln MT (CY23)	Share, Global Imports (%)	YoY Δ
Saudi Arabia	349.1	16.4%	-5.1%	China	563.9	26.5%	+11.0%
Russia	240.8	11.3%	-8.3%	Europe	436.6	20.5%	-10.7%
Canada	207.2	9.7%	+4.2%	US	323.8	15.2%	+3.5%
US	185.0	8.7%	+14.7%	Other Asia Pacific	288.5	13.6%	-3.1%
Iraq	184.2	8.7%	-3.6%	India	231.0	10.9%	-0.1%
UAE	170.7	8.0%	-4.3%	Japan	125.5	5.9%	-5.3%
ROW	790.0	37.1%	+1.9%	ROW	157.7	7.4%	-3.9%
World	2,127.1	100%	-0.4%	World	2,127.1	100%	-0.4%

# Exploration & Production

## Trade | POL Products Trade

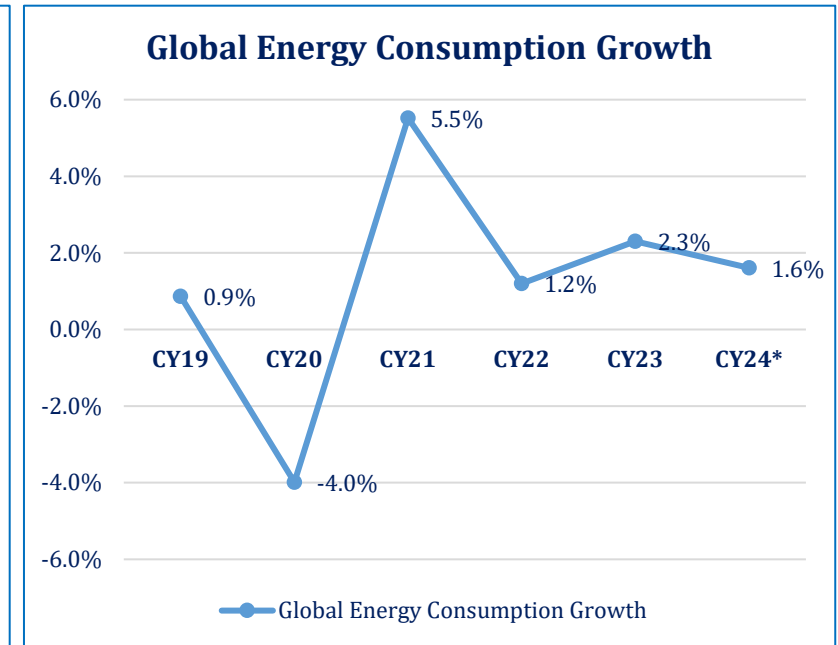
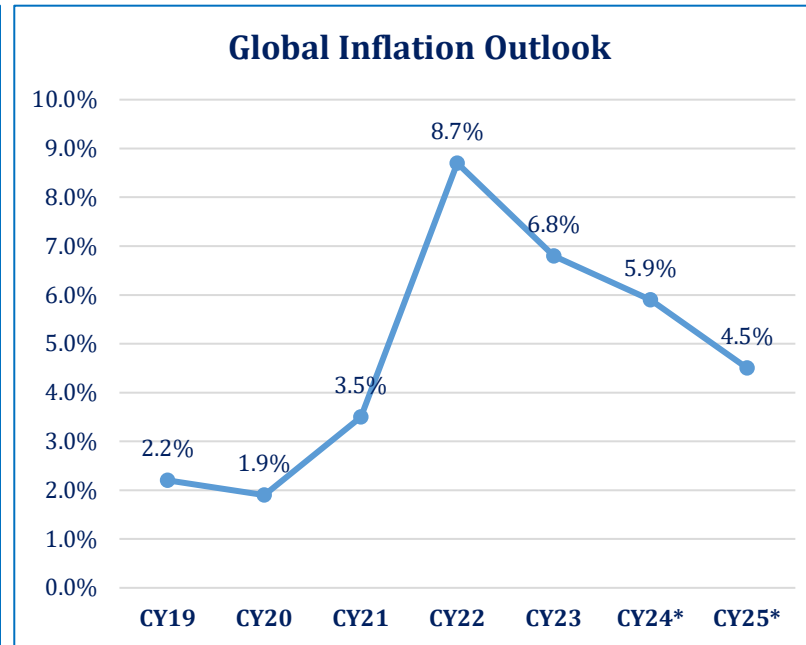
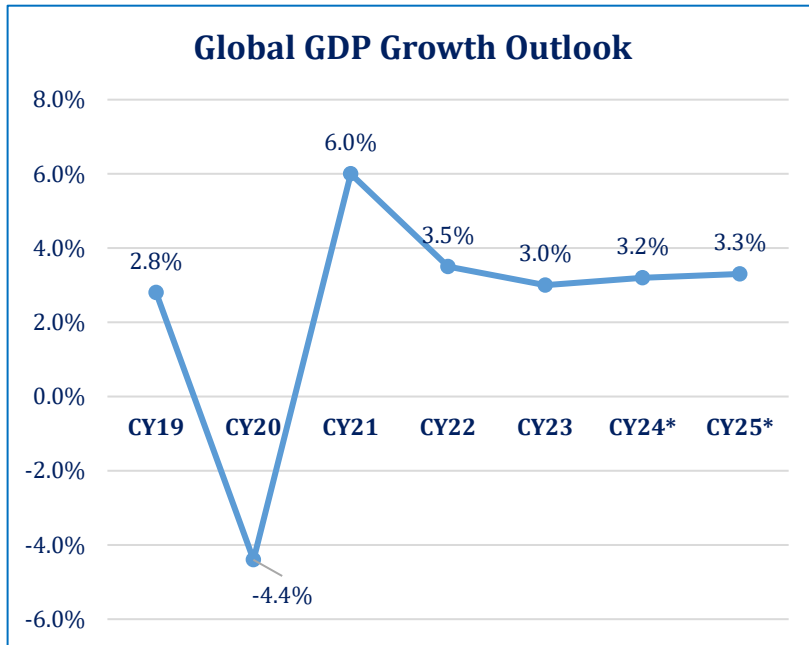
- POL Product Exports:** In CY23, major exporters of POL products included the USA, Asia Pacific, and Europe, with combined export share clocking in at ~39.9% (SPLY: ~39.7%). Meanwhile, Russia's export market share declined from ~10.0% in CY22 to ~7.3% in CY23, with the country's exports to Europe down ~50.9% YoY. For Asia Pacific, Australasia and China remained the top export destinations, forming ~52.9% during the year (SPLY: ~52.0%). With respect to India, these rose ~6.8% YoY, with exports to Europe up ~47.0% YoY and those Europe, the Middle East, and Africa forming ~71.4% of the country's total POL product exports (SPLY: ~62.9%).
- POL Product Imports:** The top three importers (as depicted) comprised ~40.6% of total POL products imported (SPLY: ~41.7%), with Asia Pacific recording a net trade deficit of ~58.6mln MT in CY23 (~65.6mn MT). During the year, China's imports rose ~23.5% YoY, with imports from Russia up ~68.7% YoY and Russia, Asia Pacific, and the USA cumulatively forming ~64.2% of the country's total POL product imports (SPLY: ~59.4%).

Country	Exports   mln MT (CY23)	Share, Global Exports (%)	YoY Δ	Country	Imports   mln MT (CY23)	Share, Global Exports (%)	YoY Δ
US	258.0	21.2%	+1.6%	Europe	193.4	15.9%	-6.2%
Other Asia Pacific	126.6	10.4%	+2.9%	Other Asia Pacific	185.2	15.2%	-1.8%
Europe	100.3	8.3%	-6.5%	China	114.4	9.4%	+23.5%
India	93.3	7.7%	+6.8%	S. & Cent. America	105.9	8.7%	-6.9%
UAE	92.5	7.6%	+2.6%	US	97.5	8.0%	-1.1%
Russia	90.9	7.5%	-25.4%	Singapore	72.2	5.9%	-0.3%
ROW	453.9	37.3%	+3.8%	ROW	446.9	36.8%	-0.4%
World	1,215.5	100%	-0.4%	World	1,215.5	100%	-0.4%

# Exploration & Production

## Global | Outlook

- Global GDP Growth** is expected to remain stable at ~3.2% in CY24 and ~3.3% in CY25. For the USA, projected growth is revised downward to ~2.6% during CY24, slowing further to ~1.9% in CY25 on account of cooling the labor market. In China, this is forecast at ~5.0% in CY24 on account of a rebound in private consumption and strong exports in 1QCY24, before slowing down to ~4.5% in CY25 because of an aging population and slowing productivity growth. For India, it is likely to clock in at ~7.0% in CY24, owing to improved private consumption, especially in rural areas, while Pakistan’s growth forecast is projected at ~2.0% in CY24 and ~3.5% by CY25.
- Global Headline Inflation** is expected to fall to ~5.9% in CY24 and to ~4.5% in CY25. New commodity price spikes from geopolitical shocks, including but not limited to continued attacks in the Red Sea, and supply disruptions or more persistent underlying inflation, in all likelihood, could prolong tight monetary conditions. At the same time, most economies have fared well through tight monetary policy during the year, with interest rates starting to be revised downwards by a few advanced economies (except the USA) in 1HCY24.



\*Projected. **Note:** Energy consumption forecast for CY24 is latest available.



