



Rising LNG Dependence in Pakistan Is a Recipe for High Costs, Financial Instability, and Energy Insecurity

The Shift From Domestically Produced Gas to LNG Warrants a Rethink of Gas Sector Regulation and Energy Priorities

Executive Summary

Pakistan's increasing dependence on imported liquefied natural gas (LNG) is exacerbating energy insecurity and financial struggles in the country's energy sector.

Natural gas has historically played a large role in Pakistan's economy, but as domestic production declines, policymakers are increasingly looking to replace lost production with LNG imports. As a result, Pakistan meets many of the criteria for optimistic LNG demand growth scenarios, including rising demand, a diversified gas end-user base composed of various economic sectors, and a dense and growing network of transmission and distribution pipelines.

However, plans for an expanded role of LNG in the country's primary energy supply have turned into an economic and energy security disaster.

LNG suppliers have repeatedly failed to deliver contractually obligated volumes, which, in some cases, has left the country without fuel or power.¹ Power and fuel shortages have directly impacted the economic productivity of domestic firms.²

Moreover, LNG sourced from global markets has recently been 5-10 times more expensive than domestically produced gas. Extreme volatility of LNG prices over the past two years has undermined energy sector planning and exposed the government to ongoing budgetary risks.

Often hailed as a "bridge fuel" to cleaner, cheaper energy sources, LNG has instead caused Pakistan to rely more heavily on dirtier, more polluting fuels when natural gas prices spike, such as cement factories buying coal from Afghanistan as prices surge.³

¹ Bloomberg. [Cash-Strapped Pakistan Cuts Power to Households on Fuel Shortage](#). April 18, 2022.

² The Business Standard. [Natural gas shortage leads to Pakistan losing 20% of vital textile exports](#). January 3, 2022.

³ Bloomberg. [Pakistan's Energy Crunch Spurs 'Barter' Trade for Afghani Coal](#). March 28, 2022.

LNG prices are expected to remain high and volatile for the next several years.⁴ The high cost of gas has shed new light on many of the pre-existing issues with the country's gas system. These problems include final tariffs that are not reflective of gas costs, inefficient cross-subsidization of gas tariffs, and high volumes of unaccounted for gas (UFG) that are lost in transportation through the network.

As more LNG is injected into Pakistan's gas system, these issues are likely to worsen significantly. Circular debt—chronic cash flow shortages caused by accumulation of delinquent accounts payable between buyers and sellers which have historically plagued Pakistan's power sector—is now rampant in the gas sector.

The high financial burden of LNG, whose spiking commodity cost is exacerbated by required payments in U.S. dollars, is likely to have ripple effects throughout the economy: the government budget, household energy bills, investor confidence in the energy sector, and the productivity of key economic sectors like textiles and fertilizers.

Key Findings of This Report Include:

- **Reliance on LNG has exacerbated energy insecurity in Pakistan.** Over the last two years, LNG suppliers under contract with Pakistan have defaulted on at least 11 LNG cargoes. As a result, Pakistan has been forced to source LNG volumes via emergency tenders, which have either yielded exorbitant prices or no bids at all.

Suppliers face a large financial incentive to default on contracted cargoes when prices are higher in spot markets elsewhere, even if a penalty exists in the contract.

LNG supplies to Pakistan are therefore highly unpredictable, despite the existence of long-term contracts. IEEFA estimates that based on the difference between Asian LNG spot prices and the publicly available pricing formulas of term contracts, total profits realized by defaulting suppliers could have reached nearly US\$400 million from August 2021 to February 2022. This does not include one supplier's more recent default on four contractually obligated cargoes.

- **LNG delivered to Pakistan has recently been up to eight times more expensive than domestically-produced gas.** A recent tender by Pakistan LNG Limited (PLL) yielded a price of US\$30 per million British thermal unit (MMBtu), which is far above average domestic wellhead prices averaging US\$3.50-4.00/MMBtu.

On a weighted average basis, prices of LNG delivered to end-users in Pakistan have reached US\$16 per million British thermal unit (MMBtu), or more than four times average domestic wellhead prices. Ultimately, the

⁴ IEEFA. [For price-sensitive LNG buyers in Asia, now is not the time to build new LNG import terminals](#). March 31, 2022.

higher costs of imported LNG will be distributed among actors in Pakistan's gas value chain and wider economy.

- **LNG procured through emergency tenders have been significantly more expensive than undelivered contract volumes.** IEEFA estimates that since late 2021, each emergency LNG cargo cost Pakistan on average US\$58.57 million more dollars than cargoes that would have otherwise been delivered under existing long-term contracts.
- **LNG prices in spot markets are expected to remain elevated until the middle of this decade.** There is wide consensus that global LNG markets are expected to remain tight for the next several years,⁵ given that significant new LNG supply capacity is not expected online until 2025-2026. With European demand for non-Russian LNG rising in the wake of the Russian invasion of Ukraine, price-sensitive countries like Pakistan may continue to be priced out of LNG markets, unable to compete with European and North Asian buyers.
- **Pakistan's LNG import bill could increase rapidly over the next decade.** IEEFA estimates that growing LNG imports in Pakistan could raise the country's LNG import bill to more than US\$32 billion by FY2030, up from nearly US\$2.6 billion in FY2021. LNG supplies will require recurring, foreign currency-denominated payments that could result in currency depreciation during times of high fuel prices. Depreciation of the Pakistani rupees hinders the country's ability to service existing foreign currency-denominated debt or obtain new loans.⁶
- **LNG is rapidly exacerbating circular debt in the gas sector.** Prior to the onset of LNG imports in Pakistan, the payables and receivables on gas distribution company balance sheets were at manageable levels.

Once LNG imports began, however, gas distribution companies have been unable to repay fuel suppliers. This is due to high LNG costs and technical inefficiencies in the gas network, and growing delinquent receivables from customers either unwilling or unable to pass on the full cost of the LNG-blended supplies.

The total payables of gas distribution companies have ballooned to US\$4.32 billion (PKR812 billion), according to their most recent financial statements.

- **Injecting more expensive LNG to the gas network will significantly increase the value of financial losses due to UFG.** UFG in Pakistan is roughly eight times more than the global average. Based on the share LNG in Pakistan's total gas consumption, and the average domestic wellhead and LNG import prices in FY2020, IEEFA estimates the total annual value of UFG

⁵ World Bank. [Food and Energy Price Shocks from Ukraine War Could Last for Years](#). April 26, 2022.

⁶ IEEFA. [Emerging Asia's unrealistic LNG-to-power project pipeline threatens macroeconomic and financial stability](#). December 15, 2021.

to be US\$543.92 million. If all of this gas came hypothetically from LNG, the total volume of UFG lost annually would translate to roughly the equivalent of 38 cargoes of imported LNG. For perspective, Pakistan imported 132 cargoes in 2021.

Expanding LNG capacity in Pakistan will not resolve the country's energy security problems. Instead, increased dependence on LNG is likely to intensify the financial unsustainability of the energy sector.

Pakistan's energy sector issues are unique in their complexity and interconnectedness. There will be no one-size-fits-all solution. However, IEEFA recommends the following suite of actions be considered in the short, medium, and long terms to mitigate the financially unsustainable increase in LNG demand.

These actions are discussed in greater detail in the body of the report:

- Optimize LNG procurement strategies to manage volatility and non-delivery risks.
- Reform tender processes for LNG.
- Reform gas distribution company revenue regulations through performance-based mechanisms.
- Focus on energy demand, not supply, by rapidly scaling up energy efficiency programs and rationalizing tariffs.
- Maximize utilization of existing LNG terminals before constructing new ones.
- Reduce gas demand in the power sector first by accelerating new utility-scale and behind-the-meter renewable energy and battery storage generation projects.
- Begin to develop capabilities to transition non-power sectors from gas/LNG reliance, through alternative energy sources such as biogas and hydrogen.

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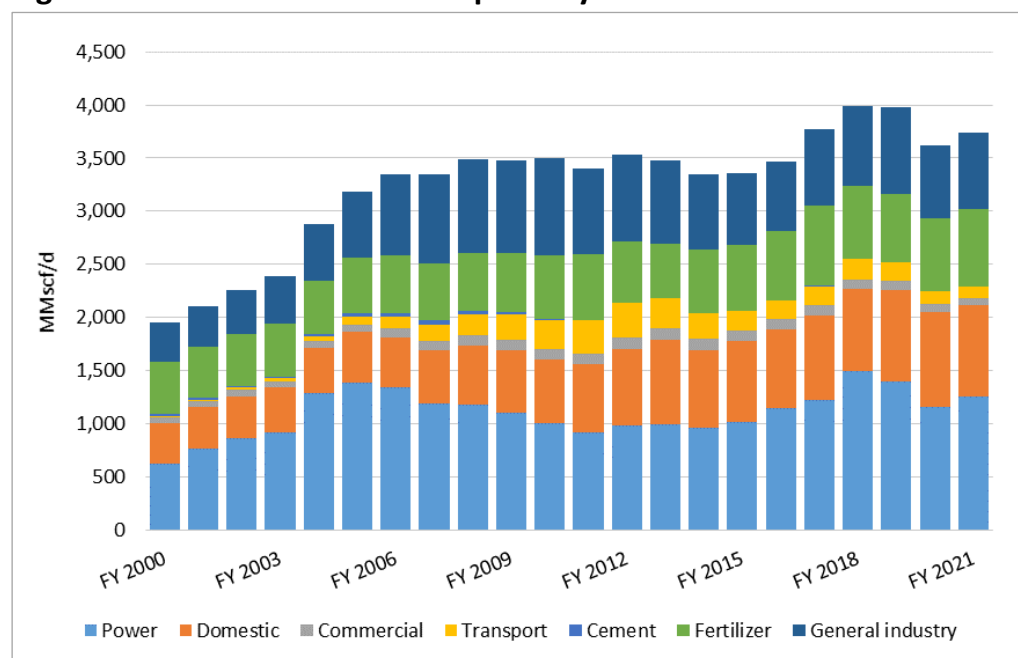
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Pakistan's Gas and LNG Market Overview

Natural Gas Demand

Pakistan's natural gas consumption reached 41.2 billion cubic meters (Bcm) in 2020, distributed mainly among the power (32%), residential (24%), industrial (19%), and fertilizer (19%) sectors.⁷ Notably, the domestic sector accounts for an increasingly large share of gas demand.

Figure 1: Pakistan's Gas Consumption by Sector



Source: IHS Markit, Pakistan Economic Survey.

In the power sector, 15.94 GW of installed LNG and natural gas-fired power capacity currently provides over 47 GWh of generation, or roughly 35% of total electricity consumption. In addition to use for power generation, natural gas is also an important raw material for export-related industries, such as the textile sector. The fertilizer sector is also highly dependent on natural gas as a fuel and feedstock.

Since most of Pakistan's domestic gas is produced in Sindh province, industries there are offered gas at lower prices than the rest of the country. The textile industry in Sindh pays between US\$4.47-5.90/MMBtu.^{8 9} By comparison, the textile sector in Punjab pays a much higher rate of US\$9.00/MMBtu, since industry gas

⁷ PACRA. *Gas Distribution – Sector Study*, p. 10. June 2021.

⁸ Business Recorder. *Higher gas/RLNG rates: Punjab-based textile industry to resist govt move*. November 09, 2021.

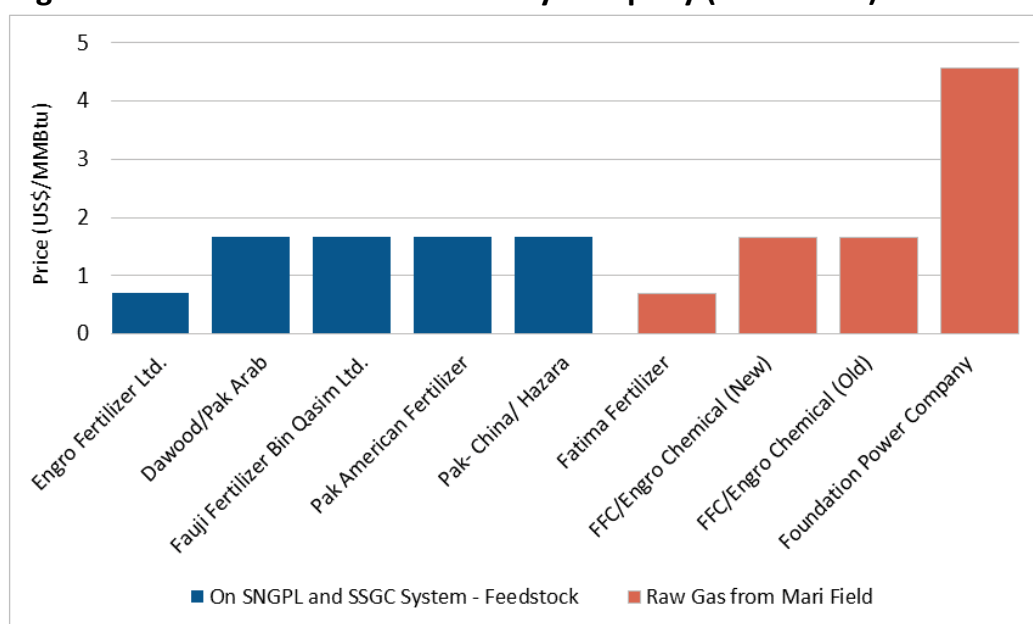
⁹ Pakistan Institute of Development Economics. *Regionally Competitive Energy Tariffs and Textile Sector's Competitiveness*. March, 2021.

needs are met by a larger share of imported LNG.¹⁰

To incentivize investments in the fertilizer sector, the government announced a policy in 2001 offering new fertilizer production facilities subsidized natural gas rates as low as \$0.70/MMBtu for feedstock.

The rates were initially anticipated to last just two years, but some companies—including Fatima Fertilizer and Engro Fertilizer—managed to get their rates extended until June 2021.¹¹ Other fertilizer plants pay US\$1.66/MMBtu (PKR 300) for feedstock and US\$5.65/MMBtu (PKR 1,021) for fuel (see Figure 2 below).¹²

Figure 2: Fertilizer Feedstock Rates by Company (2019-2020)



Source: Pakistan Energy Yearbook, 2020.

Natural Gas Supply

Domestic gas production rates and proved reserves are declining, hastening a shift to LNG. Annual domestic gas production has declined steadily since 2012 (see Figure 3 below). Proved reserves have also fallen from a peak of 23.9 trillion cubic feet (Tcf) in 2006 to 13.6 Tcf in 2020, which could last another 12.6 years at the country's current rate of production.¹³

Declining annual domestic gas production is expected to continue due to a wave of divestments in exploration and production (E&P) activities by major international

¹⁰ The News. [Gas tariff for textiles jacked up 38.46 percent](#). November 13, 2021.

