GAS MARKET REFORMS

6% TO 15% PATHWAY

DECEMBER 2023

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EXECUTIVE SUMMARY

A well-functioning gas market relies on a combination of regulatory, economic, and technical factors to foster competition, ensure efficient operations, and address the needs of both producers and consumers. The creation of an efficient and liquid gas market is crucial for achieving the government's vision of a 15% share of gas in the energy basket by 2030.

Liquid gas markets globally have delivered considerable economic advantages to the gas sector overall. In the context of India, the anticipation is that liquid markets will propel competition within the gas sector, thereby fostering an increase in price competitiveness. This enhancement of price competitiveness can significantly contribute to India's pursuit of a 15% share of gas, given its high sensitivity to price considerations.

However, the gas market in India currently falls short of being a liquid market. Several challenges, including a lack of transparency, an uneven playing field, the absence of GST integration in the gas sector, and limited infrastructure availability, pose obstacles to the development of a liquid market. Addressing these challenges is imperative for realizing the full potential of the gas sector in India.

In the journey to create a more liquid gas market, India can draw valuable insights from the evolution of gas markets in other countries with mature market structures. Analysing these experiences can inform and guide India in determining the path it wishes to undertake for the development of its own gas market.

Finally, to establish a liquid gas market, India must implement a comprehensive set of regulatory, technical, and economic changes. These reforms can be categorized into short-term, medium-term, and long-term initiatives, based on the urgency of their implementation. Essential reforms required are:

Short-term Initiatives

- Implementation of heightened transparency measures
- Establishment of a day-ahead capacity market
- Facilitation of fertilizer spot sales via gas exchange
- Rigorous enforcement of the Affiliate Code of Conduct
- Elimination of price resale trade caps

Medium-Term Initiatives

- Unbundling and setting up ISO
- Adjustments to tariff reforms
- Introduction of GST in the natural gas sector
- Establishment of virtual trading hubs

Long-term Initiatives

- Hedging and futures gas markets
- Gas trading partnerships with South Asian countries
- Focus on infrastructure development

In conclusion, the imperative need for a liquid gas market is evident to enhance gas consumption in the country. All stakeholders involved must collaborate and take concerted actions to facilitate India's achievement of this crucial objective.

1. INTRODUCTION

India is a developing nation with an increasing appetite for energy consumption. This increase in consumption is expected to be met by a variety of fuel options, including renewables and natural gas. The natural gas as a fuel source is key to India's energy transition as it is much greener than the alternative fuels such as coal and liquid fuels. The burning of natural gas produces half as much CO_2 per unit of energy compared to coal (Source: EIA). Thus, the Indian government has set a target to raise the share of natural gas in the energy basket to 15% from the current 6%. While the target and direction are clear, concrete steps need to be taken to achieve this objective. As evident from the chart below, India has witnessed limited progress, with its gas demand remaining flat in the last five years, despite multiple initiatives.

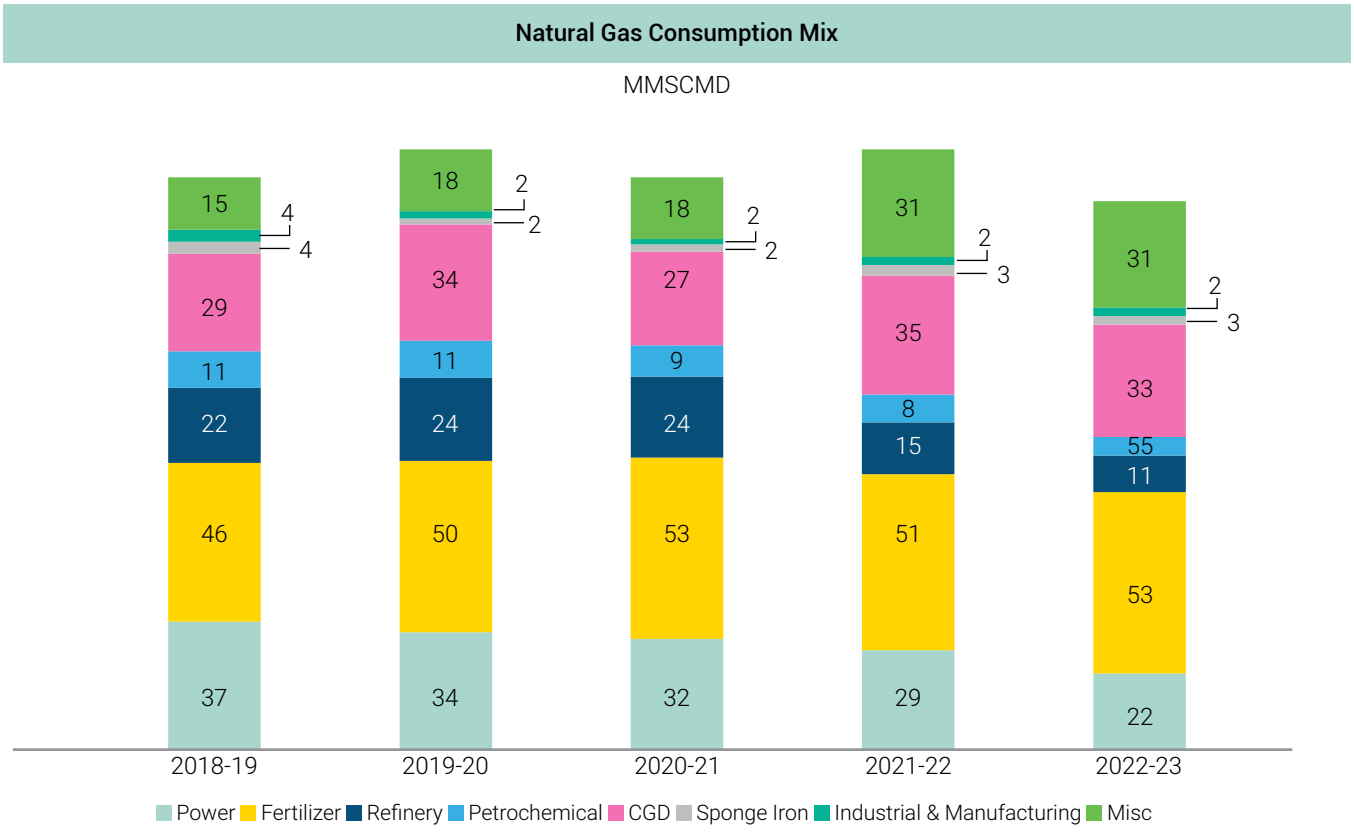

Figure 1 India's Natural Gas Consumption Mix FY 19-23 (Source: PPAC)

While there are multiple demand drivers for natural gas consumption in India, a fully functioning liquid natural gas market is one of the key drivers. Liquid and competitive gas markets worldwide have yielded substantial economic benefits to the sector, fostering demand expansion, and concurrently providing price signals that incentivize new investments. Our literature review suggests that liquid market offers efficient price discovery by accurately reflecting supply and pricing dynamics, reduced price volatility, support market participants to effectively manage their commodity risks and increase trading volume.

