IPRI - PIP Research Study

Pakistan's Energy Sector: Need for Strategic and Commercial Storages (Oil & Gas)

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Petroleum Institute of Pakistan

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Oil & Gas Regulatory Authority (OGRA)
Pakistan State Oil (PSO)
Sui Southern Gas Company Ltd (SSGCL)

Preface

The energy sector of any country is the most accurate barometer of its economic health. Apart from commercial interests, there are security imperatives for creating an energy architecture that is impervious to oil and gas supply disruptions. For an oil and gas importing country like Pakistan, the need to create strategic oil and gas storages assumes paramount importance. India in our neighbourhood has a strategic oil reserve for 87 days which indicates its energy security priorities. Pakistan has a vibrant oil marketing and distribution network run by the private sector. If properly incentivised and regulated that network can be used to create strategic storages especially in gas sector through the commercial storage network of private sector.

Islamabad Policy Research Institute (IPRI) undertook this important study in collaboration with Petroleum Institute of Pakistan (PIP) to highlight the energy security issue for the attention of national policymakers. The study focused on the existing deficit of strategic oil and gas storage and the associated infrastructural and policy interventions that are required to create the desired strategic storages to cater for any emergency or supply disruptions in future. The policy prescriptions at the concluding section of the book provide a roadmap for the policy planners, as well as the private sector, to adopt a symbiotic approach to plan the strategic storages in collaboration with the relevant stakeholders in security and governance domains.

It is hoped that the policy recommendations help the policy planners in addressing the strategic storage issue as per the best international practices and the domestic requirements keeping a proper balance between the interests of the public and private sectors. Thanks are due to the collaborative efforts and facilitation of the PIP team, the Ministry of Energy, OGRA, OGDCL, SSGCL, PSO, Port Qasim, KPT, FOTCO and OMCs without which this study would not have been possible.

Dr Raashid Wali Janjua
Director Research, IPRI

Foreword

Energy security is the cornerstone of national progress, underpinning economic stability and sustainable growth. Pakistan's energy sector is at a critical juncture, faced with challenges that demand innovative solutions, comprehensive planning, and a forward-looking strategy. This collaborative study by the Pakistan Institute of Petroleum (PIP) and the Islamabad Policy Research Institute (IPRI) explores the need for strategic and commercial oil and gas storages in Pakistan.

The report is a qualitative and quantitative assessment of the country's oil and gas infrastructure, giving not only technical but also strategic insights. It highlights the importance of mandatory oil storages, the modernisation of energy infrastructure, and the creation of robust policies to meet the growing energy demands of a developing nation.

The study's recommendations are based on a deep understanding of global energy practices and tailored to address Pakistan's unique energy challenges. From revisiting the policy on mandatory oil storages to proposing enhanced pipeline networks, LNG terminals, and the exploration of subterranean storage caverns, the findings present a roadmap for building a resilient energy framework.

In an era of rapid global change, ensuring energy security requires forward-thinking initiatives. The emphasis of this report is on strategic infrastructure scattered across Pakistan, through public-private collaboration. By proposing comprehensive upgrades, the report highlights how modernising existing infrastructure and developing new facilities will not only improve operational efficiency but also bolster economic resilience and national security.

This report is a product of institutional collaboration, bringing together the technical expertise of PIP and its member organisations, and the policy insights of IPRI. It is our hope that the recommendations outlined in this study will guide policymakers, industry leaders, and stakeholders toward decisive action.

Implementation of these strategies will not only address current vulnerabilities but also set the foundation for a more secure, self-reliant, and prosperous Pakistan.

Shehryar Omar
Chief Executive Officer
Petroleum Institute of Pakistan

Acronyms

ARAMCO	Saudi Arabian Oil Company
ARL	Attock Oil Refinery Limited
BBL	Barrel of Crude Oil
BCF	Billion Cubic Feet
BCM	Billion cubic meters
BPD	Barrels Per Day
CCOE	Cabinet Committee on Energy
CNG	Compressed Natural Gas
CTL	Coal to Liquids
DWT	Dead Weight
E&P	Exploration and Production
ECC	Economic Coordination Committee
EETL	Engro Elengy Terminal Limited
FOTCO	Fauji Oil Terminal Company
FSRU	Floating Storage and Regasification Unit
GHPL	Government Holdings (Private) Limited
HELP	Hydrocarbon Exploration Licensing Policy
IEA	International Energy Agency
IFEM	Inland Freight Equalization Margins
IMF	International Monetary Fund
KPLP	Korangi Port-Qasim Link Pipeline
KPT	Karachi Port Trust
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MMBtu	Metric Million British Thermal Unit
MMCF	Million Cubic Feet
MMCFD	Million Cubic Feet Per Day
MMT	Million Metric Ton
MMTOE	Million Metric Ton of Oil Equivalent
MPCL	Mari Petroleum Company Limited

NRL	National Refinery Limited
OCAC	Oil Companies Advisory Council
OGDCL	Oil and Gas Development Company Limited
OGRA	Oil and Gas Regulatory Authority
OMCs	Oil Marketing Companies
PAPCO	Pak-Arab Pipeline Company
PARCO	Pak Arab Refinery Limited
PGPCL	Pakistan Gas Port Consortium Limited
PPL	Pakistan Petroleum Limited
PQ	Port Qasim
PSO	Pakistan State Oil
SBA	Standby Arrangement
SNGPL	Sui Northern Gas Pipelines Limited
SOF	Saudi Oil Facility SOF
SPM	Single Point Mooring
SSGCL	Sui Southern Gas Company Limited
SUGS	Strategic Underground Gas Storage
TCF	Trillion Cubic Feet
VLCC	Very Large Crude Carriers

Executive Summary

The study on “Pakistan’s Energy Sector: Need for Strategic and Commercial Storages (Oil and Gas)”, identifies the rapid depletion of the country's oil and gas reserves. The findings of the study reveal that the major gas fields in Pakistan including Sui, Mari and Qadirpur are on a decline. The country fulfills almost 25 per cent of its gas needs through imported Liquefied Natural Gas (LNG). On account of oil production, 20% is indigenously produced while 80% is imported.

The study further concludes that Pakistan’s dependence on imported fuel will increase in coming years. A correlation is also drawn in the study between sustainable economic growth and energy supply. It is argued that with a 5 per cent economic yearly growth, energy demand is likely to increase by 50%. Thereby, to meet with the increase in energy demand, new reserves of oil and gas need to be explored. This is essential not only to become energy secure but also to lessen the dependence on imported fuel, and to ensure sustainable economic growth.

The total exploration area in Pakistan is 243,000 square kilometres, out of which an area of only 94,000 square kilometres is being explored for oil and gas. To expand the exploration area, the Exploration and Production (E&P) companies need to be equipped with advanced technology and qualified manpower.

Pakistan’s oil refining sector needs expansion with the addition of new refineries. Presently, 9 to 10 million tons of crude is refined by refineries, and the rest i.e. 10-12 million tons of oil is imported. Pakistan has reached out to foreign countries like Saudi Arabia for setting-up an oil refinery in Balochistan.

The creation of strategic oil and gas storages is essential to ensure uninterrupted supply of fuel to the industrial as well as defence sectors in case of emergency. Lately, the government has announced a “bonded bulk storage policy;” aimed at maintaining stockpiles of oil for energy security. Under this policy, international firms will be allowed to construct warehouses for oil storage near Pakistani ports.

The oil storage warehouses will function without payment of foreign exchange until the oil products are sold in the local market or re-exported.

This study recommends the creation of strategic storages. It also recommends that in order to become self-reliant, the infrastructure of ports must be upgraded along with introduction of new technologies for efficient disembarkation of oil. Moreover, it suggests that a new jetty be developed at Port Qasim and interconnectivity between terminals at Keamari, Port Qasim and Hub be enhanced. Likewise, in order to have sound reserves of LNG, an underground terminal needs to be built at Fauji Oil Terminal Company (FOTCO). Moreover, the Oil Marketing Companies (OMCs) should be encouraged and facilitated to come up with more reserve storages on their own, and the pricing of oil, and gas be rationalised.

Chapter 1
Introduction

Pakistan is one of the largest countries in the world, with a population of around 242 million[1], and is supposed to hit 400 million by the year 2092.[2] The country has a diverse mix of energy sources, including fossil fuels, hydropower, and renewable energy. The country's energy mix is dominated by fossil fuels, with natural gas and oil being the most widely used energy resources.

Pakistan's natural gas reserves are estimated at 18.3 trillion cubic feet.[3] Pakistan accounts for 0.77 per cent of global gas production.[4] In South Asia, Pakistan is the second-largest natural gas producer whereas, globally, Pakistan is the 19th largest producer of natural gas,[5] as other largest natural gas producers globally include the US, Russia and Iran.[6]

The crude oil reserves in Pakistan are estimated at 243 million barrels[7], while the country imports oil on a net basis.

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[1] Ministry of Information and Broadcasting, July 18, 2024, https://moib.gov.pk/News/62983

[2] Ministry of Information and Broadcasting, July 18, 2024, https://moib.gov.pk/News/62983 "Pakistan's Population Projected to Reach 400 million by 2092: UN Report," *The Economic Times*, July 12, 2024, accessed August 10, 2024, https://economictimes.indiatimes.com//news/international/world-news/pakistans-population-projected-to-reach-400-million-by-2092-un-report/articleshow/111691193.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

[3] "Pakistan's Oil and Gas Reserves Increase in Fiscal Year 2024," *SAMAA TV*, September 15, 2024, accessed August 20, 2024, https://www.samaa.tv/2087320856-pakistan-s-oil-and-gas-reserves-increase-in-fiscal-year-2024; and Pakistan's Oil and Gas Reserves Rise with Support from SIFC Facilitation, *Express Tribune*, September 15, 2024.

[4] Pakistan Natural Gas Production: Data and Insights, *Offshore Technology*, July 11, 2024, accessed July 12, 2024, https://www.offshore-technology.com/data-insights/pakistan-natural-gas-production/?cf-view.

[5] Pakistan Natural Gas Production: Data and Insights.

[6] Pakistan Natural Gas Production: Data and Insights.

[7] "Pakistan's Oil and Gas Reserves Increase in Fiscal Year 2024," *SAMAA TV*, September 15, 2024, https://www.samaa.tv/2087320856-pakistan-s-oil-and-gas-reserves-increase-in-fiscal-year-2024.

Pakistan's energy sector comprises the upstream sector, oil downstream sector, gas downstream sector and the power sector. The upstream sector consists of 24 Exploration and Production (E&P) companies that supply the country with indigenous oil and gas. The average oil and gas production in 2023 remained at 68,500 barrels[8] of oil per day (25 million barrels/annum) and 3,259 million cft of natural gas per day.[9] The Oil and Gas Development Company Limited (OGDCL) remains the largest producer of oil and gas in the country. As of June 30, 2024, the company contributed 46 per cent, 28 per cent and 37 per cent towards country's total oil, natural gas and LPG (Liquefied Petroleum Gas) production.[10]

The oil downstream sector can be further segregated into oil refining, marketing, and pipeline. There are six refineries operating in the country with a combined refining capacity of 20.8 million tonnes per year (2023), however, peak refining processing has only reached 11.8 million tonnes.[11] PARCO remains the largest refinery in the country with an output capacity of 5.5 million tons per annum (2023).[12] In 2023, the combined refining capacity was recorded at 20 million tonnes per annum, however, the peak refining processing remained 10 million tonnes per annum.[13]

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[8] The Global Economy, Annual Report 2023, https://www.theglobaleconomy.com/Pakistan/oil_production.

[9] Investor's Guide to the Oil & Gas sector of Pakistan (2023-2024), https://joshandmakinternational.com/investors-guide-to-the-oil-gas-sector-of-pakistan-2023-2024.

[10] OGDCL Audited Financial Results for the Year Ended 30 June 2024, September 23, 2024, accessed October 10, 2024, https://ogdcl.com/sites/default/files/Annex-III%2030-06-2024.pdf.

[11] "Pakistan's Refining Sector Upgradation Policy to Incentivize Refineries," Arif Habib Limited (AHL), March 6, 2024, 3 accessed October 10, 2024, https://arifhabibltd.com/api/research/open?path=178/65e83999e70d0bde7313daeb.pdf.

[12] "Pakistan Oil Refining Policy for Upgradation of Existing/Brownfield Refineries, 2023," Directorate General (Oil) Petroleum Division, Ministry of Energy, Government of Pakistan, 8, accessed August 12, 2024, https://petroleum.gov.pk/SiteImage/Downloads/Brownfield%20Refinery%20Policy-2023.pdf.

[13] Pakistan's Refining Sector Upgradation Policy to Incentivize Refineries.

There are 34 Oil Marketing Companies (OMCs) operating in the country. Pakistan State Oil (PSO) remains the largest OMC in the country with a 54 per cent share of the High Speed Diesel (HSD) market and 44 per cent share of the MS market (2023). Total PARCO Pakistan Limited (TPPL) remains the second largest OMC with a market share of 10 per cent of the HSD market and 13 per cent of the MS market (2023).

The gas downstream sector is dominated by two state-owned entities: Sui Southern Gas Company Limited (SSGCL) and Sui Northern Gas Pipelines Limited (SNGPL) that own and operate a gas transmission and distribution network of over 212,000 kilometers in the country. A few E&P companies also supply gas through small exclusive pipelines to power and fertilizer companies.

