PRIED
Policy Research Institute
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ENERGY MONITOR

GAS SECTOR

IN PAKISTAN

DEEPENING CRISIS AND WAY FORWARD

November 2022 – April 2023

Policy Research Institute for Equitable Development

Gas Sector in Pakistan: Deepening Crisis and Way Forward

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Introduction

Pakistan is in the midst of a severe gas crisis. The nature of crisis has taken all precarious forms in the gas supply chain and hit all sectors utilizing gas either as primary or secondary fuel. Unfortunately, while the demand for gas has been on an increasing trend, the supply of gas continues to dwindle. The domestic gas reserves which were first discovered in 1952 are projected to last less than 13 years.[1] And now due to widening demand-supply gap, the country has quickly become a major LNG importer in the past few years. This creates significant vulnerability for the economy where the import reliance and LNG spot price trading in dollars exacerbate the pressure on the balance of payment situation. In parallel, gross underpricing of gas and subsidies has put the financial sustainability of large LNG imports in question—consequently leading to a growing *Circular Debt* in the gas sector.[2]

Alongside switching to the import of gas supplies, the government is also now practicing severe load-shedding to handle the gas crisis. This load-shedding is more pervasive in winters during which the unmet demand exceeds around 1,200 million cubic feet per day (MMcf/d). [11] As a result residential, commercial and industrial sectors, all get adversely impacted. The reliance on alternative means for domestic heating, cooking, and other uses thus increases which brings with them environmental and health concerns. Moreover, the industries lose their productivity, and commercial economic activity is also hampered.

How do we deal with this crisis? The current context demands not only an autopsy of the gas sector, but also emphasizes the need for reduced reliance on natural gas. The latter has become unavoidable for energy security of the country and there is clearly a need for a coherent strategy on how to cater this issue. There are already statements by the government on reducing dependence on natural gas in the power sector. The residential sector—second largest consumer of gas—could be an important sector to play a strong role in reducing reliance on gas. Overall, a timely tailored roadmap to reconfigure the traditional gas appliances and switching to renewable-based technologies for heating and cooking space is imperative. In this energy monitor, we discuss the gas sector in detail with a focus on current crisis and sustainable solutions that can enable a green energy transition away from fossil fuels.

Natural Gas – a Key Player in the Energy Mix

Pakistan is the 21st largest user of gas in the world- contributing to nearly 40% of the country's primary energy supplies, it plays a major role in several sectors. [10] Currently, power sector remains the largest consumer of gas. In addition to electricity generation, it is used for residential cooking and heating, for fertilizer production and in manufacturing, and as compressed natural gas for transportation.

1 With unchecked gas demand, indigenous gas supplies are anticipated to run out in about 8 years

2 The stock of circular debt of the gas sector has spiked to PKR 1.642 trillion by June 2022 from PKR 350 billion in 2018

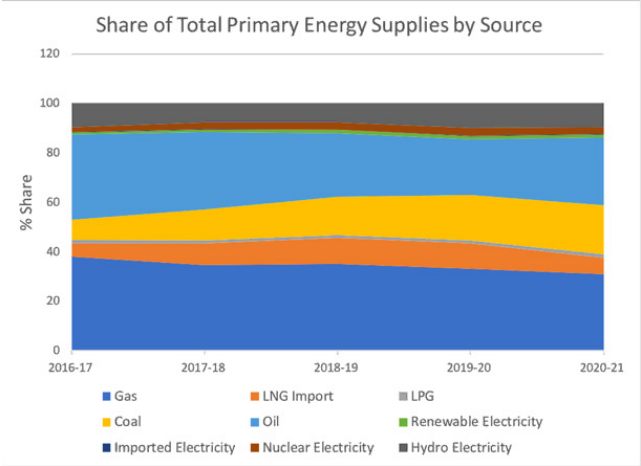
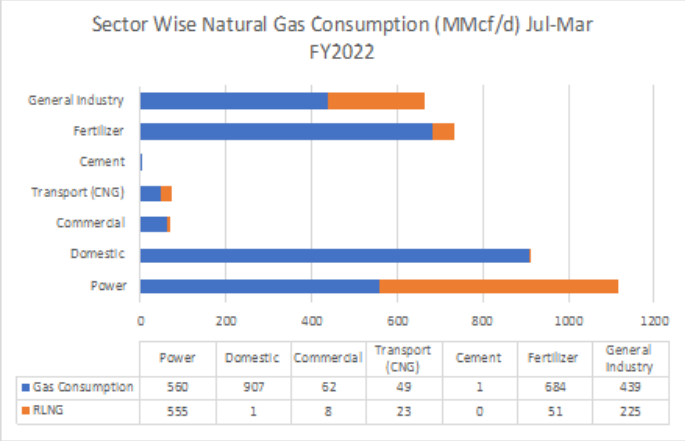


Fig. 1a: Primary Energy Supply.
Source: State of Industry Report 2022



	Power	Domestic	Commercial	Transport (CNG)	Cement	Fertilizer	General Industry
Gas Consumption	560	907	62	49	1	684	439
RLNG	555	1	8	23	0	51	225

Fig. 1b: Sector wise Gas Consumption (MMcf/d). Source: Pakistan Economic Survey, 2021-2022

Till a decade back, Pakistan had sizeable reserves of natural gas. Reliance on it therefore enjoyed broader policy support by the government. This explains the rapid expansion of the country's piped gas distribution networks, reaching a total length of roughly 200,000 kilometers and 10.3 million connections by 2020.