# Local Synopsis | Crude Oil



# Exploration & Production

## Oil Value Chain



**Upstream**

- Exploration
- Field Development
- Production Operations



**Midstream**

- Transportation
- Processing & Refining
- Storage & Distribution



**Downstream**

- Wholesale & Marketing



Oil & Gas Development Company Limited (OGDCL)



MOL Pakistan



United Energy Pakistan Limited (UEPL)



Pakistan Petroleum Limited (PPL)



Mari Petroleum Company Limited (MPCL)



Pakistan Oilfields Limited (POL)



Cynergyico (Formerly Byco)



Pak Arab Refinery Limited (PARCO)



National Refinery Limited (NRL)



Attock Refinery Limited (ARL)



Pakistan Refinery Limited (PRL)



Pakistan State Oil (PSO)



Total Parco Pakistan Limited (TPPL)



Shell Pakistan Limited (SPL)



Gas and Oil Pakistan Limited (GO)



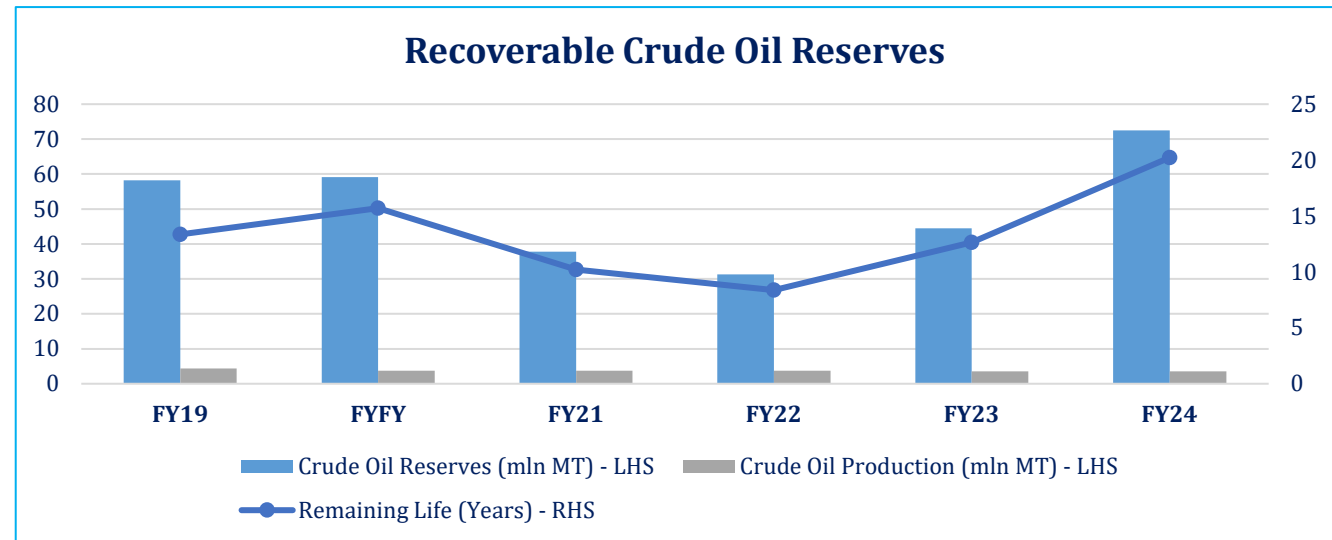
Attock Petroleum Limited (APL)

# Exploration & Production

## Crude Oil Reserves

- Pakistan’s recoverable crude oil reserves are estimated at ~72.5mln MT as at End-Jun’24, up ~63.0% (SPLY: ~44.5mln MT).
- OGDCL hold the largest oil & gas reserves base, while MARI Petroleum holds the second largest reserve base.
- New Discoveries extend the lifespan of Oil and Gas Reserves. On the other hand, declining reserve life significantly increases the reliance on imported fuel to meet local demand
- The increase in oil reserves in Pakistan during FY24 is attributable to discoveries e.g. exploratory efforts of OGDCL led to five oil and gas discoveries, with an anticipated total daily production potential of 481bpd. In pursuit of discovering new oil and gas reserves, OGDCL acquired 1,236 km of 2D seismic data and 1,201 square kilometers of 3D seismic data.
- While MARI Petroleum Company Ltd. successfully made an oil discovery at Shawal-1.

Recoverable Crude Oil Reserves & Extraction						
Period	FY19	FY20	FY21	FY22	FY23	FY24
<b>Crude Oil Reserves (mln MT)</b>	58.2	59.2	37.8	31.3	44.5	72.5
<b>Local Crude Production (mln MT)</b>	4.4	3.8	3.7	3.7	3.5	3.6
<b>Remaining Life (Years)</b>	13	16	10	8	13	20



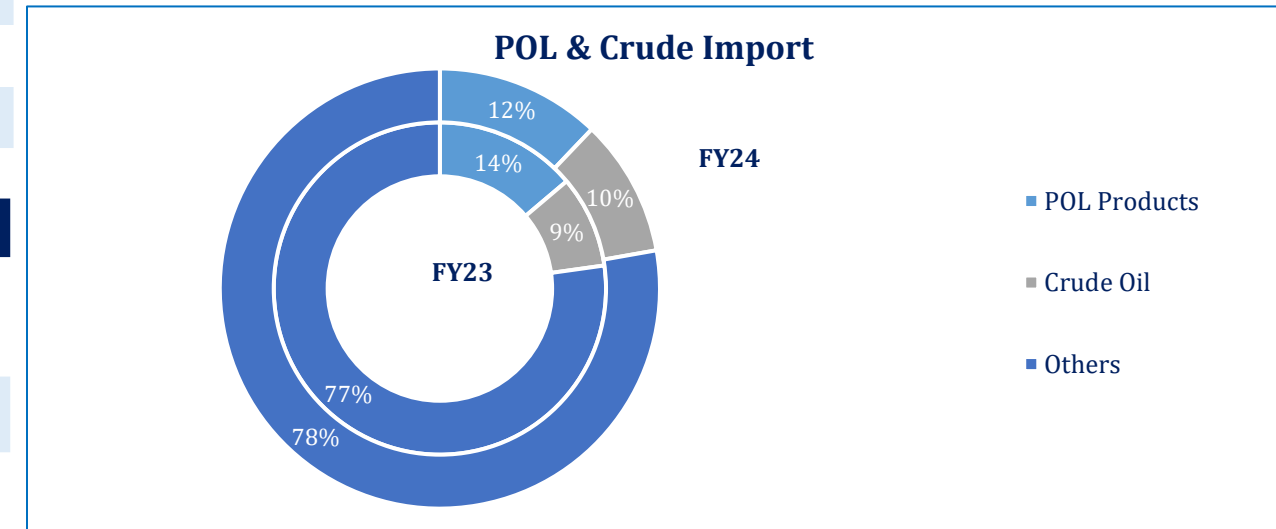
# Exploration & Production

## Local | Crude Oil Industry Snapshot | Upstream | Midstream | Downstream

Upstream	FY21	FY22	FY23	FY24
Est. Local Crude Production (mln MT)	3.7	3.7	3.5	3.6
Imported Crude (mln MT)	8.8	9.3	7.9	9.1
Crude Condensate Exports (mln MT)	0.3	0.4	0.3	0.06
Crude Supply (mln MT)	12.2	12.6	11.1	12.6
Major Players	5			
Structure	Oligopoly			
Regulator	Ministry of Energy (Petroleum Division)			
Association	OCAC			

Downstream	FY21	FY22	FY23	FY24
Local POL Production (mln MT)	10.3	10.3	9.0	10.1
POL Imports (mln MT)	10.1	13.1	8.2	6.6
POL Product Exports (mln MT)	0.2	0.3	0.1	0.7
Est. POL Storage (mln MT)	0.3	0.3	-0.1	0.1
POL Consumption (mln MT)	20.1	23.1	17.1	16.0
Regulator	OGRA			