Engro Elengy Terminal Limited (EETL) and Pakistan Gas Port Consortium Limited (PGPCL), own and operate the two Liquefied Natural Gas (LNG) terminals in the country,[14] with a regasification capacity of 690 mmcfd (maximum) and 750 mmcfd (maximum) each, making the total existing maximum available regasification capacity at 1.44 bcfd.

In addition to the two LNG import terminals, one license has been issued for construction to "Global Energy Infrastructure Pakistan (GEIP), while two more construction licenses were granted to the Project developers i.e. Energas Terminal (Pvt.) Limited and Tabeer Energy (Pvt.) Limited for FSRU based LNG terminals at Port Qasim. Moreover, OGRA has granted five provisional licenses for virtual pipeline projects, with three of these provisional licenses being active. One of the projects i.e. Gwadar Gas Port (Pvt.) Ltd. is located at Gwadar Port, while others are located at KPT, Karachi.

[14] Zofeen T. Ebrahim, "Does LNG Hold the Key to Pakistan's Energy Woes?" *Dawn*, April 21, 2022.

Eighty per cent of oil demand is fulfilled through import[15] and 25 per cent of gas demand is addressed through imported LNG.[16] Meeting of energy demand through imports weighs heavily on Pakistan's trade and current account deficit. Pakistan's gas resources are depleting by approximately 10 per cent yearly.[17] The major gas fields in the country, including Sui (Dera Bugti, Balochistan), Mari (Daharki, District Ghotki Sindh), Qadirpur (near Ghotki, Sindh) have started to decline.[18] It is officially documented that "only 1,600 Million Cubic Feet Per Day (MMCFD) of gas is left, while the demand is on the rise."[19] Gas prices in country have increased, and the Oil and Gas Regulatory Authority (OGRA) keeps on raising the Liquid Petroleum Gas (LPG) rates for domestic users.[20] The circular debt in the power sector as of December 31, 2023, was Rs.2.4 trillion.[21] These indicators point towards the energy crisis in Pakistan, which is a profound challenge to the country's energy security.

Petroleum Products Demand

Unit: MMT

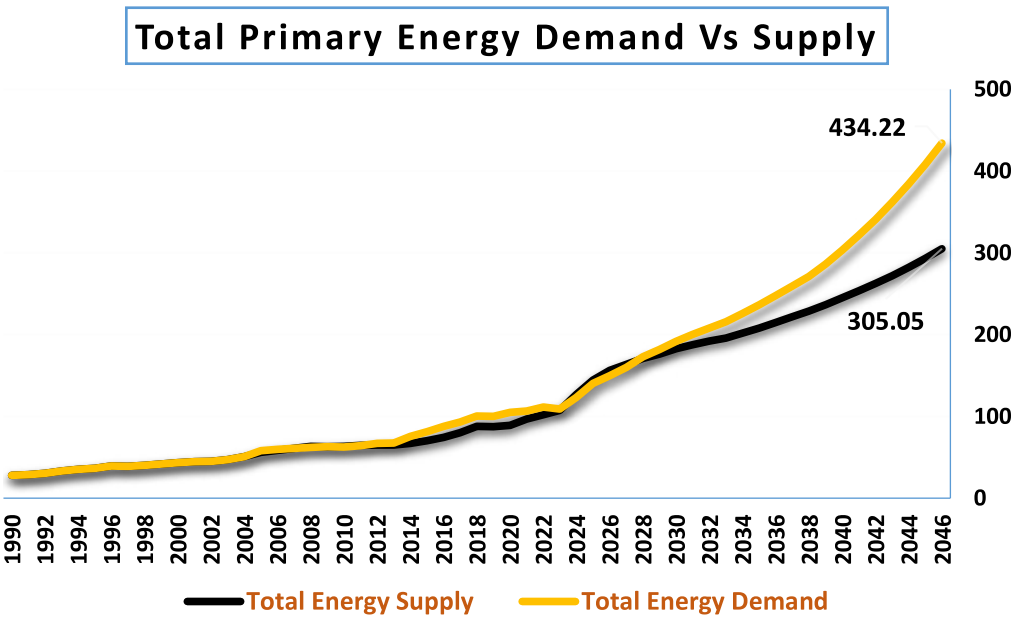
Year	*MOGAS*	*HSD*	*FO*
2020-21	8.853	7.877	3.239
2021-22	9.006	8.919	4.311
2022-23	7.477	6.366	2.595
2023-2024	7.701	6.429	2.6
2024-25	8.009	6.526	2.6

[15] Farrukh Saghir, Executive Director Exploration, Oil and Gas Development Company Limited (OGDCL), "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Amna Ejaz Rafi, November 2, 2023.
[16] Saghir, Executive Director Exploration OGDCL…
[17] Shujauddin Qureshi, "The Gas Crisis," *The News International*, October 15, 2023.
[18] Saghir, Executive Director Exploration OGDCL ...
[19] Qureshi, The Gas Crisis.
[20] Qureshi, The Gas Crisis.
[21] Khalid Mustafa, "Oil and Gas Firms to be Allowed to Sell 50pc Gas to Private Sector: Minister," *The News International*, January 17, 2024.

2025-26	8.41	6.656	2.6
2026-27	8.87	6.82	2.6
2027-28	9.40	7.027	2.6

Source: OCAC

The demand for petroleum products is projected to slow down in the coming years, primarily driven by the impact of an economic slowdown. Reduced industrial activity, slower growth in transportation needs, and a shift towards energy efficiency and alternative fuels are expected to moderate the consumption of key products like HSD and Motor Gasoline (MOGAS). While some recovery in demand is anticipated in the medium to long term, the overall growth trajectory remains subdued compared to previous years, reflecting the broader economic challenges and evolving energy consumption patterns, especially the electrification of motorbikes in the transport sector and captive power usage in the industrial sector.



Source: PEO 2022

Pakistan being an energy deficit country is susceptible to fluctuations in oil prices internationally.[22] For instance, the Russia-Ukraine conflict had impacted the fuel prices in Pakistan. In February 2022, gasoline price was Rs.134.5 and in August 2022, the gasoline price increased to Rs.224.7.[23] Likewise, the Israel-Hamas conflict came as another challenge to world peace and economy. Israel and Palestine are not oil producing territories[24] but the Middle Eastern region accounts for almost a third of global oil supply. Oil prices have risen by about $5 a barrel since the start of the conflict in 2023.[25] Oil supply shocks would take a toll on economic activity in energy importing countries and on the global economy more generally, with International Monetary Fund (IMF) estimates suggesting that a 10 per cent increase in oil prices could bring down global growth by 0.15 percentage point. According to World Bank statistics, "the global oil supply could shrink by 6 million to 8 million barrels a day, sending prices to between $140 and $157 per barrel."[26]

On the exploration side, three new discoveries of oil and gas in the areas of Khyber Pakhtunkhwa (Wali, Bannu, and Baska) are indicative of potential untapped energy reserves.[27] Engineer Arshad H. Abbasi, an eminent energy expert, refers to the lack of commitment to develop the oil and gas sectors. According to him, "an area of around 361,218.72 square kilometers out of a total sedimentary area of 827,268 square kilometers has been under exploration for oil and gas throughout the country. Yet an area of only 27,710

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[22] Tanveer Malik, "Govt to Slash Petroleum Prices Amid Global Oil Slump," *The News International*, October 7, 2023

[23] "Evaluating Energy Security Paradigm of Pakistan – Challenges and Opportunities," Working Paper-WP02, *The Federation of Pakistan Chambers of Commerce & Industry (FPCCI)*, *Policy Advisory Board*, 13.

[24] Annabelle Liang, "Oil Prices Rise Following Hamas Attack on Israel," *BBC*, October 9, 2023, accessed January 7, 2024, https://www.bbc.com/news/business-67050612.

[25] Gian Maria Milesi-Ferretti, "The Israel and Gaza War: Economic Repercussions," *Brookings*, October 23, 2023, accessed January 15, 2024, https://www.brookings.edu/articles/the-israel-and-gaza-war-economic-repercussions/.

[26] Vishala Sri-Pathma, "World Bank Warns Oil Prices Could Reach $150 a Barrel," *BBC*, October 30, 2023, accessed January 10, 2024, https://www.bbc.com/news/business-67267719.

[27] Saghir, Executive Director Exploration OGDCL...

square kilometers located in Khyber Pakhtunkhwa has been explored. This shows that only 27 per cent of the area of Khyber Pakhtunkhwa has been explored for oil and gas," (Hydrocarbon Exploration Licensing Policy-HELP: Way Forward to Self Sufficiency in Oil and Gas).[28] The province of Balochistan alone has oil reserves of 313 million barrels and gas reserves of 29.67 trillion cubic feet.[29] Pakistan also has Shale gas reserves. According to the US Energy Information Administration (EIA) assessment, Pakistan has the reserves of 51 trillion cubic feet of Shale gas.[30] Shale gas was discovered in Pakistan in 2008 by an American George Mitchell,[31] since then Pakistan has failed to explore the Shale gas reserves. Pakistan has about 205 Trillion Cubic Feet (TCF) Shale gas[32] reserves and stands 19th in the world. Building a Shale oil and gas industry[33] for the future of Pakistan will generate vast investment opportunities. Shale gas exploration and production will help Pakistan in producing cheap domestic gas, saving the foreign exchange spent on imports of hydrocarbon fuels, and reducing electricity crisis.

Pakistan's Tight Gas Policy, introduced in 2011, aims to encourage exploration and production of tight gas reserves, which require advanced technology and significant investment to extract. The policy offers attractive incentives, including a 40 per cent premium over the conventional gas price, reduced royalties, and extended production leases to offset the higher costs associated with tight gas extraction. Additionally, it provides tax holidays and fast-track approvals for exploration and development. These measures are designed to attract investment and boost domestic gas production to meet the country's growing energy demand.

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[28] Khalid Mustafa, "Oil and Gas Reserves of Pakistan Going to India Due to Lack of Exploration," *The News International*, November 25, 2019.
[29] Mustafa, Oil and Gas Reserves of Pakistan Going to India Due to Lack of Exploration.
[30] Zafar Bhutta, "Samples Sent: US to Assess Potential of Pakistan's Shale Gas Reserves," *Express Tribune*, August 22, 2014.
[31] Sunil Sharan, "Shale Gas Solution?" *Dawn*, June 26, 2012.
[32] Mustafa, "Oil and Gas Reserves of Pakistan Going to India Due to Lack of Exploration."
[33] Mustafa, "Oil and Gas Reserves of Pakistan …"

Pakistan's oil refining sector needs upgradation with the addition of new refineries. Extended discussions have taken place between the Government of Pakistan and Saudi Arabia for the establishment of an oil refinery and petrochemical complex project in Balochistan (either in Gwadar or Hub).[34] The refinery will have the capacity to process up to 450,000 barrels of crude oil per day. The investment for the project will be extended by Saudi Arabia; $10 billion for oil refinery and $1 billion for petrochemical complex project.[35]

The government's policy to allow OGDCL, Pakistan Petroleum Limited (PPL), Government Holdings Private Limited (GHPL), Mari gas and foreign companies to directly sell 50 per cent of gas to the private sector and 50 per cent to state-owned gas companies could be termed as a positive move.[36] The initiative would not only help reduce the financial problems of the E&P companies that emerged in the wake of their circular debt because of non-payments by Sui gas companies, but would also provide fiscal relief because of direct sale of gas directly to the private sector. The private sector may pay the E&P companies in advance providing fiscal space enabling them to increase exploration production activities in the country for more discovery of oil and gas.[37]

Pakistan does not have LNG storages. The two Floating Storage and Regasification Units (FSRU) based offshore LNG import terminals at Port Qasim Karachi have a limited combined storage capacity of about 0.3 million cubic meters.[38] The in-built storage capacity in FSRUs is for supply chain continuity and that too for limited periods. FSRUs storage capacity cannot avert gas supply disruptions.[39]

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[34] "Pakistan Expects Progress on $10 Billion Saudi Oil Refinery Project in Two Months," *The News International*, November 16, 2023.
[35] "Pakistan Expects Progress on $10 Billion Saudi Oil Refinery Project …"
[36] Mustafa, "Oil and Gas Firms to be allowed to Sell 50pc Gas to Private Sector: Minister."
[37] Mustafa, "Oil and Gas Firms to be allowed…"
[38] Hammad Ahsan, "CORPORATE WINDOW: Developing Gas Storage," *Dawn*, October 2, 2023.
[39] Ahsan, "CORPORATE WINDOW: Developing Gas Storage."

The idea to develop Strategic Underground Gas Storage (SUGS) might not be a feasible option for Pakistan. For underground gas storage to operate, a minimum essential amount of gas (25-50 per cent of the underground gas reserve) needs to be present.[40] This "cushion gas" is non-retrievable and cannot be used to serve the needs of the gas utility.[41]

The development of on-ground LNG storage may create higher benefits as compared to SUGS, as it is a proven fact that the storage of gas in liquefied form is much cheaper. Onshore terminals have the additional inherent benefit of having the option of enhancing the initially installed storage capacity at a relatively lesser incremental cost, as and when required to meet the future storage needs of the country.[42]

The Oil & Gas Regulatory Authority (OGRA) has drafted the country's first "LNG Terminal and Storage Access Rules" and "LNG Terminal and Storage Access Code" as a strategy to liberalise the Gas/LNG market of the country and to promote the uniform principles of transparency, fair and non-discriminatory practices in all transactions concerning the use of LNG terminals and ensuring safe and reliable supply of gas.