¹¹ The Business Tribune. [Government decides to end low gas tariffs for Fatima, Engro Fertilizer Cos.](#) February 8, 2021.

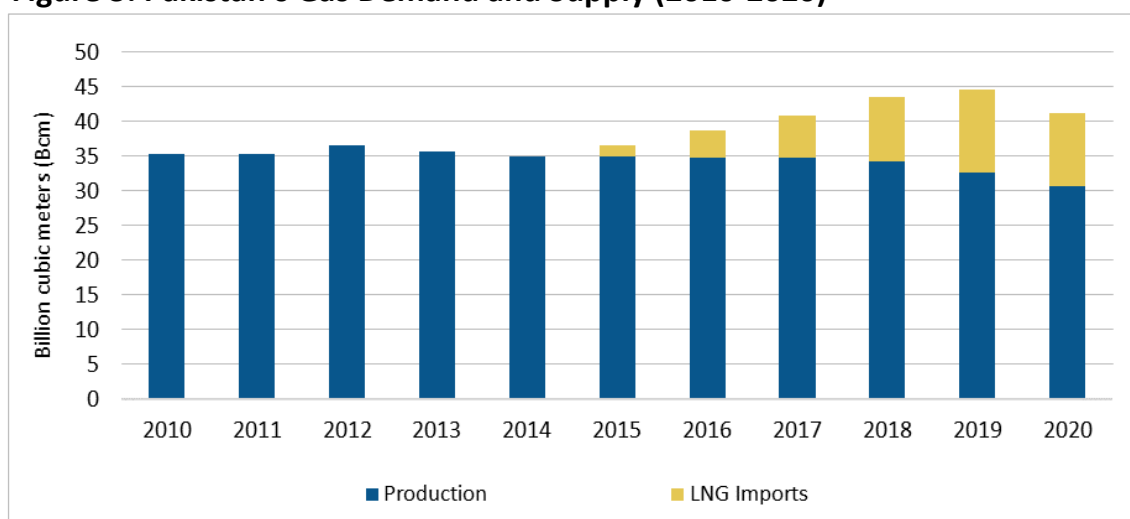
¹² Pakistan Ministry of Energy, Hydrocarbon Development Institute of Pakistan. Pakistan Energy Yearbook. 2020.

¹³ British Petroleum (BP). Statistical Review of Energy 2021, p. 34. 2021.

oil companies (IOCs).

For example, after a series of unsuccessful exploration efforts, Italian oil major Eni announced an agreement in March 2021 to divest its E&P assets in Pakistan to a newly established company, Prime International Oil & Gas Company. Australia's BHP and Austria's OMV divested in upstream assets in Pakistan in 2015 and 2018, respectively.¹⁴

Figure 3: Pakistan's Gas Demand and Supply (2010-2020)



Source: BP Statistical Review of Energy.

To import LNG, the country commissioned the 4.8-mtpa Engro Elengy import terminal in 2015, followed by a second 5-mtpa terminal in 2018 owned by Pakistan GasPort Consortium Ltd. (PGCL). Both terminals are offshore floating storage and regasification units (FSRUs) underpinned by guaranteed offtake agreements from the government.¹⁵ In 2020, Pakistan imported 7.4mtpa of LNG (see Figure 4 below), and the government has previously claimed that imports would reach 30mtpa by 2022.¹⁶

¹⁴Upstream Online. [Italian giant Eni streamlines its upstream portfolio](#). March 10, 2021.

Reuters. [BHP agrees to sell Pakistan gas business](#). February 15, 2015.

Euro-Petrole. [OMV closed the divestment of OMV Pakistan](#). June 29, 2018.

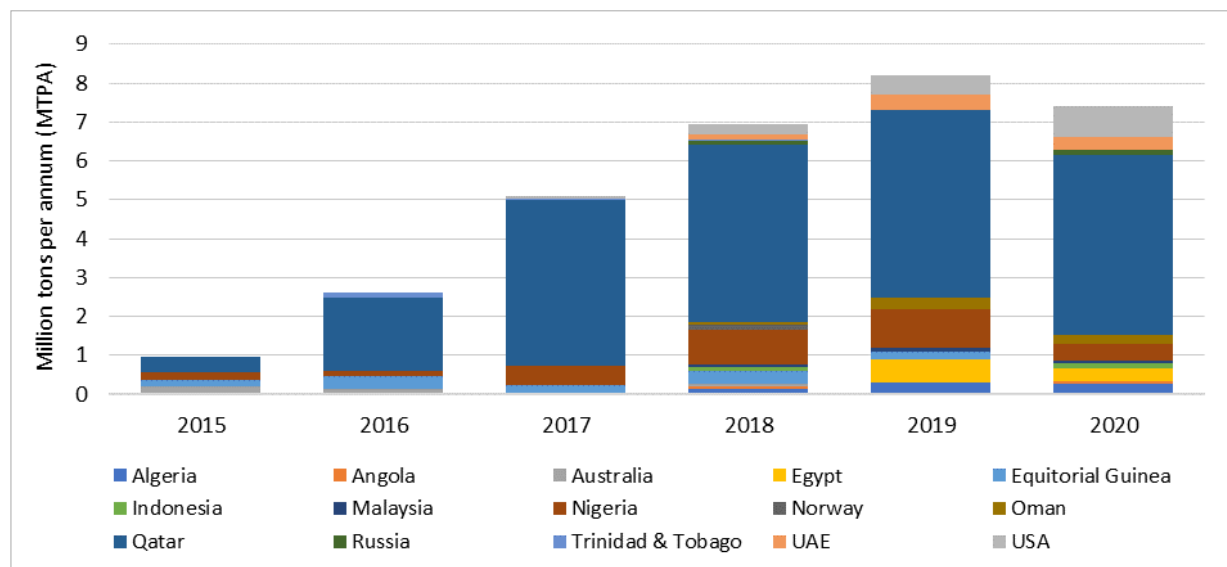
¹⁵ For example, state-owned gas transmission and distribution company SSGC reached a take-or-pay arrangement with the Engro's Elengy Terminal, in which SSGC initially paid a tolling fee of US\$0.66/MMBtu to Engro's wholly owned Elengy Terminal Pakistan subsidiary. The toll was comprised of capacity fees (US\$272,479/day during year one, decreasing to US\$228,016/day in year two until the end of the contract in year 15) and utilization fees (fixed at US\$0.063/MMBtu over the contract period). In 2017, both parties agreed to a downward revision of the final tolling fee to US\$0.479/MMBtu. Pakistan Today Profit. [EETL and SSGC revise LNG deal](#). March 9, 2017.

Independent Commodity Intelligence Services (ICIS). [Pakistan fast-track FSRU receives breakthrough endorsement](#). March 6, 2013.

¹⁶ Offshore Energy. [Pakistan's LNG imports to shoot over 30 mtpa by 2022?](#) July 11, 2017.

As a result of declining production and growing LNG imports, the share of RLNG in the country's total gas demand has risen to 26% in FY2020, up from just under 8% in FY2016.

Figure 4: Pakistan LNG Imports by Supplier (2015-2020)



Source: International Gas Union Annual Reports.

Gas in Pakistan is currently imported by two state-owned enterprises, Pakistan LNG Ltd. (PLL) and Pakistan State Oil (PSO), although the government is in the process of allowing private companies to import LNG. Two state-owned companies, Sui South Gas Company (SSGC) and Sui Northern Gas Pipeline Limited (SNGPL), are responsible for gas transmission and distribution.

Most imported LNG has been historically directed towards power generation and industrial users (see Figure 5). Limited amounts of LNG have been diverted towards households, but domestic consumption of LNG is increasing.¹⁷

Given that residential users pay among the lowest tariffs for natural gas in the country (discussed in further detail in the next section), diversion of expensive LNG to households can disproportionately increase gas sector circular debt.¹⁸

Despite importation of LNG, gas supply to Pakistan is still insufficient during peak demand periods, resulting in recurring gas shortages.

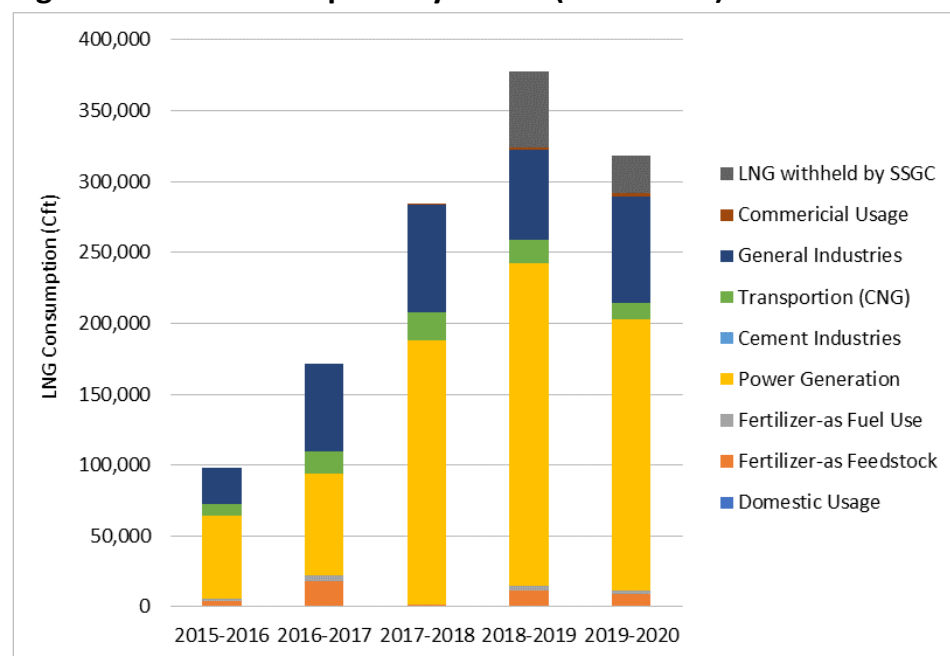
During winter months, demand for natural gas as a heating fuel increases. Pakistan's domestic production is only capable of supplying up to 3,300-3,600 million cubic feet per day (mmcf), while LNG imports can supplement supplies by another 1,000 mmcf. Average winter demand, meanwhile, ranges from 6,500-7,000 mmcf,

¹⁷ Pakistan Ministry of Energy, Hydrocarbon Development Institute of Pakistan. Pakistan Energy Yearbook. 2020.

¹⁸ The News. [Gas circular debt surges to Rs.350 billion](#). December 03, 2020.

leading to a supply demand mismatch of more than 2,000 mmcf. As a result, certain consumer categories—particularly domestic and industrial sectors—face supply shortages and gas rationing during peak demand periods.

Figure 5: LNG Consumption by Sector (FY2016-20)



Source: Pakistan Energy Yearbook, 2020.

In 2018, three high-efficiency combined cycle power plants fueled by re-gasified LNG (RLNG) were brought online in Punjab at Haveli Bahadur Shah, Balloki, and Bhikki. The 1,230MW Haveli Bahadur Shah plant and 1,223MW Balloki plant are owned by National Power Parks Management, a federal government subsidiary.²¹ The Bhikki plant has a capacity of 1,180 MW and is owned by Quaid-e-Azam Thermal Power (Private) Limited (QATPL), a wholly-owned entity of the Government of Punjab.²²

¹⁹ Peak winters can even see a demand of 8000 mmcf, which further extends the supply demand mismatch. (Official Sources)

²⁰ The News. [Winter 2021-22: Govt to continue gas supply to power and fertiliser sectors.](#) November 12, 2021.

²¹ National Power Parks Management Company.

²² Quaid-e-Azam Thermal Power (Pvt.) Limited.

Table 1: Major Proposed LNG Infrastructure Projects

Proposed Power Plants						
Project Name	Location	Capacity (MW)	Target COD	Project Cost	Developer	Financiers
Trimmu LNG-fired Power Plant	Trimmu Barrage, District Jhang	1,263	Apr-22	US\$708 million	Punjab Thermal Power Ltd.	National Bank of Pakistan, Bank of Punjab, United Bank Limited

Proposed LNG Import Terminals							
Project Name	Type	Location	Throughput Capacity	Developer	Cost	Construction Time	Status
Tabeer LNG	Onshore	Jhari Creek, Port Qasim	750-1,000 mmcf (Phase 1)	Tabeer Energy Private Ltd. (subsidiary of Mitsubishi Corp.)	US\$300 million	20-24 months	Awaiting FID
Energas LNG	Offshore FSRU	Chara Creek, Port Qasim	750-1,000 mmcf	Energas Consortium (51%); Qatar Petroleum (49%)	US\$180 million	12-15 months	Awaiting FID
Daewoo Gas Terminal	Offshore	Karachi	356 mmcf (2.5 MTPA)	Daewoo Gas and China National Chemical Engineering Construction Company (CNCEC)- CNEC to design, construct and finance the offshore LNG terminal	US\$300 million	12 months	Daewoo Gas signed a Master Engineering Procurement Construction and Finance (EPCF) contract with CNEC in April, 2022
Easy LNG Terminal	Offshore	Karachi	50-60 mmcf	Singapore based LNG Easy Pvt. Ltd.	US\$ 200 million	12 months	Provisional license for construction granted by OGRA

Source: Various Media Reports, Dawn News, The Express Tribune, Energy Update & S&P Global.

In January 2021, local consortium Energas and Mitsubishi subsidiary Tabeer Energy were granted licenses to import and sell LNG in the country.^{23 24} Their proposed regasification terminals have also received LNG marketing, terminal and pipeline construction, and operational licenses from OGRA.²⁵

Despite the advanced stage of approvals for both projects, the project sponsors have been unable to take final investment decisions (FIDs). In both projects, the pipeline capacity allocation from the two gas utilities SNGPL and SSGC remains unresolved. The terminal developers reportedly require 250-350 mmcf of pipeline egress capacity, but SSGC and SNGPL have shown reluctance to award these companies with the required capacity,²⁶ despite directives by OGRA, Cabinet Committee on Energy (CCOE), and the Petroleum Division.

SSGC has indicated an availability of 44 mmcf and 150 mmcf in its transmission network for Energas and Tabeer Energy respectively, while SNGPL has offered a capacity of 75-100 mmcf for both companies.²⁷ The capacity offered by SNGPL and SSGC is also on a 3-month rolling basis, rather than on a long-term basis that Tabeer

²³ Dawn. [Ogra grants RLNG marketing licences to Tabeer, Energas](#). January 13, 2021.