A liquid natural gas market becomes even more crucial for India as we are looking to increase natural gas share from 6% to 15%. Enhanced market liquidity will increase the number of participants in the market, ultimately increasing the price competitiveness of the gas market. India being a price-sensitive country, enhanced market liquidity can be the key to reducing domestic gas and LNG's prices, ultimately increasing natural gas consumption. However, natural gas market in India remains fairly illiquid due to current market structure, regulatory constraints, and other challenges. The market of natural gas in India lacks liquidity with the presence of only a small number of producers, small number of shippers and a limited number of consumers. Consequently, the market is mostly limited to bilateral contracts between natural gas producers/marketers and consumers. The spot market experiences a lack of liquidity attributed to minimal participation. Lack of liquidity remains one of the greatest impediments to the development of a transparent spot market in the country.

Developing competitive gas markets and attracting investments for gas infrastructure development requires regulatory reforms, structural changes, and liquid markets. This paper analyses key roadblocks in developing liquid gas market, recommendations, and roadmap to achieve a functioning liquid gas market. The paper will take guidance from how gas markets in UK, USA and Australia have evolved and thus providing a well-developed pathway for India to move towards a functioning gas market.

2. WHAT ARE LIQUID MARKETS?

Market liquidity in the context of natural gas pertains to the ease with which the natural gas can be bought or sold without significantly impacting its price. This factor plays a critical role in shaping pricing dynamics, trading volumes, and overall market stability.

A liquid market is characterized by an ample presence of buyers and sellers, facilitating efficient price discovery, and minimizing price volatility. Market liquidity affects the pricing dynamics, trading volumes, and overall market stability (Energy5, 2023)[1]. In a liquid market, there is a robust presence of both buyers and sellers, facilitating efficient price discovery and minimizing price volatility.

How liquid market will benefit natural gas stakeholders in India?

Alternative to long-term contracts: India has traditionally favoured long-term contracts and places huge reliance on them (S&P Global, 2022)[2]. India had long-term LNG contracts of 21 MMTPA in 2022 (Petronet LNG Limited)[3]. Upon achieving liquidity, the market can evolve into a secondary source for gas trade, providing an alternative to reliance on long-term contracts (Shi, 2018)[4]. This would provide end users with the flexibility of managing their portfolio taking advantage of commodity price movement across term contracts and spot. This will allow users with volatile demand to explore spot gas market as an option.

Development of derivative market: In an illiquid market, bilateral trades occur, and thus, risks from price variability arise. To manage such risks, financial instruments are used. Trading in gas derivatives can occur on exchange or OTC. In matured gas markets, a substantial volume of trading activity occurs through derivatives, encompassing diverse timeframes across relevant market domains (Oxera, 2022)[5] . It also leads to a key concept -'forward curve', which defines the prices at a specific time when gas, accessible on the exchange, can be acquired for current purchase with delivery scheduled for the future.

Power sector may adopt natural gas if available on short notice: Electricity demand undergoes fluctuations, with the evening load significantly impacting gas demand in the power sector. Managing these variations is crucial for effective energy planning.

Currently, gas capacity needs to be booked at least 3 days in advance. The existing take-or-pay policy further exacerbates the situation in the power sector. Prompt availability of natural gas is imperative to increase gas consumption in power plants. Dividing a gas day into four blocks, each comprising of six trading hours can effectively address the challenge. A mechanism where gas may be supplied to power plant on flexible contracts where there is no take or pay commitment, but power plants may pay a premium for the flexibility in the contract.

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[1] Measuring Natural Gas Market Liquidity and Its Effect on Pricing; www.energy5.com

[2] S&P Global; www.spglobal.com

[3] India LNG Scenario, Petronet LNG

[4] Key elements for functioning gas hubs; www.sciencedirect.com

[5] Oxera study into the functioning of gas market; www.ice.com

Fertilizer plants may be enabled and incentivised to source spot gas from the market: Fertilizer sector constitutes a significant share of India's natural gas consumption. The fertilizer sector may save significantly by procuring their spot requirement of gas through the exchanges. The flexible sourcing as well as competitive price for the fertilizer companies may happen through exchanges' liquid markets. This approach will also help in reducing the subsidy burden for the fertilizer sector.

Small industries be enabled to purchase gas directly after: The expiration of exclusivity agreements signifies a crucial milestone in the gas market, promoting a more open and competitive environment for gas procurement. Small industries may directly purchase gas from the liquid market, allowing for more direct control over their gas procurement strategies. In a monopoly market, the customers are beholden to the prices set up the monopoly and they have no recourse. Thus, the small-scale industries (with demand less than 50,000 SCMD), are dependent on prices offered by CGD companies. Thus, in a liquid market where market exclusivity has expired, small industrial customers may discover price more efficiently and hence lowering their cost of procurement.

Thus, it would help them optimize their gas purchase based on their variable requirements, providing a demand impetus to the industry. They will be incentivised to use natural gas and avoid dirtier fuels like coal, pet coke, naphtha, furnace oil etc.

'Vision 2030' report by PNGRB- Need for liquidity in Indian gas markets

"In order to provide adequate support to the development of natural gas market and encourage investment in the natural gas infrastructure in India, policy level initiatives would be required to allow gas to trade freely in the market where suppliers, large consumers, traders etc. could all participate.

Development of such a trading platform is likely to facilitate establishment of aggregators/traders in the market place with varied business models who would in turn provide depth to the market and address the divergent needs of different suppliers and buyers of natural gas. It is essential to develop a trading platform to discover prices and create sufficient depth in the Indian natural gas market so that more investment finds its way into the natural gas infrastructure and the infrastructure that gets created gets utilized efficiently."

What is needed for a liquid market?

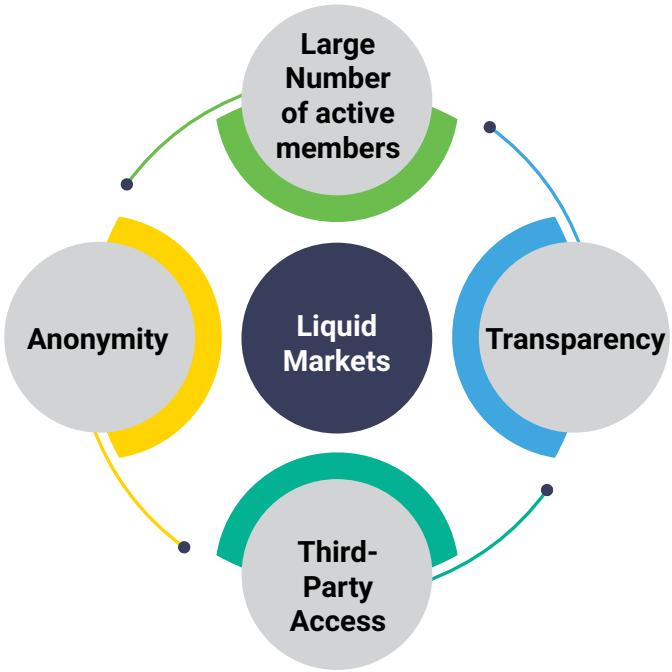


Figure 2 Key Elements of a Liquid Market

1. **Large number of active members:** The number of active hub members is an indicator of the diversity in participant's profile on the hubs, and therefore an indicator concerning the liquidity of hubs (Council of European Energy Regulators)[6].