Pakistan's existing storage capacity of petroleum products and crude oil available with OMCs, refineries and pipeline operators is around 2.5 and 0.9 Million Metric Ton (MMT), respectively.[43]

The debate over strategic and commercial storages is an effort directed towards making Pakistan an energy secure country. Strategic and Commercial storages refer to different domains when it comes to the usage but as far as the benefit is concerned both are essential for country's defense.

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[40] Ahsan, "CORPORATE WINDOW: Developing Gas Storage."
[41] Ahsan, "CORPORATE WINDOW: Developing Gas Storage."
[42] Ahsan, "CORPORATE WINDOW: Developing Gas Storage."
[43] Mushtaq Ghumman, "JSHQ Underscores Need for Setting Up Underground SPR Facility," *Business Recorder*, March 4, 2022, accessed January 10, 2024, https://www.brecorder.com/news/40158486.

The strategic storages are to deter an emergency like situation whereas the commercial storages are to ensure uninterrupted supply of fuel to industrial sector. Pakistan's commercial storages have an estimated storage capacity to last for about 20 days, as mandated by OGRA to OMCs.[44] The storages with OMCs are primarily treated as commercial in essence.[45] Business entities develop commercial storage to ensure their product's supply continuity and optimize their levels to attain maximum commercial benefits. The presence of a clear market incentive is a prerequisite for these commercial entities to construct and maintain these storages.[46]

The commercial storages are not 'strategic reserves,' per se. As per the law, the State/Government can takeover 'commercial storages' in case of a war.[47] It has been pointed out that the PSO is almost 50 per cent shareholder in storages.[48]

The decision towards building of strategic reserves is primarily linked to Pakistan's growing energy needs, dependence on imported fuel and the geopolitical developments impacting the supply / prices of oil internationally.

The vision behind strategic storages is to ensure uninterrupted supply of fuel to industrial sector as well as defense in case of war, or calamities. The framework towards construction of strategic reserves should feature the country's fuel requirements as well as the economic feasibility. Thus, through

[44] Shahram Haq, Salman Siddiqui, "Pakistan increasing storage capacity to more than 20 days," *Express Tribune,* November 16, 2016.
[45] Dr. Syed Nazir Abbas Zaidi, Secretary General, Oil Companies Advisory Council (OCAC), Karachi, "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Ishtiaq Ali Mehkri, December 6, 2023.
[46] Ahsan, "CORPORATE WINDOW: Developing Gas Storage."
[47] Zaidi, Secretary General, Oil Companies Advisory Council (OCAC), Karachi…
[48] Zaidi, Secretary General, OCAC Karachi…

a combination of strategic planning, technological advancements and sustained investment, Pakistan can become energy secure.[49]

Significance and Methodology

This study was beneficial in discovering as to what extent the country is self-sufficient in meeting its energy requirements, in terms of availability of oil and gas reserves. The study carefully distinguishes between commercial and strategic reserves, and dwells in detail about the stock situation of oil and gas stockpiles at the moment.

In conducting this empirical study, all the stakeholders related to oil and gas were tapped, and their primary and secondary input incorporated. Pakistan's energy pattern and its consumption module was also studied, vis-à-vis the volume of indigenous production, imports and refining, as well as storing and supply avenues were tapped.

[49] "Pakistan Decides to Expand Strategic Petroleum Reserves as Tensions Escalate in Middle East," *Islamabad Daily Post*, November 5, 2023, accessed January 24, 2024, https://islamabadpost.com.pk/pakistan-decides-to-expand-strategic-petroleum-reserves-as-tensions-escalate-in-middle-east/.

Chapter 2
Storages & Port Handling

Commercial Storage of oil refers to the stocks of crude oil, petroleum products, or natural gas liquids that are held by private companies such as Oil Marketing Companies (OMCs), for commercial purposes. These storages are typically owned and controlled by the companies themselves and are used to meet their day-to-day operational needs, including production, refining, and distribution.

Strategic Storages, on the other hand, are reserves of oil that are held by the government or the appointed agencies for strategic or emergency purposes. These reserves are maintained to ensure the ready supply of oil during times of supply disruptions, geopolitical tensions, or other emergencies that may affect the regular supply and stability of energy markets. Strategic reserves are considered a national security imperative and are designed to safeguard the country's energy security.

The main differences between commercial and strategic reserves are as follows;

Factor	***Commercial Storages***	***Strategic Storages***
Ownership and Control	Commercial Storages are privately owned by companies.	Strategic Storages are owned and managed by government or mandated agencies.
Purpose	Commercial Storages are primarily used for regular business operations to ensure a continuous supply of oil.	Strategic Storages are intended to address emergencies or supply disruptions serving as a backup supply to stabilise the energy

		market and ensure national security
Access and Availability	Commercial Storages are typically readily available to the companies that own them, allowing them to respond to market demands and fluctuations.	Strategic Storages are held off-market and are only released during specific circumstances or crises as determined by the government.
Size and Composition	Commercial Storages vary in size and can be tailored to the specific needs of individual companies. They can include crude oil, refined petroleum products, or natural gas liquids.	Strategic Storages are larger in scale and are often maintained at the national level. They are typically composed of crude oil and are strategically located across different storage facilities within a country.
Funding	Commercial Storages are funded by private companies through their resources or financial arrangements.	Strategic Storages are usually funded by government budgets or special needs allocated for emergency or strategic purposes.

Commercial & Strategic Storages of Oil in Pakistan

A detailed breakdown of the existing levels of Pakistan's commercial and strategic reserves of oil is as follows:

Commercial Storages of Oil in Pakistan

Rule 28 (1) of Pakistan Oil Rules (Refining, Blending, Transportation, Storage, and Marketing), 2016, bars any person from constructing or operating any Oil Storage facility, with the purpose of commercial oil storage of crude oil and petroleum products without obtaining permission from OGRA. As such, commercial reserves in Pakistan are held by various OMCs, refineries,

and power-producing companies, after obtaining the required licenses from OGRA.[50]

Oil Storage

The government mandates every OMC to develop and maintain minimum storage of 20 days of its proposed sales, as infrastructure prior to commencing commercial operations. The Federal War Book 1983 requires maintenance of the strategic reserves equivalent to 45 days demand at national level. However, no such facility exists in the country.[51]

Omcs Product Wise Storage Capacity at Terminals (Keamari & ZOT) - June 2023 (OCAC)

Unit: M. Tons

Products	***Quantity***
JP-1	13,074
MS	462,540
HOBC	24,405
SKO	2,642
HSD	324,482
HSFO	275,702
CHEMICAL/BASE OIL	12,357
LSFO	61,090
100/LL	1,383
Total	**1,179,364**

Source: OCAC

[50] "Pakistan Decides to Expand Strategic Petroleum Reserves as Tensions Escalate in Middle East," *Islamabad Daily Post*, November 5, 2023, accessed January 24, 2024, https://islamabadpost.com.pk/pakistan-decides-to-expand-strategic-petroleum-reserves-as-tensions-escalate-in-middle-east/.

[51] Federal War Book, 1983, revised by Cabinet Division in the FY 2018-19, http://efaidnbmnnnibpcajpcglclefindmkaj/https://cabinet.gov.pk/SiteImage/Misc/files/Year%20Book%20(2018-19).pdf, accessed on May 15, 2024.

PAPCO Product Wise Storage Capacity at Terminals (PQA) - June 2023 (OCAC)

Unit: M. Tons

Products	*Quantity*
MS	111,900
HSD	107,500
Total	**219,400**

Source: OCAC

Refineries Product Wise Gross Storage Capacity June 2023 (OCAC)

Unit: M. Tons

Products	*Quantity*
Naphtha	57,650
LPG	3,326
100/LL	-
JP-1	33,930
JP-8	10,650
MS	107,800
HOBC	3,100
SKO	18,108
HSD	232,750
LDO	6,000
LSFO	-
HSFO	201,650
Chemical/ Base Oil	-
Crude	897,400
Total	**1,572,096**

Source: OCAC

Strategic Storages of Oil in Pakistan

OGRA Ordinance 2002, Section 2 (1) (xxxiii), defines strategic petroleum storage as a fuel reserve in the event of a public emergency. Public emergency has been defined in Section 2 (1) (xxxiii) of the same Ordinance as the occurrence of any natural calamity, or an event that threatens public safety, or the sovereignty, security, or integrity of Pakistan and has been so declared by the Federal Government.

Moreover, Section 21 (2) (e) of the OGRA Ordinance empowers the Federal Government and in particular the Ministry of Energy (Petroleum Division), for the establishment and maintenance of strategic petroleum storage.[52]

Additionally, the Federal War Book 1983, puts forth the requirement to maintain strategic reserves equivalent to 45 days of the country's demand at the national level.[53] However, in spite of these rules and ordinances, no such facility exists. By and large, Pakistan does not maintain any strategic reserves of oil or petroleum products at the moment.

Although, a change in this trend has been observed in recent years. In an October 29, 2021, meeting of the Cabinet Committee on Energy (CCoE), OGRA was directed to conduct a study on the development of strategic petroleum reserves in the country.[54] In 2022, OGRA suggested the construction of large-scale oil storage facilities to protect consumers from any abrupt price hikes in the international market.[55] This move was also supported by Joint Staff Head Quarters (JSHQ), Ministry of Defense, which commented

[52] Federal War Book, 1983, revised by Cabinet Division in the FY 2018-19, http://efaidnbmnnnibpcajpcglclefindmkaj/https://cabinet.gov.pk/SiteImage/Misc/files/Year%20Book%20(2018-19).pdf, accessed on May 15, 2024.

[53] Zaidi, Secretary General, OCAC Karachi…

[54] Zafar Bhutta, "Push to Develop Strategic Reserves of POL Products," October 30, 2021, *Express Tribune*, https://tribune.com.pk/story/2327031/push-to-develop-strategic-reserves-of-pol-products.

[55] "OGRA Suggests 'Large Scale' POL Products' Storage Facilities to Absorb Abrupt Price Hike," *Daily Times/APP,* October 29, 2021.

on the need to establish these reserves underground, in order to secure them from terrorist attacks or enemy aerial bombardment.[56]

Commercial & Strategic Storage of Natural Gas in Pakistan

Commercial Storage of Natural Gas in Pakistan

Pakistan currently does not have any largescale Natural Gas or LNG storage capacity. The country does have two Floating Storage and Regasification Units (FSRU), which have a combined capacity of 0.3 million cubic meters and are used to store LNG for a limited amount of time. These terminals are Engro Elengy Terminal Limited (EETL) and Pakistan GasPort Consortium Limited (PGPCL). EETL is onshore while PGPC is offshore. Both the terminals are located in Port Qasim (PQ), Karachi.[57] Imported LNG is re-gasified at the terminals, afterward through the Sui Southern Gas Company (SSGC) pipeline, the gas is distributed to Punjab and upcountry.[58] The storage capacities can cater to one cargo each. This is a very small storage capacity and is insufficient in case of any possible supply disruption. There are also the gas transmission networks of the Sui companies. These networks contain about 6 Billion Cubic Feet (BCF) of natural gas storage. These storages can manage small-scale surges.[59]

Strategic Storages of Natural Gas in Pakistan

Pakistan does not have any strategic storage of natural gas presently.[60] However, the government is planning to create such storages considering increased domestic consumption during winter months and for energy

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[56] Mushtaq Ghumman, "JSHQ Underscores Need for Setting up Underground SPR Facility," *Business Recorder*, March 4, 2022.

[57] Zofeen T. Ebrahim, "Does LNG Hold the Key to Pakistan's Energy Woes?" *DAWN,* April 21, 2022.

[58] Ebrahim, "Does LNG Hold the Key to Pakistan's Energy Woes?"

[59] Kashif Siddiqui, Chief Executive Officer, Pak Arab Refinery Company Limited (PARCO) Pearl Gas Private Limited, "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Sharjeel Siddiqui, October 13, 2023.

[60] Zaidi, Secretary General, OCAC Karachi…

security. In this regard, the Ministry of Energy (Petroleum Division) ordered a comprehensive feasibility study for the construction of Strategic Underground Gas Storages (SUGS). The study was financed with the aid of the Asian Development Bank.[61] The consultant hired for the study was SOFREGAZ France and it recommended that Khorewah and Bukhari gas fields in Badin, Sindh be converted to gas storages.[62]

Elengy Terminal Pakistan Limited (ETPL) has applied for onshore LNG storage and regasification facility at Port Qasim Karachi, which is pending approval by the Port Qasim authority.

Port Handling

Pakistan currently imports POL products through its terminals at Keamari Port operated by Karachi Port Trust and at Port Qasim operated by Port Qasim Authority. Both terminals are situated in Karachi, Sindh. A Single Point Mooring (SPM) exists in the Hub area operated by Cynergyico PK Limited. The Karachi Port Trust operates the Keamari Port that is the largest oil terminal in the country with three piers I, II, III.

Karachi Port Trust (KPT) 24 MMT

The Karachi Port Trust (KPT) is the oldest and largest port in Pakistan, serving as a vital gateway for the country's maritime trade. Established in the 19th century, KPT has grown to become a crucial hub for both national and international shipping. With the capacity to process up to 24 million metric tons (MMT) of oil annually, it stands as the port with the largest oil processing capacity in Pakistan.