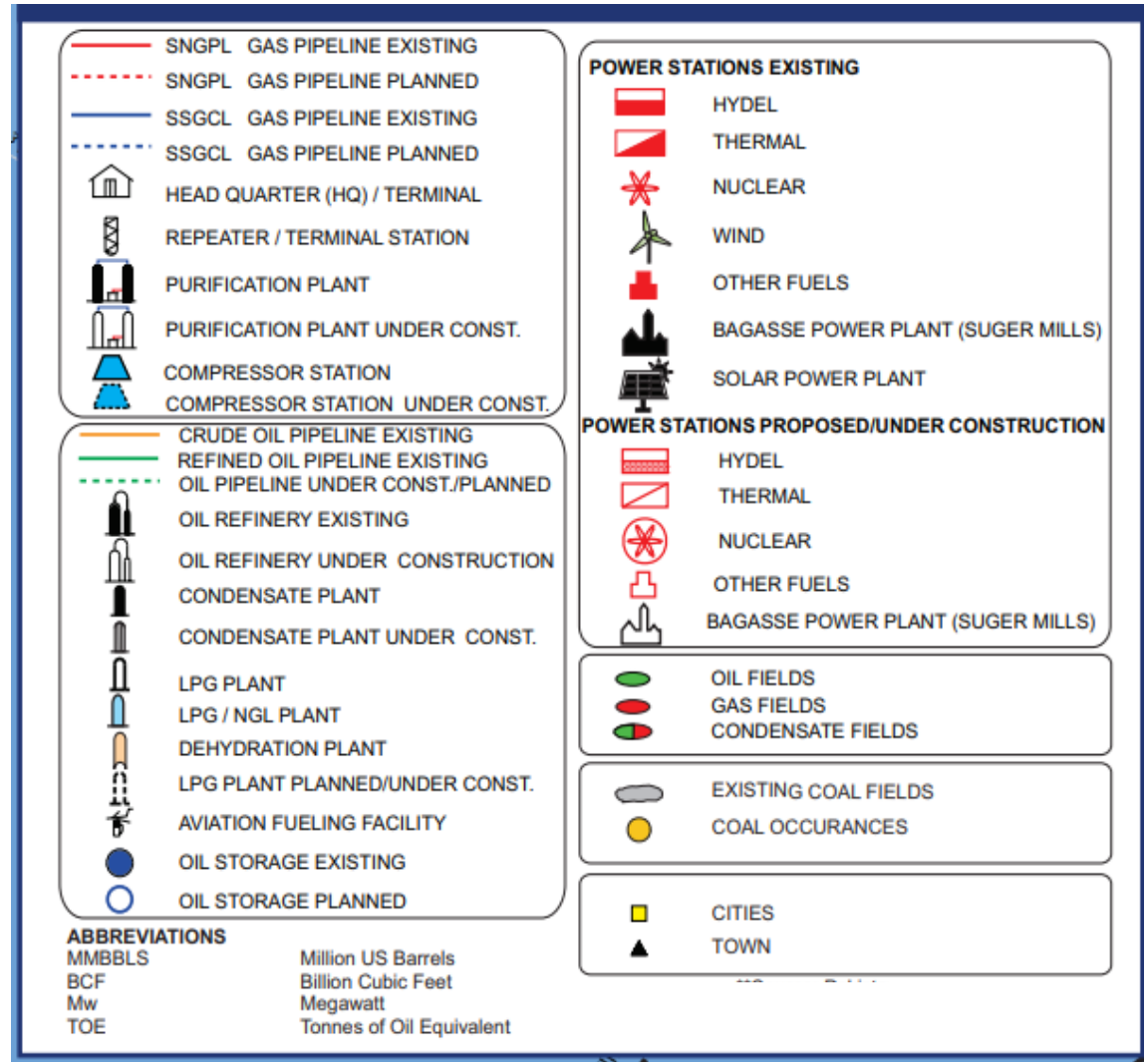
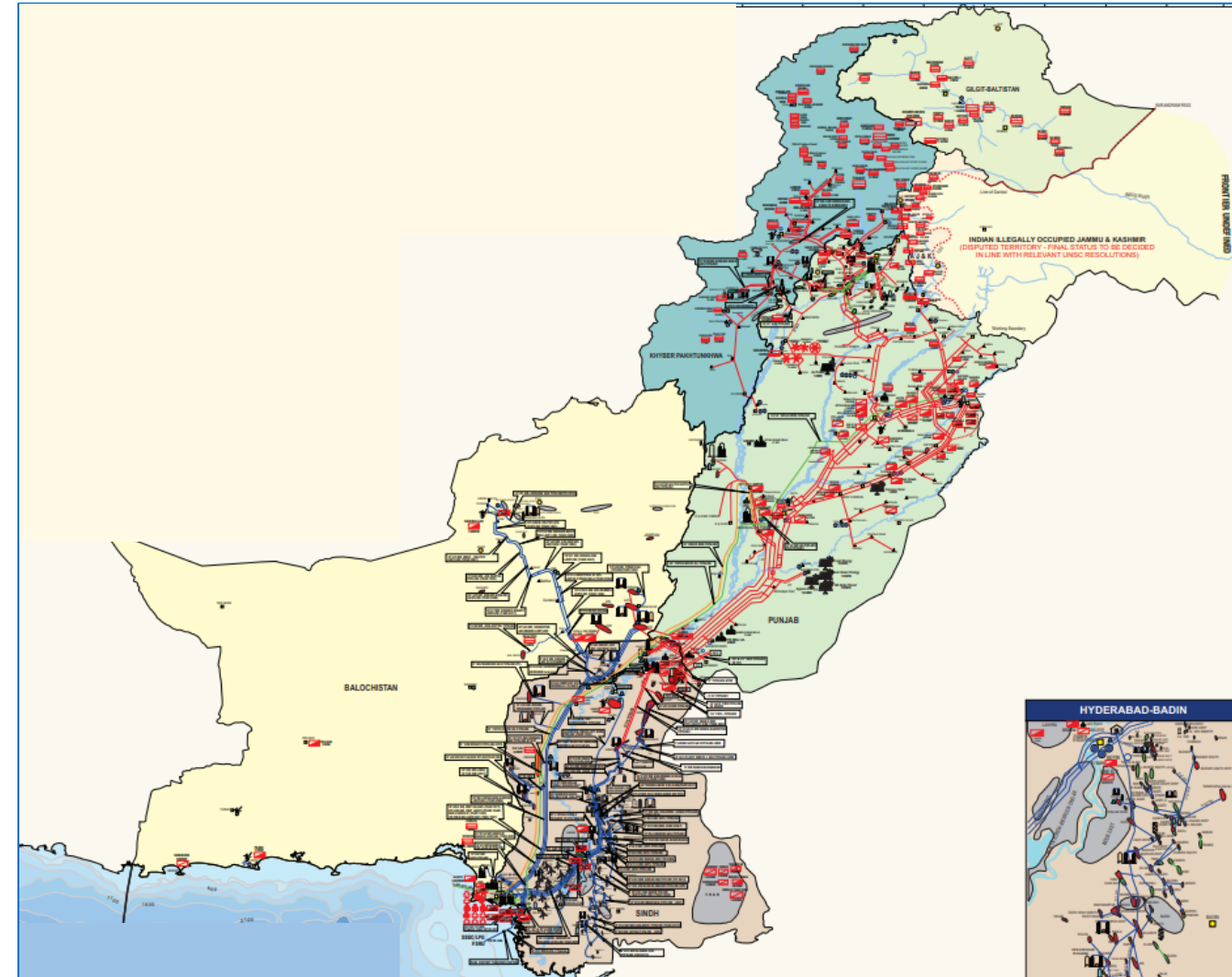
Midstream	FY21	FY22	FY23	FY24
Refinery Offtake/ Crude Processed (mln MT)	12.2	12.6	11.1	12.1
Refinery Production (mln MT)	10.3	10.3	9.0	10.1
Regulator	OGRA			