²⁴ Although ExxonMobil was initially involved in the Energas project, the company exited in October 2021, citing regulatory delays and partnership difficulties. The disagreements caused a local official to put the odds of project completion as low as 10%. Reuters. [Exclusive: Exxon exit deals blow to Pakistan plans for LNG imports](#). October 30, 2017.

²⁵ As a concession from the government, the land for the tie-in points for the terminals will be leased to the project developers by SSGC, which has purchased it from Pakistan Steel Mills. The Express Tribune. [SSGC board set to approve purchase of PSM land](#). October 24, 2021.

²⁶ Dawn. [Sponsors protest hurdles in setting up LNG terminals](#). October 18, 2021.

²⁷ Business Recorder. [M/s Energas, Tabeer Energy: Gas cos convey availability of LNG pipeline capacity for transmission, distribution](#). June 28, 2021.

and Energas have demand. Both terminal developers have said these terms will not support a 30-year investment in the country.^{28 29}

Unless counterparty incentives are aligned to permit new projects quickly, all privately proposed import terminals are likely to continue to face significant delays.

While private entities blame public utilities and planning agencies for the delays associated with their projects, in a counter narrative the petroleum division this winter cited the slow progress made by Tabeer Energy and Energas responsible for gas crises.

In January 2022, the prime minister ordered collective efforts from the Sui utilities and Pakistan State Oil to establish a public LNG terminal, preferably an offshore FSRU by FY2022-2023.³⁰ There has been little progress since the announcement.³¹

A new phenomenon known as a ‘virtual pipeline network’ is also on the rise in Pakistan. In January 2021, OGRA granted provisional licenses to two private companies—LNG Easy (Private) Limited and Daewoo Gas (Private) Limited—to set up private LNG terminals and a virtual LNG distribution network through cryogenic bowlers and ISO tanks.³² This virtual mechanism of LNG provision would mainly target off-grid private consumers in remote locations that do not have access to the Sui pipeline networks.

On April 21, 2022, Daewoo Gas signed a master engineering, procurement, construction, and finance (EPCF) contract with the Fourth Construction Company Limited (FCC)—a subsidiary of China National Chemical Engineering Group Corporation (CNCEC)—for the construction of a new offshore LNG terminal. The terminal’s daily output of 10,000 metric tons would mainly be utilized for Daewoo’s own long-distance bus and truck fleet, along with other private customers. The terminal is expected to be operational by 2023.³³

²⁸ Dawn. [Sponsors protest hurdles in setting up LNG terminals](#). October 18, 2021.

²⁹ Other projects have faced similar barriers to FID. Trafigura Pakistan—a subsidiary of global LNG trading firm Trafigura—was awarded the first license for a private company to import LNG. Although the company initially aimed to have its project online in 2019, there have been few updates on the project and delays are likely due to difficulties securing additional licensing approvals, gas transportation permits, and downstream customers. Shell has also been granted a license to import and market LNG in Pakistan but has been unable due to issues securing a GTA with SSGC. Similar to the Trafigura project, there have been few public updates regarding Shell’s proposed terminal project.

The Nation. [Shell Pakistan can’t bring LNG this year, OGRA informed](#). December 25, 2021.

³⁰ Dawn. [Govt entities told to develop new LNG terminal](#). January 10, 2022.

³¹ However, the country’s energy minister has described plans to establish a public LNG terminal by converting an existing liquefied petroleum gas (LPG) terminal. The Express Tribune, [Third LNG facility to become functional in 2023](#). February 6, 2022. This may not come about as planned either since LPG terminals are designed to handle smaller quantities of gas. The requirements of an LNG terminal may thus not be fully met if an existing LPG terminal is retrofitted to accommodate LNG volumes too.

³² The Express Tribune. [OGRA grants licences to two virtual pipeline firms](#). January 15, 2021.

³³ CPEC Info. [Daewoo Gas signs contract with Chinese company in offshore LNG terminal](#). April 25, 2022.

Establishing a virtual LNG network may be an important step toward the liberalization of Pakistan's gas market. Such a distribution system may first target private, off-grid consumers, then large industrial and commercial consumers.

Sui companies must eventually be prepared to compete for large customers by offering competitive pricing and reliable supplies.

Table 2: Major Proposed Gas Pipeline Projects

Major Pipeline Projects in Pakistan				
Project Name	Capacity (Bcm)	Length	Cost (US\$ billion)	Status
Turkmenistan-Afghanistan-Pakistan-India (TAPI) Pipeline	11 (Phase 1), 33 (Phase 2)	1,884	7.7	Delayed. Construction on Pakistan portion to re-commence in 2H2022.
Iran-Pakistan Gas Pipeline	8	1,880	7.5	Iranian portion complete. Minor progress in Pakistan since 2015.
Pakistan Stream Gas Pipeline	12.4	1,100	2-3	Construction not yet begun. Uncertain outlook following Russia-Ukraine conflict.

Source: Various Media & News outlets.

TAPI Pipeline: The TAPI Pipeline was proposed in the 1990s to foster regional cooperation, but 30 years later the project is yet to be completed. The ADB is co-financing and advising the project. The financing for Phase I is to come from stakeholders and export credit agency (ECA) supported debt financing backed by 100% sovereign guarantees from Turkmenistan. Phase II will follow a similar approach with ECA financing supported by sovereign guarantees from other TAPI countries. ADB has already spent more than US\$4 million on the project in various technical studies.^{34 35}

The TAPI pipeline project has experienced numerous delays due to the regional instability. The recent imposition of Taliban rule in Afghanistan caused the ADB to pause due diligence and processing activities. However, the four partnering countries have indicated that work will resume despite the ADB's reservation.³⁶ Local Pakistani media has reported that work on the pipeline will re-commence in the second half of 2022.³⁷

Iran-Pakistan Gas Pipeline: The Iran-Pakistan pipeline was also proposed in the 1990s. The project expects to bring gas from Iran's South Pars gas field to Nawabshah in Pakistan. The Pakistani section will run across the province of Balochistan (665 Km) and Sindh (115 Km).³⁸

³⁴ Asian Development Bank. [Project Concept Paper](#)- Proposed Loan, Grant, Partial Credit Guarantee, and Transaction Technical Assistance Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline Project (Phase 1).

³⁵ Hydrocarbons Technology. [Turkmenistan-Afghanistan-Pakistan-India \(TAPI\) Gas Pipeline Project](#).

³⁶ The print. [Regional conference of Afghan's neighbours highlights India's initiatives in the war-torn country](#). April 01, 2022.

³⁷ Pakistan Observer. [TAPI pipeline to resume after acquisition of land: MoF](#). April 2, 2022.

³⁸ Hydrocarbons Technology. [Iran-Pakistan Pipeline](#).

The Iranian segment of the pipeline was completed in 2011, but the Pakistani portion of the pipeline remains in limbo due to US sanctions on Iran and a lack of investor interest in Pakistan. In 2013, an agreement was signed to begin construction of the Pakistani segment of the pipeline. However, little progress has been made due to US sanctions and Pakistan's shift to imported LNG in 2015.³⁹ Another agreement was signed in 2019 to revive the pipeline, although there has been little concrete progress.⁴⁰

Pakistan Stream Gas Pipeline: Originally envisioned as the North-South Pipeline in 2015, the pipeline aims to transport gas from the port city of Karachi to Kasur in Punjab. Initially, Russia planned to provide 85% of the financing and operate the pipeline for 25 years. Following geopolitical developments, however, Pakistan now holds a 74% stake in the project, while Russia holds the remaining 26%.⁴¹ Although an intergovernmental agreement was renewed in May 2021 between both countries, the future of the project remains uncertain in the wake of the Russian invasion of Ukraine.⁴²

Key Economic and Financial Risks of LNG Imports in Pakistan

LNG Imports Have Significantly Jeopardized Pakistan's Energy Security

Pakistan sources 56% of its LNG volumes from long-term contracts, leaving it significantly more exposed to spot prices than more mature LNG importers. To make matter worse, suppliers under long-term contracts defaulted on term deliveries seven times between January 2021 and February 2022, coinciding with a period of extreme price volatility in regional LNG markets. In March 2022, commodity trader Gunvor reportedly defaulted on four more LNG cargoes it was supposed to deliver until the end of its term contract in July.⁴³

³⁹ Islamabad Policy Research Institute. [Iran-Pakistan Gas Pipeline: Cost-Benefit Analysis](#). April 2014.

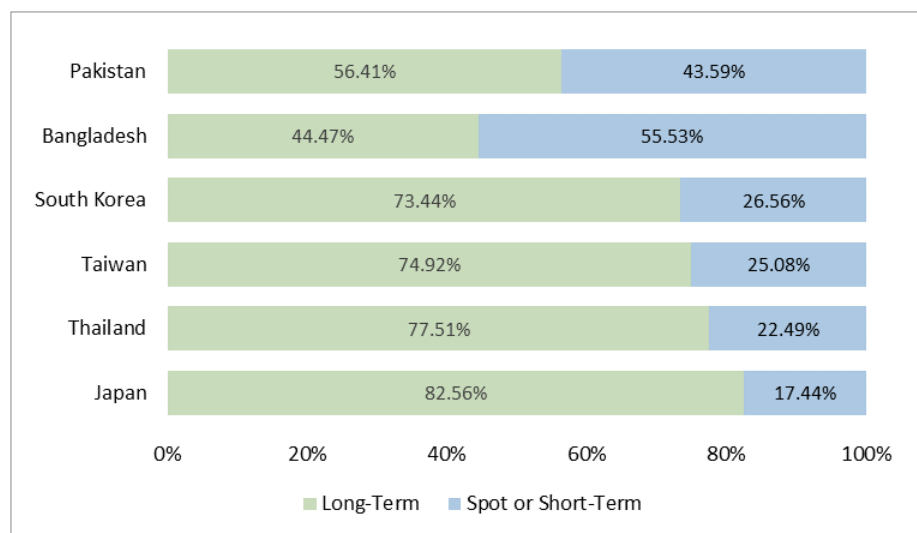
⁴⁰ The Express Tribune. [ISGS, NIGC ink revised accord for IP gas pipeline project](#). September 16, 2019.

⁴¹ Diplomatic Courier. [How Russia Benefits From The Pakistan Stream Pipeline](#). December 21, 2021.

⁴² Institute of Energy Economics and Financial Analysis. [PM Imran Khan's ill-timed visit to Russia highlights the risks of Pakistan's LNG investment](#). March 07, 2022.

⁴³ S&P Global. [Guvor backs out of LNG deliveries to Pakistan for April-June deliveries: officials](#). March 28, 2022.

Figure 6: Import Exposure of Various Asian Countries (2020)



Source: IHS Markit.

There is intense speculation in Pakistani media that suppliers defaulted on their term deliveries to realize higher profits in Asian or European spot markets, where prices climbed to unprecedented levels in late 2021 and early 2022. This speculation is still unconfirmed, since suppliers have not publicly responded to allegations.

However, IEEFA estimates that based on the difference between Asian LNG spot prices and the publicly available pricing formulas of term contracts, total profits realized by defaulting suppliers could have reached nearly US\$400 million from August 2021 to February 2022. Note that this figure is not intended to confirm or deny speculation regarding the reasons behind said defaults, but rather to provide an estimate of the financial incentive associated with reselling term cargoes in spot markets.

This estimate also does not include any penalties for defaults that suppliers may have incurred. Although the supply contracts specify a penalty amount, it is unclear whether such penalties have been imposed. According to a senior official at the Energy Ministry, “Gunvor sought force majeure for every time to avoid the penalty.”^{44 45}

The chart below shows the defaults by ENI and Gunvor according to Asian LNG spot prices at the time of default. To highlight the difference in the price of term cargoes and spot prices, the chart also shows the estimated price of LNG that would have been delivered under long-term contracts. These estimates are based on the pricing formula of each oil-linked contract—which determine an LNG price based on a

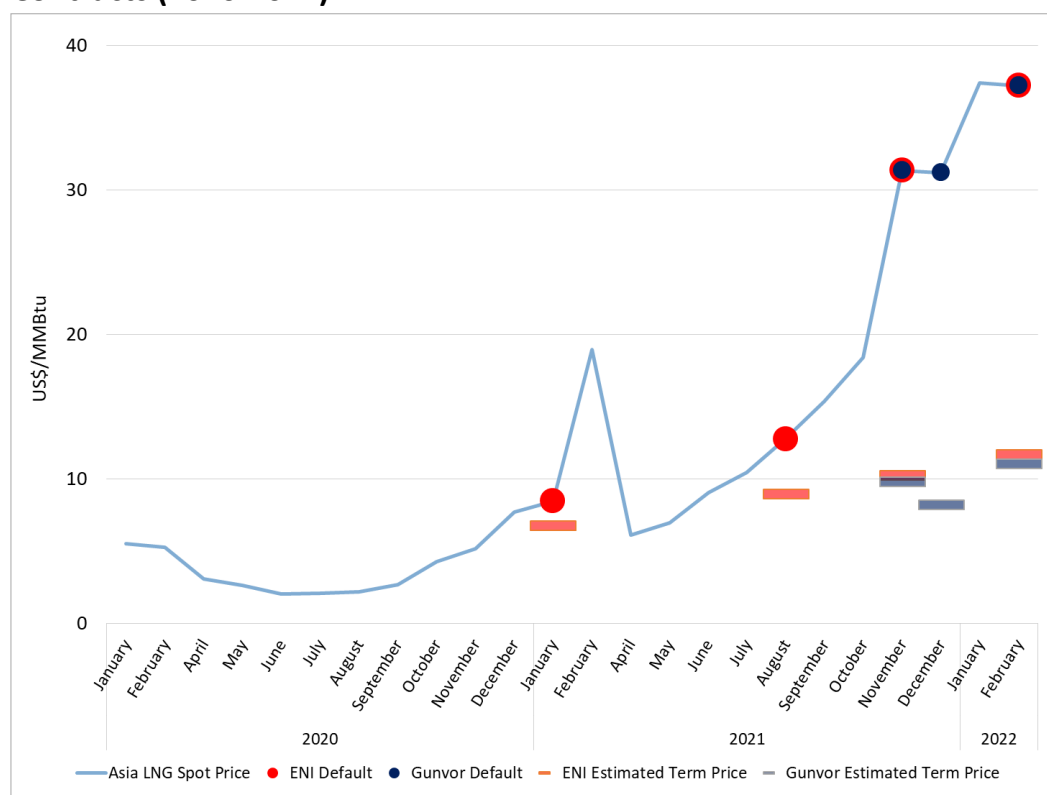
⁴⁴ The News. [Pakistan to penalise defaulting LNG supplier](#). February 24, 2022.