[61] Asian Development Bank, "Gas Storage Development Systems," https://www.adb.org/projects/documents/pak-55170-002-tar.

[62] "Strategic Underground Gas Storages (SUGS) – ISGS," https://www.isgs.com.pk/index.php/strategic-underground-gas-storages-sugs/.

Oil Pier I	**8 MMT**
Oil Pier II	**8 MMT**
Oil Pier III	**8 MMT**

Oil Pier I and II are predominantly used, whereas, the functionality of the third oil pier is contested by the port and OMCs. Keamari has the largest oil storage facility of any port in the country. However, further extensions in the storage capacity is a challenge as the port is surrounded by residential areas such as Shireen Jinnah colony. This is a challenge as the import capacity would remain underutilized due to a shortage of storages and adequate pipelines to offtake oil.

Source: Karachi Port Trust

The issues at Keamari Port encompass a variety of operational, logistical, and safety challenges. These issues have also acted as a barrier to introducing infrastructure expansion in the port.

Traffic Congestion

- **Description:** Keamari Port handles a significant portion of the country's trade and oil imports. Heavy-duty vehicles, including oil tankers, must be moved at night to prevent daytime traffic congestion in Karachi.
- **Impact:** This restriction complicates logistics, potentially causing delays and increasing operational costs. Nighttime movement might also pose additional safety risks due to reduced visibility and untrained manpower.

Oil Piers

- **Description:** The port has three oil piers (I, II, and III), each with a capacity of 8 MMT (Million Metric Tons). However, there is an ongoing dispute between the Karachi Port Trust (KPT) and Oil Marketing Companies (OMCs) regarding the operation of Oil Pier III, which remained inactive during the fiscal year 2021.
- **Impact:** The underutilisation of Oil Pier III limits the port's overall handling capacity, potentially leading to bottlenecks and inefficiencies. The dispute needs resolution to optimise the port's operations fully.

Storage Limitation

- **Description:** A moratorium on expanding oil storage facilities at Keamari Port has been in place since the 1971 war, imposed by the Ministry of Defence, Government of Pakistan.

- **Impact:** This limitation restricts the port's ability to increase its import capacity, thereby constraining growth and possibly leading to supply chain disruptions. With the existing storage reaching capacity limits, future increases in oil import demand might be challenging to meet.

Source: Karachi Port Trust

Hazard Operability

- **Description:** The proximity of residential and commercial areas to the oil storage and ancillary infrastructure poses significant hazard operability challenges. The sizeable population as shown in the figure above, would be a challenge to relocate to a different location both in terms of logistics and financial expenditure.
- **Impact:** The risk of accidents or hazardous incidents increases with such proximity, raising safety concerns for both the port operations and nearby communities. This could lead to stringent regulatory measures and potential public outcry, affecting port operations and necessitating comprehensive safety and emergency response plans.

Port Qasim Authority (PQA)
FOTCO 9MMT

Port Qasim is the second largest port terminal in Pakistan, playing a crucial role in catering to the country's imports of oil, coal, LPG, and other commodities. Among its facilities is an advanced oil terminal operated by the Fauji Oil Terminal & Distribution Company (FOTCO), which offers several strategic advantages.

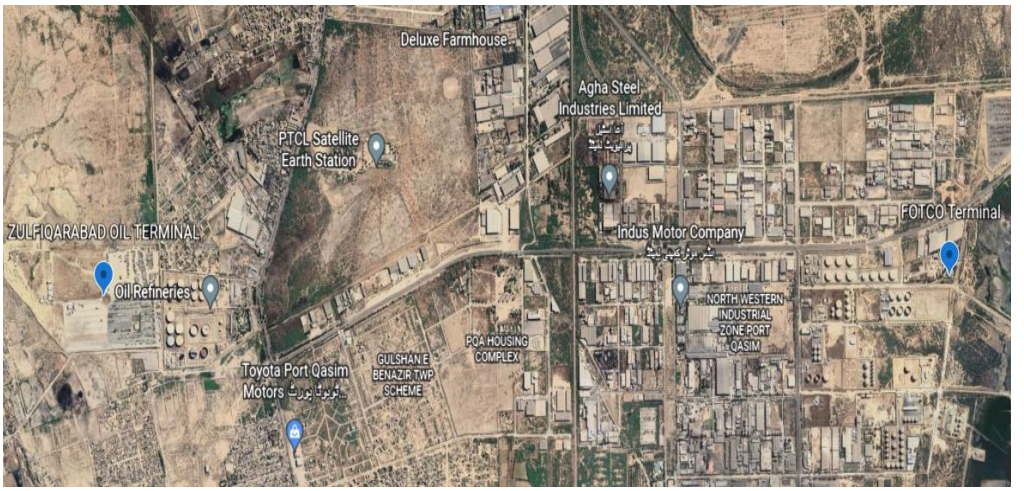
One of the primary benefits of FOTCO's oil terminal is its proximity to the Pak-Arab Pipeline Company's (PAPCO) White Oil Pipeline Terminal Station 1 (WOTS-1). PAPCO owns and operates the white oil pipeline infrastructure, which is integral to the efficient transportation of petroleum products across the region. The Zulfiqarabad Oil Terminal as shown in images below, is also in proximity of the terminal increasing the operability of the terminal. Existing infrastructure further reduces the costs of terminal development and operations.

With the planned dualisation of the White Oil Pipeline (WOP), there will be an increased capacity for transporting Motor Gasoline (MOGAS) alongside High-Speed Diesel (HSD). This expansion necessitates greater terminal capacity at Port Qasim. To accommodate this increased demand, there will be a need for additional jetties and enhanced storage facilities in the vicinity.

This development will not only support the growing import volumes but also improve the efficiency and reliability of petroleum product distribution within the country. Enhancing terminal capacity and expanding infrastructure at Port Qasim is essential for meeting future logistical needs and ensuring a seamless supply chain for critical imports like oil, coal, and LPG.

Source: Karachi Port Trust

Further, the Zulfiqarabad Oil Terminal is approximately 7km away from FOTCO terminal, whereby oil transportation through an oil pipeline is a relatively more streamlined operation compared to Keamari. The lack of residential construction in Port Qasim and the vicinity pose a lower hazard compared to Keamari.



Source: Karachi Port Trust

The following issues are faced at Port Qasim

Vessel congestion

The lack of capability of Port Qasim to cater to multiple vessels simultaneously is an issue as terminal enhancement would result in a greater number of vessels at the port.

The LNG terminal coupled with Coal import terminal have also increased the frequency of vessels at the port. LNG operations pose risk of sea channel closure in case of any eventuality. Sea channel is closed when LNG vessels move in and out.

As shown in the satellite image below, the narrow passage in the mangroves at Port Qasim pose a challenge for vessels to navigate as opposed to the Keamari Port.

Time constraint

Port Qasim lacks the infrastructure to receive vessels at night. This allows only a 14-hour window to receive vessels.

Source: Karachi Port Trust

Hub -Balochistan
Byco SPM 12 MMT

Hub area comes under the Lasbela district of Balochistan. However, its proximity to Karachi city (less than 60km) and its ports makes it a suitable alternative to the existing oil import and storage facility.

Energy infrastructure (coal, power, and oil facilities) already exists in the Hub area. Cynergyico operates its 155,000 bpd refinery facility in the Hub area coupled with its storages.

Cynergyico also owns and operates its Single Point Mooring facility capacity to handle 100,000 Deadweight Tonnage (DWT) vessels.

Source: Karachi Port Trust

The Single Point Mooring owned and operated by Byco allows import of POL products from vessels in deep sea without docking the vessels. This reduces the issue with vessel congestion as faced in Port Qasim. The SPM is currently only used by Byco and its use by other OMCs can be looked at as an option. Further, a new SPM can also be looked into to diversify the oil supply chain. For this purpose, storages and pipelines connectivity can also be carried out by the appropriate body.

Source: Karachi Port Trust

Satellite images below provide oil storage and refining facilities in the Hub area. New facilities for oil and natural gas import and storages with auxiliary arrangements can be created in the vicinity. However, detailed feasibility and environmental impact studies may be undertaken by third party consultants.

Source: Karachi Port Trust

Pipelines in Hub area

Byco Petroleum Pakistan Limited owns and operates two pipelines in Hub to cater to its refinery needs. This includes a 28" diameter pipeline from its Single Point Mooring to its refinery area spread over 15 KM to transfer crude oil. Further, a 16" diameter pipeline spread over 1.8KM transfers POL products from BTPL terminal to Oil Pier III.

If an oil import facility is constructed at Hub area, pipeline and storages infrastructure may also be needed to support oil transportation from the area.

International Oil Storage Practices

International Oil Storages

Oil is one of the most important commodities in the world. Its uses range from being a heat source to energy production, as well as feedstock for products such as plastics, polyurethane, and numerous other products. Refined petroleum products such as kerosene, lubricants, asphalt, etc. have further uses that make consistent oil supply a vital imperative for nations. Thus, there are increasing attempts by states to create a reserve stock in case of any supply disruption.

International Energy Agency (IEA)

The International Energy Agency (IEA) is an intergovernmental organisation that advises its members regarding the global energy sector. It comprises 31 nations, including the US, Japan, and Turkey. The IEA obligates its member countries to have minimum oil feedstocks equivalent to 90 days of their net imports. This is to ensure that they can adequately respond to any disruptions to the global oil market. An account of some members of the IEA and their oil reserves is given below.[63]

[63] "Oil Stocks of IEA Countries – Data Tools," *IEA*, https://www.iea.org/data-and-statistics/data-tools/oil-stocks-of-iea-countries.

Country	**Oil Reserve (No. of days)**
Australia	51
Japan	193
South Korea	247
New Zealand	92
France	113
Germany	129
United Kingdom	143
Canada	Net Exporter
Mexico	Net Exporter
Norway	Net Exporter
United States	Net Exporter

However, the net exporter members of the IEA are exempt from this requirement of maintaining minimum oil reserves. Before the start of the Russian invasion of Ukraine and the subsequent release of reserve oil to stabilise the global markets, the IEA members collectively held 1.5 billion barrels of oil.[64]

United States

The United States has the world's largest strategic reserves of oil despite being a net exporter. The US strategic reserve has an authorised storage capacity of 714 million barrels. As of August 25, 2023, the current inventory of the reserve stands at 349.5 million barrels.[65] The US Strategic Reserve is based in underground salt caverns along the coastline of the Gulf of Mexico, in the US states of Louisiana and Texas.

[64] "IEA Confirms Member Country Contributions to Second Collective Action to Release Oil Stocks in Response to Russia's Invasion of Ukraine" IEA, April 7, 2022, https://www.iea.org/news/iea-confirms-member-country-contributions-to-second-collective-action-to-release-oil-stocks-in-response-to-russia-s-invasion-of-ukraine.

[65] "Strategic Petroleum Reserve Inventory 2005," https://www.spr.doe.gov/dir/dir.html.

The US pioneered the idea of Strategic Oil reserves following the Arab oil embargo of 1973. This prompted the passage of the Energy Policy and Conservation Act, signed by President Gerald Ford in 1975 which among other measures established the Strategic Petroleum Reserve. The US has released oil from its strategic reserve in times of economic hardships, supply disruptions, and natural disasters. The latest release of oil, about one million barrels of oil per day for six months, is an attempt to limit the economic impact of Russian oil supply disruptions.

India

India began construction of its strategic petroleum reserve in the wake of the 1990 Gulf War and the subsequent Indian economic crisis that had brought India to the brink of default. While India was able to avert the financial catastrophe, it made the Indian policymakers realise the volatility of the global oil market and the need to secure their oil supply. As a result, the Atal Bihari Vajpayee government introduced the idea of a Strategic Petroleum Reserve.

Indian Strategic Reserves are located along its eastern and western coastline. The reserves are located in the underground caverns of Visakhapatnam (Andhra Pradesh) as well as in Mangalore and Padur (Karnataka). The details of the storage are as follow:

Location	**Storage (Million Metric Ton)**
Visakhapatnam	1.33
Mangalore	1.50
Padur	2.5

Combined, these locations have a strategic oil reserve of 5.33 MMT, which is enough to fulfil the daily Indian requirement for 9.5 days. Additionally, in June 2018, the Narendra Modi government announced plans to create an

additional storage of 4 MMT at Chandikhol, Odisha. Moreover, the reserve capacity in Padur is to be doubled to 5 MMT.[66]

This would bring India's storage reserve to 11.83 MMT, raising Indian strategic cover to 22 days.[67] The Indian refineries also maintain crude oil reserves of 65 days.[68] Thus, this brings the overall oil reserve of India to 87 days. This is near the benchmark set by the IEA, of which India is an Association Country.

China

China's oil requirement to feed its industrial growth stood at 16.2 million barrels per day (mbpd) in 2023, while its domestic oil production is only 4.3 mbpd.[69] This has resulted in China becoming a net importer of oil. Considering that China's main trading partners for oil are the Middle Eastern countries, and the increasing competition between India and China in the Indian Ocean Region as well as the strategic chokepoint of Malacca Strait, China is being forced to rapidly increase its strategic oil reserves.