\*Estimated  
1 MT Crude = 7.454 bbl

# Exploration & Production

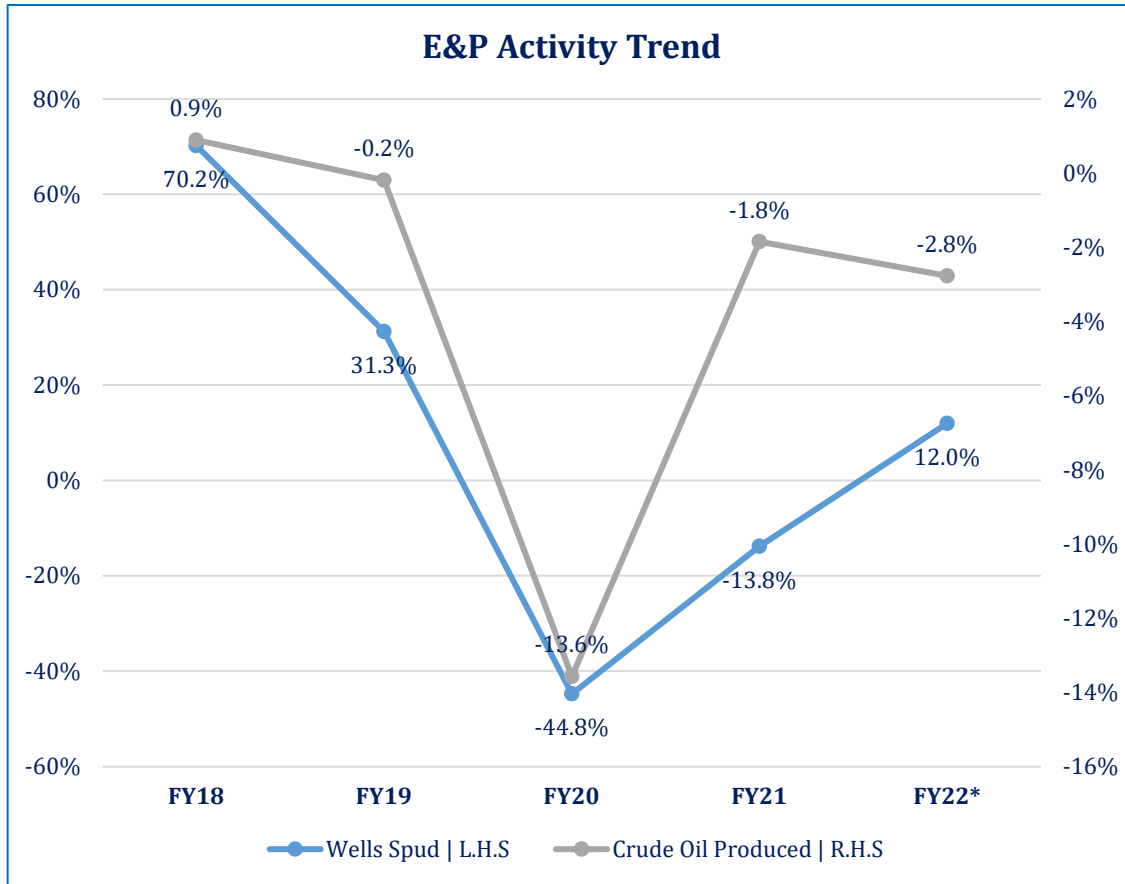
## Energy Map | 2020





# Exploration & Production

## Province Wise Wells, E&P Activity



**As of End FY21\* (Reserve and Extraction amount in mln BBL)**

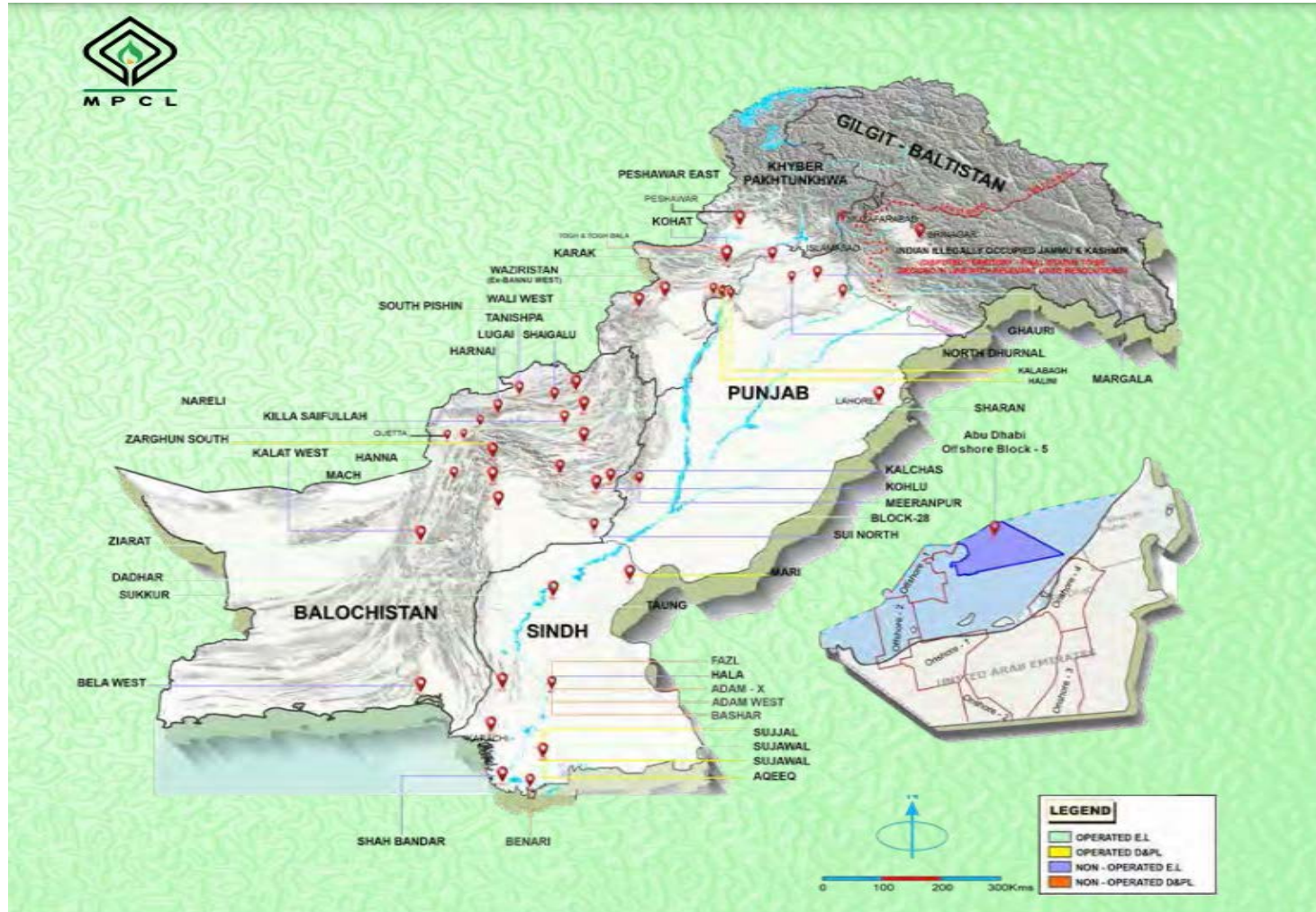
Province	Number of Wells	Number of Exaused Wells	Original Recoverable Reserves	Cumulative Production	Remaining Recoverable Reserves
Sindh	247	75	510	431	79
Punjab	33	0	457	383	74
KPK	15	2	265	171	94
Balochistan	4	0	2	0	2
<b>Pakistan</b>	<b>299</b>	<b>77</b>	<b>1234</b>	<b>985</b>	<b>249</b>

\*Latest available



# Exploration & Production

## Geographical Presence | MARI Petroleum



### MARI Petroleum Ltd:

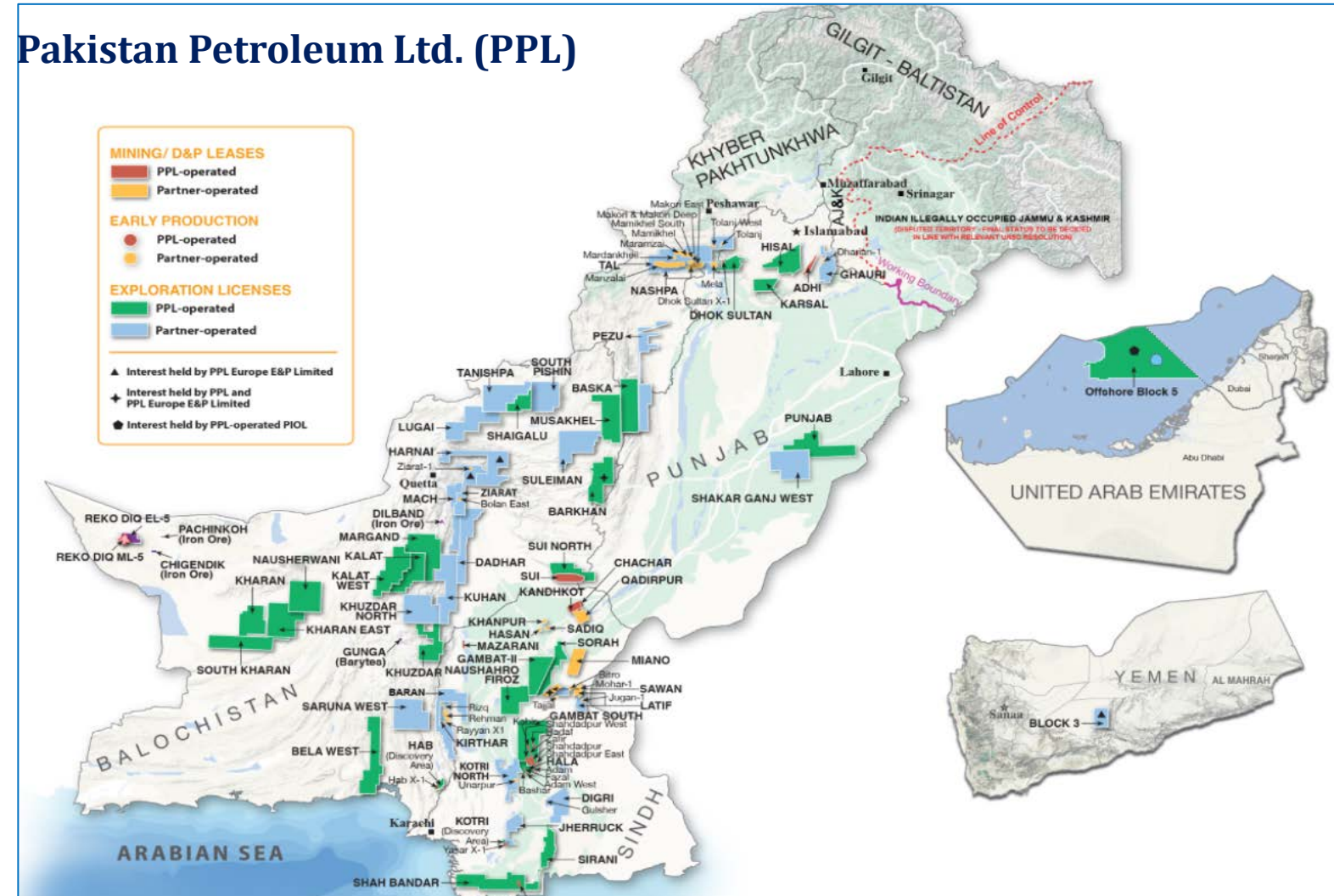
- MARI Petroleum holds ~2.5% market share in oil and condensate and produces ~115,000 bpd of oil.
- MARI Petroleum Ltd. total estimated reserves\* and resources (2P+2C) increased from ~682 MMBOE in FY23 to ~816 MMBOE in FY24.
- Proved and Probable (2P) Reserves denote the best estimates of reserves to be commercially recoverable from known reservoirs under defined economic conditions, operating methods, and government regulations.
- Contingent (2C) Resources denote the best estimate of contingent resources to be potentially recoverable from known accumulations by application of development projects, but which are not currently considered to be commercially recoverable owing to one or more contingencies.



# Exploration & Production

## Production Activities | PPL Ltd. & POL Ltd.

### Pakistan Petroleum Ltd. (PPL)



### Pakistan Petroleum Ltd. (PPL):

- As of Jun'24, PPL has ~99,846,000 bbl of crude oil recoverable reserves and ~17,723,732 MMSCF of Natural Gas recoverable reserves. During FY24, PPL produced ~11,442 bpd of oil and NGL and has ten exploration wells and seven development wells. PPL conducted ~1.475 Km of 2D Seismic Acquisition.

### Pakistan Oilfields Ltd. :

- During FY24, POL produced ~1,730,118 bbl of crude oil (FY23: ~1,829,336 bbl).

Note: The map shows PPL crude Oil Reserves as of February 16, 2024.

# Exploration & Production

## Crude Oil Production | 5 Years at a Glance | Top 4 Entities

### Production | 5 Years at a Glance | OGDCL

Fuel/Product	Unit	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	bbbl	13,202,852	13,465,580	12,881,744	11,854,368	12,120,663
Natural Gas	MMSCF	326,767	317,443	301,286	278,903	262,520
LPG	MT	270,600	293,153	294,747	262,852	262,436
Sulphur and Others	MT	19,637	18,827	14,160	10,635	8,677

### Production | 5 Years at a Glance | MARI Petroleum

Fuel/Product	Unit	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	bbbl	383,548	457,205	458,509	387,456	436,800
Natural Gas	MMSCF	249,550	-	283,173	275,214	292,256
LPG	MT	21.9	54.3	32.2	17.6	-
Sulphur and Others	MT	-	-	-	-	-

### Production | 5 Years at a Glance | PPL

Fuel/Product	Unit	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	bbbl	5,142,000	5,132,000	4,560,000	4,407,000	4,188,000
Natural Gas	MMSCF	283,792	276,309	263,481	266,567	231,574
LPG	MT	107,114	115,835	116,498	116,881	113,104
Sulphur and Others	MT	90,853	64,206	118,505	134,397	127,111

### Production | 5 Years at a Glance | POL

Fuel/Product	Unit	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	bbbl	2,282,029	2,264,413	2,017,581	1,829,336	1,730,118
Natural Gas	MMSCF	29,336	28,596	25,825	23,726	22,548
LPG	MT	55,778	56,660	55,418	53,177	50,280
Sulphur and Others	MT	19,904	17,086	19,080	18,943	19,261