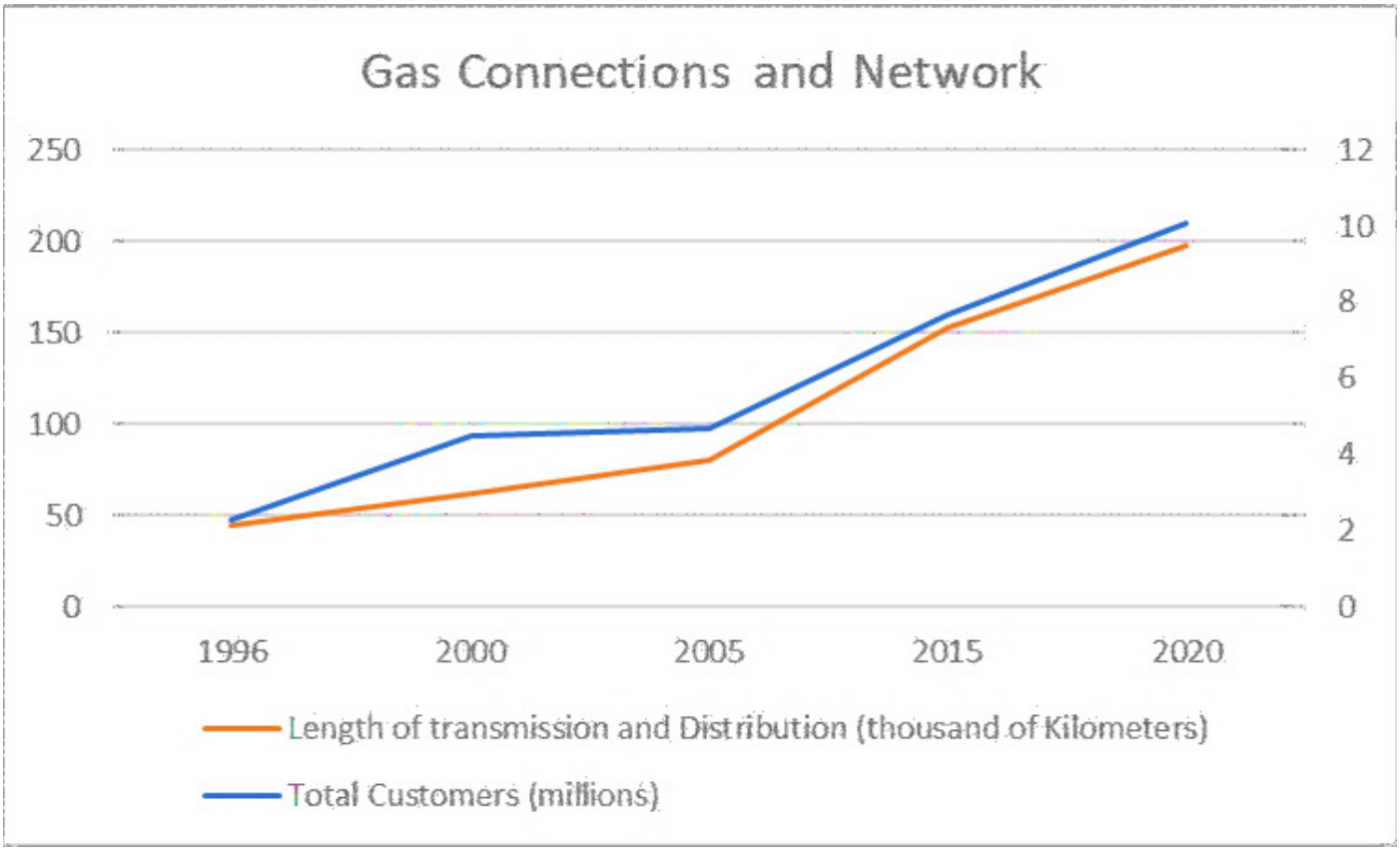


Fig.2 Gas Connections and Network. Source: MOE, 2000, 2010, 2015, 2020

Pakistan's gas supply is secured through these domestic gas reserves and imported gas. Domestic gas is supplied from local gas fields, whereas, the delta of domestic production and domestic demand is met through import of gas under long-term gas supply agreements as well as spot market purchases. Pakistan has signed several pipeline gas trade agreements which include: Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline; the Iran-Pakistan (I-P) Gas Pipeline; and the Pakistan Stream Gas Pipeline—most recently signed with Russia. All these projects have been facing delays due to geo-political conditions in the region. The recent trade agreement with Russia is also shrouded in uncertainty due to the greater sanctions now imposed on Russia.

In addition to piped gas import, Pakistan also started importing LNG in sizable quantities since 2015. This is evident from the rising demand for imported gas which tipped to 26% in FY 2020 up from just 8% in FY 2016. These imports are being carried out under the long-term contracts which include a government-to-government 15-year agreement between Qatar and Pakistan; as well as four other agreements with private suppliers in Italy on take-or-pay basis. Imported LNG is then re-gasified before supply to the end users. For this purpose, currently two LNG regasification terminals exist but government is also planning to enhance the regassification capacity by building additional LNG regassification terminals. To cater to the demand in excess of the term contracts and defaults on contracted supplies[3], LNG is also being sourced from spot markets.