⁴⁵ Gunvor’s 5-year LNG sales agreement expires June 2022. The News. [Backing out of LNG term cargo: PLL not keen to penalise ENI](#). August 26, 2021.

percentage of the Brent crude oil price—and the price of Brent crude at the time of default.

The timeline shows that defaults by the two companies only occurred when Asian spot prices were above term cargo prices. The timeline also shows that no defaults occurred during the low Asian spot environment in 2020.

Figure 7: Timeline of Defaults on LNG Cargo Deliveries Under Long-term Contracts (2020-2022)



Source: IEEFA calculations based on: Brent crude data from EIA; monthly Asia spot prices from IHS Markit; pricing formulas for LNG supply contracts from various media sources.

Following defaults by both ENI and Gunvor in November 2021 and February 2022, PLL issued emergency tenders to replace four non-delivered cargoes. The winning bidders for the November tender were Vitol and Qatar Petroleum, which offered final prices of US\$29.8966/MMBtu and US\$30.6500/MMBtu, respectively. These prices were nearly three times the rate that would have been offered under PLL's term contracts.

The tender issued in February 2022 sought two cargoes for delivery on March 2 and March 10, respectively. No bids were received for the former, while two bids were received for the March 10 delivery schedule. The winning bidder, Qatar Petroleum Trading, offered a price of US\$25.12/MMBtu—more than twice the price of what should have been offered under PLL's term contracts.

As a result of the significantly higher prices realized during PLL's recent emergency tenders, IEEFA estimates that between November 2021 and February 2022, each emergency LNG cargo cost Pakistan on average US\$58.57 million more dollars than cargoes that would have otherwise been delivered under existing long-term contracts. The government of Pakistan bears these costs through increased budget allocations, which are ultimately shouldered by taxpayers.

Any significant increase in spot market LNG prices, like those experienced following the Russian invasion of Ukraine,⁴⁶ could have two impacts. First, it could incentivize further defaults by suppliers under long-term contracts that seek greater profits in spot markets. Second, it would add to the costs of emergency tenders to replace non-delivered term cargoes.

Issues with LNG supply security, even under long-term contracts, are not unique to Pakistan. There were also reports in early 2021 that "major Asian buyers JERA and Korea Gas were defaulted on,"⁴⁷ although these reports could not be confirmed in public sources. In late 2021, suppliers under long-term contracts with Bangladesh reduced delivered LNG volumes to the minimum contractually allowable levels, and one supplier delayed a term cargo during a price spike in the Asia spot market.⁴⁸ The Bangladeshi government did not take punitive action against the company.⁴⁹

In general, price volatility can result in greater contractual disputes between buyers and sellers. When LNG prices skyrocket, sellers will be tempted to find ways to divert cargoes to buyers willing to pay higher prices.

The incentive to cancel cargoes altogether is arguably higher in LNG markets than other commodity markets because an LNG seller's liability for a cancelled cargo is typically capped at a certain percentage of the non-delivered cargo price. In Pakistan, sellers are typically required to pay 30% of the cancelled cargo price. This creates an opportunity to game the contract—legally or illegally—if the resale price is high enough to cover the penalty. For buyer's, this can have significant implications for energy security.

One potential solution is to include a "willful default" provision in LNG supply contracts, which removes the penalty cap when a buyer can demonstrate that an LNG cargo has been diverted and resold for profit. While this may provide some protection, LNG contracts involve long and complex legal negotiations. Buyers in emerging markets often lack sufficient legal safeguards, institutional capacity, and money to deal with the numerous legal issues that may arise, especially during periods of intense price volatility.⁵⁰

⁴⁶ Following Russia's invasion of Ukraine, LNG spot prices in Asia reached a record high of US\$59/MMBtu. Bloomberg. [Asia LNG Price Surges to Record as War Spurs 'Panic' Over Supply](#). March 4, 2022.

⁴⁷ Energy Intelligence. [Seller Defaults Set LNG Contract Changes in Motion](#). March 6, 2021.

⁴⁸ Financial Express. [Contracted foreign suppliers slash LNG sale to Bangladesh](#). October 26, 2021.

⁴⁹ Ibid.

⁵⁰ S&P Global. [LNG buyers mull tactical changes to procurement plans after winter disruptions](#). February 4, 2021.

The past two years have demonstrated clearly that LNG supplies to Pakistan are highly unpredictable, despite the existence of long-term contracts. When LNG spot prices are extremely volatile, suppliers may face a financial incentive to reroute term cargoes elsewhere. When that happens, Pakistan can issue emergency LNG tenders, but these have either yielded (a) bids that are exorbitantly more expensive than term cargoes, or (b) no bids at all.

Raised Gas Costs: Who Will Bear the Financial Burden?

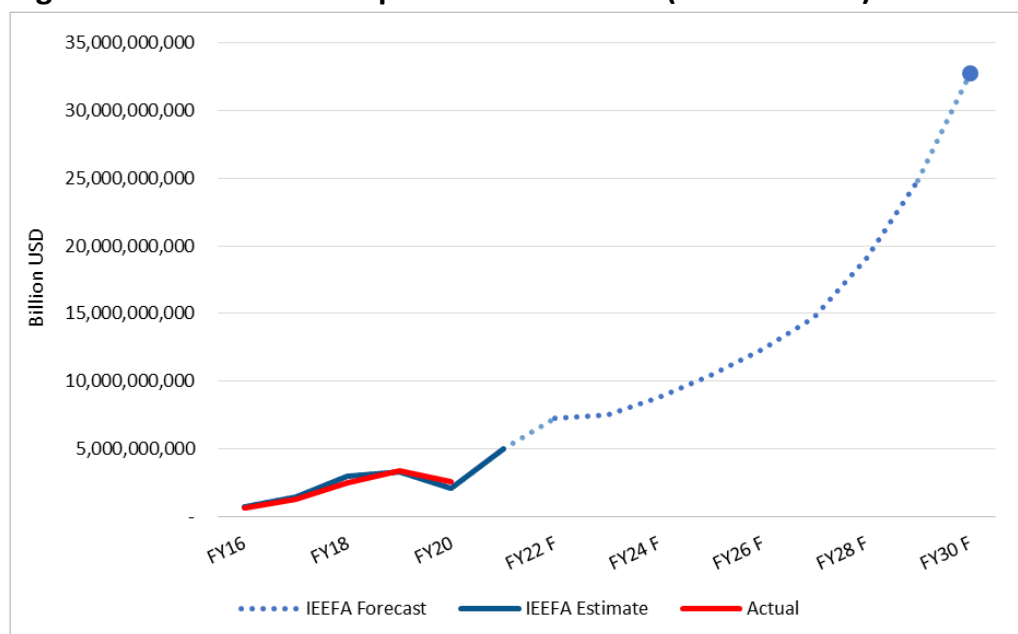
In Pakistan, an increasing shift from domestically produced gas to imported LNG is also likely to entail a step change in natural gas prices throughout the country.

IEEFA estimates that growing LNG imports in Pakistan could raise the country's LNG import bill to more than US\$32 billion by FY2030, up from just over US\$5 billion in FY2021 (see Figure 8 below).⁵¹

This estimate assumes that LNG imports continue to grow at an increasing annual rate—as imports replace falling domestic supply and meet incremental demand growth—in line with the growth rates Pakistan has experienced since the start of LNG imports in March 2015.

This also assumes that the country's procurement strategy trends more heavily in favor of long-term contracts, with 75% of supply from term contracts to 2030.

Figure 8: Forecast LNG Import Bill in Pakistan (FY2016-2030)

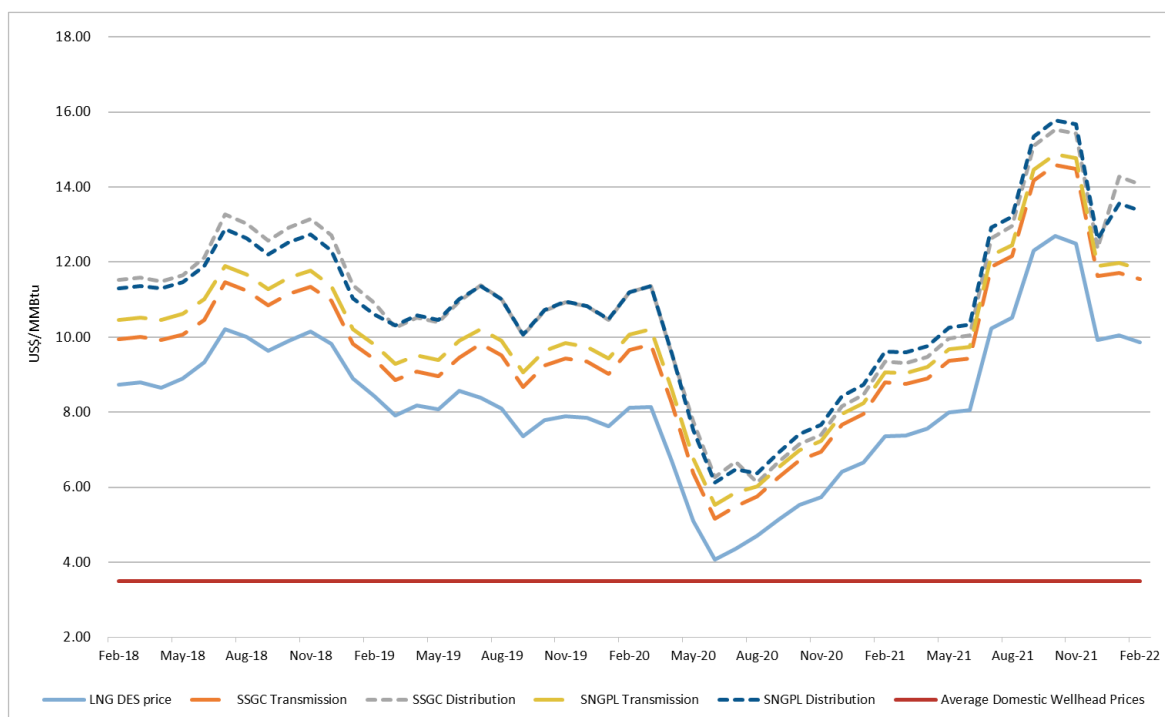


Source: IEEFA estimates based on LNG demand, spot and term market exposure, and historical average spot and estimated landed term prices. Actual historical values provided by Pakistan Energy Yearbook 2020 and included here for comparison.

⁵¹ Pakistan's fiscal year runs from July 1 to June 30.

Gas prices are regulated at the wholesale and retail levels. At the wholesale level, wellhead prices are linked to international oil prices, although each field has a different price formula. The current average weighted wellhead price for gas sold to SSGC and SNGPL is US\$3.50/MMBtu,⁵² well below international LNG prices. In late 2021, the final price of LNG delivered to Pakistan reached nearly US\$16/MMBtu—more than four times the average price of domestic gas (see Figure 9 below).

Figure 9: Weighted Average RLNG Prices vs. Current Average Domestic Wellhead Prices in Pakistan



Source: IHS Markit, IEEFA analysis, various media reports.

LNG prices are expected to remain elevated over the next two years, due largely to the global economic recovery from the COVID-19 pandemic. Moreover, the Russian invasion of Ukraine in February 2021 is likely to exacerbate LNG price volatility, given that any limitation on Russian gas supplies to Europe could aggravate interregional competition for LNG cargoes between Asia and Europe.⁵³

Following the invasion, Asian LNG spot prices jumped to a record US\$59/MMBtu, up from US\$2/MMBtu just two years prior.⁵⁴ According to the World Bank, high prices could persist through 2024, if not longer, due to market tightness and increased European demand for non-Russian LNG supplies.⁵⁵

⁵² The Express Tribune. [A review of gas sector and prices](#). March 16, 2020.

⁵³ IEEFA. [Russia-Ukraine conflict adds impetus to Asia's energy transition](#). March 3, 2022.

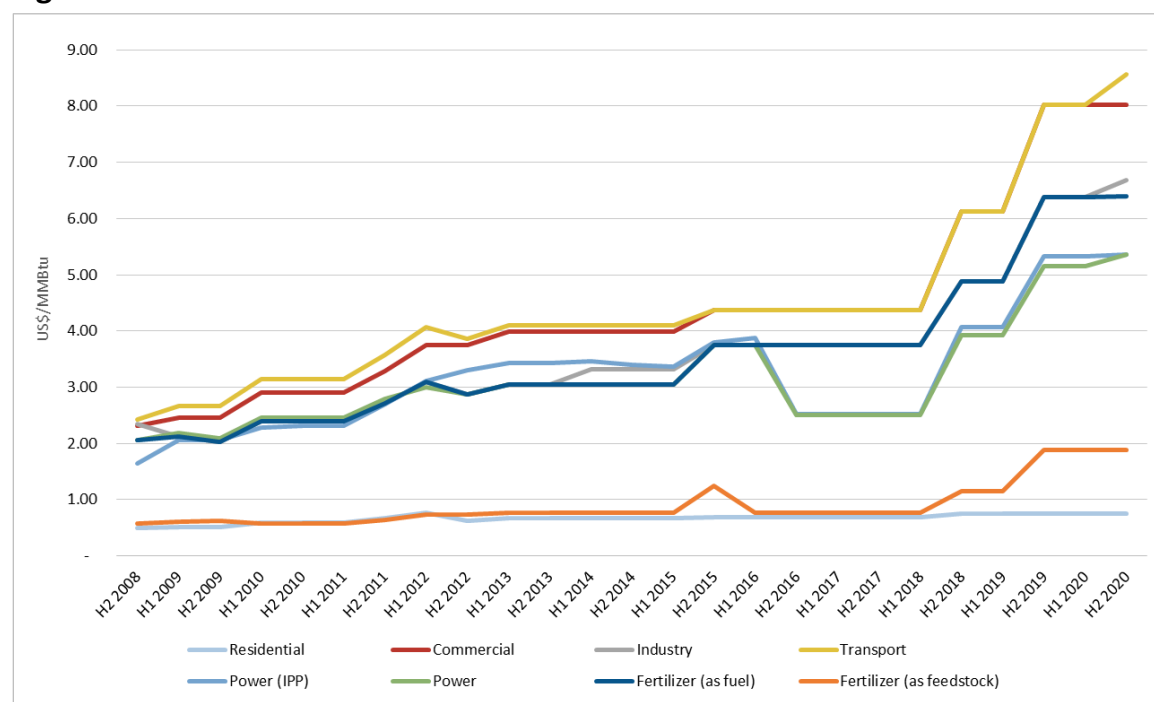
⁵⁴ Reuters. [Asia LNG spot prices hit record high, S&P data shows](#). March 4, 2022.