# Exploration & Production

## Crude Oil Gross Sales | 5 Years at a Glance | OGDCL and PPL Ltd.

Gross Sales   PKR '000   5Years at a Glance   OGDCL					
Fuel/Product	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	95,456,260	97,257,246	182,410,718	203,568,100	229,844,027
Natural Gas	165,144,064	148,346,586	157,865,216	207,370,205	232,847,239
LPG	21,702,920	24,399,345	44,262,484	47,180,204	51,566,516
Sulphur and Others	348,376	501,467	862,814	380,948	281,188
Gas Processing	121,523	115,519	8,119	0	0
Gross Sales	282,773,143	270,620,163	385,409,351	458,499,457	514,538,970

Gross Sales   PKR '000   5 Years at a Glance   PPL					
Fuel/Product	FY20	FY21	FY22	FY23	FY24
Crude & Condensate	40,083,837	41,395,058	74,048,563	86,593,573	91,924,582
Natural Gas	155,257,986	120,021,585	141,388,688	216,752,522	211,402,888
LPG	8,846,659	10,000,452	18,036,904	21,200,110	22,282,258
Sulphur and Others	910,702	737,142	1,281,011	1,783,811	1,893,589
Gas Processing	409,959	353,067	485,018	719,722	774,925
Gross Sales	205,509,143	172,507,304	235,240,184	327,049,738	328,278,242

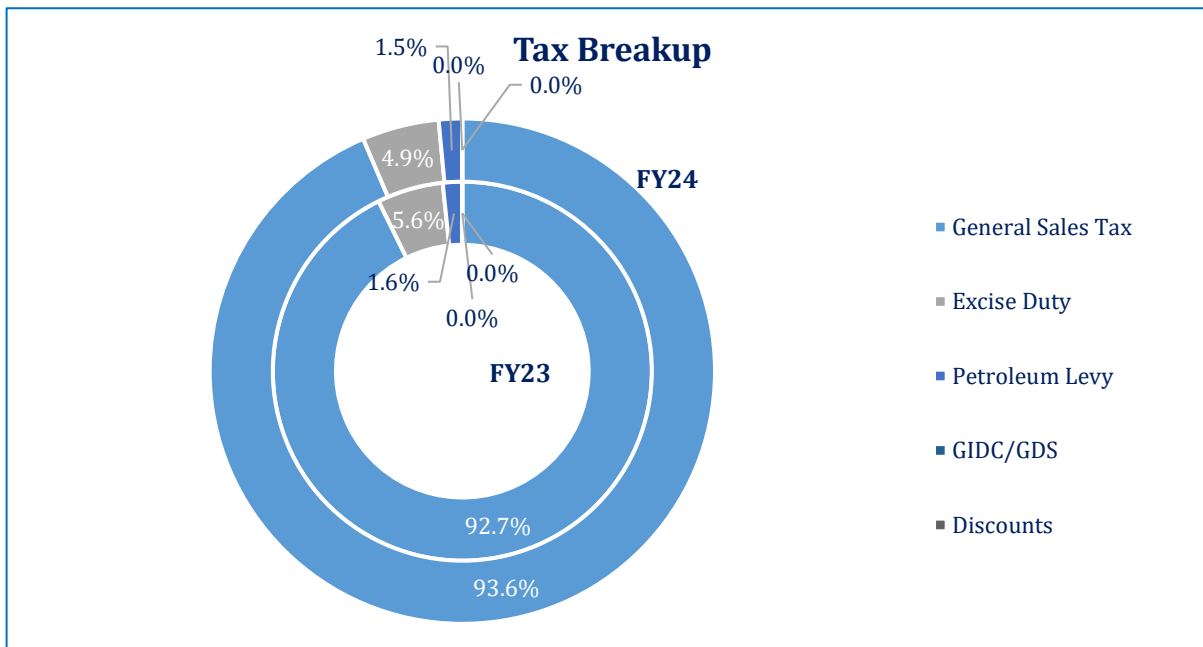
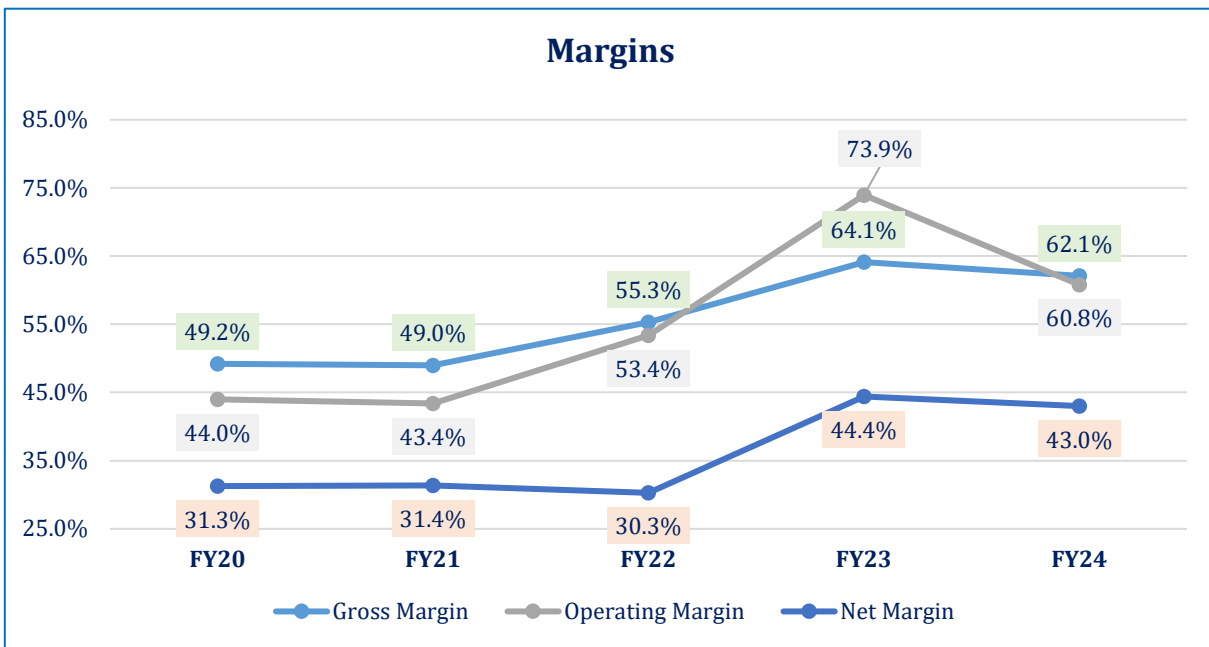
Gross Sales   PKR '000   5 Years at a Glance   MARI Petroleum Ltd. & POL Ltd.		
Year	MARI Petroleum Ltd.	POL Ltd.
FY20	126,847,608	41,840,700
FY21	82,692,664	39,481,675
FY22	108,969,625	58,394,092
FY23	163,156,446	65,983,520
FY24	204,604,788	70,884,309

*Note: POL Ltd. And MARI Petroleum do not show a breakdown of the Sales*

# Exploration & Production

## Business Risk | Margins

- During FY24, the gross margin decreased to ~62.1% (FY23: ~64.1%), down ~3.1% YoY. The fall in gross margin was driven by sales growing at a slower pace than the taxes during FY24 (sales growth rate: ~8.7% YoY, compared to a ~10.0% YoY increase in taxes).
- During FY24, the operating margin dropped by ~17.7% and clocked in at ~60.8% (FY23: ~73.9%) on account of ~10.3% YoY lower operating profit. Although net profit increased by ~5.9% YoY, net margin decreased from ~44.4% in FY23 to ~43.0% in FY24 on account of growth in sales (~8.7%) being higher than the growth of net profit (~5.9% YoY) i.e growth in the denominator is greater than the numerator.
- General Sales Tax is the largest component dragging down gross sales. General Sales Tax accounted for ~93.6% of the total taxes during FY24 (FY23: ~92.7%), followed by Excise duty comprising ~4.9% of the total taxes (FY23: ~5.6%).



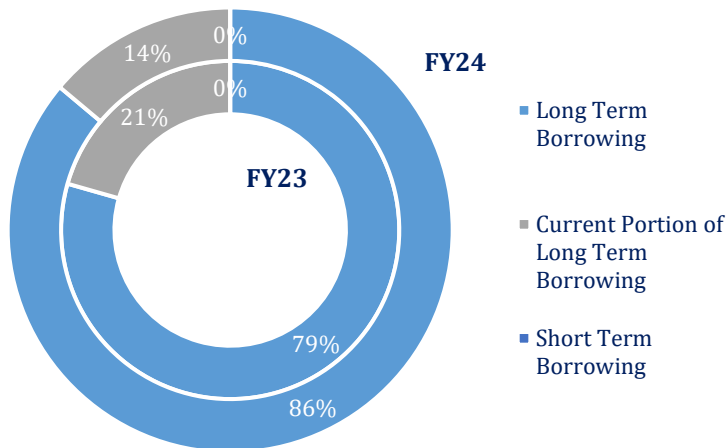
**Note:** Figures are based on financials of 5 Listed/PACRA-rated clients during FY18-FY23 and 4 Listed/PACRA-rated clients during FY24