   TTF, which is considered one of the most mature and liquid hubs in the world, is composed of 275 active participants, as of 2022 (The Oxford Institute for Energy Studies, 2023)[7]. The more active participants there are, the more liquidity there will be in the market.

Active Market Participants & Traded Products in EU hubs

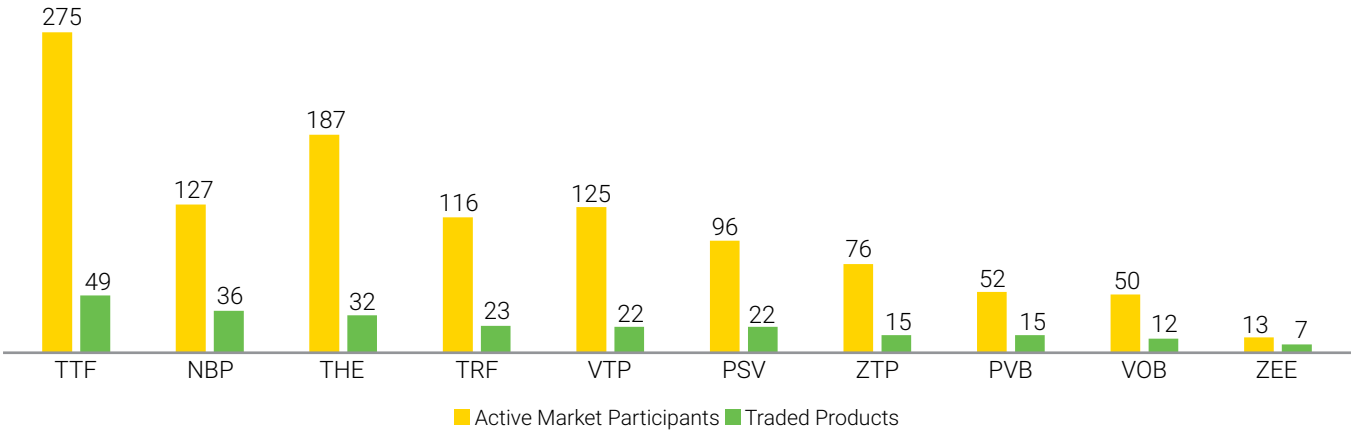
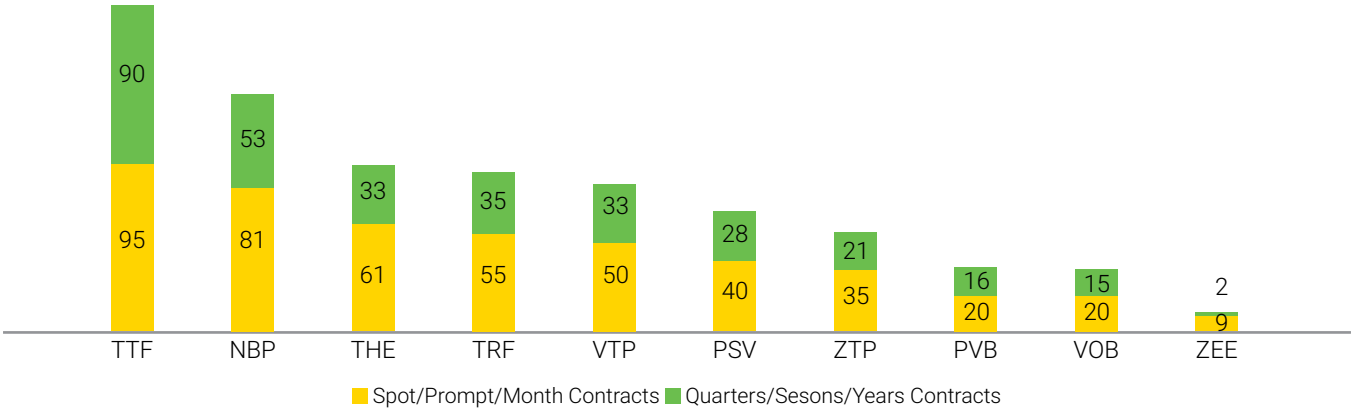


Figure 3 EU Gas Hubs: Active Market Participants & Traded Products (Source: The Oxford Institute for Energy Studies)

OTC Active Traders



2. **Transparency in Operations:** All mature, liquid hubs in the world emphasise transparency in grid operations. In the US, FERC order 636 mandates the creation of an electronic bulletin board, accessible to public, including non-shippers, on an equal basis. The aim is to provide a high level of transparency to foster shipper's confidence in both the pipeline and the broader market. Usually, all information related to gas supply such as capacity, quality requirements, etc. are made available.

[6] Paper on gas hub liquidity; www.ceer.eu

[7] European Traded Gas Hubs: their continued relevance, OIES; www.oxfordenergy.org

3. **Non-Discriminatory Third-Party Access:** Non-discriminatory third-party access (TPA) has been considered as article of faith in the liberalization of gas markets in developed nations, and countries who pioneered TPA have gained substantial economic benefits (Arthur D Little). TPA encourages competition by allowing multiple suppliers and consumers to access the same pipeline infrastructure. TPA helps in non-discriminatory access over the transportation network by all grid user.