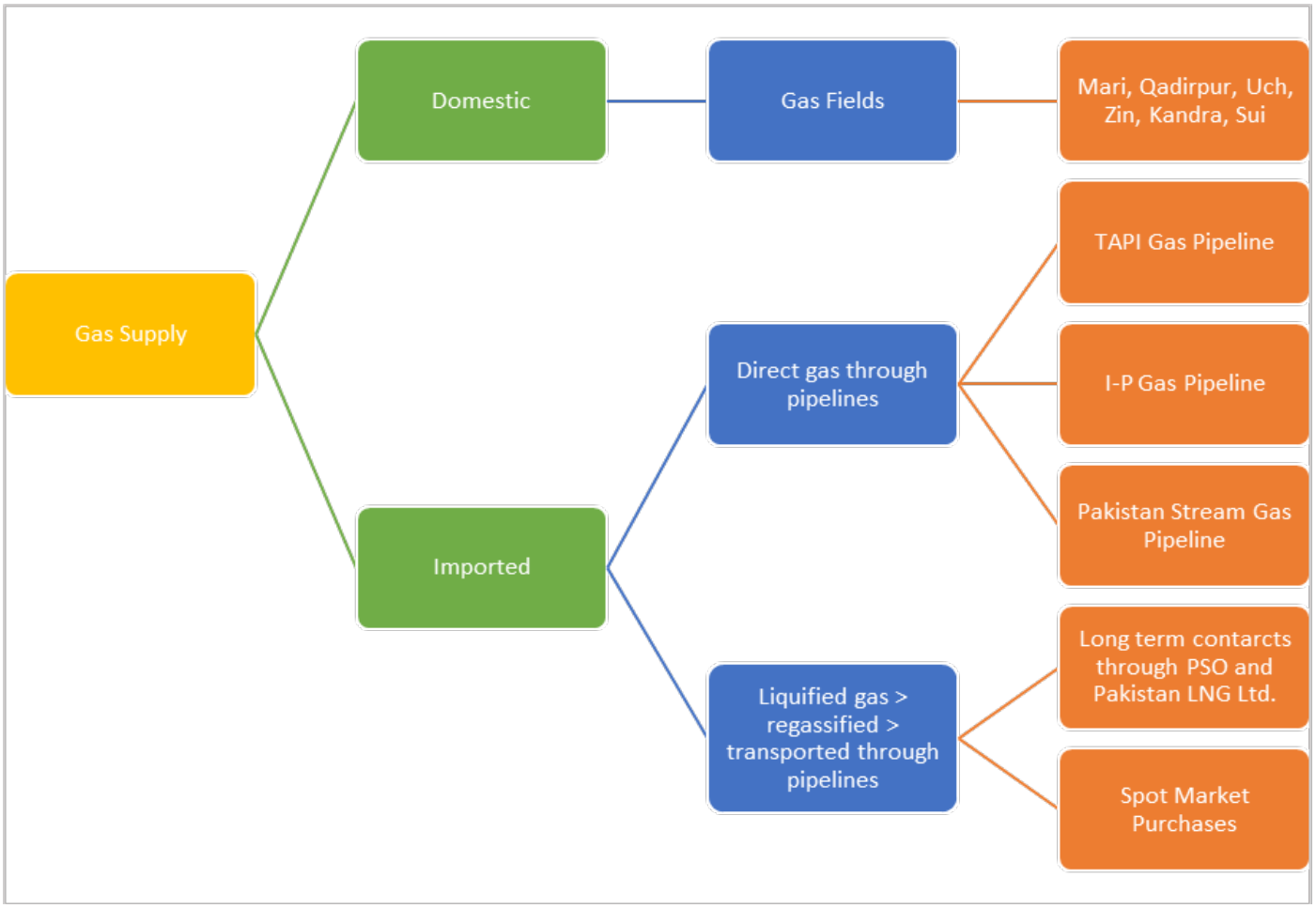


Fig. 3: Pakistan's Gas Supply Network
Source: State of Regulated Petroleum Industry 2020-2021

3 LNG suppliers have defaulted at least over 11 times in last 3 years. Gunvor declined to ship four LNG cargoes in 2022, scheduled for delivery on April 15, May 14, June 4 and June 9 as per contracts.[6]

Depleting Natural Gas Reserves

Pakistan was self-sufficient in gas till 2005. However, indigenous gas production stagnated since 2008, and then started declining after 2015. Demand for gas on the other hand has been continuously increasing — rising at 2.1% compound annual growth rate (CAGR) over fiscal years 2013 to 2018. This has led to a widening supply and demand gap. Projections by Oil and Gas Regulatory Authority (OGRA) also indicate worsening demand-supply gap. The projected constrained demand for gas by year 2030 is roughly 6,000 MMcf/d whereas supply capacity including both domestic production and LNG imports is barely 50%. Gas supply from major indigenous gas fields has been declining at an average rate of 3% annually. A recent entrant Mari Petroleum Company Limited shows a positive outlook as the proven reserves in their gas fields have been improving. But looking at overall proven gas reserves — currently standing at 20.95 trillion cubic feet — Pakistan is left with about less than 10 years of gas reserves considering the growing demand. With faltering indigenous reserves and no large new discoveries in the recent years, Pakistan has now become a major importer of LNG. Presently, 30% of the gas consumption is met through imported LNG and in FY 2021 it has costed the national exchequer around $3.4 billion. The gas shortfall is projected to increase substantially in the years ahead, stoking demand for further imports. As per the planning commission of Pakistan, the gap between gas supply and demand could triple to 4,000 MMcf/d by 2030, about 50% of which would be met through LNG imports.

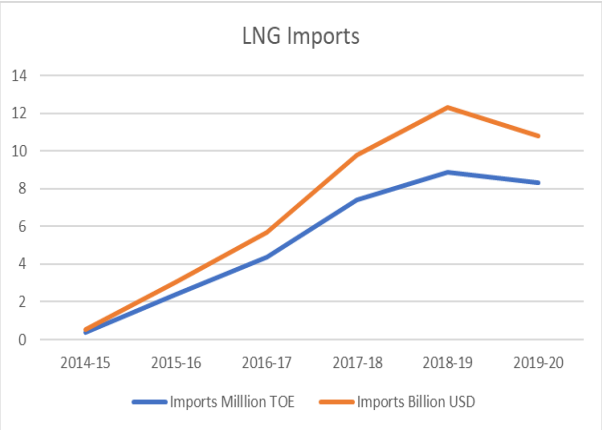


Fig. 4a: LNG Imports. Source: Pakistan Energy Yearbook 2020

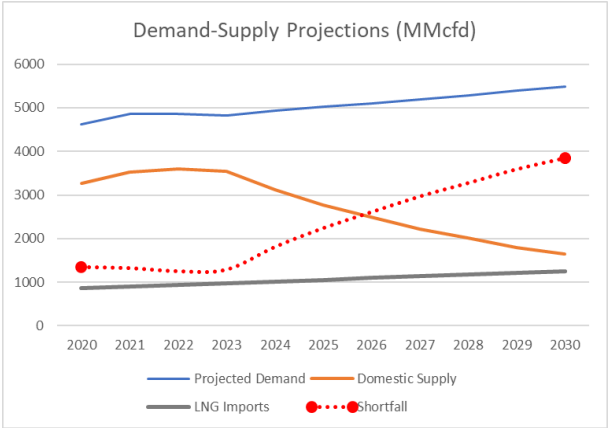


Fig. 4b: Demand Supply Projections. Source: OGRA, 2020

With LNG imports meeting only partial demand, the country continues to face chronic shortfall. Load-shedding of gas in the winter season—when demand peaks—has become a permanent custom since the past few years. A gas allocation policy was also adopted in 2005 that gives lower priority to the power and transport sector—gas goes first to residential users and the fertilizer sector. Despite the preferential allocation criteria for domestic sector, increasing demand and decreasing gas supply is resulting in gas shortage for residential users. In the current fiscal year, gas load-shedding has continued from winter season to summer season, and peaked particularly in the month of Ramadan. The Minister of State for Petroleum addressing a press conference in January stated that 24/7 supply of gas cannot be ensured as gas reserves have dropped. Fig. 5 below shows declining proven gas reserves in the country.