⁵⁵ World Bank. [Food and Energy Price Shocks from Ukraine War Could Last for Years](#). April 26, 2022.

Imported LNG is regulated separately from domestic gas and sold to specific buyers at a wholesale price determined monthly by the Oil and Gas Regulatory Authority (OGRA).

PLL and PSO import LNG, which is then sold by state-owned distribution companies SSGC and SNGPL at prices that vary according to eight consumer types. The government of Pakistan is responsible for paying the difference between retail gas tariffs and the cost of the gas (domestic and imported).

Figure 10: Gas Retail Tariffs in Pakistan



Source: IHS Markit, OGRA.

Ultimately, the higher costs of imported LNG will be distributed among actors in Pakistan's gas value chain and wider economy.

There are three overarching impacts of this structural increase in gas prices that will determine who bears the financial burden of fuel input costs:

1. The **Pakistani government** subsidy burden is likely to grow rapidly, compounding circular debt in the gas and power sectors. Greater circular debt will exacerbate credit risks for **investors** in the LNG-to-power value chain.
2. Political pressure to increase end-user gas tariffs is likely to increase, which threatens to raise gas and power prices for **households and businesses** throughout the country.
3. Higher natural gas prices are likely to have negative spillover effects on

other sectors of Pakistan's economy—including the fertilizer, industrial, and textile sectors—with destabilizing impacts on economic growth.

These consequences of greater LNG imports are discussed in detail in the following sections.

Circular Debt in the Gas Sector

Despite optimistic outlooks for the country's LNG demand, the country's energy sector is plagued by recurring non-payment issues that have cascaded throughout the gas and power value chains. Compounding cashflow shortages, known collectively as “circular debt,”⁵⁶ limit the ability of each supply chain segment to repay its suppliers. As of July 2021, gas sector circular debt amounted to an estimated US\$3.2 billion (PKR 532 billion).⁵⁷ By February 2022, that amount had risen to US\$3.5 billion (PKR 650 billion), with some estimates reaching as high as PKR 1.5 trillion.^{58 59}

Circular debt in Pakistan's gas sector is due primarily to: (1) end-user tariffs that are not reflective of gas costs; (2) inefficient cross subsidies that distort gas demand; (3) gas leakage throughout the pipeline network; and (4) non-technical gas losses (e.g. theft). The higher costs associated with RLNG add to the debt burden building in the system.

Although RLNG has recently been more than four times the price of domestic gas, gas sold to consumers does not reflect higher costs. This is especially true in the domestic sector, where gas tariffs are kept particularly low due likely to political reasons.

Due to these highly subsidized rates, there is no economic price signal to consumers to conserve or use gas efficiently. As a result, gas distributors are unable to recoup their investments. According to SNGPL's 2020 financial report, RLNG “is an expensive fuel and *its diversion to domestic sector without any recovery mechanism is hampering SNGPL's financial position*” (emphasis added).⁶⁰

The difference between the OGRA-determined cost of gas and the final retail tariffs approved by the government is called the “tariff adjustment recoverable.”⁶¹ In past years this margin was manageable. Domestically-produced gas was sold to

⁵⁶ Pakistan's Economic Coordination Committee (ECC) has defined circular debt as “the amount of cash shortfall within the Central Power Purchasing Agency (CPPA), which it cannot pay to power supply companies.” Generation companies are in turn unable to remunerate fuel suppliers. The Express Tribune. [Pakistan's power sector — how to eliminate the circular debt](#). March 21, 2017.

⁵⁷ Dawn. [Gas sector circular debt crosses Rs532bn](#). July 10, 2021.

⁵⁸ The News. [Gas sector circular debt doubles to Rs650bn in three years](#). February 20, 2022.

⁵⁹ Mettis Global. [Circular debt in gas sector reaches Rs1,500 billion, says Miftah Ismail](#). April 21, 2022.

⁶⁰ SNGPL. [Annual Report 2020](#), p. 40.

⁶¹ Note that this is similar to the tariff differential subsidy in the power sector, which equals the difference between power tariffs prescribed by NEPRA and the final government-approved power tariffs for end-users.

households and fertilizer businesses at a discount, which was covered by cross-subsidies mainly from the industrial, power generation, and commercial sectors.

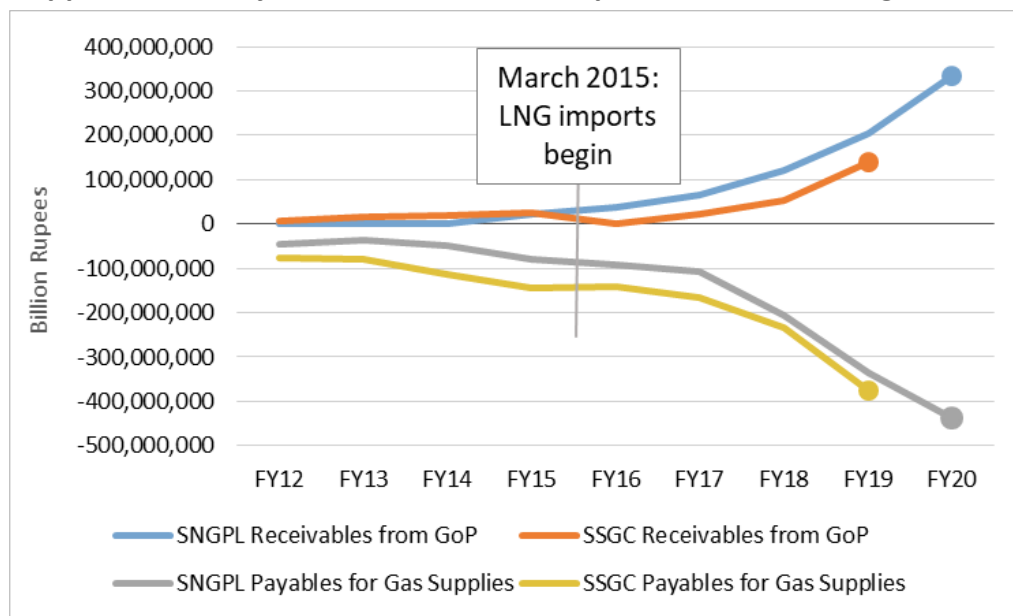
However, higher-priced RLNG is rapidly increasing while the domestic consumer base is growing. Residential and fertilizer sectors are also growing at a faster rate than other sectors, meaning the cross-subsidy is becoming increasingly insufficient.⁶² The fertilizer sector, for example, consumes 16% of natural gas but accounts for only 3% of SSGC and SNGPL revenues.⁶³

Ultimately, recovery of the tariff adjustment depends on a settlement by the Government of Pakistan to raise tariffs or provide a direct subsidy.

In the meantime, the debts owed to gas distribution companies build up on their balance sheets as receivables, which represent the value of goods delivered but not yet paid for. SSGC and SNGPL receivables for RLNG deliveries have skyrocketed since the onset of RLNG imports in Pakistan, with little sign of waning (see Figure 11 below).

As a result, gas distribution companies have been unable to repay fuel suppliers, and the total payables have ballooned to US\$4.32 billion (PKR812 billion), according to their most recent financial statements.

Figure 11: Gas Distribution Company Receivables and Payables for Gas Supplies Have Skyrocketed Since LNG Imports in Pakistan Began



Source: Company financials.

⁶² PACRA. [Gas Distribution – Sector Study](#), p. 16. June 2021.

⁶³ Business Recorder. [LNG sector in Pakistan — IV](#). August 5, 2021.

With limited cash flows to repay gas suppliers, SNGPL and SSGC payables have also ballooned since the onset of more expensive LNG imports.

Non-payment issues have directly impacted LNG suppliers. In February 2021, PLL defaulted on its LNG payments to the United Bank Limited (UBL).⁶⁴ PLL blamed non-payment of nearly USD 400 million from SNGPL for gas supplies, and UBL responded by threatening to withdraw credit lines for additional LNG cargoes. PLL noted that it also owed over US\$24 million to LNG suppliers. Similarly, in May 2020, state-owned LNG buyer Pakistan State Oil (PSO) defaulted on LNG payments to Gunvor due to non-payment of US\$626 million from gas offtaker SNGPL.⁶⁵ To avoid defaulting on payments to Qatar Gas Company as well, PSO diverted payments away from several local refineries.⁶⁶

The Value of UFG Is Likely to Balloon as More Expensive RLNG Is Added

Along with inefficient subsidy allocations, other issues are also causing cashflow shortages in the gas system, including leakage and theft.

UFG lost in the midstream network before reaching end-users means that distribution companies do not recover the costs of lost gas. In FY 2019-20, gas losses reached 17.05% and 12.32% in SSGC and SNGPL systems, respectively, far exceeding international norms of around 2%.⁶⁷

According to figures from the Ministry of Energy, the total volume of UFG in FY20 was 116 billion cubic feet (Bcf) or 3.3 billion cubic meters (Bcm).⁶⁸ Based on the share LNG in Pakistan's total gas consumption, and the average domestic wellhead and LNG import prices in FY2020, IEEFA estimates the total annual value of UFG to be US\$543.92 million. UFG volumes were slightly lower in FY2021, and IEEFA estimates that the total value of lost gas in FY2021 was US\$504.5 million. Despite improvements, the UFG valuation remained elevated due to higher imported LNG prices in FY2021.

As more expensive RLNG is injected into the leaking network, the value of UFG is sure to rise unless pipeline networks are upgraded and efforts are made to resolve gas theft.

UFG is linked to regulatory incentives and guaranteed financial returns; Sui companies are guaranteed returns on fixed assets of 17.43%, encouraging new capital investment and network expansion over operational efficiency and

⁶⁴ The News. [LNG supply chain in jeopardy as PLL defaults on payments](#). February 11, 2021.

⁶⁵ The News. [PSO defaults on payments to LNG supplier, local refineries](#). May 15, 2020.

⁶⁶ The News. [PSO defaults on payments to LNG supplier, local refineries](#). May 15, 2020.

⁶⁷ Government of Pakistan, Petroleum Division, Ministry of Energy. [Unaccounted for Gas \(UFG\) Report FY2020-2021](#).

⁶⁸ Government of Pakistan, Petroleum Division, Ministry of Energy. [Unaccounted for Gas \(UFG\) Report FY2020-2021](#).

maintenance.⁶⁹

This has encouraged the deterioration of pipelines due to aging and poor maintenance. There is a need to rethink the regulatory mechanism for the distribution companies, adding in penalties and incentives for operational performance and efficiency.

The high price of LNG imports relative to domestically produced gas is likely to exacerbate circular debt in Pakistan's gas and power sectors. In IEEFA's view, greater reliance on imported LNG could therefore reinforce, rather than relieve, credit risks for investors in the country's LNG-to-power value chain.

Mounting Pressure to Raise Gas Tariffs

Final gas tariffs for end-users are not cost-reflective. Instead, consumer prices are kept artificially low by massive subsidies, leading to distorted consumption habits and circular debt. However, implementing a cost-reflective regime is no easy task in Pakistan, where provincial governments hold significant power. Pakistan's constitution states that gas-producing provinces such as Sindh have a first right over cheaper, domestically produced gas. As a result, these provinces have resisted a shift toward gas tariffs based on a weighted average cost of gas (WACOG).

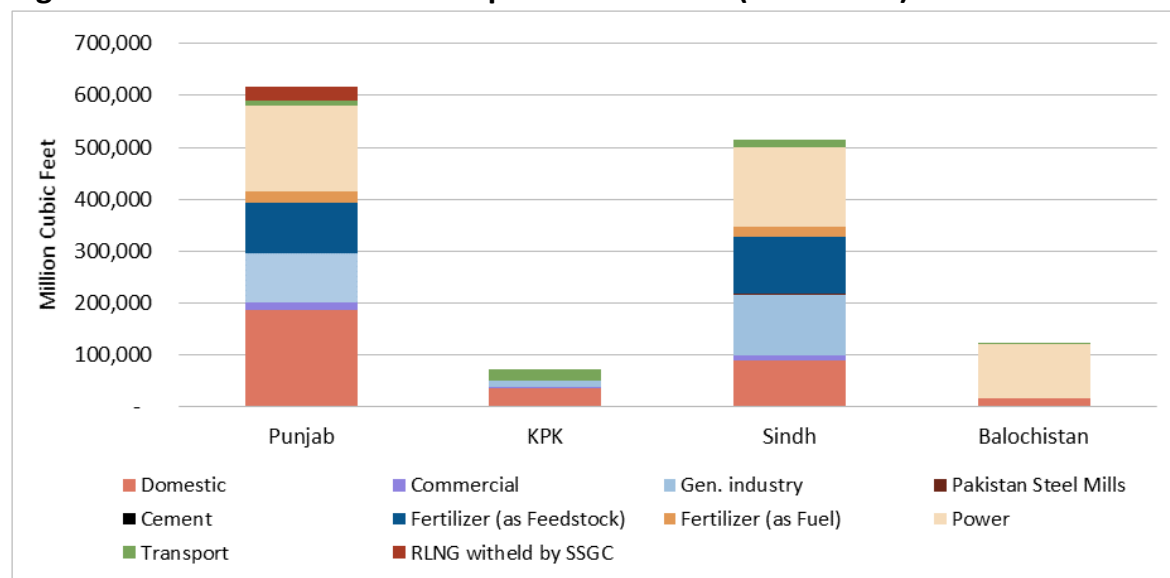
As more LNG is added to the system, however, pressure is rising to establish more cost-reflective tariffs. In its latest review of the Extended Fund Facility for Pakistan, the International Monetary Fund (IMF) noted the buildup of circular debt within the gas sector, relating its growth to high UFG losses, delayed sales price adjustments, collection shortfalls by the utilities, and unbudgeted subsidies for export and zero-rated industries. In its recommendations, the IMF encouraged Pakistan to sustain energy reforms including reduction of net subsidies and tariff rationalization.

However, a move toward WACOG pricing has always been met with severe opposition from gas-producing provinces. Punjab consumes the most gas but produces very little, which explains why power plants and industries within the province operate mostly on LNG. Other provinces have therefore opposed a uniform pricing regime, claiming that such a mechanism would unfairly benefit Punjab.⁷⁰

⁶⁹ World Bank. *In the Dark: How Much Do Power Sector Distortions Cost South Asia?* p. 178. 2019.

⁷⁰ Dawn. *Sindh decries move to average out gas price*. August 18, 2021.

Figure 12: Provincial Gas Consumption in Pakistan (2019-2020)



Source: Pakistan Energy Yearbook, 2020.