# Exploration & Production

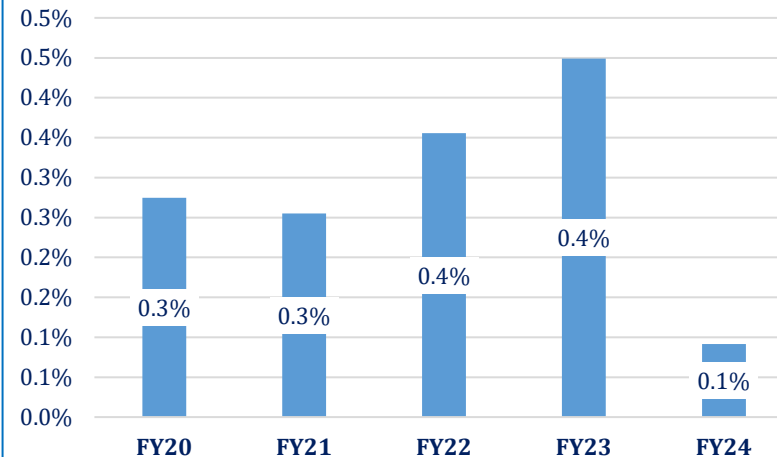
## Financial Risk

- During FY24, the sector's total borrowing stood at PKR~2,008mln compared to PKR~8,389mln during FY23, down ~76.0% YoY. Long-term borrowing, comprising ~86.0% of total borrowing were recorded at PKR~1,729mln during FY 24 (FY23: PKR~6,662mln), down ~74.0% YoY. Meanwhile, short-term borrowing remained Nil during FY24 (FY23: PKR: ~0mln). In addition, the current maturity of long-term borrowing (CMLTB) comprising ~14.0% of total borrowing were recorded at PKR~279mln (FY23: PKR~ 1,727mln), down ~84.0% YoY.
- The sector's average leverage has been quite low compared with equity, indicating its reliance on internally generated income. During FY24, the sector's leverage was recorded at ~0.1% (FY23: ~0.4%), indicating a negligible level of financial risk.
- During FY24, the sector's coverage ratio improved and was recorded at ~41.6x (FY23: ~37.9x), on the back of a decline in finance cost (~18.6%) that outpaced the decline in the EBITDA. (~10.6%). During FY24, the sector's finance cost declined despite high interest rates (11MFY24: ~22.0%, w.e.f 10 June 2024: ~20.5%) on the back of lower borrowing during the year. Going forward, sectors, finance cost is expected to reduce further as interest rates w.e.f September 12, 2024 stand at ~17.5% and are expected to go down on the next MPR meeting to be held on November 04, 2024, on account of lower inflation levels.

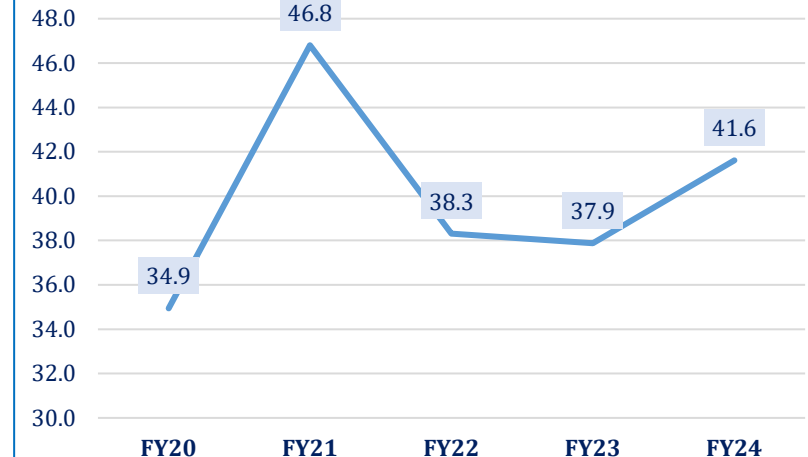
### Borrowing Mix



### Leverage (%)



### Coverage (Times)

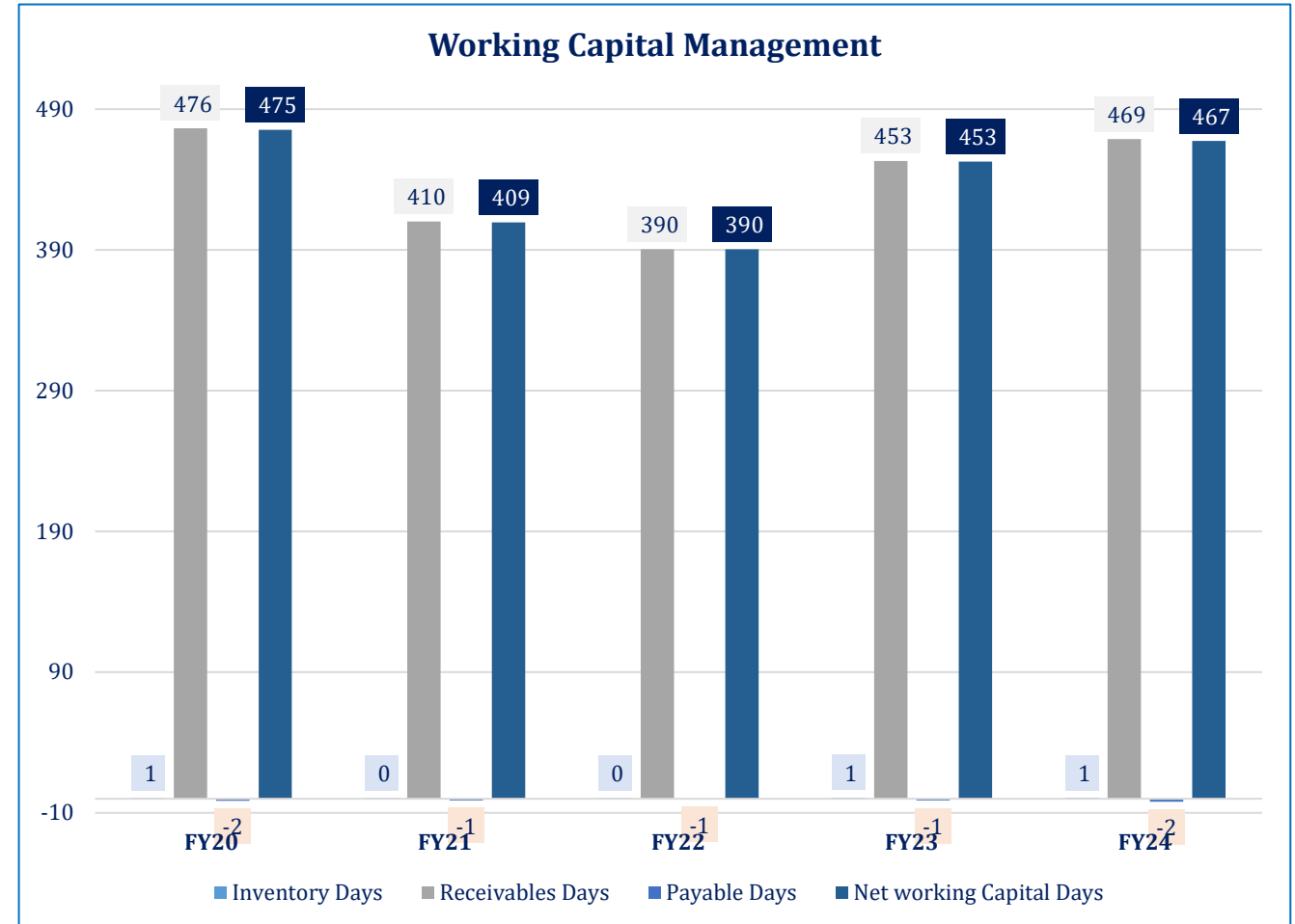


**Note:** Figures are based on financials of 5 Listed/PACRA-rated clients during FY18-FY23 and 4 Listed/PACRA-rated clients during FY24

# Exploration & Production

## Financial Risk | Working Capital

- During FY24, the sector's average working capital deteriorated by ~14 days and stood at ~467 days compared to ~453 days during FY23, on the back of increase in receivable days from ~453 days in FY23 to ~469 days in FY24.
- Historically, (FY20-23) both the inventory days and payable days have been negligible, this trend continued during FY24 as well.



# Exploration & Production

---

## Regulatory Framework | Salient Features

### **Petroleum Policy 2012 (Updated Mar'24)**

Petroleum Policy 2012 has superseded all previous policies (1993, 1994, 1997, 2001, 2007, and 2009).

#### **Salient features:**

- licensing process
- licensing system, Onshore Petroleum Concession Agreement (PCA)
- Offshore Production Sharing Agreement (PSA)
- Regulatory Process & Obligations
- Pricing and Incentives for Petroleum Exploration & Production
- Implementation of the Policy, removal of difficulties, addressing of anomalies, a framework for institutional development and strengthening of the Policy Wing
- Incentives for Incremental Production

# Exploration & Production

---

## Regulatory Framework | Salient Features

### Pakistan Onshore Petroleum Exploration & Production Rules 2013 & Pakistan Offshore Petroleum Exploration & Production Rules 2023

#### Salient features:

- Permit for Reconnaissance surveys
- License for petroleum exploration
- Lease for petroleum development and production
- Accounts, records, inspection and reports
- Standards of Operation





**Local Synopsis |  
Natural Gas**

# Exploration & Production

## Local | Natural Gas | Snapshot

- Natural gas is a fossil fuel energy source, comprising methane, in large part, as well as trace amounts of natural gas liquids and non-hydrocarbon gases. Its uses comprise commercial, power and industrial consumption, among others. and is also used as pipeline, lease and vehicle fuel.
- In FY23, local gas consumption was recorded at ~29.4mln MT, registering a decline of ~8.7% YoY. Local production during the year dipped by ~3.9% YoY, whereas RLNG imports, down ~15.2% YoY, stood at ~8.3mln MT. Therefore, total supply of gas stood at ~36.8mln MT, down ~6.7% YoY.
- Total supply during 9MFY24 was recorded at ~20.8mln MT, registering a decline of ~1.4% YoY. Of this, local production formed ~78.3% (SPLY: ~78.7%), while the share of RLNG imports stood at ~21.7% (SPLY: ~21.3%) during the year. During the period, indigenous gas contributed ~9.3% (SPLY: ~11.6%) to the country's power generation mix.
- Pakistan's reliance on imported Re-gasified Liquefied Natural Gas (RLNG) has traced an increasing trend over the recent years. During 9MFY24, RLNG imports rose ~15.0% YoY to ~6.9mln MT.
- During 9MFY24, the two gas utility companies (SNGPL & SSGCL) had laid a ~156Km gas transmission network, including ~3,614Km mains and ~76Km services lines.
- Unlike the transmission system that carries large volumes of natural gas at high pressures, the distribution system winds through cities and other areas of demand at low pressure.