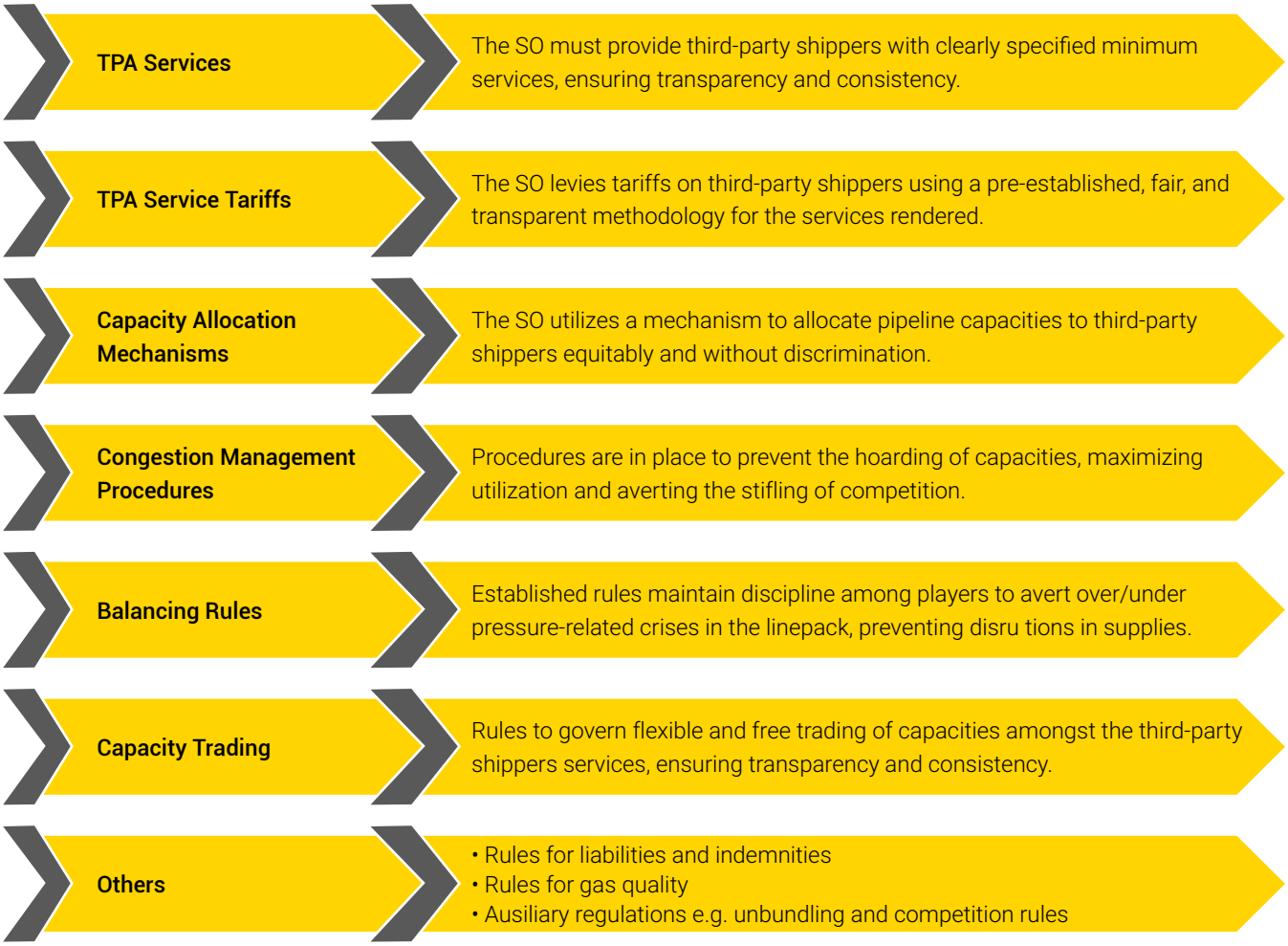


Figure 5 Seven Key Aspects of TPA market rules (Source: Arthur D Little)

4. **Anonymity:** Anonymity is important from three aspects. First, anonymity allows traders to execute their transactions without disclosing sensitive information about their positions, helping them maintain a competitive advantage. Second, anonymity contributes to market liquidity by encouraging more participants to enter the market. Third, in order to promote risk management and hedging through derivative markets, it is essential that anonymous trading be adopted.

Natural gas hubs/markets play a crucial role in gas markets, serving as the focal point in a gas network. In the European Union and the US, hubs are used as the central pricing point for the network's natural gas. In these countries, financial derivative contracts are priced off the gas supplied at these hubs. With higher transactions in a hub, the price transparency increases, and transaction costs decrease. This leads to an increase in the attractiveness and reliability of hubs as a means to manage gas portfolio hedging and optimisation (Timera Energy, 2013)[9]. Trading within hubs allows an increased transparency of the prices, leading to formation of stronger and clearer economic signals for the market participant (ERGEG)[10]. The number of active members in a hub and the churn factor usually indicate the liquidity of a hub.

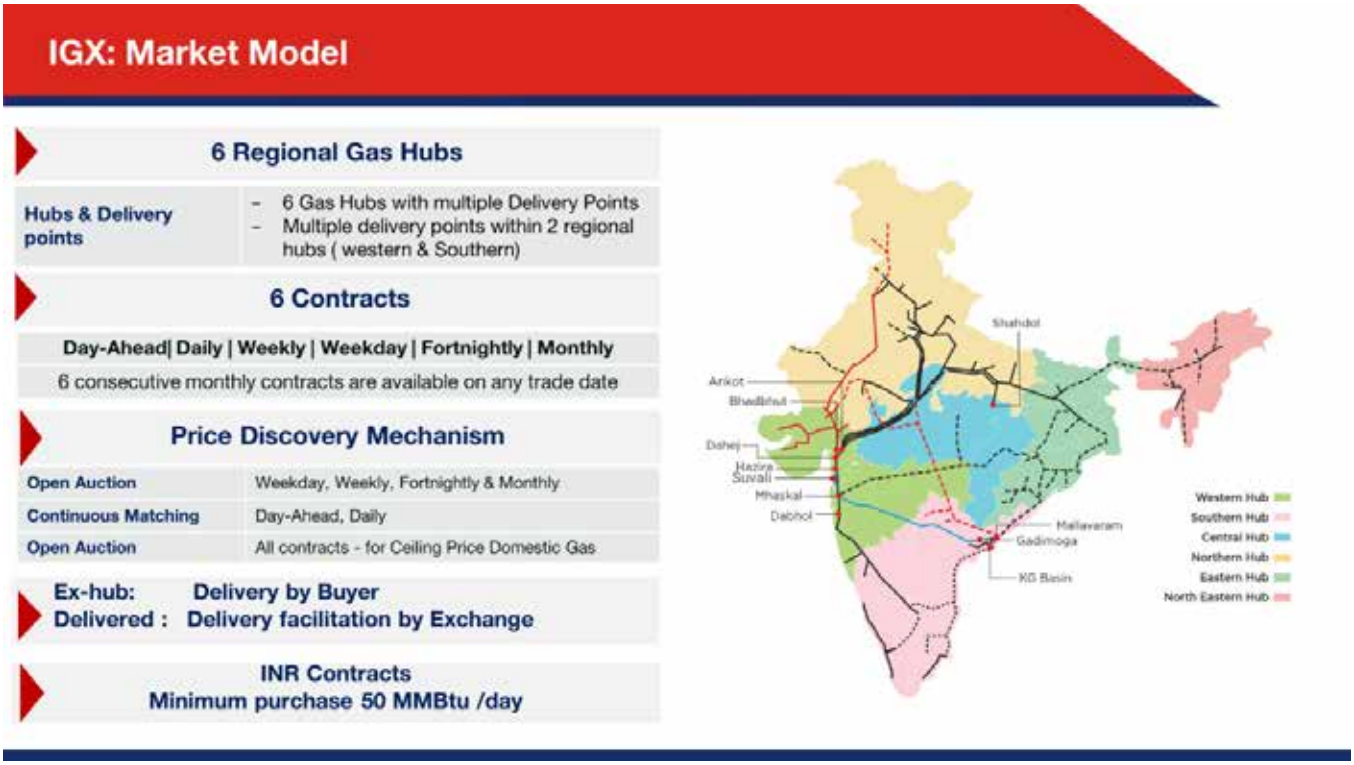
[8] Third Party Access in Gas Transportation; www.adlittle.com

[9] Gas Hub Liquidity, www.timera-energy.com

[10] The hub used as a balancing point, ERGEG; www.ceer.eu

Greater the number of active members in a hub, the greater liquidity the market will have. The churn factor describes how many times the same physical gas is exchanged on the hub. It is determined by the ratio of the traded volume to the physically delivered volume. A churn factor of 1 signifies that the physical gas within the hub undergoes a single trade. The greater the number of trades, the higher the liquidity of the hub. A hub is considered mature when the churn rate is 10 times or more (The Oxford Institute for Energy Studies, 2023)[11]. Currently, TTF is the leading mature hub with a net churn rate of 142.1 as of 2022. Henry Hub, another mature hub, has a churn rate of 49.7, as of 2022.