After years of negotiations and debate between provinces, the PTI government was finally able to get the WACOG bill passed by the Senate in February 2022.⁷¹ The bill would implement a blended cost regime where all consumers would pay a weighted average cost of domestic natural gas and imported LNG, according to their respective proportions in the fuel mix.

According to IEEFA's estimates at present ratios of LNG consumption to domestic gas, this would produce a price signal of US\$7-9/MMBtu, given the current high prices for spot market LNG. This is a conservative estimate keeping in mind the large contribution of domestic reserves to gas consumption in Pakistan.⁷²

The introduction of the WACOG bill is an historic feat, but it will require significant political will for proper implementation. This is because a cost-reflective tariff regime could raise prices for the heavily subsidized domestic and fertilizer sectors.⁷³

However, details on the actual implementation of the bill have been hazy, especially in light of the recent political instability in Pakistan. The bill has already been challenged in court by a private company. The Sindh government recently became a party to the case as well. If a legal battle ensues between the provinces and the federal government, implementation of the bill could become more complicated.

⁷¹ Dawn. Senate clears new gas pricing mechanism.

⁷² LNG constitutes about 26% of the gas consumption mix in the country (Source: Pakistan Energy Yearbook, 2020, IEEFA estimates)

⁷³ However, some speculate that the domestic sector would only see a modest rise in consumer bills, since it would probably still receive cross-subsidies from other sectors. If the cross-subsidies are still insufficient, the government would still have to subsidize the domestic sector in one way or another.

Negative Spillover Effects

Recent times have witnessed the LNG supply crisis manifest itself in the form of forced power plant shutdowns and severe electricity shortages for the masses. A tweet by the new government's Finance Minister Miftah Ismail indicates that almost 1.2 GW of installed capacity had been shut down since December 13, 2021 owing to non-availability of LNG.⁷⁴

While this did not pose much of a challenge during the winters due to lower power demand, the country is currently battling an intense heatwave, and forced outages have led to nationwide load shedding. Urban centers and rural areas both face power outages of 7-10 hours per day.⁷⁵

In addition to load management in the power sector, continued fuel shortages in the LNG value chain can have broader impacts on other segments of the economy as well. The fertilizer and textile sector are beginning to emerge as key consumers of LNG as local indigenous supplies diminish.

Since most of the fertilizer industry is based in Sindh, fertilizer companies there enjoy preferential use of lower-priced domestically produced gas as a feedstock.⁷⁶ As domestic reserves continue to decline, however, the fertilizer sector is likely to face the switch to more expensive LNG as an alternative. This would raise the overall cost of fertilizer production, which would in turn be passed through to end-user retail prices for urea and DAP (di-ammonium phosphate). Fertilizer companies in Pakistan are not allowed to export their products to other markets, meaning the domestic agricultural sector is their sole customer. High fertilizer costs could therefore have severe implications for food security within the country.

Alternatives under consideration to replace natural gas as a feedstock in the fertilizer manufacturing process include synthetic natural gas produced from gasified coal. The government is also keen to utilize the vast coal reserves of the Thar region to produce liquid and gaseous fuel.

A coal-to-liquid and coal-to-gas policy, which would offer lucrative tax breaks and incentives for utilization of domestic coal for petroleum/petrochemical products, is also under consideration by the government for the country's next federal budget.⁷⁷

However, the economics and environmental impact of gasified coal are highly controversial and any such activity in Pakistan would require a significant scaling up of mining operations in Thar. Even mature gasified coal producers like Sasol are pivoting towards cleaner fuels like green hydrogen, which could provide a more

⁷⁴ Miftah Ismail. [Tweet](#). April 13, 2022.

⁷⁵ The Express Tribune. [Power cuts return as shortfall tops 7,000MW](#). April 26, 2022.

⁷⁶ According to a prominent fertilizer producer in the country that receives gas directly from the Mari Gas fields, fertilizer production processes have not been severely interrupted by gas shortages. Gas supplies have continued, albeit with lower gas pressures due to declining production. To support higher pressures and maintain production processes, companies have invested in compressors and motor-driven pumps, raising overall production costs.

⁷⁷ Dawn News. [Govt plans coal conversion to gas, liquid fuels](#). March 22, 2022

suitable alternative to natural gas in the fertilizer sector.⁷⁸

The country's textile sector will arguably be even more directly affected by LNG shortages and higher fuel prices. In December 2021, textile mills in Punjab were forced to close for 15 days due to gas shortages caused by LNG supplier defaults and the government's inability to procure emergency cargoes. As a result, exports worth US\$250 million—or 20% of the entire sector's annual revenue—were lost.^{79 80}

Pakistan's textile sector was critical in keeping exports afloat during the outbreak of the COVID-19 pandemic. But the industry is volume-based, meaning that companies must keep prices at a minimum level to remain regionally competitive. Power generation costs can amount to roughly 30-40% of the production costs, and since the textile industry mainly produces its own power through gas-based captive generation, rising LNG prices can grossly reduce profit margins.⁸¹

To make matters worse, the industry employs machinery that is highly sensitive to electricity supply disruptions. Most of the machinery is computerized, with many of the processes interlinked. According to a leading textile industry representative association, a one-second breakdown in spinning can lead to a 20-25 minutes loss in the weaving processes. Some machinery may even stop working altogether and may have to be replaced. In such circumstances the sector cannot rely on the national grid, which is prone to frequent outages for sensitive production processes.

This has led to the industry adapting in ways which have not only added to investment costs for the sector, but are also unsustainable in the longer run. For example, Lucky Textile Mills in Karachi has responded to low gas pressures by adding a backup coal boiler for steam production. According to a company official, imported coal used by the boiler can be three times as expensive as domestic gas. Given the current price surges in the cost of imported coal recently, this fuel switching can be even more damaging to the competitiveness of textile products manufactured in Pakistan.

As LNG spot prices remain alarmingly high, the government is faced with two choices 1) procure LNG at exorbitantly high prices and increase the subsidy to LNG dependent sectors such as the textile industry; or 2) forgo cargoes altogether, leading to supply shortages and loss in revenue for export-oriented industries dependent on imported LNG. Neither bodes well for the country's ailing economy.

Recommendations

Pakistan relies heavily on imported fuels, meaning that its economy is particularly vulnerable to commodity market shocks like those experienced in the wake of the

⁷⁸ News 24. [Sasol is speeding up its green hydrogen plans amid European energy crisis](#). April 26, 2022.

⁷⁹ Bloomberg. [Pakistan Textile Exports Hit by Gas Crunch, Industry Body Says](#). January 03, 2022.

⁸⁰ The News International. [Gas suspension: Pakistan loses textile exports worth \\$250m](#). January 08, 2022.

⁸¹ Pakistan institute of Development Economics. [Resolve to Revive Our Textile Sector](#). May 26, 2021.

Russian invasion of Ukraine. In 2019, total energy imports amounted to 5.9% of the country's gross domestic product (GDP)—a high ratio among large energy importing countries.⁸²

As detailed in the previous section, energy market shocks can have almost immediate impacts on Pakistan's energy security, even with the existence of long-term purchase contracts. Given the diversity of the country's demand base for gas, fuel shortages can have broader impacts on economic growth and development, including on food supplies and the regional competitiveness of the nation's textile sector.

It is clear that this dependence on imported, foreign currency-denominated fuels exacerbates the fragility of Pakistan's economy.

To reduce the country's dependence on imported LNG and improve the stability of the country's economic growth, it would be prudent for Pakistani policymakers and regulators to consider the following recommendations over the short, medium, and long-term. Importantly, issues in Pakistan's gas sector are complex, interconnected, and deeply entrenched. The following measures are meant to provide overarching considerations with specific examples, rather than an exhaustive prescription.

Short-term (1-2 Years):

Focus on Energy Demand, Not Supply

Energy sectors planning in Pakistan has historically centered on meeting rapid demand growth by increasing supply. Any emphasis and action on the demand side of the equation is still in nascent stages. As a result, energy intensity—or the amount of energy consumed per unit of GDP—in Pakistan is significantly higher than neighboring India and other countries in Southeast Asia.

In 2016, the National Energy Efficiency and Conservation Authority (NEECA) under the Ministry of Energy Power Division was tasked with developing energy efficiency targets. The agency released a National Strategic Plan 2020-2023, which set a target of saving 3 million tons of oil equivalent (mtoe) through energy efficiency measures by 2023.⁸³ The agency also recognized that Pakistan has the potential to save up to 10-15% (10-12 mtoe) of primary energy supply through energy efficiency and conservation.

According to NEECA, these standards can be achieved in part through the application and enforcement of energy efficiency standards on industrial, commercial, and residential equipment. Incentives for promoting industrial efficiency along with an efficient system of checks and balances through minimum performance standards are particularly critical.⁸⁴

⁸² Bloomberg. [Energy Shock Hitting Poorer Nations Reliant on Imports Hardest](#). March 17, 2022.

⁸³ NEECA. [Strategic Plan \(2020-2023\)](#). October 2020.

⁸⁴ Global Village Space. [Addressing Pakistan's Gas Crisis through Energy Efficiency](#). March 11, 2021.

Some of the industry has already instituted energy efficiency changes to their manufacturing processes to deal with low gas pressures and supply uncertainties.

Much of the textile sector which relies on gas-powered captive power generation. The installation of economizers on gas generators utilize the high temperature of flue gases released during power generation to produce steam in a process called co-generation.

Other low-hanging fruit for such industries could include the use of energy efficient lighting such as LEDs, regular maintenance and upgradation of manufacturing equipment, and efficient space heating within better insulated building envelopes.

Along with an emphasis on verification and enforcement of standards, tariff rationalization will play a key role in incentivizing the use of energy efficient equipment. At present, certain segments of gas users see little to no increase in their gas bills when import prices spike, and therefore have no reason to use gas efficiently.

As a result, gas demand in Pakistan continues to grow sharply even as more expensive RLNG is injected into the system. Tariff rationalization can have the dual impact of incentivizing more efficient use of gas, while ensuring that the actual economic cost of procuring expensive LNG is recovered from consumers. The continued inefficient consumption of gas despite higher imported fuel costs is simply incompatible with the financial sustainability of the country's gas system.

Efforts to rationalize tariffs should be done in a pro-poor manner. Changes to tariff structures are a highly political matter, meaning that a compromise may have to be reached for the domestic sector, with different pricing slabs according to the affordability and consumption level of the public (much like it is right now, but with blended costs of gas) or by ensuring the provision of targeted subsidies in the form of tax rebates or cash disbursement to more economically vulnerable groups.

This latter mechanism allows for the price signal to be sent to consumers first, triggering more economic behavior, even when rebates or credits are provided later.

Reform Gas Distribution Company Revenue Regulations

UFG adds to the final volume of RLNG that must be purchased to meet demand. In other words, the high percentage of gas lost in transmission and distribution networks can artificially inflate the final demand for RLNG, adding to importation requirements and increasing prices for end-users.

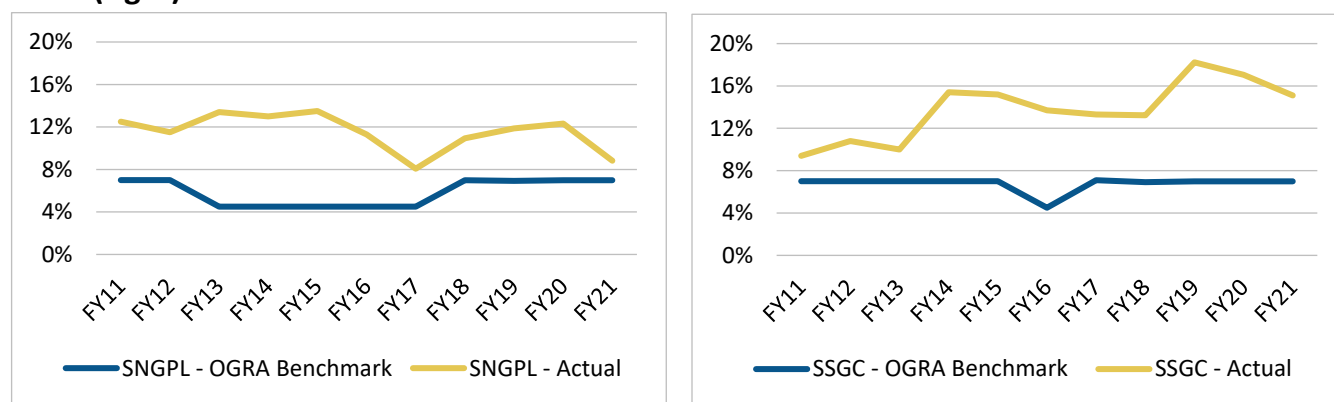
Based on Ministry of Energy figures stating that 116.12 Bcf of gas was unaccounted for in FY2020, IEEFA estimates that the volume of UFG lost in FY2020 translates to roughly the equivalent of 38 cargoes of imported LNG. For perspective, Pakistan imported 132 cargoes in 2021.

A reformed approach to gas T&D regulation can help discourage UFG and alter the incentives surrounding maintenance of the existing network. Before 2002, the full

value of UFG was passed on to consumers, which were required to pay for inefficiencies in gas company networks. As a result, OGRA began setting UFG benchmarks, or predetermined percentages of allowable UFG, beyond which gas companies would not be allowed to recover costs through retail tariffs.

Although the allowable benchmark was set at 4.5% in FY2016, it was subsequently increased to nearly 7% for FY2018—significantly higher than other developing economies.⁸⁵ During that time, gas companies reportedly lobbied for an 11% UFG allowance.⁸⁶ And between FY2017 and FY2020, actual UFG percentages for SNGPL increased from 8.07% to 12.32%, while UFG in the SSGC network increased from 13.30% to 17.05%.⁸⁷

Figure 13: OGRA UFG Benchmarks vs. Actual UFG for SNGPL (left) and SSGC (right)



Source: OGRA benchmarks from company financial statements; actual UFG from KPMG, PACRA, Ministry of Petroleum, and media sources.

Increasing the cap on recoverable UFG undermines the original purpose of the benchmark, which is to incentivize a reduction in UFG and protect consumers from bearing the cost of gas system inefficiencies. Figure 13 above shows that lower benchmarks were effective reducing UFG, in contrast to higher benchmarks, which have yielded higher UFG rates. Instead, OGRA can consider instituting a firm, non-negotiable timetable for reducing allowable UFG losses to greater align with international standards.

Along with a UFG allowance, current regulations incentivize the expansion of the gas network, rather than pipeline upgrades and maintenance to mitigate UFG. Gas companies receive a guaranteed return of 17.43% on fixed asset investments. As a

⁸⁵ KPMG. Oil & Gas Regulatory Authority Unaccounted for Gas – Study. July 2017.