China began the construction of its reserves in 2007.[70] The first phase of this project called for the construction of four facilities at Dalian (Liaoning Province), Qingdao (Shandong Province), Zhenhai (Zhejiang Province) and Zhoushan (Zhejiang Province). Combined these facilities have a storage

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[66] "Ministry of Petroleum and Natural Gas | Government of India - Ministry of Petroleum and Natural Gas," https://mopng.gov.in/en.

[67] "Why India Is Storing Crude Oil in Underground Caves, and Who Came up with the Idea," *The Financial Express*, June 29, 2018, https://www.financialexpress.com/policy/economy-why-india-is-storing-crude-oil-in-underground-caves-and-who-came-up-with-the-idea-1224902/.

[68] Utpal Bhaskar, "India to Leverage Low Prices to Fill Strategic Crude Oil Reserves," March 17, 2020, https://www.livemint.com/news/india/india-to-leverage-low-prices-to-fill-strategic-crude-oil-reserves-11584431985105.html.

[69] "China's Oil Production Boom Shouldn't Be Overlooked," *Bloomberg*, December 7, 2023, https://www.bnnbloomberg.ca/china-s-oil-demand-growth-seen-cooling-in-2024-as-recovery-fades-1.2008853.

[70] "More Oil Reserve Bases to Be Built," China News, July 19, 2007, https://www.chinadaily.com.cn/cndy/2007-07/19/content_5439011.htm.

capacity of 16.4 million metric tons. In its second phase, China planned to create 8 additional storages of up to 26.8 million metric tons. Thus, the storage at Dushanzi (Xinjiang Region) of 5.4 metric tons was created.[71] Additional storages were also set up as a part of the second phase at Huangdao (Shandong Province), Lanzhou (Gansu Province), and Tianjin Municipality. These planned storages raised China's reserves to 44 million metric tons or 281 million barrels.

China does not release official figures regarding the inventory of its strategic petroleum reserves. By some estimates, China's reserves stand at 55.2 million metric tons which is equivalent to 40 to 50 day coverage of their national demand.[72] Other estimates, however, consider China's coverage to be at 100 to 120 days of their peacetime imports.[73]

International Natural Gas Storage

Natural gas is one of the most important energy sources in the world. It accounts for nearly 25% of the global energy production.[74] Due to the fact, that it emits less carbon as compared to other fossil fuels, it is considered as a transition fuel from fossil fuels to renewables. In addition to energy production, natural gas plays a role in transportation, heating as well as chemical feedstock. The importance of this natural resource to a state's energy policy cannot be overstated. This has resulted in numerous nations around the world to develop strategic storages of natural gas.

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[71] "China to Build Third Phase Strategic Oil reserves," *Xinhua*, March 18, 2024, https://english.news.cn/20240318/ea4fdf3ea2634a35b12908aa8cc008fd/c.html.

[72] Air Marshal Anil Chopra, "China Leads In Petroleum Reserves While 'Arch Rival' India Catching Up In Both Shipping & Strategic Storage," October 26, 2022, https://www.eurasiantimes.com/china-leads-in-strategic-petroleum-reserves-while-arch-rival-india-lags/.

[73] "China's Energy Security: Strategic Petroleum Reserves - The China Sourcing Blog," August 2014, https://www.researchgate.net/publication/262975634_Chinas_energy_security_and_its_challenges_towards_2035.

[74] "Gas," IEA, June 14, 2023, https://www.hudson.org/energy/will-china-increased-oil-supplies-change-xis-taiwan-calculus-lewis-libby.

European Union (EU)

Natural gas is a critical resource for the 27 nations of the European Union. In 2022 alone, the EU consumed more than 350 billion cubic meters of gas.[75] This is mainly utilised in industrial use, power generation, and household heating. Prior to the Russia-Ukraine war, the EU had a steady import partner in the form of Russian Federation. For instance, in 2021, the EU imported 140 billion cubic meters (bcm) of natural gas and 15 bcm of LNG from Russia.[76] However, the situation drastically changed after the initiation of the conflict, with increasing European efforts to divest from Russian energy imports which were seen as a comprising factor in European energy security.

This resulted in the replacement of Russia as a trade partner by the EU in favour of Norway, the United States, and Qatar. Another impact of this conflict was the European Union's increasing focus on the development of natural gas storage. According to data from Gas Infrastructure Europe (GIE), an association of gas infrastructure operators in Europe, the EU has the capacity to store 117 bcm of natural gas.[77] In response to the invasion, the EU adopted the Gas Storage Regulation in June 2022.[78] These regulations called for refilling EU storage sites to 80% capacity by November 2022, and 90% in the following years. At the time of the passage of this bill, EU storage tanks stood at 55.7% of their designed capacity.

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[75] European Council, "Where Does the EU's Gas Come from?" https://www.consilium.europa.eu/en/infographics/eu-gas-supply/.

[76] "A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas – Analysis - IEA," March 3, 2022, https://www.iea.org/reports/a-10-point-plan-to-reduce-the-european-unions-reliance-on-russian-natural-gas.

[77] Kate Abnett et al., "Explainer: Could a 'strategic Reserve' Ease Europe's Gas Crisis?" Reuters, https://www.reuters.com/world/europe/could-strategic-reserve-ease-europes-gas-crisis-2021-10-06/.

[78] Stuart Elliott, "EU Council Adopts New Minimum Gas Storage Rules in Final Step of Approval," June 27, 2022, https://www.spglobal.com/commodityinsights/pt/market-insights/latest-news/natural-gas/062722-eu-council-adopts-new-minimum-gas-storage-rules-in-final-step-of-approval.

However, not all EU countries have gas storage facilities of their own. Germany, Italy, France, Netherlands, and Austria combined constitute nearly 67% of the EU's natural gas storage capacity. Under EU regulations enacted in November 2022, such states that do not have storage on their territory such as Ireland, Greece, and Slovenia will store 15% of their annual consumption in other states' stocks.[79]

India

The estimated reserves of Natural Gas in India as per a report by the Ministry of Statistics and Programme Implementation (MOSPI) are 1138.67 billion Cubic Feet.[80] However, in 2022 alone, India consumed about 7 billion cubic feet of gas per day. Of this, 70% of the total consumption was in the industrial sector followed by 17% in power generation.[81] This highlights the necessity of India to have a consistent supply of natural gas, especially with regard to its growing population and industrial growth.

In these circumstances, India is presently seeking to build natural gas strategic reserves in order to safeguard against any supply disruptions. The Ministry of Petroleum and Natural Gas has directed the Oil and Natural Gas Corp (OGNC), Oil India, and Gas Authority of India Limited (GAIL) to prepare a feasibility study for the construction of these reserves.[82] According to Sumit Kishore, an executive director at GAIL, these storages would have a storage capacity of 3-4 billion cubic meters and would be built in India's western and

[79] European Council, "How Much Gas Have the EU Countries Stored?" Reuter, January 1. 2023, https://www.reuters.com/graphics/UKRAINE-CRISIS/EUROPE-GAS/zdvxozxzopx/.

[80] Ministry of Statistics and Programme Implementation, "Chapter 1-Reserves and Potential for Generation."

[81] "Industry to Drive Tripling of Natural Gas Consumption in India by 2050 - U.S. Energy Information Administration (EIA)," February 14, 2024, https://www.eia.gov/todayinenergy/detail.php?id=61423#:~:text=In%20our%20International%20Energy%20Outlook,next%2Dfastest%2Dgrowing%20country.

[82] Choudhary, "Plans Afoot to Build Strategic Natural Gas Reserve," *The Economic Times*, November 20, 2023.

north-western states.[83] This is expected to cost nearly $1-2 billion. Presently, India does not possess any strategic natural gas storage, and its commercial storages stand at 2 billion cubic meters held in pipelines and LNG storage tanks.[84]

China

China's gas storage capacity in 2020, stood at 10 billion cubic meters which is equivalent to only 4 per cent of China's domestic consumption.[85] This is an alarming situation for Chinese policymakers who are cognizant of their growing dependence on imports. For instance, China's natural gas imports formed 46 per cent of the nation's total natural gas supply in 2021.[86] This reliance can prove to be a source of vulnerability for China which receives a significant portion of its natural gas imports via maritime trade with Australia, Qatar, and Malaysia.

So, in order to ensure energy security and actualise its green "coal to gas" initiative, the 14th Five-Year Plan given by China envisions that by 2035, the state's natural gas storage capacity will be 55-60 billion cubic meters. This is equivalent to 13 per cent of Chinese natural gas consumption. In the pursuit of this objective, China is aggressively pursuing multiple projects. PetroChina, which is the largest Chinese gas supplier, plans to create 23 underground storage facilities and upgrade a further 10 pre-existing facilities. This would raise China's storage capacity to 40 bcm. In addition to underground storage, China is also increasing its tank storage at LNG terminals. It is expected that

[83] "India May Use Old Hydrocarbon Wells to Store Natural Gas: GAIL Official," Reuter, November 24, 2023, https://www.ndtv.com/india-news/india-may-use-old-hydrocarbon-wells-to-store-natural-gas-gail-official-4602942.

[84] Ghosh, "Viewpoint: India Eyes Strategic Gas Storage Reserve," *Argus Media*, January 8, 2024, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2525293-viewpoint-india-eyes-strategic-gas-storage-reserve.

[85] Elena Qi, "China Looks to Boost Development of Gas Storage," April 16, 2020, https://www.icis.com/explore/resources/news/2020/04/16/10496721/china-looks-to-boost-development-of-gas-storage/.

[86] "China's Natural Gas Consumption and LNG Imports Declined in 2022, amid Zero-COVID Policies - U.S. Energy Information Administration (EIA)."

by 2030, China's LNG storage capacity at terminals will reach 24.5 bcm of gas.

Table: International Comparison of Reserves

Country	Reserves	*Oil*	*Gas*
USA	Commercial	97.104 MMT	--
	Strategic	Net Exporter	--
China	Commercial	40-50 days	10 BCM
	Strategic	55.2 MMT	24.5 BCM
India	Commercial	87 days	2 BCM
	Strategic	11.83 MMT	NO
E.U			117 BCM

Million Barrels (MB); Billion Cubic Meter (BCM); Million Metric Ton (MMT).

Strategic reserves, both oil and natural gas are an established phenomenon on the global stage. Their utility has become evident in recent years with the supply chain disruptions during the COVID-19 pandemic and the skyrocketing energy prices due to the Russia-Ukraine war. States around the world are becoming increasingly cognizant of the need for strategic reserves. There are observable attempts by multiple nations to construct strategic reserves of their own.

Pakistan's energy demand is expected to rise by nearly a third of its current requirement by 2030.[87] Coupled with Pakistan's geostrategic position, building strategic reserves appears to be the only viable policy position for Pakistan. The need for Pakistan to develop strategic reserves is expanded upon in the next chapter.

[87] "Pakistan Energy Demand Forecast 2021-2030", Ministry of Planning, Development and Special Initiatives.

Chapter 3
Need for Strategic and Commercial Storages

There are several reasons for Pakistan to build strategic and commercial oil and gas storages. Some of the important reasons are:

Addressing Short-Term Supply Chain Disruptions

Building strategic and commercial storages offers a buffer against any adverse eventualities or short-term disruptions in the supply chain. Massive disruptions in the global value chains risk increasing Pakistan's dependence on energy imports. These can arise from geopolitical challenges, such as heightened tensions in the Taiwan Strait or potential pathway blockage in the Persian Gulf. All these contribute to a shipment crisis obstructing consistent energy supplies into a country like Pakistan which has limited leverage to offset these disruptions.

The absence of strategic oil and gas storages leave energy-dependent nations such as Pakistan exposed to immediate energy shortages and unmet domestic and commercial demand at the heart of the country's economic security. For a country that is dependent on foreign resources for importing 80 per cent of oil[88] and around 25 per cent of gas (LNG),[89] the lack of storage capacity for maintaining reserves emerges as a serious vulnerability.

At present, the natural gas production in Pakistan is 3,390 Million Cubic Feet Per Day (MMCFD).[90] The constrained demand of gas in country is 5000 MMCFD, while, the unconstrained demand of gas is 7000 MMCFD. This gap varies in summers and winters; in winters[91] demand increases due to domestic

[88] Saghir, Executive Director Exploration, OGDCL…
[89] Saghir, Executive Director Exploration, OGDCL…
[90] Engineer Hussain Ahmad Siddiqui, "Running Out of Resources," *Dawn*, August 28, 2023.
[91] Saghir, Executive Director Exploration, OGDCL…

consumption and space heating requirements.[92] At the international stage, Pakistan is also a very modest procurement player and its dwindling foreign exchange reserves make it difficult to treat consistent oil and gas procurement as a cost-effective, long-term strategy.

At present, both of Pakistan's gas terminals are without any permanent storages, marking a major competitive disadvantage when compared to other regional economies. It is also worth noting that Pakistan's gas terminals are configured as Floating Storage Regasification Units (FSRU) terminals. FSRU are a terminal type which comes equipped with in-built storage, but cannot be scaled up to hold storage beyond a single cargo.[93] In effect, the current storage capacities for Pakistan are insufficient to offset sudden supply chain disruptions, underlining the merits of establishing strategic and commercial storages to overcome those constraints.