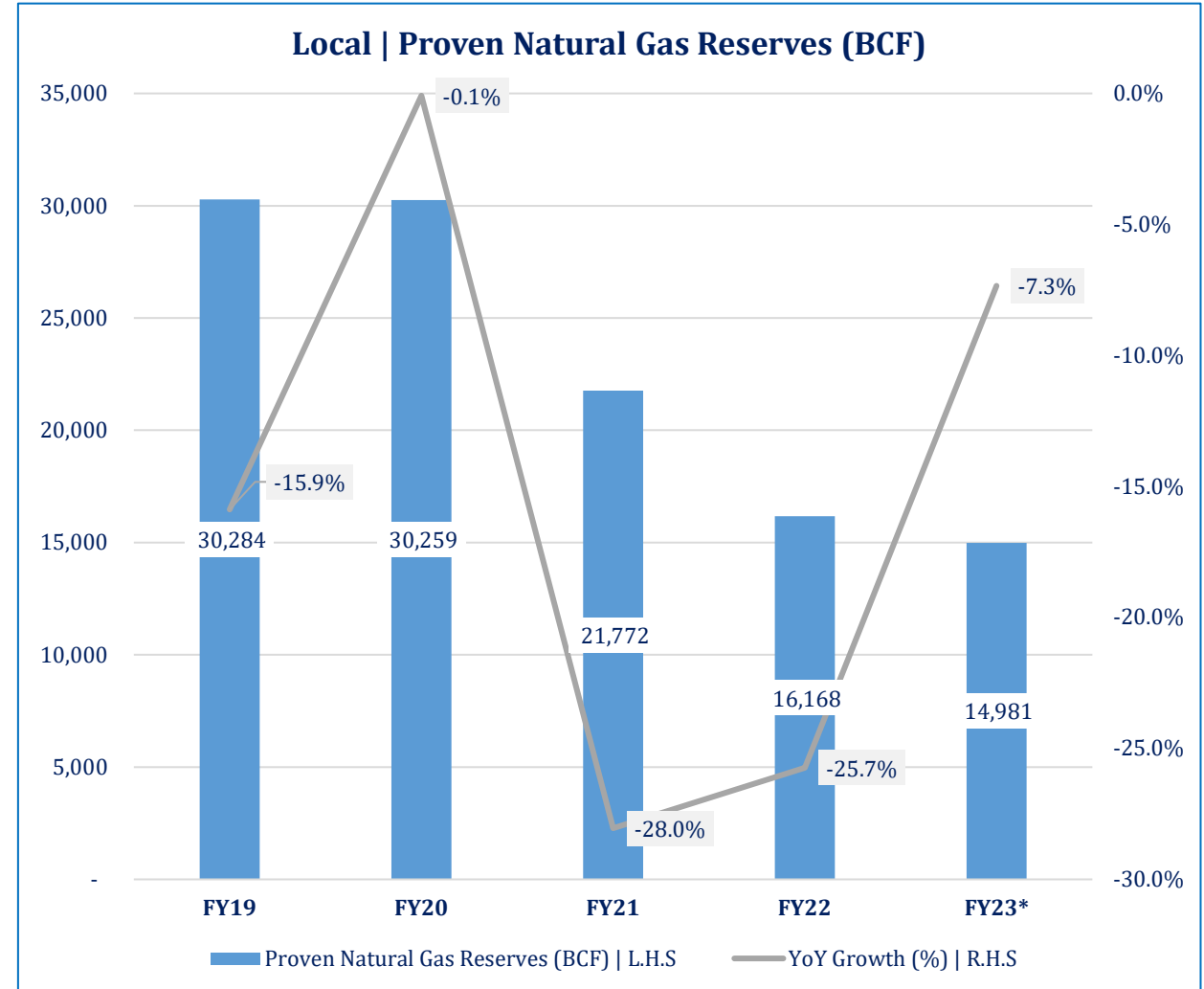
Particulars	FY22	FY23	9MFY23	9MFY24
<b>Local Consumption (mln MT)</b>	<b>32.2</b>	<b>29.4</b>	<b>21.1</b>	<b>20.8</b>
<b>Natural Gas</b>	24.2*	22.1*	17.0	16.3
<b>RLNG</b>	8.0*	7.3*	4.1	4.5
<b>Local Production   Natural Gas (mln MT)</b>	<b>29.7</b>	<b>28.5</b>	<b>21.6</b>	<b>20.8</b>
<b>RLNG Imported (mln MT)</b>	<b>9.7</b>	<b>8.3</b>	<b>6.0</b>	<b>6.9</b>
<b>Floating Storage and Re-gasification Unit (FSRU) (No.)</b>	2			
<b>Capacity FSRUs (mln MT)</b>	10.5			
<b>Transmission Lines (Km)</b>	13,513	13,775	13,989	
<b>Distribution Lines (Km)</b>	41,231	41,352	41,463	
<b>Mains (Km)</b>	155,679	157,395	161,806	
<b>Total Number of Connections (mln No.)</b>	10.7		10.8	
<b>Structure</b>	Oligopolistic			
<b>Regulator</b>	OGRA			

*Note: Conversion Factor of ~1BCF (billion cubic feet) = 0.024mln MTOE (mln MT oil equivalent). \*Estimated using ~75:25 ratio in supply mix.*

# Exploration & Production

## Local | Natural Gas Reserves

- Pakistan’s proven natural gas reserves have been on a decline owing to lack of substantial discoveries.
- During FY15-23, natural gas reserves of the country have declined at a CAGR of ~8.5%. During FY23, the country's proven natural gas reserves stood at ~14,981bcf down by ~7.3% YoY.
- Four new gas condensate discoveries were made by OGDCL during 9MFY24 with a combined daily production potential of ~28MMCF of gas (SPLY: three discoveries).
- Additionally, eight (~08) wells were spud (SPLY: ~04 wells) which included three (~03) exploratory wells.



*Note: Data estimated using OGDCL’s share in recoverable natural gas reserves. BCF stands for billion cubic feet.*

*\*Latest available*

# Exploration & Production

## Local | Tight Gas Policy 2024

- Tight Gas (Exploration & Production) Policy, 2011 was the first initiative to encourage upstream petroleum industry to invest in the exploration and production of tight gas. The document served as a comprehensive policy framework to promote and incentivize exploration and production of unconventional sources of hydrocarbons against the backdrop of growing population and economic expansion.
- **Definition**
  - Tight Gas is defined as a natural gas that cannot flow naturally at commercial rates with conventional methods despite having hydrocarbon reserves.
  - Extraction thus requires advanced technologies for its exploitation/production such as high-performance perforation, hydraulic fracturing, horizontal wells, slanted/deviated wells, multilateral wells &/or infill drilling or combination of these technologies or any new technology.
  - Moreover, it has an estimated value of effective permeability calculated using geometric mean of less than “~1.0 milli Darcy (mD).”
- The CY24 Policy has been designed to incentivize local and foreign E&P companies to invest in the unconventional hydrocarbons and is aimed at enabling the oil & gas industry to invest in unconventional ventures, mitigate demand-supply gap and provide a fair pricing regime compatible with market realities.
- **Objectives**
  - Incentivize Oil and Gas industry to invest in the exploration of unconventional/Tight gas resources that are not being produced due to non-commerciality.
  - Provide a Policy regime for transparent, effective, and efficient processing of regulatory approvals.
  - Address commercial viability issues of existing Tight Gas reservoirs.
  - To open new frontiers for exploration of Tight Gas which would help increase the exploration activities in the country.
  - Enhance indigenous production of hydrocarbons.
  - Minimize reliance on imported fuels and regenerate additional revenues for GoP.

# SEISMIC ACQUISITION SERVICES



# Exploration & Production

## Overview | Seismic Acquisition Services

- Declining reserve life significantly increases the reliance on imported fuel to meet local demand. Exploration of new wells and major discoveries is imperative to improve local crude supply and reduce imports.
- Entities such as Polaris Geo offer seismic services that can facilitate exploration companies in the discovery of new oil and gas reserves and reduce reliance on imported crude. Such entities offer extensive project design and management services, cutting-edge technologies, and a highly skilled team of seismic experts to assist oil, gas, and mining companies in exploring challenging regions across the globe. These entities prioritize clients' needs and requirements to guarantee that the desired outcome is achieved.
- Some of the typical methods used by seismic acquisition services include vibroseis, dynamite, and 860 Accelerated Weight Drop System. Additionally, they offer GPS-guided mulchers to prevent cutting and narrow-width line construction. Moreover, these seismic acquisition entities conduct drilling using narrow-tracked, low-impact drilling equipment. Moreover, after completion, their projects undergo a comprehensive inspection to ensure that all environmental issues have been addressed.
- Currently, Pakistan's recoverable crude oil reserves are estimated at ~72.5mln MT as of End-Jun'24 (SPLY: ~44.5mln MT). The increase in oil reserves during FY24 is attributable to discoveries. Exploratory efforts of OGDCL led to five oil and gas discoveries, with an anticipated total daily production potential of 481 bpd. Meanwhile, MARI Petroleum Company Ltd. successfully made an oil discovery at Shawal-1.
- If the exploration companies take the services of the entities like Polaris Geo, the number of discoveries especially in challenging terrains and remote areas of Pakistan is most likely to increase. Hence, it will increase the recoverable reserves going forward.



# Exploration & Production

---

## Overview | Polaris Geo

**Introduction:** Polaris Geo is a world leader in Seismic Acquisition and has successfully executed some of the world's most challenging seismic programs in some of the world's most remote and demanding locations. Polaris Geo is based in the Rocky Mountains of Canada but applies its expertise globally, its seismic team has operated in a wide range of climates and terrains, including challenging heli-portable environments.