⁸⁶ World Bank. In the Dark: How Much Do Power Sector Distortions Cost South Asia, p. 179. December 12, 2018.

⁸⁷ PACRA. [Gas Utilities – Sector Overview](#). June 2020.

Government of Pakistan, Petroleum Division, Ministry of Energy. [Unaccounted for Gas \(UFG\) Report FY2020-2021](#).

result, Pakistan has one of the most expansive gas networks in the entire world.⁸⁸

Recent gas network expansions have focused primarily on increasing residential connections. The State Bank of Pakistan notes that residential connections increased by 6.5% per year between FY2016-19, compared to much lower increases for commercial and industrial connections (2.8% and 1%, respectively).⁸⁹

When considering the cost-plus return formula of Sui companies, several perverse incentives in the Pakistani gas network become clear. The increasing consumption of RLNG by the domestic sector is increasing the financial burden of LNG imports on the government, since residential users are the most subsidized consumer category. Due to subsidies, households face little incentive to reduce gas demand despite high LNG costs.

At the same time, however, gas utilities are incentivized to expand gas networks to households rather than upgrade or maintain the leaking gas system. Continued network expansion, particularly to highly subsidized residential consumers, will only increase UFG rates and financial inefficiencies in the system.

There are notable efforts to reduce UFG rates, including a three-year UFG reduction plan that aims to reduce UFG in SNGPL and SSGC networks by 4% and 9.55%, respectively.⁹⁰ As more RLNG is injected into the network, the need for lower UFG benchmarks and other performance-based revenue determination mechanisms will become more urgent.

Assigning penalties to distribution companies, wherein their regulated rate of return is reduced in proportion to how far off target their agreed UFG reductions are from plan could be considered one such way to mitigate the creation of perverse incentives and link the performance of gas utilities to improved distribution efficiency.

Optimize LNG Procurement Strategies

LNG can be purchased according to numerous contract types and structures. These contracts define terms such as volumes, prices, indexation, destinations, and durations—whether long-term, medium-term, short-term, or spot contracts.

Pakistan currently sources ~40-50% of its LNG from international spot markets, exposing the country to extreme spot price volatility. This exposure is significantly higher than mature LNG buyers in Asia like Japan. On the other hand, signing exclusively new long-term purchase contracts risks locking-in take-or-pay volumes for 20 years, which may ultimately hinder Pakistan's efforts to improve domestic energy self-sufficiency and affordability.

⁸⁸ World Bank. In the Dark: How Much Do Power Sector Distortions Cost South Asia. December 12, 2018.

⁸⁹ State Bank of Pakistan. [Special Section: LNG Sector in Pakistan – Attaining Sustainability through Deregulation and Structural Reforms](#). 2021.

⁹⁰ State Bank of Pakistan. [Special Section: LNG Sector in Pakistan – Attaining Sustainability through Deregulation and Structural Reforms](#). 2021.

Instead, LNG buyers in Pakistan PLL and PSO can aim to develop a portfolio approach to LNG procurement. Overall, an optimal procurement strategy in Pakistan would improve supply security, diversify LNG sources, yield competitive prices, and closely align actual demand with contractual volume obligations.

A portfolio approach that optimizes contract lengths, term flexibilities, indexation options, and other contract terms may reinforce national energy security, while providing access to an array of pricing options that may improve the country's access to competitively-priced volumes in various market environments.

Regarding contract indexation, for example, some have suggested that gas-linked contracts could be a beneficial addition to Pakistan's portfolio of oil-linked contracts. Gas-linked contracts may provide lower delivered LNG prices at times of higher oil prices, and crude oil prices are typically viewed as more subject to geopolitical shocks than, for example, Henry Hub prices in the United States. Henry Hub-indexed contracts typically provide total volume and destination flexibility, although buyers are responsible for paying a liquefaction fee to US suppliers regardless of whether capacity is used.

However, there are significant downsides to LNG procurement this way. The US has historically been among the most expensive suppliers of LNG to Asian markets.⁹¹

While less price-sensitive buyers like Japan and China have absorbed this premium to diversify their supply portfolio, emerging LNG buyers may prioritize price over other benefits of Henry Hub-linked contracts. Offtakers in US contracts are required to pay for and arrange shipping, which may require more extensive overseas trading experience. US feedgas prices may not reflect the actual supply-demand fundamentals in Asia, and shipping times are much longer than geographically closer sellers.

Lastly, the availability of US LNG supply to emerging Asian markets will be limited in the wake of the Russia-Ukraine crisis, as mature Asian buyers like Japan, Korea, and China compete with Europe for non-Russian LNG supplies.⁹² US supply may not be readily available for price-sensitive buyers until new liquefaction capacity comes online later in the decade.

The determination of an optimal LNG procurement strategy will depend on the country's desired level of risk in both supply security and price sensitivity. For example, terms such as destination flexibility may allow the buyer to resell cargoes in higher-priced markets elsewhere, but this may be less relevant for countries aiming to prioritize supply security. Any new contracts must also include sufficient legal protections and penalties to ensure that volatility in spot markets do not interfere with counterparty incentives to deliver on term cargo requirements.

⁹¹ Rystad Energy. [Supplying Asia with LNG got much costlier for the US, but strong demand brings export records](#). June 23, 2021.

⁹² IEEFA. [For price-sensitive LNG buyers in Asia, now is not the time to build new LNG import terminals](#). March 31, 2022.

While it is beyond the scope of this report to define an optimal strategy for LNG procurement, this report has demonstrated that more can be done in terms of procurement strategy to ensure energy security and price competitiveness. A greater emphasis on LNG procurement planning will encourage the country's energy security and ability to flexibly respond to market changes.

Reform Tender Processes for Spot Market LNG

Spot market LNG procurement in Pakistan follows a lengthy process, beginning with gas utilities estimating RLNG demand based on indication by end consumers like the power sector, general industries, transport, and domestic households. The Sui utilities are also responsible for future demand projections for different consumer segments as well.

These forecasts are forwarded to the Petroleum Division, which assesses spot LNG requirements by weighing these projections against contracted LNG capacity. A formal demand is then submitted to PLL to procure these additional volumes.⁹³

PLL then invites tenders for spot cargoes in line with projected LNG delivery dates. The bidding takes follows rules from the Public Procurement Regulatory Authority (PPRA) mandating a gap of at least 30 days between tender advertisement and bid opening. This is followed by a 10-day period from bid announcement to the final awarding of the tender.⁹⁴ These excessive lead times can prevent the timely procurement of LNG, as the spot market requires more nimble decision-making.⁹⁵ The process—from demand confirmation to actual cargo delivery—can take up to 60 days effectively.

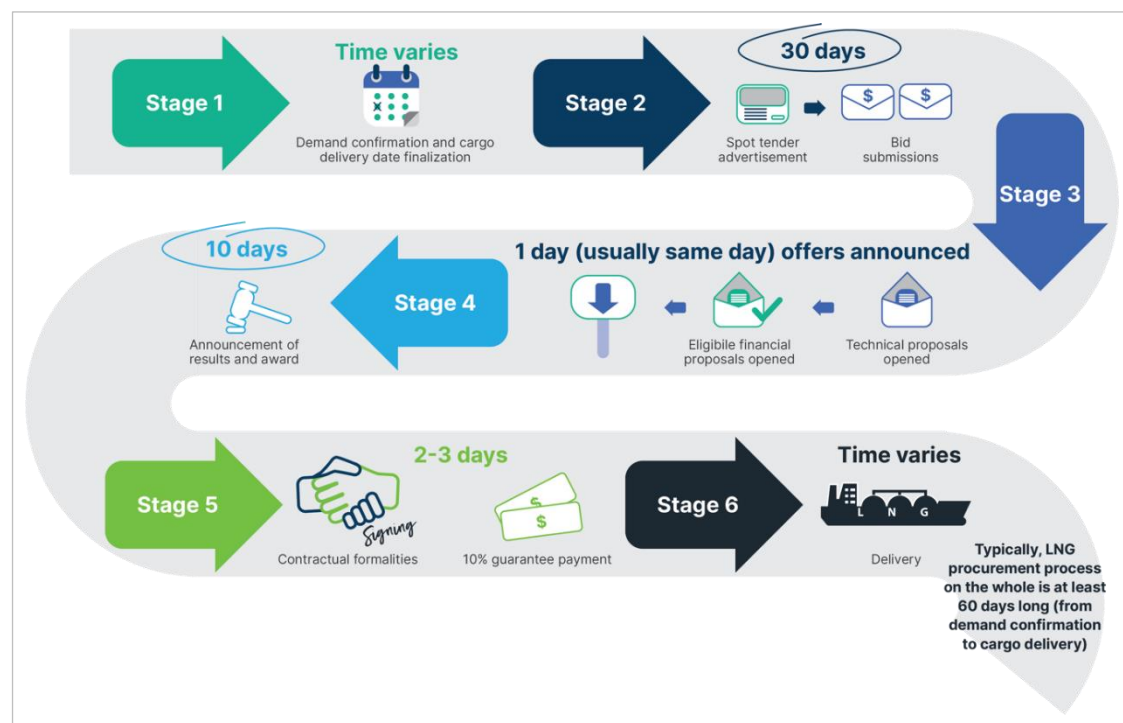
In other markets, spot purchases can be done in a matter of hours. Long lead times in Pakistan create a timing mismatch between when the LNG is needed and when it is actually supplied. This also adds risk that suppliers awarded in the tender may divert cargoes to higher priced markets elsewhere. Moreover, bidders may factor premiums into their bid submissions in anticipation of volatility and potential increases in global LNG prices. If global price increases fail to materialize, PLL may end up paying more for tendered cargoes than actual market prices due to time lags in the procurement process.

⁹³ State Bank of Pakistan. [LNG – Attaining Sustainability through Deregulation and Structural Reforms](#).2021.

⁹⁴ State Bank of Pakistan. [LNG – Attaining Sustainability through Deregulation and Structural Reforms](#).2021.

⁹⁵ Business Recorder. [PPRA rules: 16 LNG spot cargoes given partial exemption](#). September 01, 2021.

Figure 14: The Process for Spot Market LNG Procurement in Pakistan



Source: State Bank of Pakistan.

To ensure that LNG imports are locked in at competitive prices, PPRA rules may need to be revised to reduce the time between tender opening, bid reception, notification of results, and award of contract. PPRA recently exempted PLL from following these rules for spot procurement, allowing for a response time of three days between tender advertisement and bid submission.

Contracts are also awarded the same day bids are received, improving the efficiency of the LNG procurement process.⁹⁶ However, these exemptions are being made on a periodic basis and are subject to reversal. A more permanent approach is needed to ensure lasting improvements in the LNG supply chain.

Demand forecasting is also critical to optimal LNG procurement, since cargoes are booked before actual utilization periods. While demand projections for industries and the transportation sector are fairly stable, the power generation sector—which consumes almost 60% of the imported LNG—can experience frequent fluctuations, especially during seasonal peaks.

Past incidences have indicated that current demand forecasting and communication practices have not been timely, leading to procurement of expensive cargoes on shorter delivery timelines.^{97 98}

⁹⁶ Business Recorder. [LNG Cargoes given 6 month exemption](#). February 09, 2022.

⁹⁷ Dawn. [The LNG fiasco](#). December 3, 2020.

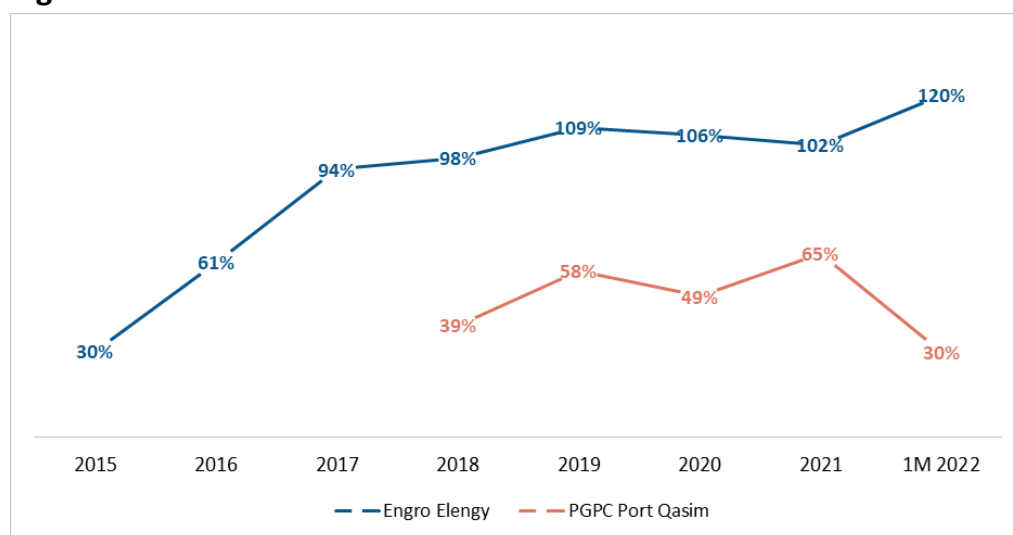
⁹⁸ Dawn. [The Great LNG Scramble](#). September 5, 2021.

Maximize Utilization of Existing LNG Terminals

The numerous gas transportation projects and LNG terminals in the pipeline may take years to materialize—if at all—given unfavorable market conditions, a lack of financing, and the difficult geo-strategic environment. It may therefore be prudent to focus on maximizing the utilization of existing infrastructure rather than building new LNG terminals and imported natural gas pipelines.

While the Engro Elengy terminal has one of the highest utilization rates in the region, Pakistan's second LNG terminal owned by the Pakistan GasPort Consortium (PGPC) Limited has been severely underutilized with an average utilization rate of just 48% over the past four years. This is mainly because PLL has used the PGPC terminal for the regasification of LNG cargoes purchased on spot markets. Recent extreme volatility of spot prices has meant that PLL has been unable to procure sufficient cargoes to meet demand.

Figure 15: Annual Utilization Rates for LNG Terminals in Pakistan



Source: IHS Markit.

Complemented by better planning and an improved LNG procurement strategy (see recommendations above), improved utilization rates for the PGPC terminal could help ensure adequate LNG supplies in the short term rather than constructing new terminals.

Medium-term (2-5 Years):

Accelerate New Utility-scale and Behind-the-Meter Renewable Energy and Battery Storage Projects

The power sector is the largest consumer of natural gas and RLNG in Pakistan, making it a key focal point for reducing the country's reliance on both fuels.