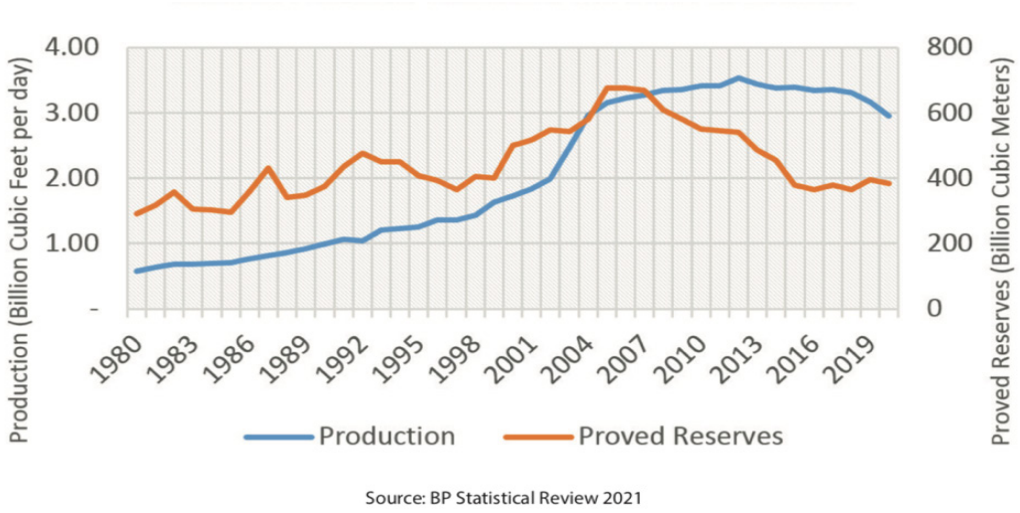


Fig. 5: Domestic Gas Production and Proven Reserves. Source: BP Statistical Review 2021

Sectoral Impacts of Gas Shortage

The shortage of natural gas has been adversely impacting all major sectors of our economy. Power sector, fertilizer industry, and residential consumers of natural gas are among the most effected sectors as historically these categories have the highest share in the natural gas consumption.

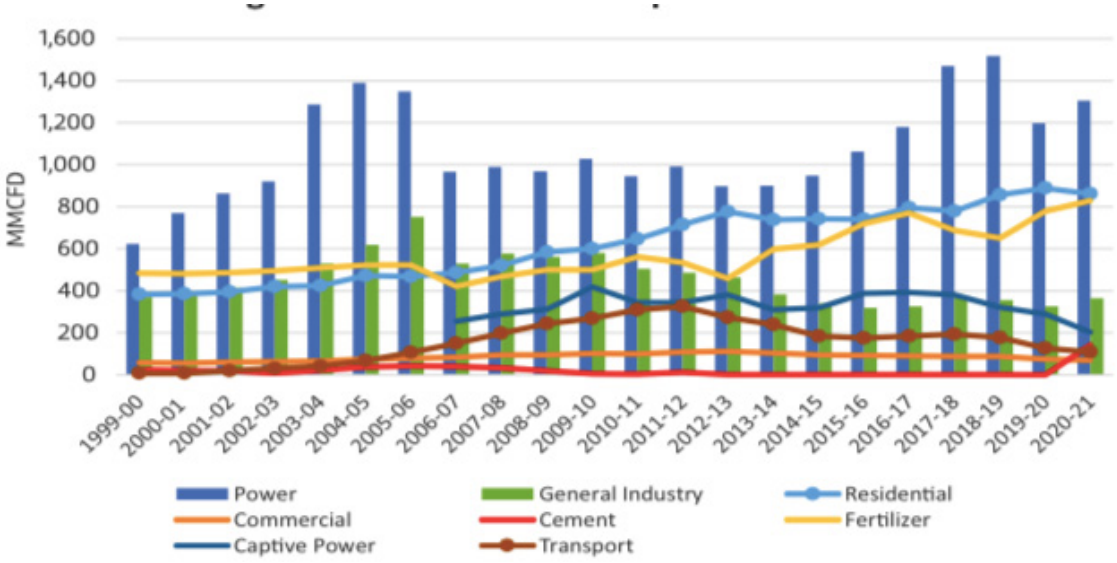


Fig. 6: Yearly Sector wise Natural Gas Consumption. Source: State of Petroleum Industry Report 2020-2021

Impacts in the Power Sector

Natural gas based power generation — which includes both plants that run on domestic gas and reliquefied LNG (RLNG) power plants —enjoys a dominant share in the thermal power fleet. The share has remained consistently high at 57% on average over the past 6 years. As compared to conventional thermal generation, these plants are more efficient. But their dependence on imported fuel exposes their operations to international market shocks. The situation further worsens as Pakistan is struggling in maintaining its foreign exchange reserves and resultantly, we see that these plants are underutilized. From July 2021 to June 2022, the RLNG power plants fell short of their reference generation 67% of the time, as can be seen in Fig 7a. On the contrary, the furnace oil fired power plants have produced 247% of their reference generation annually during the same period, as can be seen in Fig 7b. This is important in understanding the dynamics of our power sector that in the absence of natural gas, not only the reliance is shifted on a dirtier fuel, but also the operations of less efficient plants are maximized.

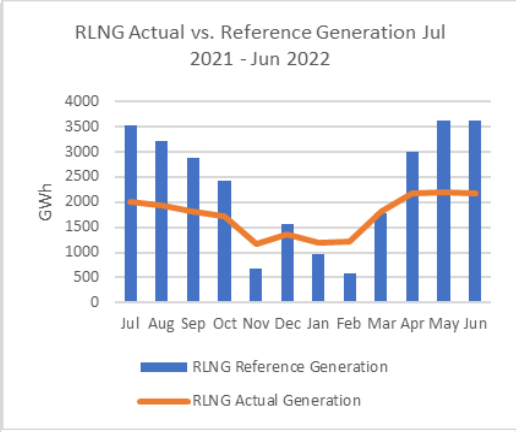


Fig. 7a: RLNG's Actual vs. Ref. Electricity Genertion
Source: State of Industry Report 2022