Constraints on Gas Imports

In the recent past, almost 75 per cent of gas demand was fulfilled through indigenous resources while 25 per cent of gas shortage was addressed through imported Liquefied Natural Gas (LNG).[94] The volume of current gas reserves are estimated at 18.3 trillion cubic feet.[95] The decision to address the increasing demand of gas through import of LNG was due to the availability of gas infrastructure in the country. At that time, it was thought to be a feasible option to import gas molecules rather than switching to other fuels.[96]

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[92] Aamir Khan, "Cooking crisis: Gas Shortage Continues in the Summer," *Express Tribune,* August 28, 2023.

[93] "Floating Storage and Regasification Units (FSRUs)," *ExxonMobil*, accessed February 5, 2024, https://www.exxonmobillng.com/-/media/project/wep/exxonmobil-lng/lng-us/pdf/110-fsru.pdf.

[94] Saghir, Executive Director Exploration, OGDCL. Also See "Pakistan Energy Outlook Report 2021-2030," Ministry of Planning, Development and Special Initiatives Government of Pakistan, March 2022, Islamabad.

[95] Pakistan's Oil and Gas Reserves Rise with Support from SIFC Facilitation, *Express Tribune*, September 15, 2024.

[96] Siddiqui, Chief Executive Officer, PARCO Pearl Gas Private Limited…

Currently, two government companies in Pakistan are working on LNG imports. One is Pakistan State Oil (PSO) and the other is Pakistan LNG Limited (PLL). PSO has signed a government-to-government contract with Qatar Gas for a period of 15 years at the rate of about 13.35 per cent of Brent crude.[97] PLL has shorter-term LNG contracts with Gunvor (Geneva, Switzerland) and Shell (London, UK). PLL is importing LNG at relatively low rates. Last LNG import prices by PLL were $2.20/MMBtu (5.74 per cent of Brent crude).[98]

On an average, about 11-12 cargoes are imported in a month. Almost 90 per cent of Pakistan's gas supply is emanating through Qatar. The import of gas signifies the need to support strategic gas storages in Pakistan to offset contingencies.[99]

Demand from Industry, Power Generation Sectors

In recent past, the major gas fields in the country including Sui (Dera Bugti, Balochistan), Mari (Daharki, District Ghotki Sindh), Qadirpur (near Ghotki, Sindh) have started to decline.[100] There have been studies by the Ministry of Petroleum on re-injecting gas into depleted oil fields but that is expensive and technologically demanding.[101]

Since gas is needed in industry and in power generation sectors, hence gas storages are vital for Pakistan's energy sector and economy. With gas storages, short-term disruption of supply can be addressed. Moreover, in case of an eventuality like geopolitical tensions or natural calamities, the country's industrial sector can be supplied gas through storages.[102]

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[97] Afia Malik and Hafsa Hina, "Natural Gas Prices in Pakistan," Chapter in *Gas and Petroleum Market Structure and Pricing,* ed, Afia Malik, (Pakistan Institute of Development Economics Islamabad, PIDE Monograph Series, 2021): 31.
[98] Malik and Hina, "Natural Gas Prices in Pakistan," 31.
[99] Siddiqui, Chief Executive Officer, PARCO Pearl Gas Private Limited…
[100] Saghir, Executive Director Exploration, OGDCL…
[101] Siddiqui, Chief Executive Officer, PARCO ...
[102] Siddiqui, Chief Executive Officer, PARCO…

The building of gas storages entails high costs. Another aspect that merits consideration is that the gas storages may not give Pakistan a market advantage or commercial profit. Thus, preference should be on small scale storages.[103]

A senior official at Fauji Oil Terminal & Distribution Company Limited (FOTCO) and Fauji Trans Terminal Limited (FTTL), Karachi, opines that opting for 'strategic investments' in terms of building storages is not a viable option, rather commercial maximization of existing storages can be a best alternate. According to him, Liquefied Petroleum Gas (LPG) storages can be built at FOTCO, the storages can be a substitute to LNG.[104] FOTCO handles 40 per cent of LNG imports (60 per cent of LNG imports are handled by ENGRO).[105] FOTCO has a jetty facility, and also has enough space to build another jetty on the lands of PQ as per international standards.[106]

Exploration of Oil & Gas Indigenously

The total exploration area in Pakistan is 243,000 square kilometers.[107] The exploration area is categorized into 10 geological boundaries. The geological boundaries define the different terrains of exploration sites. Each geological site has a distinct topography. The geological site in Sindh province is flat, whereas the exploration area in Balochistan is mountainous. The exploration techniques used in Sindh and Balochistan are different.[108]

OGDCL is responsible for 50 per cent of oil and gas exploration (upstream) in Pakistan. At present, around 94,000 square kilometers of area, i.e. about 45

[103] Siddiqui, Chief Executive Officer, PARCO...
[104] Adnan Samdani, General Manager Fauji Oil Terminal and Distribution Oil Company Limited (FOTCO) and Fauji Trans Terminal Limited (FTTL) Karachi, "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Ishtiaq Ali Mehkri, December 5, 2023.
[105] Samdani, General Manager FOTCO and FTTL Karachi…
[106] Samdani, General Manager FOTCO and FTTL Karachi...
[107] Saghir, Executive Director Exploration, OGDCL…
[108] Saghir, Executive Director Exploration, OGDCL…

per cent of total exploration area is being explored for oil and gas.[109] OGDCL produces 37,000 bpd of crude oil, which is 48 per cent of the country's total production. OGDCL also generates 900 MMCFD gas, which is 29 per cent of the total production. In addition, the organization produces 850 metric tonnes of the LPG per day, which is 37 per cent of the country's total production.[110]

Newly Discovered Energy Reserves in Khyber Pakhtunkhwa

On the exploration side, three new discoveries of oil and gas in Khyber Pakhtunkhwa are indicative of potential untapped energy reserves. The first discovery is in Wali area. The field has been named as 'Bettani Field'.[111] The field has the capacity to produce 1,000 barrels of oil per day.[112] In addition, the field will add up to 1.3 million cubic feet of gas to the national grid.[113] The supply of gas from Bettani field is to be fed into the Sui Northern Gas Pipeline Limited's (SNGPL) transmission system.[114] OGDCL was behind the discovery of Bettani field. The company plans to build two wells (Wali Deep No.1 and Wali Deep No.2) in field. With the wells operational, the production would enhance to 50 Million Standard Cubic Feet per Day (MMSCF/Day) with 3000 Barrels of Crude Oil (BBL). The production from Bettani field will lessen dependence on imported energy. During initial years, $43 million foreign exchange will be saved annually.[115]

The second oil and gas field has been discovered in Bannu West, in North Waziristan.[116] The 'Waziristan field' is the first ever gas and condensate

[109] Saghir, Executive Director Exploration, OGDCL…
[110] Mustafa, "OGDCL Discovers Huge Oil, Gas Reserves in KP."
[111] Saghir, Executive Director Exploration, OGDCL…
[112] "Lakki Marwat Oil and Gas Field Project Completed," *The Express Tribune*, June 20, 2023.
[113] "Lakki Marwat Oil and Gas Field Project Completed..."
[114] "Lakki Marwat Oil and Gas Field Project Completed..."
[115] "OGDCL Starts Oil, Gas Production from Wali (Bettani) Field," *Daily Times*, June 18, 2023.
[116] Saghir, Executive Director Exploration OGDCL...

discovery in North Waziristan area.[117] Mari Petroleum Company Limited (MPCL) was behind the discovery.[118] MPCL drilled an exploration well namely 'Bannu West-1' and made a gas discovery in Lockhart and Hangu formations, which has opened up the new exploration potential in the Kohat Plateau.[119]

A third oil and gas discovery is in Baska, near Dera Ismail Khan. Al Haj Enterprises Private Limited (owner Senator Taj) was behind the discovery.[120]

Oil Refining Sector

The oil refineries are meeting 55 per cent of the annual demand for petroleum products.[121] Around 70,000 barrels of local crude and condensate is utilized per day.[122] In addition to crude extracted from local explorations, imported oil is also refined at Pak Arab Refinery Limited-PARCO (located at Mahmoodkot, near Multan), National Refinery Limited-NRL (located in Karachi), Pakistan Refinery Ltd. (PRL) and Cynergyico (Hub).[123]

Attock Oil Refinery Limited-ARL, Rawalpindi (located in north of country) receives crude oil from the operative wells in Khyber Pakhtunkhwa and Potohar regions. The refinery has the capacity to refine, 53,400 barrels of oil per day. The refinery receives oil from 30 to 40 fields, and many of them are

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[117] "Hydrocarbon Discovery at Exploratory Well Bannu West-1 in Bannu West Block, KP," Mari Petroleum, accessed February 10, 2024, https://mpcl.com.pk/2022/06/01/hydrocarbon-discovery-at-exploratory-well-bannu-west-1-in-bannu-west-block-kp/.

[118] Saghir, Executive Director Exploration OGDCL...

[119] Zafar Bhutta, "Mari Seeks Early Production from Bannu Field," *Express Tribune*, September 11, 2022.

[120] Saghir, Executive Director Exploration OGDCL...

[121] "Govt Prepares New Oil Refinery Policy that Envisages Several Tax Exemptions," *Pakistan Today*, January 29, 2023.

[122] Govt Prepares New Oil Refinery Policy that Envisages Several Tax Exemptions.

[123] Munir Temuri, Assistant General Manager (Operations), Attock Oil Refinery Limited (ARL), Morgah, Rawalpindi, "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Ishtiaq Ali Mehkri, October 24, 2023.

of small capacities of up to 50/2000/10,000 bpd.[124] The ARL's operability often slows down due to the low level of production of oil in north, which is approximately estimated at 40,000 barrels per day. [125]

A senior official at ARL opines, "…the crude from South should be brought to ARL for processing." In order to enable ARL to operate at its optimum capacity, the crude oil from Sindh needs to be transported to ARL. In this regard, the Economic Coordination Committee (ECC) of the Cabinet had already allowed allocation of 5,000 barrels per day of condensate /crude oil from fields in Sindh to ARL which were earlier being exported.[126] The supply of crude from Sindh to ARL will save foreign exchange by reducing oil imports.

ARL refined product is supplied to all the major and emerging OMCs, including PSO, Shell, Attock Petroleum Limited (APL), and others. The refinery these days is facing challenges to sell the product to local consumers, primarily due to influx of smuggled product and excessive imports. According to the sales figures of last four months, the total petrol sales in ARL-fed areas including Khyber-Pakhtunkhwa, Gilgit-Baltistan, Azad Jammu & Kashmir and northern parts of Punjab stood at 148,600 tonnes in August 2023 against which ARL had offered 63,000 tonnes, but only 57,000 tonnes of the fuel was lifted by OMCs.[127] In September 2023, the total sales stood at 114,139 tonnes and ARL offered 54,000 tonnes but OMCs lifted only 43,000 tonnes.[128] In October total sales were 107,500 tonnes with ARL offering 69,000 tonnes while upliftment was only 39,000 tonnes.[129] Finally, in November 2023, total sales in the region amounted to 117,485 tonnes and ARL offered 71,000

[124] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi...
[125] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi…
[126] Khaleeq Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister," *Dawn*, December 9, 2023.
[127] Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister."
[128] Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister."
[129] Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister."

tonnes while OMCs lifted 51,400 tonnes only.[130] The same pattern was observed in High-Speed Diesel (HSD) supplies and upliftment as well. Thus, the refinery is facing challenges in disposal of its products due to low upliftment by OMCs which is further compounded by smuggling from Iran.[131]

The practice to prioritize imported oil over local product has led to a higher Inland Freight Equalization Margins (IFEM). As per the Rule 35(g) of the Pakistan Oil (Refining, Blending, Transportation, Storage and Marketing) 2016, "the local refinery production must take priority over imports."[132] Therefore, the OMCs should be directed to ensure prioritizing of local product over imports. This practice could ensure the optimum operations of all refineries.