In India, it was in June 2020 Indian Gas Exchange (IGX) started as India's first online gas trading platform. The Government of India then felt need for regulations governing gas exchange operations and hence directed the Petroleum and Natural Gas Regulatory Board (PNGRB) to frame regulations. PNGRB after public consultations notified the gas exchange regulations and authorised IGX as India's first natural gas trading exchange in December 2020. IGX today provides a neutral and transparent marketplace to multiple buyers and sellers to trade in the spot and forward gas contracts at designated physical hubs. The Exchange currently offers delivery-based trade at multiple delivery points - Dahej, Hazira, Ankot, Mhaskal, Bhadhbhut, Dabhol, KG Basin, Gadimoga, Suvali. The multiple delivery points lie under six regional gas hubs across India - Western Hub, Southern Hub, Eastern Hub, Central Hub, Northern Hub, and North-Eastern Hub.



IGX has pioneered standardized market rules and bylaws for the gas sector and is responsible for introducing many firsts in the sector. It has brought out a range of flexible tenure contracts, ranging from day-ahead to up to six months, and enabled direct booking of gas pipeline capacity by Exchange. The gas exchange has brought in payment security for the participants by introducing counterparty-guarantee for clearing and settlement through arrangements with banks, as well as helping mitigate currency fluctuation risk.

IGX today constitutes nearly 15% of the country's entire spot market share, with more than 40 members and 200 active clients (IGX , 2023)[12]. The total traded volume on IGX in FY23 was 508 Lakhs MMBtu, with 2876 trades executed. More than 63 million MMBtu of gas has been traded on the Exchange since its inception till FY23.

But despite pioneering several 'firsts' in the Indian gas market the gas exchange has been facing challenges on many fronts. Some of which include supply-side dominance by few or limited players, participation from limited number of traders, lack of level playing field, dominant position of bundled entities and above all a lack of market-supportive elements.

[11] European Traded Gas Hubs: their continued relevance, OIES; www.oxfordenergy.org

[12] Indian Gas Exchange; www.igxindia.com

Average churn rate for transactions in Indian market is still less than 3. Higher churn rate also signifies efficient trading environment which prompts several trade opportunities between production and end consumption.

IGX trade volumes (QoQ)

(in lac MMBTU)

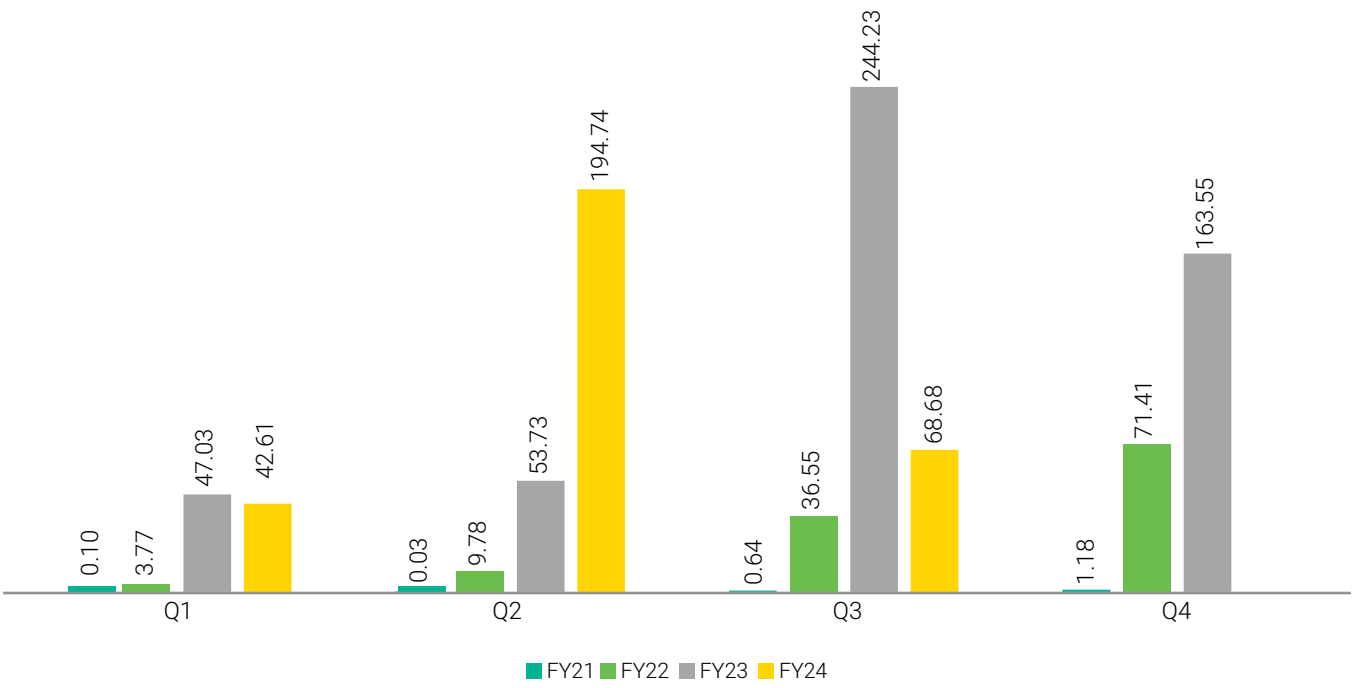


Figure 7 Volume Traded (QoQ) on Indian Gas Exchange (Source: Indian Gas Exchange)- Data till 12 Dec 23

3. WHY IS INDIA'S GAS MARKET'S LIQUIDITY STILL LOW?

India is still in the process of liberalizing its gas market. With the launch of IGX, India has taken a positive step in the direction of building a liquid gas market, but overall market liquidity still remains low. Some of the key roadblocks in India's market liquidity are:

Lack of transparency and level playing field

No unified repository (FERC Order 636)[13]: India lacks a unified repository or portal for accessing information on gas transmission capacities, LNG terminal capacity and trades. In contrast, developed gas markets, such as the US, have Electronic Bullet Boards (EBBs) mandated by regulator FERC's Order 636. Such EBBs provide comprehensive data on capacity, gas quality requirements, imbalances, operational flow orders, nominations, etc. Establishing a similar portal in India is imperative to enhance information transparency within the system.

Inability to meet volatile and uncertain demand: Indian gas customers using third party pipelines require a lead period of few days as per current regulations. Thus, it is not possible to meet variable demand through exchange such as power demand. Most of the power plants required gas on trade on day ahead market and three days capacity window does not support delivering gas for power plants. The customers who already have capacity contracts with pipeline carriers face no such roadblocks. Additionally, the take-or-pay policy imposes heightened financial burdens and inflexibility upon consumers with volatile demand.