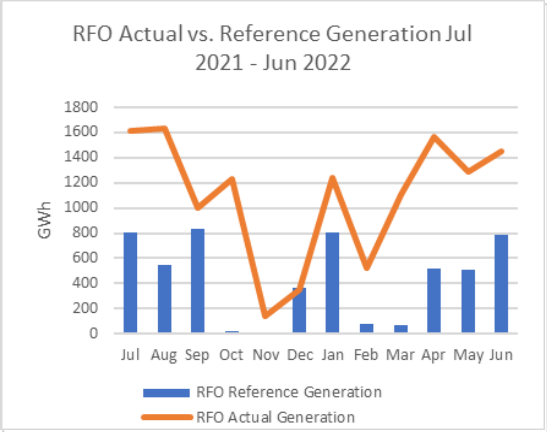


Fig. 7b: RFO's Actual vs. Ref. Electricity Generation
Source: State of Industry Report 2022

The Russia-Ukraine war has particularly exacerbated the energy crisis in Pakistan. The prices of LNG cargoes hit record high last year amid Russia's invasion of Ukraine. Accordingly, the LNG suppliers defaulted on their contracted shipments to Pakistan, and Pakistan had to buy LNG in the spot market in which prices spiked to $39.8/MMbtu in July 2022, and $69/MMbtu[4] in August 2022, as compared to an average price of $10-$15/MMbtu that Pakistan pays for its contracted LNG. At such times, the government considered load-shedding as a less costly option than procuring LNG at high rates in the spot markets. For example, Karachi experienced heavy gas load-shedding throughout winters this year and it continued until recently during the month of Ramadan. The government explicitly announced the inability to ensure continuous gas supply however promised to make it available during hours of keeping and breaking fast.

4 one million British thermal units

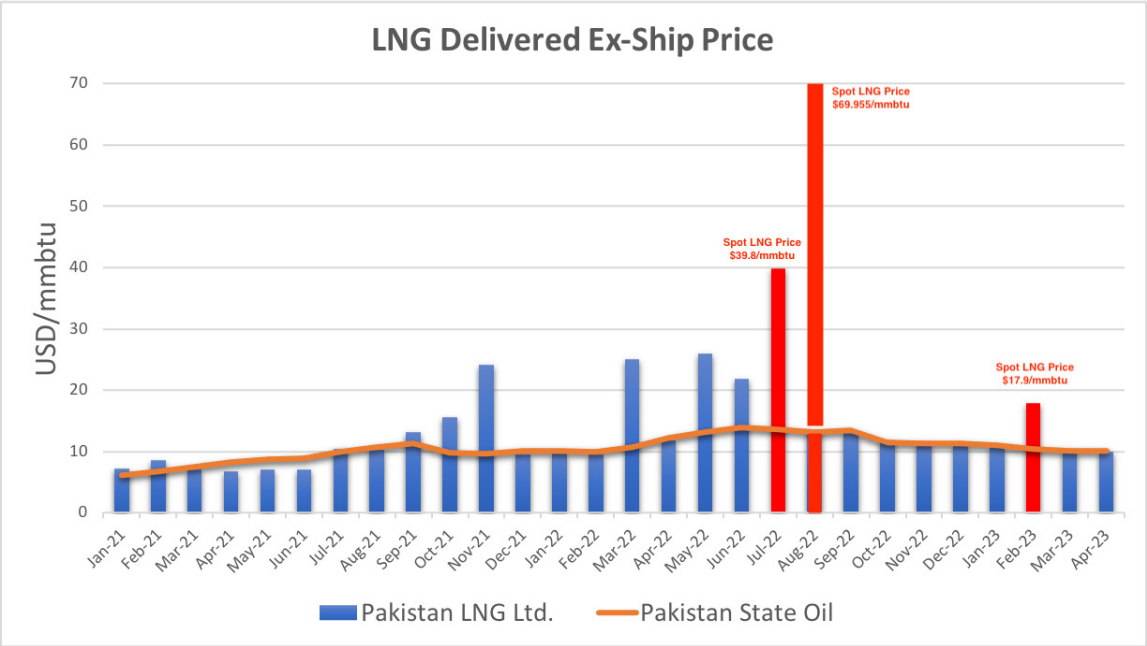


Fig. 8: LNG Delivered Ex-Ship Prices in Pakistan Source: OGRA, RLNG Weighted Average Sale Price Determinations Jan 2021 to Apr 2023

Impacts on the Fertilizer Industry

The fertilizer industry is the 3rd highest consumer of the natural gas, where it is used both as a fuel and as a feedstock. The urea fertilizer — which becomes essential during the Rabi and Kharif cropping seasons — is produced when natural gas combines with ammonia. [8]Traditionally, the local fertilizer production plants have been running on indigenous gas. Mari Petroleum Company Limited, operating at Mari Gas Field — the second largest domestic gas reserves — has been providing over 90% of the gas required for urea fertilizer production. [11]But with depleting gas reserves, gas supply to these plants have been affected and therefore some of these plants stopped production. Earlier in January, at the time of cropping season of wheat, two urea fertilizer plants had to shut down. The government managed supply of gas to the residential sector by cutting down gas supply to the fertilizer plants. [9] So supply shortage coupled with increase in demand during the wheat cropping season led to spiked prices of urea fertilizer. As a result, a 50kg bag of urea fertilizer was selling for PKR 2900, PKR 460 above the maximum retail price of PKR 2440. [9]

The demand for the fertilizer is expected to increase again in the upcoming Kharif cropping season. The government estimates the demand to be around 3.2 Million Metric Ton (MT), of which 2.9 Million MT will be met through domestic production and remaining 0.3 Million MT will be imported. [5]However, if foreign exchange reserves do not stabilize and domestic urea production slows down because of gas shortage, it will become a matter of national food security. There will be a cascading effect on supply of domestic produce, need for food imports, and in turn availability of foreign exchange reserves. The government is taking measures to mitigate the potential impact on the agriculture sector. In March, the government announced to resume operations of the two fertilizer plants shut down earlier in January, and also to provide subsidized gas to the fertilizer manufacturers by May 31, 2023.

Impacts in the Industrial and Transportation Sector

The industrial sector also consumes natural gas to generate heat for industrial processes. These industries include cement, steel, glass, tiles ceramics, paper, bricks, food products etc. Although natural gas can be substituted by other alternative fuels, it has been predominantly used by the industries because of its lower price. As industrial sector is lower in the gas allocation order, during times of gas shortage, domestic demand is met by cutting down supplies to the industrial sector if needed.