Another aspect that needs correction is the equating of refineries with storage facilities. ARL can store up to 750,000 barrels of crude oil for about 15 days requirement to provide flexibility of operations for uninterrupted receipts from oil fields in case of any eventuality.[133] However, to enhance the storage facilities of crude oil, building of storage facilities alongside the oil wells should be considered as part of development of fields to ensure that adequate capacity is also available at site to handle any disruption in the supply chain.[134]

The oil refineries have to maintain a balance between incoming crude and refined product. This balance gets disturbed when oil prices fluctuate as OMCs manipulate supply chain according to expected prices in the next fortnight (prices fixed for 15 days).[135] In extreme situations, refineries end up

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[130] Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister."
[131] Khaleeq Kiani, "FBR, Interior Ministry Told to Crack Down on Rampant Oil Smuggling," *Dawn*, April 26, 2024.
[132] Kiani, "Attock Refinery on Verge of Closure, CEO Alerts Minister."
[133] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.
[134] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.
[135] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.

with huge stocks. When storages run to full capacity, refineries are thus forced to shut down refinery plants.[136]

Refineries in Karachi and southern parts of the country can delay shipments in case they have enough stocks. Refineries at times have to pay demurrages as ships are stranded owing to OMCs arm-twisting in lifting the product on the premise of unfavorable price index. In north, however, the refineries do not have the leverage of delaying procurement of crude (owing to demand requirements).[137]

Role of Regulator

OMCs at times sell their complete stocks, and do not buy from refineries due to price tag issues. In this way the OMCs manipulate the mandate of 20 days storage too. Here comes the role of regulator to keep the supply chain going. In order to control the impact of price fluctuation and exploitation by OMCs, and other dealers, the pricing policy should not be of 15 days rather, or the pricing should be rated on a daily basis, as is the case in India and the United States.[138]

Bonded Bulk Storage Policy

The bonded bulk storage policy by the government of Pakistan has allowed the international firms to build strategic storages in Pakistan by retaining big volumes of crude, and sell it to refineries on requirement.[139] The policy provides for foreign suppliers to maintain crude oil and product inventories in bulk within their own Customs Public Bonded Warehouses near Pakistani ports, and would function without payment of foreign exchange until the products are sold in the local market or re-exported.[140] There would be no restriction on the foreign supplier to register a local subsidiary too. The move

[136] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.
[137] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.
[138] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi.
[139] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi…
[140] Sohail Sarfraz, "Petroleum Products: Foreign Suppliers Allowed to Maintain Inventories in Bulk," *Business Recorder*, April 16, 2024.

would help address oil supply challenges, including those relating to foreign exchange and create an additional facility without any cost to the government as traders would arrange imports on supplier's credit compared to the letters of credit-based imports by major domestic companies. Under the above policy, oil companies around the world would be able to construct bonded warehouses for oil storage in various major cities and it would not just secure foreign exchange reserves for Pakistan, but also ensure the continuous availability of petrol and diesel in the country.[141]

Foreign companies storing petroleum and diesel in the bonded warehouses would register themselves in Pakistan, and would have to open their business accounts in local commercial banks.[142] The policy is likely to end the problem of dry-outs in the petroleum sector.[143] This policy to this day is not fully functional.

However, a divergent view on the bonded bulk storage policy is that the foreign companies might not invest in building of oil storages in Pakistan, due to high costs running in billions of dollars. Moreover, the presence of foreign oil companies will impact the domestic market dynamics of oil sector, especially the cushion capacity of OMCs.[144] Local importers clearly fear foreign monopoly in the bonded storage policy.

Lack of Infrastructure to Handle Oil Storages, Shipments and Transportation

Karachi Port Trust-KPT (Keamari) and Port Qasim (PQ) lack in infrastructure to handle large oil vessels. The ports can berth ships of 50,000 to 60,000

[141] "New Bonded Bulk Storage Policy to end dry-outs in Petroleum Sector: Musadik Malik," *Dawn*, June 28, 2023.
[142] "Import Guidelines for Foreign Suppliers of POL Notified," *The News International*, September 5, 2023.
[143] New Bonded Bulk Storage Policy to end dry-outs in Petroleum Sector: Musadik Malik.
[144] Temuri, Assistant General Manager (Operations), ARL, Rawalpindi…

tons.[145] Ships sailing in PQ discharge oil either in storages, or in White Oil Pipeline that goes up to Mahmoodkot.[146] PQ has storage facilities while KPT does not have storage facilities. The port constraints have hampered the storage possibility to a great extent.[147] The plan to build a seaport at Hub having storage facilities is essential towards pursuing a strategic oil storage capacity. Meanwhile, an efficient transportation mechanism of delivery needs to be in place for timely movement of the product which obviously would require building of pipelines.

Should Pakistan opt for Strategic Storages?

The concern over strategic storages emanates from the need to ensure uninterrupted supply of fuel to industrial sector, as well as defense. The strategic storages should have enough stock to cater for country's economic and defense needs in case of war, or calamities. Presently, 9 to 10 million tons of crude is refined by refineries, and the rest i.e., 10 to 12 million tons of oil is imported, along with some crude.[148]

Worldwide strategic storages are in crude form. In Pakistan, the practice to store crude oil might not be feasible in current circumstances due to less number of refineries in the country. Moreover, the existing refineries lack the capacity to refine large scale crude product. In addition, the building of strategic storages requires huge finances. In 2018-2019, a study conducted by PSO reflected upon the economic cost of storage buildup. The study underscored that buying oil cost is $2 billion while the storage construction cost is $12 billion.[149]

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[145] Asad Raza Faiz, General Manager, Strategic Consumer Business & Cards, Pakistan State Oil (PSO), Karachi, "IPRI-PIP Research Study (Pakistan's Energy Sector Need for Strategic and Commercial Storages)," interview by Ishtiaq Ali Mehkri, December 5, 2023.

[146] Faiz, General Manager, Strategic Consumer Business & Cards, PSO, Karachi…

[147] Faiz, General Manager, Strategic Consumer Business & Cards, PSO, Karachi…

[148] Faiz, General Manager, Strategic Consumer Business & Cards, PSO, Karachi…

[149] Faiz, General Manager, Strategic Consumer Business & Cards, PSO, Karachi…

Strategic storages are meant to ensure uninterrupted supply of fuel in emergency situations. Rising demand from the industrial and power generation sectors also makes it imperative to build strategic storages. Pakistan's bonded bulk storage policy enables international firms to build these storage facilities, allowing entities to avoid "dry-outs" in the petroleum sector.[150] Short-term supply chain disruptions – such as delayed imports due to maritime crises or geopolitical escalations – underscore the need for enough strategic storages to meet interim demands and offset sudden energy supply shocks. As highlighted in this chapter, Pakistan's import potential is also severely limited and the absence of substantial foreign exchange reserves puts new limits on consistent gas and crude imports. As such, strategic storages are critical to ensuring that Pakistan has enough stocks to offset crisis periods, including periods of high default risk or when foreign exchange reserves fall under the minimum import requirement.

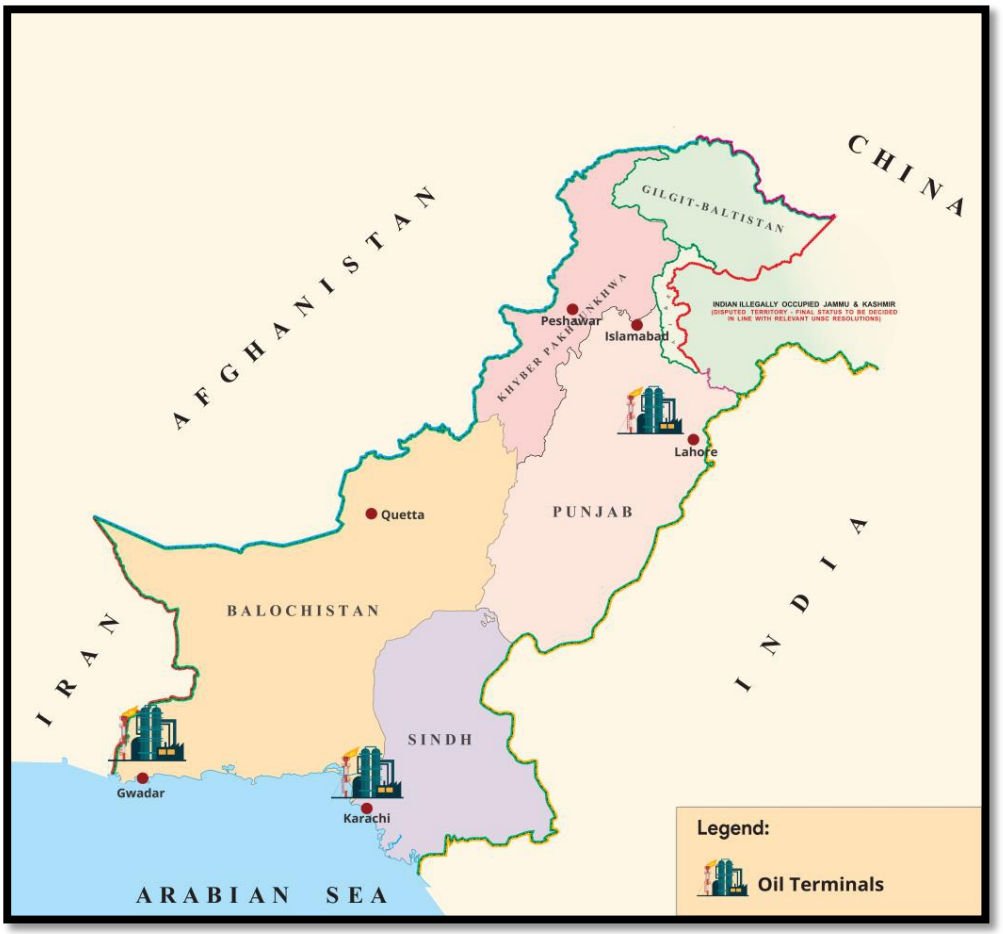
Steps towards Self-Reliance

Oil Refining

- Building refineries and oil terminals in coastal areas by shortening the transmission distance of imported crude oil, and reducing investment in ancillary facilities of refineries, such as pipelines.
- New fiscal and taxation policies to attract foreign capital.
- Introducing foreign advanced technologies, and upgrading the construction of large-scale oil refining and chemical facilities in the coastal areas.

[150] New Bonded Bulk Storage Policy to end dry-outs in Petroleum Sector: Musadik Malik.

Oil Terminals



Source: *IPRI (2025)*

Construction of oil and gas import infrastructure

- Single point mooring near the coastal refineries are required to avoid the berthing of large oil tankers at the ports and reduce the transmission distance.

- To enhance storage facilities and to ensure timely transportation, more LNG terminals should be built near Karachi.

Regional Energy Pipelines

- TAPI will help bring in 13.8 billion cubic meters of gas from Turkmenistan.[151]
- Iran-Pakistan Gas Pipeline will carry only 8.7 billion cubic meters of gas per year.[152]
- TAPI and IP pipeline projects have been delayed over the years, due to the geo-political situation of the region. The completion of both projects may be unlikely due to some participating countries facing sanctions.

[151] "TAPI Pipeline to Help Address Energy Shortages in Pakistan," Asian Development Bank (ADB), accessed February 18, 2025, https://www.adb.org/news/tapi-pipeline-help-address-energy-shortages-pakistan#:~:text=The%20agreement%20will%20pave%20the,(TAPI)%20natural%20gas%20pipeline.

[152] "Iran, Pakistan Agree to put Gas Pipeline on Fast Track," *Tasnim News Agency*, December 10, 2023, accessed February 19, 2025, https://www.tasnimnews.com/en/news/2013/12/10/216350/iran-pakistan-agree-to-put-gas-pipeline-on-fast-track.

Turkmenistan–Afghanistan–Pakistan–India (TAPI) and Iran- Pakistan (IP) Gas Pipeline

Sources:

IPRI (2025)

TAPI Gas Pipeline Project (TAPI), Inter State Gas Systems (ISGS), accessed April 18, 2025, https://www.isgs.com.pk/index.php/tapi-gas-pipeline-project-tapi/

Iran Pakistan (IP) Gas Pipeline Project, Inter State Gas Systems (ISGS), accessed April 18, 2025, /www.isgs.com.pk/index.php/iran-pakistan-ip-gas-pipeline-project/

Accelerating Oil Pipelines Construction

- Completion of the Machike-Thallian-Taru Jabba White Oil Pipeline (477 kilometers)[153] is expected to improve the efficiency and safety of oil transportation in the country. The White Oil Pipeline will also reduce traffic congestion and environmental pollution. The Pipeline will connect Punjab from Machike, near Lahore, to Taru Jabba, near Peshawar.[154] The initial capacity of pipeline is 7 MTPA (Million Ton per Annum) and will be expandable to 10 MTPA.[155]

[153] "Signing of MoU for Machike-Thallian-Tarujabba White Oil Pipeline Project," Special Investment Facilitation Council (SIFC), February 15, 2024, accessed February 10, 2025, https://www.sifc.gov.pk/success_stories/details/35.

[154] Israr Khan, "PSO, FWO Sign Deal for 427-km White Oil Pipeline Project," *The News International*, February 15, 2024.

[155] "Signing of MoU for Machike-Thallian-Tarujabba White Oil Pipeline Project."

Oil Pipeline Project

Source: *IPRI (2025)*

- An Inter-Governmental Agreement (IGA) was signed on 16th October 2015 between the Russian Federation and Pakistan for development of the NSGP Project having transmission capacity of 1.2 BCFD from Karachi to Lahore.

North-South Gas Pipeline Project

- A MOU was signed on 9th April 2018 between Power China International Group Limited (PCIGL) and Inter-State Gas Systems (ISGS) to build the North-South Gas Pipeline Project (NSGPP).[156] The project will help in reducing costs of petroleum products currently being transported via road from refineries in southern parts and also ensure uninterrupted supply.
- In August 2021, Pakistan and the Russia signed an amended Inter-Governmental Agreement (IGA) for North South Gas Pipeline (NSGPP). As per the IGA, the NSGPP has been renamed as the Pakistan Stream Gas Pipeline (PSGP).[157] Moreover, a Special Purpose Vehicle (SPV) was to be installed within 60 days of signing the protocol to implement the project. The IGA also redistributed the equity distribution of the project with Pakistan retaining a 74 per cent stake and Russia having 26 per cent equity. The PSGP has encountered delays, and its construction has not commenced.[158] The project has faced multiple postponements since with various factors contributing to the setbacks, including negotiations over equity distribution, compliance with international sanctions, and the Russia-Ukraine conflict.

[156] "Pakistan, China Ink MoU on Gas Pipeline, Refinery," *The News International*, April 9, 2018.

[157] "North South Gas Pipeline Project: Pakistan, Russia sign amended IGA," *The New International*, May 29, 2021.