Discriminatory application of Imbalance Regulations: Imbalance charges for 3rd party contracts are based on the highest gas flow's price, while for pipeline own normal contracts, they align with contract charges, creating an unjust imbalance in regulation. Gas transporter typically charges price of gas consumed to cover imbalance within volumes on marginal price of the gas. Thus, the lack of a TSO may result in discriminatory charges of gas between transporter own imbalance and third party imbalance.

No Contract Standardisation: Contract standardization, as observed in the US and EU, still does not exist for bilateral transactions. For ease of doing trade, there should be standard GSA and GTA. Each pipeline operator today has its own GTA format with its own set of conditions.

[13] FERC Order 636; www.ferc.gov

Contract standardization in US and EU	
US	EU
In the United States, adherence to the pro forma contract devised by the North American Energy Standards Board (NAESB)[14] is mandatory for all gas sales and purchases at hubs.	The European Federation of Energy Traders (EFET)[15], a coalition of European energy traders, has formulated standardized contracts for the buying and selling of gas at European gas hubs.

NGG Technical Assessment for PNGRB, 2022- Unbundling of Transportation and Marketing of natural gas

"The requirement for the separation of the transportation function from the sales and marketing function (or "unbundling") in pipelines is not happening on the legacy state-owned pipelines. While separation of pipeline functions and marketing functions are required in India regulations, this has not occurred, especially in the state-owned pipelines. Several studies of the India system have recommended unbundling, and from time to time, the press reports that unbundling is imminent. But it has not been implemented"

Lack of GST results in complexity in trading gas and LNG

The absence of Goods and Services Tax (GST) results in inconsistent treatment of gas and Liquified Natural Gas (LNG) across different states, primarily due to varying rates of Value Added Tax (VAT). One notable consequence is that GST paid on the procurement of plant and machinery cannot be claimed as input tax credit, as gas trades are not currently included within the scope of GST. While natural gas is excluded from the GST framework, regasification activities associated with Liquified Natural Gas (LNG) attract GST. Notably, the regasification process currently incurs a high GST rate of 18%, leading to an increase in the landed cost of LNG for domestic consumers.

This highlights the need for a comprehensive review and potential reform of the taxation framework to ensure a more consistent and fair treatment of gas-related activities across the country.

Limited infrastructure availability

Existing LNG terminals face connectivity issues: Petronet LNG's Kochi terminal in South India is facing connectivity challenges to the main gas grid, primarily due to resistance from landowners opposing the installation of pipelines[6]. In the case of IOCL's Ennore terminal, it currently has connections with only three customers. These customers include IOC subsidiary CPCL, MFL, and Tamil Nadu Petroproducts (Business Today, n.d.)[16].

Implementing National Gas Grid remains difficult: Implementing the National Gas Grid remains difficult due to several challenges. Firstly, there is a small fair-weather window, limiting construction activities. Additionally, the presence of difficult terrains adds complexity to the project. The acquisition of Right of Use (RoU) and Right of Way (RoW) poses further issues.

Improvements required in the natural gas sector in India as per PNGRB's 'Vision 2030' report

In the year 2013, PNGRB had published a 'Vision 2030' report for Natural Gas industry in India. The document highlighted some of the issues concerning the industry then. It is noteworthy that these issues are still grappling the sector. Prime issues worth highlighting are:

[14] US standard contract; www.naesb.org

[15] EU standard contract; www.efet.org

[16] Business Today; www.businesstoday.in

'Vision 2030' report by PNGRB- Improvements required in the sector

- Short-term (Spot) market that exists in India owing to a very limited number of players exhibits lack of liquidity as well as a lack of transparency.
- Lack of liquidity in turn is one of the greatest impediments to the development of a transparent spot market in the country.
- The unbundling of natural gas transportation and marketing is still to happen.
- Even before the unbundling is affected, it needs to be ensured that the capacity in transportation pipelines is available on a transparent basis to all the shippers and consumers.
- Natural gas pricing needs to move towards a market determined pricing mechanism.

The document further emphasises on the major elements critical for creating an enabling environment in India for the development of a liquid natural gas market as summarised below:

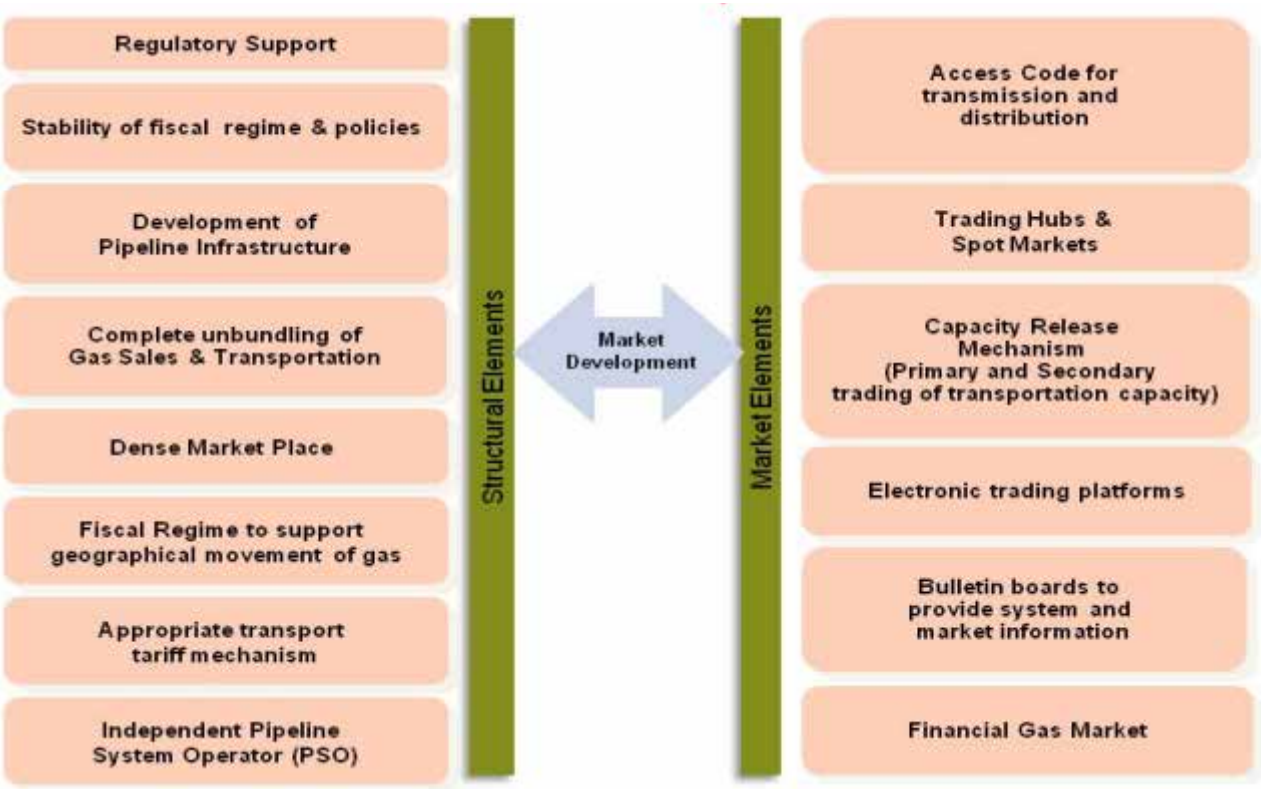


Figure 8 Major structural and market elements for an enabling environment (Source: PNGRB 'Vision 2030')

4. WHAT CAN BE LEARNT FROM OTHER COUNTRIES?

European Union

The European Union is one of the largest liberalised gas markets in the world (IEA, 2019)[17]. Natural gas consumption in the EU was 360 bcm (IEA, 2023)[18] in 2022. The vision of the European gas market, since the release of Gas Target Model in 2011, has been of a competitive European gas market, comprising entry-exit zones with liquid virtual trading points, where market integration is served by appropriate levels of infrastructure (Agency for the Cooperation of Energy Regulators, EU)[19].