Compressed Natural Gas (CNG) is also used a fuel in the transportation sector. Pakistan has a large CNG fleet. In the 1990s, the government took active steps to promote CNG as an alternative fuel for automobiles. According to NGV Global, the country had more than 900,000 gas vehicles and 800 CNG refueling stations by 2016. As per the natural gas allocation policy, CNG gets the least priority, i.e., after the needs of the other sectors are met, natural gas is supplied to the CNG stations. But, when gas shortage hits, irrespective of the allocation order, there is an outcry among the CNG station operators. Their operations are interrupted, wages to associated workers are affected, as well as the availability of vehicles that run on CNG is affected. The situation particularly worsens in winters, when domestic demand surges, and supply to CNG stations is cut to meet domestic demand. According to a news report, in Khyber Pakhtunkhwa 572 CNG stations closed in January as per government order, and which could threat employment of 165,000 people. [3]

Financial Health of Gas Sector

The gas sector is becoming financially unsustainable with growing circular debt which has reached PKR 1.642 trillion by June 2022. Underpricing of gas and provision of subsidies are the two main causes contributing towards its rapid decline. The problem begins when the revenue from gas consumers does not match the cost of gas. As per the Minister of State for Petroleum, the gas is being currently sold at "unsustainable rates" and need upward revisions. [4] According to an industry expert, the gas prices have not altered much in the last four years, there have only been some cosmetic changes. So, bringing the price of gas at par with the cost of gas is essential in reviving the sector. Earlier this year, OGRA proposed hike in the natural gas prices and the government has approved an increase of up to 113% in the gas price. The government had to give its approval, unlike in the past, as bringing the prices of electricity and gas at par with their costs was set as a precondition for release of funds by the IMF under its 9th review of Extended Finance Facility (EFF).

Pakistan is the 8th largest country when it comes to gas subsidies. The government charges a different price from each sector—with residential and fertilizer sector enjoying the highest subsidies. The price of domestic gas is substantially below the imported LNG. In Pakistan, LNG prices have reached an average of US$15/MMbtu, compared to average price of US$ 4/MMbtu charged for domestic gas (reference price from residential sector).

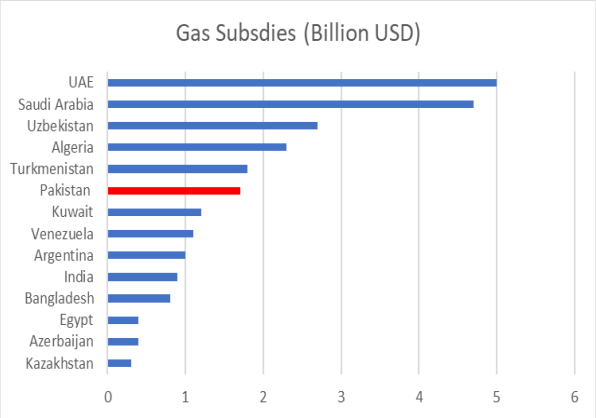


Fig. 9a: Gas Subsidies: Cross Country Comparison: IEA, 2021

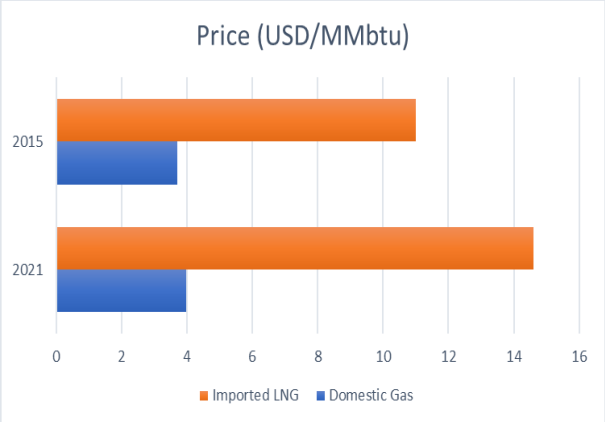


Fig. 9b: Imported LNG Prices, PSO, 2020; Domestic weighted average price, OGRA 2020

While the subsidies insulate end-users from unfair price volatility in global market, it has created significant financial sustainability challenges for the government. The government has a limited fiscal space available to provide subsidies and with IMF setting stringent targets for economic parameters of the country, the further provision of subsidies is also restricted. However, the effectiveness of subsidies also requires an in-depth analysis. For example, the government announced the supply of subsidized RLNG to five export-oriented sectors in 2022 which translates into a subsidy cover of PKR 40 billion. But no meaningful increase in the volume of exports was experienced when the same sectors were provided with subsidized gas in 2021. [13] Similarly, the fertilizer manufacturing is also highly subsidized. In 2022, urea manufacturing plants operated on subsidized RLNG at a price of PKR 839/MMbtu as compared to the actual average cost of PKR 2,925/ MMbtu. [2] In 2023 as well, fertilizer plants are ensured subsidized gas until the end of May. Adding to the problem of a low gas supply, a large share of gas is lost during delivery. Compared to the Unaccounted-for-Gas (UFG) benchmarks of 1.0-2.6 percent in the advanced economies, these losses exceed 15% in Pakistan. The subsidy burden and the UFG losses together threaten the financial stability in gas sector. Circular debt is fueled by uncovered subsidies, high UFG losses, often delayed sales price adjustments.

Crisis Management and Current Policy Landscape

The government has been handling the crisis with no clear strategy or vision. If we only review the past few years, it appears that we have been running round in circles, dealing with the same issues every year with conventional solutions. Whereby clearly an innovative approach is needed. Fig. 10 below shows the measures taken to address the gas shortage issue since 2021. It is evident that the focus has been primarily on either providing gas through imports, or managing available supplies through gas load-shedding — which used to be a feature of only winters but now summers are also not spared.