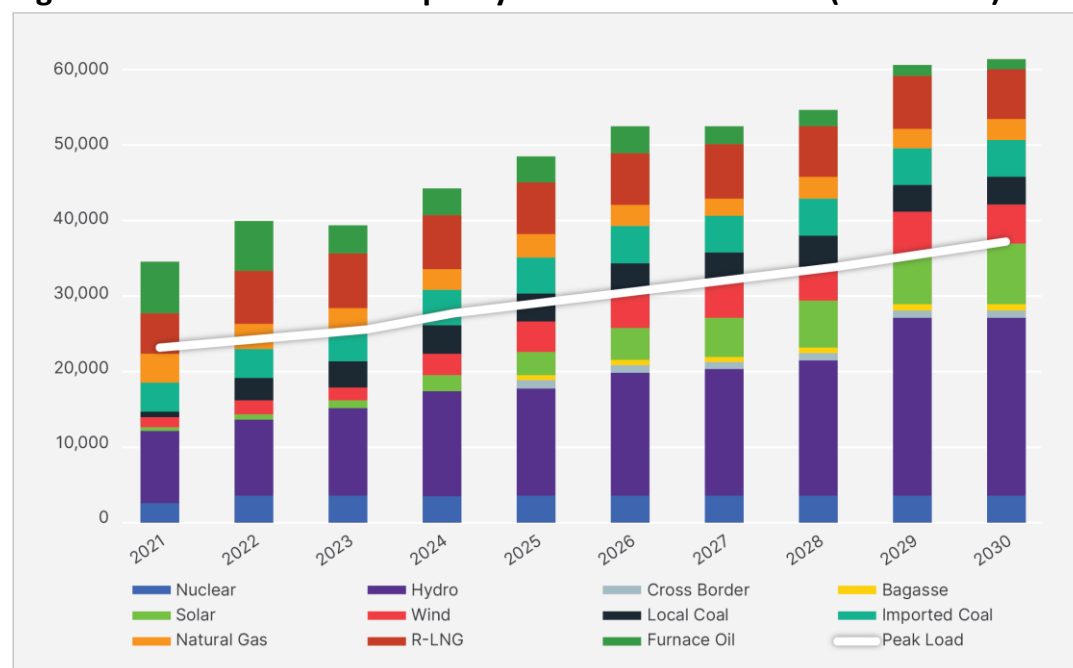
Fortunately, non-hydropower renewable energy is a readily available alternative that can (1) reduce Pakistan's fuel import bill and power tariffs, (2) improve the

country's energy security by reducing reliance on imported fuels, and (3) support the country's clean energy ambitions and improve air quality.

However, greater attention can be paid to the economic and financial benefits that non-hydro renewable resources like wind and solar can provide on a national scale.

Although the Alternative and Renewable Energy Policy 2019 set a target of achieving 30% non-hydro renewables in the electricity mix by 2030,⁹⁹ the country's Indicative Generation Capacity Expansion Plan (IGCEP) envisions the addition of 7GW of solar and 3GW of wind in that timeframe, compared to more than 14GW of hydro.¹⁰⁰ These would raise the share of non-hydro renewables to 17% and hydro generation to 46%. Overreliance on hydropower risks exposure to weather-related risks and droughts that have plagued the country's power sector in the past.

Figure 16: Planned Power Capacity Additions in Pakistan (2021-2030)



Source: *Integrated Generation Capacity Expansion Plan (IGCEP) 2021-2030*.

To support a more rapid deployment of renewables, the government can consider accelerating plans for competitive renewable energy procurement auctions.

The Alternative and Renewable Energy Policy 2019 detailed plans for competitive renewable energy auctions, a process in which potential suppliers bid for project capacity and power buyers select the cheapest options. In contrast to feed-in tariffs, which award renewable energy developers a fixed price determined by the government, auctions allow parties to compete for lower prices. Throughout Asia,

⁹⁹ Government of Pakistan. *Alternative and Renewable Energy Policy 2019*. July 21, 2019.

¹⁰⁰ National Transmission and Despatch Company. *Integrated Generation Capacity Expansion Plan (IGCEP) 2021-2030*, p. 56. May 2021.

auctions have yielded lower prices than feed-in tariffs, while encouraging price discovery, transparency, and competition.¹⁰¹

Numerous conditions must be considered to tailor auction designs to the specific needs of Pakistan.¹⁰² While auctions could lead to price discovery and encourage development of local renewable energy markets, plans for competitive auctions have been delayed so far mainly due to regulatory hurdles. The Alternative Energy Development Board (AEDB) and National Electricity and Power Regulatory Authority (NEPRA) have not yet issued a request for proposal (RFP) for competitive bidding.

Uncertainty around bidding volumes has been a key factor to these delays. The Indicative Generation Capacity Expansion Plan (IGCEP), which is supposed to provide direction for future renewable energy additions, has been pending approval since 2018.¹⁰³

AEDB issued a request for proposal (RFP) for wind energy projects in 2020.

However, bidding did not ultimately occur because NEPRA rejected the IGCEP, leaving wind energy procurement volumes unfinalized.

The IGCEP was finally approved by NEPRA in September 2021, but to date there has been no initiation of competitive auctions. The growth of non-hydro renewables in Pakistan has stalled and no new solar or wind energy projects have come online since 2020.¹⁰⁴

Auctions are therefore critical for jumpstarting renewable energy deployment in Pakistan and weaning the country off of expensive, imported fuels for power generation.

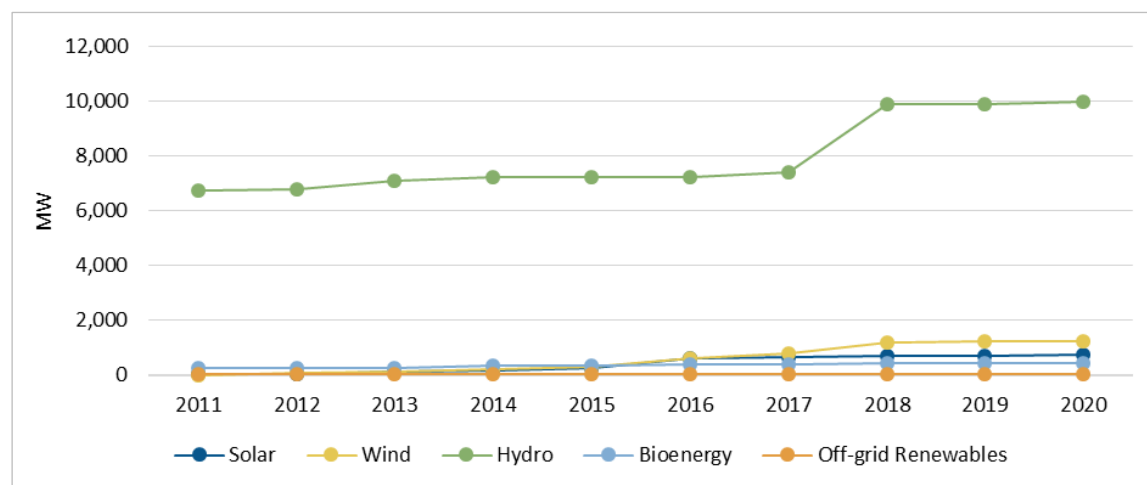
¹⁰¹ IEEFA. [For emerging Asia, LNG volatility puts energy security and economic growth in jeopardy](#). March 1, 2022.

¹⁰² For example, see, “Dawn. [Inclusive RE development](#). April 4, 2022.”

¹⁰³ In accordance with the ARE 2019 policy, the Cabinet Committee on Energy divided renewable energy projects in the pipeline into three categories, depending upon their advancement in regulatory approvals. Category III projects are the least advanced in their approvals and cannot go forward without auctions. Hence almost 6500 MW of renewable energy projects are still pending final decisions.

¹⁰⁴ NEPRA. [State of the Industry Report](#), 2021.

Figure 17: Non-hydro Renewables Capacity Additions Have Stalled in Pakistan



Source: IRENA. Renewable Power Capacity Statistics. 2021.

Apart from utility scale renewable energy generation projects, the industrial sector has great potential for renewable energy uptake as well, particularly rooftop solar. Rooftop solar offers an alternative to captive gas-fired power generation, and may lead to a reduction in industrial production costs due to the lower costs of solar power generation compared to gas and RLNG.

In the textile and fertilizer sectors for example, roughly 30-40% of the gas demand is used for power generation. There is therefore a large opportunity for solar generation to mitigate industrial gas and RLNG requirements.

In 2022, numerous cement companies in Pakistan have announced captive renewables projects to take advantage of this opportunity.

For example, Attock Cement Pakistan Ltd. commissioned a US\$9.67 million (PKR 1.8 billion), 20MW captive solar project in January, citing economic benefits. Flying Cement Company Ltd. Also announced a 12MW captive solar facility this year and claimed the investment could save the company up to 30% on energy costs. Maple Leaf Cement Factory commissioned a 5MW solar plant that is expected to begin operations in April.

And in March, Lucky Cement Ltd. Announced a 34MW captive solar plant coupled with a 5.589MWh battery storage facility. This would reportedly be the largest captive storage facility in the country.

Battery storage technologies are critical for industrial users to firm up captive or grid-connected power supply. Battery deployment in Pakistan is still nascent, but there is significant potential for batteries to support uninterruptible power supply. This is particularly true for industries aiming to reduce their exposure to electricity grid constraints and fuel supply risks.

The increased uptake of captive renewables generation in Pakistan's industrial sector is a positive signal. However, without proper tariff signals and incentives for rooftop solar deployment, industries may struggle to recognize the economic benefits of switching to captive renewable generation. Inefficient gas and RLNG usage may therefore continue to grow at the expense of the financial sustainability of Pakistan's entire gas system.

Long-term (5-10 Years):

Transition Non-power Sectors From Gas/LNG Reliance, Through Alternative Energy Sources Such as Biogas and Green Hydrogen

The availability of cheap domestic gas has traditionally discouraged environmentally friendly alternatives, such as biogas.

Biogas is not a new technology in Pakistan, and several thousand households in rural areas use biogas for cooking. However, a lack of incentivizing policy has prevented a widespread uptake of this fuel for other applications.

Biogas production is a mature technology and holds great potential as a replacement fuel. An estimated 600-1,200 mmcf of biogas can be made available in areas with a high biomass availability.¹⁰⁵

Biogas is chemically similar to natural gas and has the added advantage of being capable of transportation through existing natural gas pipelines. It can be produced through a variety of feedstock including animal manure, agricultural waste, sludge from settled wastewater and landfills containing organic waste.

The agricultural sector contributed 18.9% of Pakistan's GDP. As an agricultural economy, the country can harness its potential and complement its natural gas usage with biogas, especially for power generation. If pipeline access can be provided to production facilities, biogas may even replace natural gas usage for domestic heating and cooking.

The current economics of LNG amidst geopolitical tensions and spot market volatility, combined with dwindling supplies of domestic gas, make the case for alternative fuels such as biogas even more clear. *IHS Markit* estimates predict Asian spot LNG prices to stay above \$20/MMBtu for at least the next five years.¹⁰⁶ Biogas production costs on the other hand can range between \$3-16/MMBtu, depending on favorable economies of scale.¹⁰⁷

Green hydrogen presents another prospect for gas replacement in industries with an entrenched dependence on natural gas, such as the fertilizer sector. The economics of the technology are increasingly likely to become favorable in the future due to the decline in renewable power costs, along with a similar decline in

¹⁰⁵ The News. [Emerging Biogas](#). March 12, 2022.

¹⁰⁶ IHS Markit. Benchmark LNG price outlook: April 2022.

¹⁰⁷ International Energy Agency. [Outlook for biogas and Prospects for organic growth](#). 2020.

electrolyzer costs.

In Pakistan, Oracle and PowerChina International Group Ltd. Have signed a non-exclusive cooperation agreement to jointly develop the country's first mega-green hydrogen project. The technical feasibility study states that the cost-competitiveness of solar and wind energy in Pakistan could help the project produce green hydrogen at the cost of less than US\$2.00 per kilogram. At a total cost of US\$2 billion, the project would include a 400MW hydrogen production plant, a 700MW solar and 500MW wind hybrid power plant, as well as 450MW of battery storage.¹⁰⁸

This early example of hydrogen development in Pakistan demonstrates that renewable energy is cheap enough to attract foreign investment for novel technologies. To sustain investor interest, the government can ensure the removal of regulatory roadblocks for a large-scale penetration of renewable energy, as well as provide other fiscal and policy incentives that would allow scaling up an energy shift towards cleaner energy sources in the longer term.

Conclusion

Natural gas has historically been considered a cheap and abundant national resource. However, the country's domestic reserves are declining, causing a shift to imported LNG. Rather than simply replacing one fuel for another, the shift has backfired on the government and drastically increased the economic and financial burden of gas on public utilities.

Long-term contracts, often considered the most secure form of LNG procurement, have proven unreliable in a tight global market. Volatile spot market prices offer term suppliers more lucrative prospects elsewhere, and suppliers to Pakistan under long-term contract have defaulted on at least 11 cargoes since January 2021.

As a result, the country was forced to spend an average of US\$58.57 million more per cargo on volumes procured through emergency tenders than term contracts. Pakistan's cumbersome and time-consuming spot LNG procurement process almost assures that the country will pay the highest cost of any cargoes they do manage to secure.

The country's significant exposure to the spot market has also meant that the country had forgo cargoes altogether when prices reached upwards of \$40/MMBtu. The resulting shortages led to gas rationing in the country and massive revenue losses in key economic sectors.

Unless actions are taken to urgently reduce reliance on imported LNG, the problems are likely to become even worse. Pricing inefficiencies, cross-subsidization, and UFG losses in the system could mean that the injection of more LNG could lead to a surge in circular debt. Planned pipeline projects and terminals may also take time to

¹⁰⁸ Renewables Now. [Oracle Power unveils details on 400-MW hydrogen plan for Pakistan](#). February 9, 2020.

materialize as geopolitical conflicts and unviable economics exacerbate stranded asset risks for LNG infrastructure.

To counter the situation, policymakers should first aim to mitigate inefficiencies in the LNG supply chain through improved planning, procurement, and distribution. Rather than prioritizing ways to increase LNG supply, be it additional import terminal or pipeline, the near-term focus should turn to using existing supply more efficiently. This can be done through changes to regulatory incentives, tariff structures, and energy efficiency programs.

In the longer term, it would be prudent to limit dependence on imported LNG for power generation and other economic activities, since LNG has proven to be an unaffordable and unreliable option for Pakistan's energy sector.

Alternative energy technologies, particularly those in non-power sectors, will take time to research and develop, but it is critical to lay the groundwork now for a favorable investment environment and sustainable growth.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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