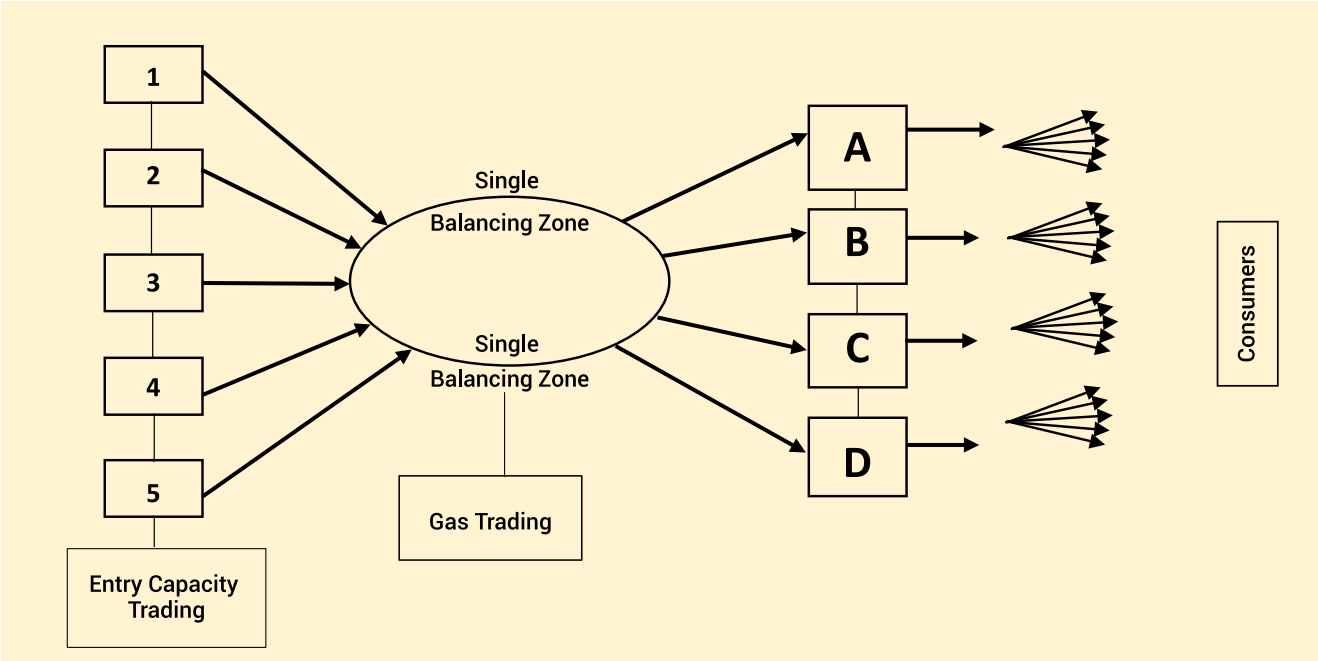


Figure 9 Schematic of Entry-Exit Trading System (Source: Kema Nederland B.V. & TPA Solutions Ltd.)

[17] Gas Market Liberalisation Reforms, IEA; www.iea.org

[18] Baseline European Union gas demand and supply in 2023 IEA; www.iea.org

[19] European Gas Target Model Review, ACER; www.documents.acer.europa.eu

Most EU nations have already achieved a single TSO and a single virtual market hub design as laid out in the European Gas Target Model. Physical gas can be transported anywhere within the TSO's pipeline network with the purchase of just two capacity contracts – one entry contract by the shipper adding gas and one exit contract by the shipper taking gas from the network. Shippers do not need to plan their physical route through the designated virtual hub to transport gas (IEA, 2019)[20].

The distinctive factors that set the European gas market apart are:

Designated Code: To attain a suitable level of harmonization in technical, operational and communication areas, and thus to achieve a high degree of market integration, the Union considered it necessary to have a Network Code on Interoperability and Data Exchange Rules. Monitored by the European Network on Transmission System Operators for Gas (ENTSOG) and enforced by the National Regulatory Authorities (NRAs) of the member nations, the code promotes harmonisation in interconnection agreements, units, gas quality, odorization, and data exchange.

Virtual Gas Trading Hubs: The EU gas model is based on limited number of liquid virtual hubs, connected by entry-exit transmission. There are around 20 virtual hubs in Europe, but not all of them are very active. The total traded volumes (TWh) of the major trading hubs in the EU are:

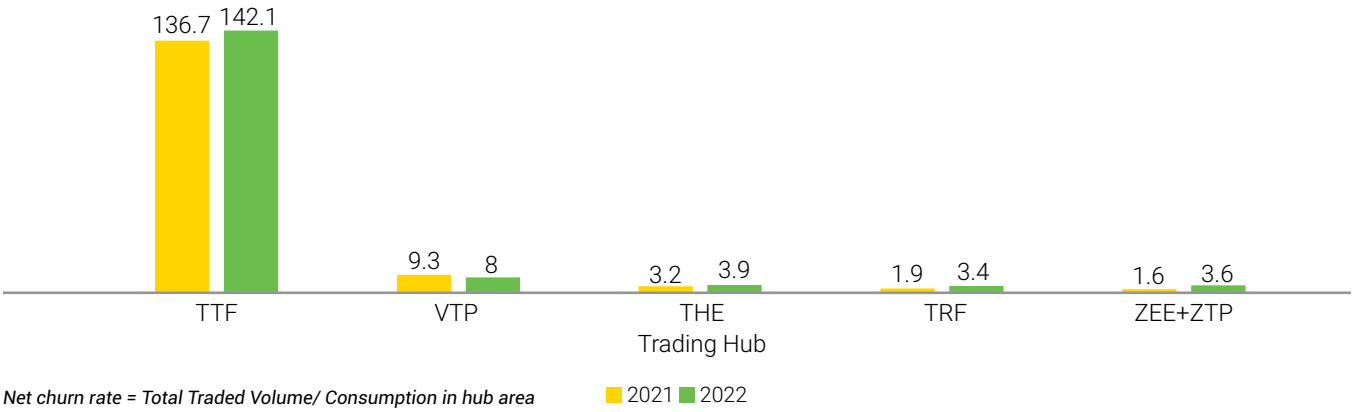
Table 1Total Traded Volumes (TWh) of Top Trading Hubs (EU) (Source: The Oxford Institute for Energy Studies)

Trading Hub	2008	2022	2021	2022
TTF	560	46690	53430	43135
VTP	165	1010	920	685
THE	360*	3315	3155	3305
TRF	185	890	855	1415
ZEE	500	235	235	560
ZTP	0	235	80	35

Contract Standardisation: The European Federation of Energy Traders has developed standardised contract for the purchase and sale of gas at European trading hubs. (EFET)[21] ENTSOG has developed a template contract for transportation agreements, delineating the fundamental terms and conditions for bundled capacity products (ENTSOG)[22].