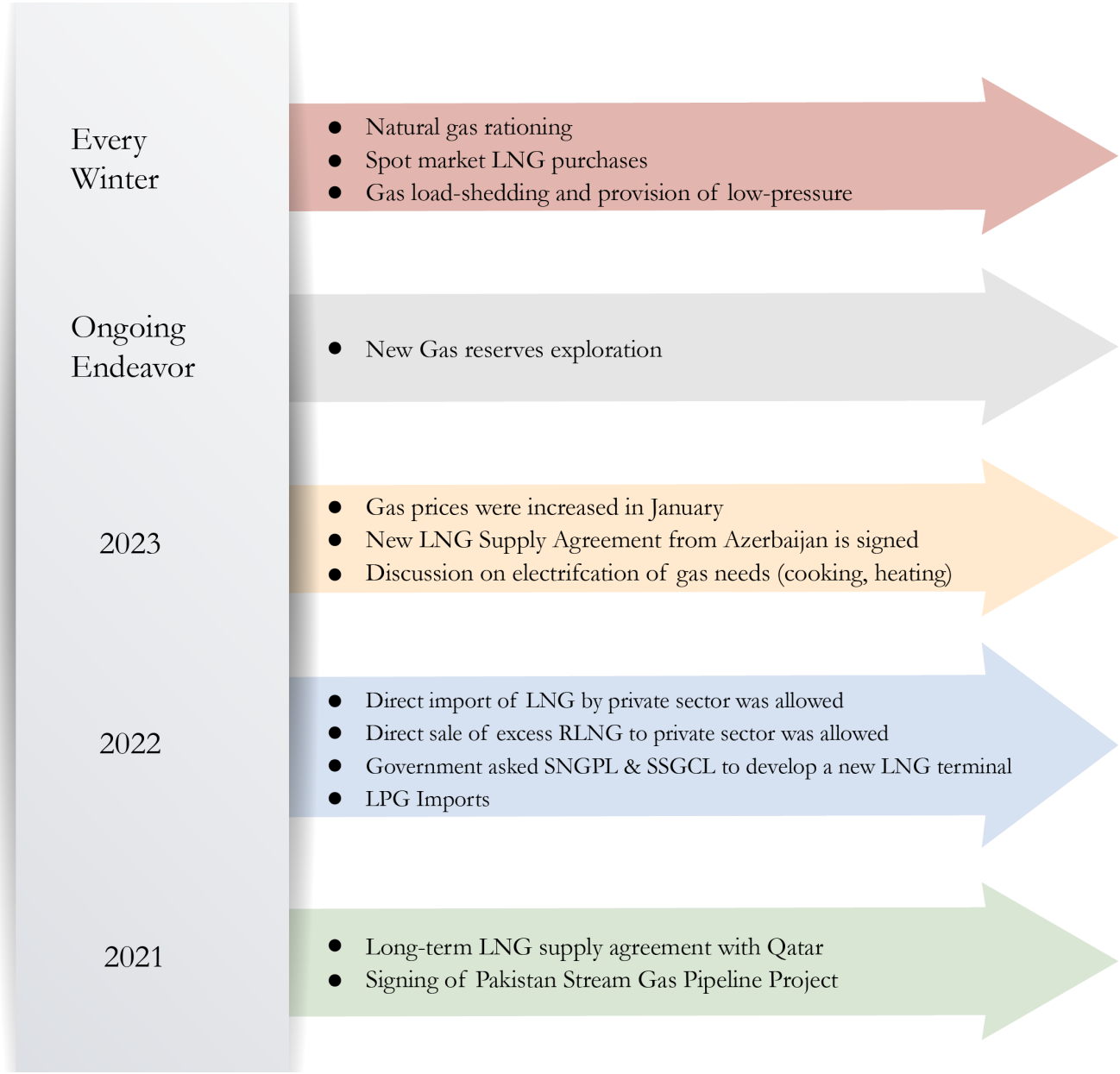


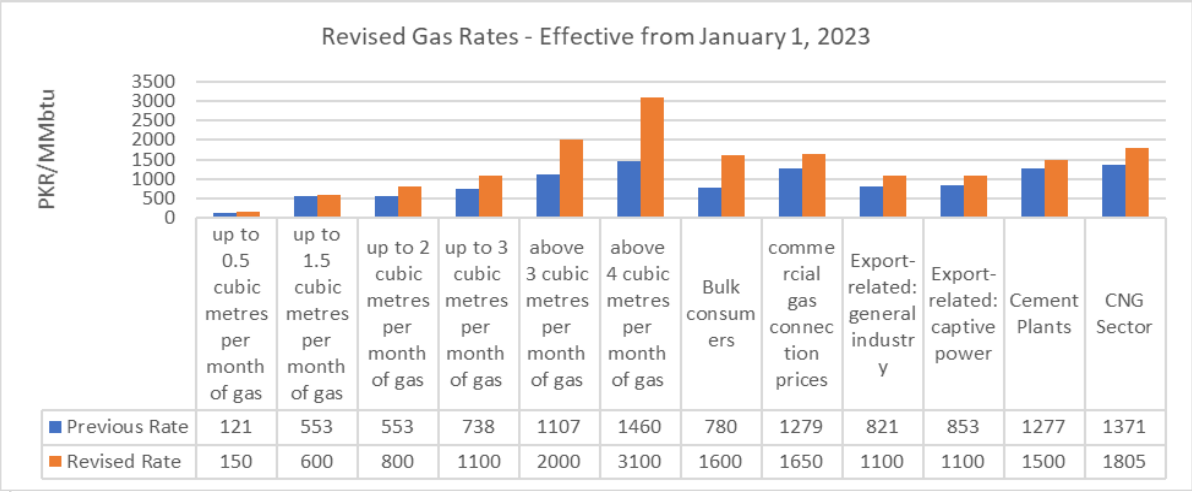
Fig. 10: Strategies employed over years for crisis management

The risky global fuel supply scenario and diminishing local gas reserves demand a long-term approach to deal with the crisis. However, the measures taken so far only address the short-to-medium term needs, which also do not meet the current demand for gas.

For instance, since the supply of LNG could not be secured, the government shifted towards Liquified Petroleum Gas (LPG). Discussions to import LPG from Turkmenistan via Afghanistan through land took place in October 2022, and the first shipment of LPG arrived in April 2023. However, sustainability of this measure is questionable. As per the State Bank of Pakistan, the country is currently capable of only financing 4 weeks of imports.[7] Additionally the $1.1 billion tranche under the IMF's Extended Finance Facility (EFF) to be released after the 9th review is still in approval process. So, meeting one imported fuel shortage with another imported fuel that also requires foreign exchange reserves only enhances the country's energy insecurity and have a toll on economic stability.