Polaris Geo has developed a new methodology for collecting high-resolution data for coal exploration in Mongolia, one of the world's most remote regions. Its trained mountaineering teams enhance its ability to deliver top-notch Seismic Acquisition services in even the most difficult terrains. Polaris Geo has ~35 years of experience in implementing robust safety and security operations, ensuring safe working conditions in high-risk areas.

**Planning & Permitting:** A thorough plan and design for the Seismic Acquisition program is key to the project's success. The creation of a comprehensive project plan begins at the outset of the bidding process. With each bid, Polaris Geo delivers a project-specific operations plan and Health & Safety Employee (HSE) project plan, leveraging the information at its disposal.

This approach allows teams to accurately estimate project costs and be prepared to start immediately upon award. Polaris understands that every project presents its unique challenges. However, its extensive experience and well-defined processes empower them to determine the most effective and efficient methods to achieve any client's objectives.

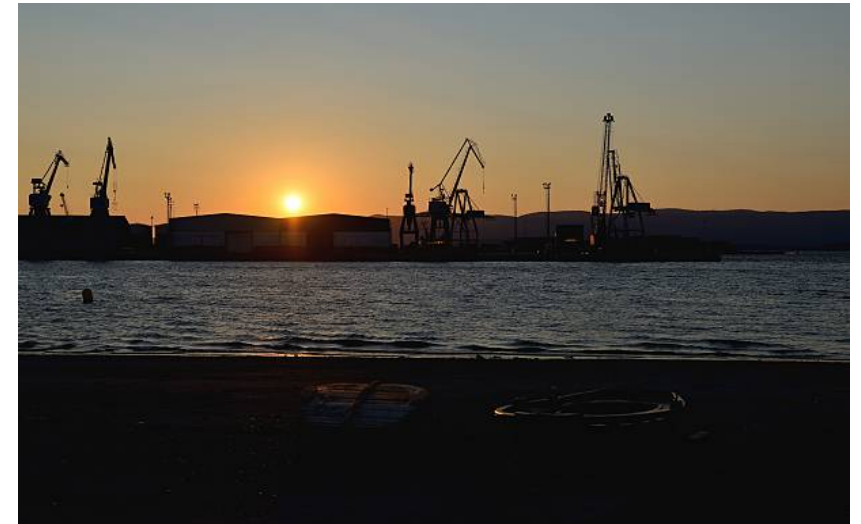
**Methods of Seismic Acquisition:** Vibroseis, dynamite, Patented Explorer 860 Accelerated Weight Drop System. The Explorer 860 is a completely new surface energy source, delivering unmatched power and efficiency. Patented Explorer 860 utilizes servo-valve and mass LVT technology to create the most powerful, consistent, and productive surface energy source in the world.

**3D Survey Evaluation & Design Services:** Polaris Geo has a wealth of experience processing Seismic data across the globe. For ~26 years, it has developed expertise to become a top client-focused seismic service provider for the Oil and Gas Industry. It provides a comprehensive array of 3D Seismic Design solutions that enhance subsurface imaging while maintaining full control over costs and environmental impact.

# Exploration & Production

## Business Risk | Seismic Acquisition Services

- Higher Costs and Fluctuating energy prices.
- Depleting reserves.
- Environmental concerns.
- Technological challenges.
- Geopolitical instability.



# Exploration & Production

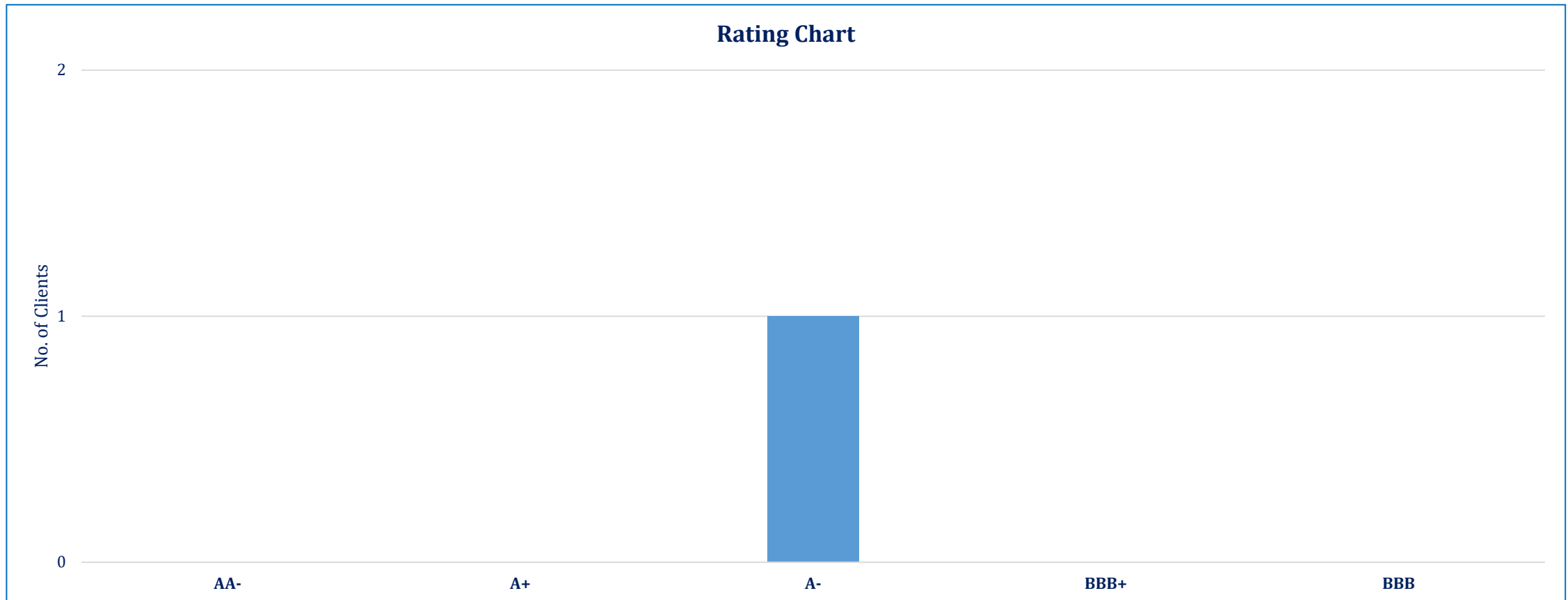
## SWOT Analysis



# Exploration & Production

## Rating Curve

- PACRA rates one client in the exploration and production sector.



# Exploration & Production

## Outlook: Stable

- In FY24, Pakistan's GDP (nominal) stood at PKR~106.0trn (FY23: PKR~83.9trn), increasing, in real terms, by ~2.4% YoY (FY23: ~-0.21% growth). Industrial activities in FY24 held ~21.9% share in the GDP while manufacturing activities made up ~62.9% of the value addition. In 3QFY24, Pakistan's GDP (nominal) stood at PKR~25.4trn (3QFY23: PKR~20.6trn), rising in real terms by ~2.1% YoY (2QFY24: ~1.8% YoY). Real GDP growth rate (~2.1%) for 3QFY24 signals a moderate improvement in economic activity as compared to SPLY.
- Pakistan's recoverable crude oil reserves are estimated at ~72.5mln MT as at End-Jun'24 (SPLY: ~44.5mln MT).
- The increase in oil reserves during FY24 is attributable to discoveries. Exploratory efforts of OGDCL led to five oil and gas discoveries, with an anticipated total daily production potential of 481 bpd. In pursuit of discovering new oil and gas reserves, OGDCL acquired 1,236 km of 2D seismic data and 1,201 square kilometers of 3D seismic data. Meanwhile, MARI Petroleum Company Ltd. successfully made an oil discovery at Shawal-1. However, if the specialized services of Seismic Acquisition entities are utilized, the number of discoveries is expected to increase.
- Pakistan relies significantly on imports to meet its demand for crude oil. During 2MFY25, total crude oil imports in terms of value were recorded at USD~945mln (2MFY24: USD~456mln). Whereas, in volumetric terms crude oil imports stood at ~1.7mln MT (2MFY24: ~0.8mln MT).
- In CY23, average crude prices averaged USD~71.3/bbl, down ~31.0% YoY, on account of slower growth in China (top crude importer in CY22, with ~23.8% share in global imports). During 8MCY24, crude prices displayed mixed trends due to factors like low demand from China, excess supply, the Israel-Gaza conflict, loose FED monetary policy e.t.c. However, going forward, prices of crude oil are expected to rise due to ongoing tension between Israel and Iran.
- Recent changes to the 2012 Petroleum Policy and the introduction of a new Tight Gas Policy are anticipated to encourage further exploration and development. These initiatives, designed to improve operational efficiency and resource recovery, have potential for the future, as long as the operational environment continues to be favorable.
- Subdued demand in tandem with structural deficiencies, in terms of technology obsolescence and low storage capacities is expected to keep capacity utilization under check. Therefore, utilizing the services of entities providing seismic acquisition services is going to improve the efficiency of oil exploration companies. 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.



# Exploration & Production

## BIBLIOGRAPHY

- International Monetary Fund (IMF)
- World Bank
- Oil and Gas Regulatory Authority (OGRA)
- Oil Companies Advisory Council (OCAC)
- BP STATS
- Energy Information Administration (EIA)
- International Energy Agency (IEA)
- 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

<b>Research Team</b>	<b>Saniya Tauseef</b> <i>Senior Manager</i> <a href="mailto:saniya.tauseef@pacra.com">saniya.tauseef@pacra.com</a>	<b>Sabeen Mirza</b> <i>Senior Research Analyst</i> <a href="mailto:sabeen.mirza@pacra.com">sabeen.mirza@pacra.com</a>
<b>Contact Number: +92 42 35869504</b>		

## DISCLAIMER

PACRA has used due care in preparation of this document. Our information has been obtained from sources we consider to be reliable but its accuracy or completeness is not guaranteed. The information in this document may be copied or otherwise reproduced, in whole or in part, provided the source is duly acknowledged. The presentation should not be relied upon as professional advice.