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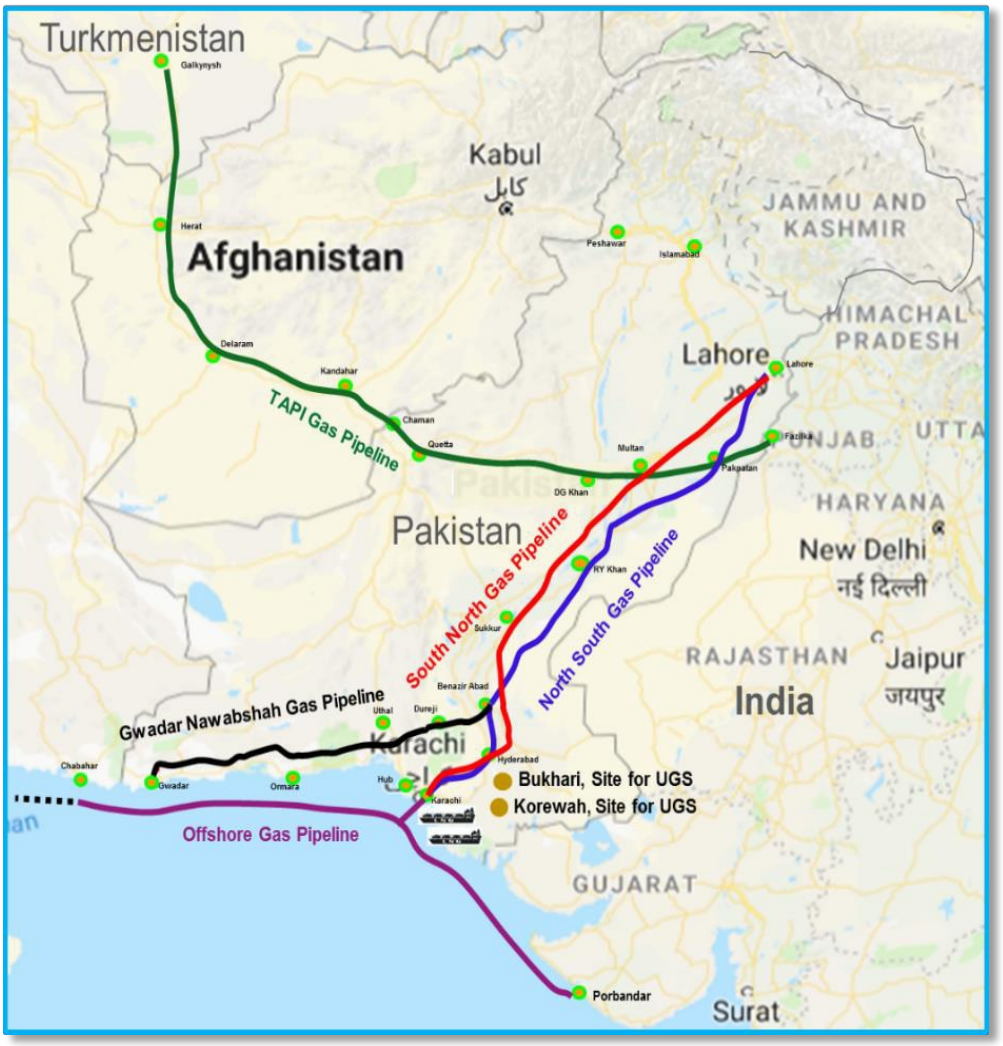

Source: *Development Plan for Pakistan Oil and Gas Industry 2020, Ministry of Energy (Petroleum Division), Government of Pakistan, 53, accessed April 15, 2025, https://petroleum.gov.pk/SiteImage/Misc/files/1389(20)Development%20Plan%20New%20Mail%20on%2011-11-2020%20(2nd%20Draft).pdf*

Seismic Surveys

- Seismic data will help in better understanding the subsurface structure in geological terms. Thereby, exploration companies may benefit, especially in frontier areas, which may lead to investment in drilling as well.

Keamari Korangi Link Pipeline KKLP 2

- PSO plans to construct and connect Keamari to Korangi Link Pipeline (KKLP-2), as the latter is already connected to White Oil Pipeline (WOP) at Port Qasim through PAPCO's Korangi to Port Qasim Link Pipeline (KPLP-1).[159] The project is of strategic importance as it connects the two main commercial sea ports of Pakistan. The project will enhance flexibility of import operations and reduce congestion at FOTCO jetty, whilst optimizing the use of Keamari Port. It will also reduce tank-trucks movement through the busy streets of Karachi.

[159] "Development Plan for Pakistan Oil and Gas Industry 2020," Ministry of Energy (Petroleum Division), 70, accessed January 12, 2025, https://petroleum.gov.pk/SiteImage/Misc/files/1389(20)Development%20Plan%20New%20Mail%20on%2011-11-2020%20(2nd%20Draft).pdf.

Chapter 4
Conclusions and Recommendations

Conclusions

Pakistan's indigenous energy resources are scarce, fostering import dependency. This aspect directly impacts the country's national security as any severe energy crisis could adversely impact the overall functioning of the state. Due to lack of storage capacity, Pakistan is constrained to regularly purchase oil and gas at market rates which adds to the financial burden on the country due to market volatility.

Pakistan is heavily dependent on imported fuels (Oil and Liquefied Natural Gas), and this reliance is likely to continue for a long time, unless it taps new Oil & Gas reservoirs, or shifts its energy consumption to renewables. It is estimated that local Oil and Gas fields will be exhausted in a decade or so based on projected consumption levels, and the pinch is already being felt in terms of rapidly depleting gas wells, necessitating the import of expensive LNG. In addition to aggressively exploring the new Oil & Gas reserves, Pakistan should quickly upgrade and enhance its refining capacity in order to increase both the quality and quantity of the refined products being produced by the oil refineries in the country, and reduce import of refined fuels, which are more expensive compared to Crude oil.

Pakistan presently does not have any strategic oil or gas storages unlike many developing as well as the developed countries, which have built large storage capacities for crude oil and / or gas, funded by the state and professionally managed on a commercial basis by state-owned organisations set up for this specific purpose. These stocks are used as buffers to efficiently manage the supply chain and minimise price volatility for consumers. Few examples of countries with robust strategic storages (oil and / or gas) are USA, India, China, Mexico, Germany, Russia, Ukraine, and several EU countries.

Currently Pakistan relies solely on commercial storages which are owned mainly by Oil Marketing Companies, which are almost all private organisations, with the exception of Pakistan State Oil. In addition, the refineries have storages for small quantities of crude and finished products.

From a strategic perspective, this is not a sustainable situation as private organisations are focused on their own commercial interests, and do not have the larger public good as a core guiding principle. In addition, they can shut down and exit the market as well, creating uncertainty and volatility in the energy supply chain that a growing economy cannot afford.

The commercial entities can continue to build storages in line with their business needs, but the country cannot depend on them for strategic storages, an aspect for which the Government of Pakistan should take the responsibility.

The current 'Explosives Rules' need to be revised in line with the current global best practices. This measure alone can significantly improve the fuel storage capacity by repurposing and expanding several unused storages.

In addition to creating and managing the strategic storages, it is imperative that the rest of the supply chain infrastructure be upgraded and modernised. A critical part of this is the port infrastructure that has been severely degraded over the last few decades and needs large investments urgently to improve reliability and build capacity to ensure that it can fulfill the requirements of a growing economy.

The challenge, of course, is that this upgrade needs to be done during the continued operation of all the port facilities as the fuel supply chain has to continue to run smoothly and cannot be shut down.

Recommendations

Oil Storages

- The GOP needs to set up a dedicated entity that builds crude oil storages and procures, stores, and sells the product to the refineries as a buffer against global price volatility, and other supply disruptions. This can be financed through an additional levy on Petroleum products.
- Explosives rules need to be modernised to enable the repurpose of existing unused storage (Furnace Oil) for storing other petroleum products.
- Restrictions on construction / expansion at current port areas need to be removed.
- Utilise the expertise of a credible body to conduct a thorough survey of the coastal regions in Pakistan. The primary objective is to employ advanced geological techniques to identify and meticulously survey the existence of subterranean storage caverns.
- Strategic storage infrastructure should be scattered throughout the country in order to reduce dependence on coastal areas.

Port Infrastructure

- Infrastructure must be upgraded, and new technologies introduced for smooth and efficient disembarkation of oil from berthed vessels, along with construction of new storages and jetty/piers.
- Night navigation facilities.
- Dredging to increase the size of ships that can berth.
- An oil import facility in Hub and one near Gwadar may be explored as a strategic option to diversify supply sources, especially in the event of blockade of existing terminals.
- A Single Point Mooring (SPM) option would be a better option than a permanent terminal infrastructure for the import of oil.

- A pipeline would, however, be needed to transport oil from SPM facility to the national grid.
- A new jetty also needs to be developed at Port Qasim, which should be connected to the existing oil jetty at PQA.

Transportation & Connectivity

- Investment in pipelines to improve efficiency, safety, and connectivity is essential. Some of the recommended pipelines are:
  - A white oil pipeline from Machike to the Northern consumption centres, reducing the need for road transportation.
  - A pipeline linking KPT and Port Qasim to increase flexibility and security of supply, and reduce vessel turnaround times at the ports.
- Investing in Railway infrastructure to enable oil transportation by rail. This adds flexibility to the supply chain and is cheaper than road transportation.
- The Hub area should be developed as an oil port and storage location, with connectivity to the other ports as well as the white and black oil pipeline networks.

Gas Storage Infrastructure

- Strategic LNG storages are desired at Port Qasim which presently is home to LNG terminals and distribution pipelines. This will enable safe and efficient discharge of LNG into storages and onwards transportation through SSGC network already available at Port Qasim.
- There is a need to construct a land-based gas terminal to overcome the reliance on FSRUs.
- Increase capacity to handle more LNG imports by considering the future demand of natural gas in the country and depleting indigenous gas reserves, including FSRU units, and additional infrastructure, along with a new jetty and pipelines in coastal areas of Pakistan.

- The excess capacity in PGPCL terminal may be utilised through third party access arrangement to encourage private sector's participation in the LNG sector, besides reducing the government's financial liabilities and ensuring diversification of supply sources.■

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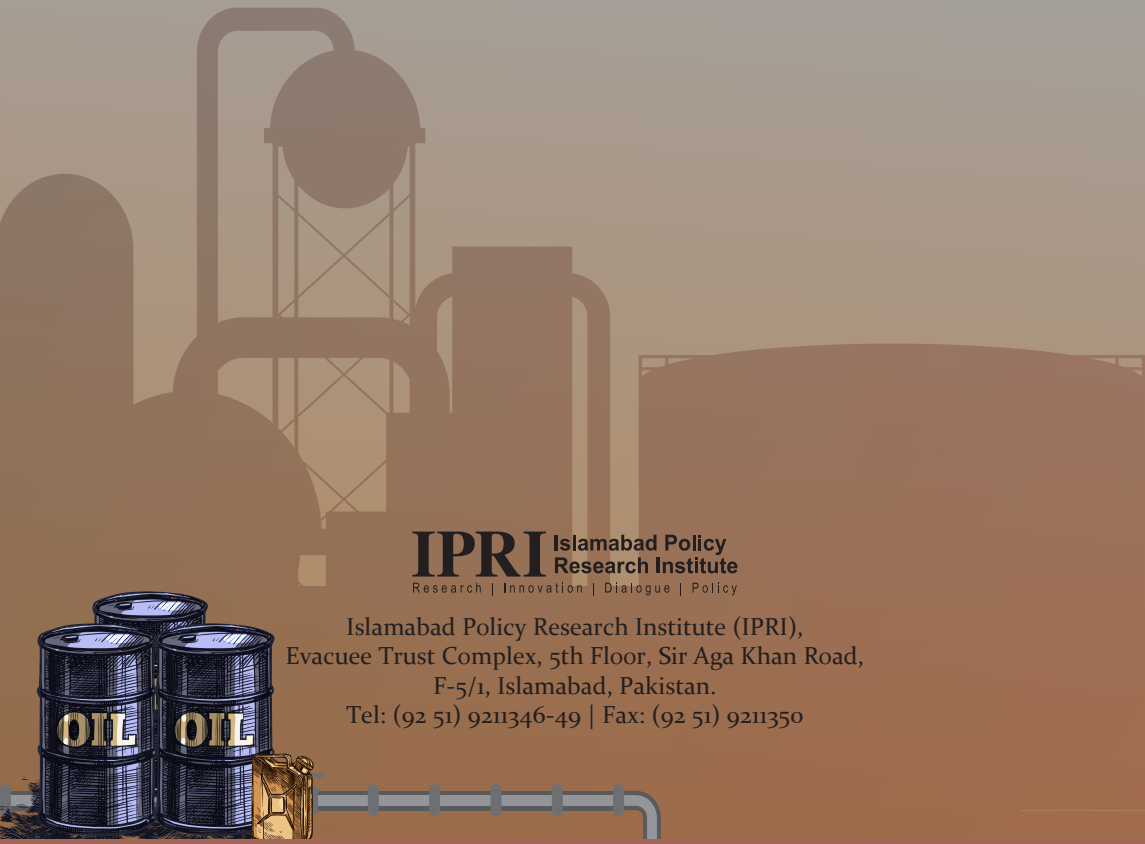

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