Similarly, in the agriculture sector, the gas needed for fertilizer production to cater to the demand during the Kharif cropping season, has been met by temporarily reconnecting the two local production facilities with gas utilities. But gas has been provided at subsidized rates until May 31st. [5] This may have met the immediate need of the sector, but sustaining the gas supply to the fertilizer industry in every cropping season is a tall order. Also, for any shortfalls, the import of fertilizers is considered an immediate solution.

The most that has been seen from the government in terms of long-term gas needs is a recent mention of demand side management, and moves of more long-term LNG and piped gas supply contracts. Demand side management has been discussed in a "Pakistan Natural Gas: Policy Issues & Way Forward" meeting held earlier in January this year. It was shared in the meeting that substitution to electric appliances for space and water heating can save yearly an estimated 74,736 Million cubic ft of gas in total.[15] To further slash the demand, the meeting suggested bringing gas price at par with electricity prices.[15] As a result gas prices were also increased effective from 1st January 2023. Figure 11 below shows a summary of revised rates. With regards to long-term LNG contracts, the meeting recommended entering into fresh contracts with existing suppliers instead of extending existing contracts, and focusing on increasing the over the surface gas storage capacity. Speeding up the piped gas inter-border contracts such as TAPI and Iran Pakistan Gas Pipeline is also on agenda.



	up to 0.5 cubic metres per month of gas	up to 1.5 cubic metres per month of gas	up to 2 cubic metres per month of gas	up to 3 cubic metres per month of gas	above 3 cubic metres per month of gas	above 4 cubic metres per month of gas	Bulk consumers	commercial gas connection prices	Export-related: general industry	Export-related: captive power	Cement Plants	CNG Sector
Previous Rate	121	553	553	738	1107	1460	780	1279	821	853	1277	1371
Revised Rate	150	600	800	1100	2000	3100	1600	1650	1100	1100	1500	1805

Fig. 11: Revised Gas Rates for End Consumers Source: Tribune

In the power sector, which is a major user of gas, no clear stance is coming from the government on the natural gas usage. The energy minister states at one occasion that "LNG is no longer part of the long-term plan" and shared plan of increasing domestic coal-fired power capacity to 10 gigawatts (GW) in the medium-term. [12] Whereas in the planning meeting on natural gas,[15] the minister stated that electrification of energy uses in domestic sector can help divert natural gas to the power sector which can potentially reduce power tariffs. Pakistan also became part of ADB's ETM[5] program, which sees natural gas as a transition fuel and thus no gas-based power plants have been identified for early retirement. The direction in which the power sector is headed is thus ambiguous.

5 Asian Development Bank's Energy Transition Mechanism (ETM) program aims at reducing greenhouse gas emissions in Asia and the Pacific by early retirement of fossil fuels-based power plants and replacing them with clean energy alternatives.

But altogether, the adopted long-term measures are inadequate in addressing the natural gas shortage. Imports are expensive and unreliable, domestic gas is depleting, and fossil based indigenous resources have associated environmental degradation. It is time that the government resort to innovative, environment friendly, and indigenous renewables based energy sources to meet energy needs, and formulates a strategy along these lines.

Dealing with the Crisis—Strategy for Moving Forward

The large-scale reliance on LNG imports is locking Pakistan into an unstable market characterized by a suite of risks including commodity price fluctuations, exchange rate volatility, not to overlook fuel supply insecurity. The current geopolitical instability (Russian invasion of Ukraine) has also exposed the cost and insecurity of relying on gas. Any further investments on expensive LNG infrastructure or piped-gas projects only threatens larger macro-economic stability making little economic sense.

What could be a medium-long term response to this deepening crisis in gas sector? The solution is clear: Pakistan needs to reduce its dependency on gas and focus more on replacing gas with local renewables which is affordable and could deliver long run economic benefits and energy security. Pakistan has a clear opportunity to transition towards a more secure and sustained pathway. Renewables-based technologies provide a better alternative to achieve broader energy security over the medium-to-long-term. In the power sector, overall, we see a lower share of gas fired generation by 2031, as is shown in the latest iteration of Indicative Generation Capacity Expansion Plan (IGCEP). In the IGCEP, the installed RLNG and gas-based generation capacity falls to 15% in 2031 from existing 32%. However, this reduction is still not ambitious enough and we need to further reduce reliance on gas in power sector. This could be done by relying more on renewable energies which do not have variable fuel costs and are indigenous reserves.

The government should also encourage decarbonization initiatives in the residential sector—the second largest gas consumer. From an energy efficiency perspective, Pakistan has some of the worst performing existing buildings; while presently new-build housing has no effective plans to change. Gas is used as a primary cooking fuel in household sector of Pakistan. It is important to note here that Pakistan does not have a central heating system. In general, household use a wide variety of heating appliances. Gas heaters are in general used for heating rooms, and gas geysers for heating water. The traditional gas-based cooking stoves should be swapped with electric stoves. Further, renewable heating solutions such as solar heating pumps, and solar geysers could replace the conventional piped-gas geysers and heaters. By electrifying household heating and cooking, there will also be benefits in terms of better utilization of existing power generation fleet. As currently for existing thermal power plants, the average annual utilization rate is about 28% only. [10]

It is only essential to put measures in place which can drive the transition toward these emerging solutions. These can potentially include: planned decarbonization roadmap, awareness-raising campaigns, regulatory measures, and most importantly financing instruments—for instance through interest free loans, tax reliefs, and other consumer financing schemes which can support more equitable access to renewable based cooking and heating solutions. Further, the government can set mandates for use of electric devices in new housing schemes, and no new gas connections alongside halting any prior planned spread of gas pipelines. It can also

facilitate setups of solar PV mini-grids so that these housing schemes, and industries become self-sufficient in their energy needs. Similarly, such solutions can be extended to rural populations, where gas supply networks are absent, and people are currently relying on unhealthy alternatives such as burning of biomass, charcoal, and kerosene to meet their cooking and heating needs. It is important that the government pays attention to this segment of our society and comes up with innovative and healthy alternatives to meet their energy needs. The supply of electricity through off-grid solutions, and then electrification of energy uses such as cooking and heating, along with necessary infrastructure to facilitate such transitions, is a much-needed direction.

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