Gas Pooling in Trade Hubs: TSOs acts as manager of trading hubs and offer gas pooling services. Customers can enter into pooling agreements with the TSO, which keeps the track of gas being added and taken out of the gas pool (IEA, 2019)[23]. To add gas to the virtual hub, a customer purchase entry capacity contract from TSO, and to take gas off the virtual hub, customer must purchase exit capacity contract. However, if the customers offset their transactions to net zero physical delivery by the time of physical delivery, they are not required to purchase entry or exit capacity but are still required to inform the TSO of their transactions through nominations. Such nominations help TSOs in calculating the churn rate. Churn signals

Traded Gas Hubs Net Churn Rates (EU)



Net churn rate = Total Traded Volume/ Consumption in hub area

indicate the level of market liquidity. A churn rate of above 10 usually indicates a liquid hub (IEA)[24].

[20] Gas Market Liberalisation Reforms-Page 47, IEA; www.iea.org

[21] EFET General Agreement Natural Gas; www.efet.org

[22] ENTSOG Interconnection Agreement Template; www.entsog.eu

[23] Gas Market Liberalisation Reforms-Page 66, IEA; www.iea.org

[24] Fast-tracking gas market reforms, IEA; www.iea.org

Netherland's TTF is currently the only mature hub in the EU, with a net churn rate of 142.1 as of 2022 (The Oxford Institute for Energy Studies, 2023)[25].

Capacity Booking: In the EU, transparent platforms for capacity bookings are offered across major TSOs. There are multiple platforms that offer capacity booking services:

- **PRISMA:** The European PRISMA capacity booking platform enables shippers to reserve capacity at domestic entry and exit points, excluding virtual interconnection points, using a 'first come, first served' basis (Gasunie Transport Services)[26]. PRISMA charges 65% of its costs to TSOs based on the ENTSOG voting rights system (which reflects country population, gas consumption and total transported through TSO-network volumes), and the remaining is charged equally per participating TSO (Baringa)[27]. By default, no fees are paid by shippers or users.
- **GSA:** Auctions are conducted for gas capacity on the GSA platform. GSA charges TSOs for use of the platform based on the number of interconnection points (IPs) they hold within the platform (Gasunie Transport Services)[27]. There are no fees paid by shippers or users.
- **RBP.** The Regional Booking Platform is an electronic capacity trading platform operated by FGSZ Natural Gas Transmission Private Company. RBP services are priced equally between TSO members (Gasunie Transport Services)[27].

Grid Balancing: Most systems incentivize network users to achieve balance by the end of gas day to avoid imbalance charges. Exposure to imbalance charges varies depending on the system's balancing rules. Some systems allow the network users some tolerances, and thus their inputs and outputs can vary up to a certain range. In some systems however, network users must react to any intraday changes in demand. Regardless of the exposure to imbalance charges, the network users can ensure input-output balance only if they have sufficient information available to estimate their current imbalance and have access to flexible sources of gas like from a traded market. For this, EU has a separate Network Code on balancing in force (ENTSOG)[28].

Nominations: In Europe, shippers use electronic platforms set up by TSOs such as, GTS in the Netherlands, for sending nominations. Nominations are validated against the capacity booked (Gasunie Transport Services)[29]. Gate closure for capacity booking is 30 minutes in the trading hubs in the EU and UK.

Transparency in Pipeline Operations: A high level of transparency in pipeline operations is offered. All required information such as capacity, gas quality requirements , operational flow orders, service outages , imbalances, etc. are made publicly available (IEA, 2019)[30].

Unbundling options that can be learnt from EU[31]:

Account unbundling (1st Gas Directive)	Integrated undertaking is required to maintain separate accounts for gas transmission activities. This is done to avoid discrimination and distortion of competition.
Legal and functional unbundling (2nd Gas Directive)	The transmission system operator operates independently as a separate legal entity. Parent company, may however, set the annual financial plan.
Ownership Unbundling (3rd Package)	The transmission system operator and not the parent company owns the transmission system. The same entity cannot be involved in both transport and marketing of gas.

Independent / Transmission System Operators: The role of a System Operator is to manage the gas transmission pipeline network. It may own the network or may not. Particularly, in the countries with many transmission operators, it has been mandated to either make it independent or operate with a Chinese wall. In EU directive of third energy package, 2009/73/EC, its mandated – where a transmission system is a part of a vertically integrated undertaking, Member States may allow derogation and either: Designate Independent System Operator (ISO): ISO performs all TSO functions – without owning assets – under permanent monitoring. Energy supply company still owns assets. OR comply with requirements of Independent Transmission

[25] European Traded Gas Hubs- Page 4, OIES; www.oxfordenergy.org

[26] Booking capacity at FCFS network points, Gasunie Transport Services; www.gasunietransportservices.nl

[27] Gas Capacity Auctions: EU Study Platforms; Baringa Partners LLP

[28] Gas Balancing Launch Documentation-Page 4, ENTSOG; www.entsog.eu

[29] Nomination Process, Gasunie Transport Services; www.gasunietransportservices.nl

[30] Gas Market Liberalisation Reforms-Page 71, IEA; www.iea.org

[31] Natural Gas Market- Evolution Experience; ExxonMobil

Operator (ITO) where energy supply company still owns assets, employs personnel and has appropriate financial resources. Measures are required to be put in place to ensure independence of ITO & its Supervisory Board – often via a subsidiary.

System Operators are generally responsible for: Portfolio balancing of supply and offtake, capacity management, fair allocation of capacity, daily operation of grid including balancing, new capacity planning, ensure transparency with regulatory oversight by National Regulatory Authority (NRA). Typically one per country. Some countries have several like Germany.

US

The US is also one of the largest liberalised gas markets in the world (IEA, 2019)[32]. As of 2022, natural gas accounts for 33% of the total primary energy consumption in the US (US Energy Information Administration). In the US, certain parts of the pipelines are promoted as market centres/ trading hubs. Key characteristics of such hubs usually include (IEA, 2019)[33] - receipt and delivery access to two or more pipeline systems, transportation between pipeline systems and availability of storage or supply. However, infrastructure configuration of these hubs varies from region to region in the US.

Market centre configurations can be of multiple types. For example, pipeline segment connected to a processing plant (Henry Hub connected to Henry Hub processing plant prior to its shutdown)[34], highly liquid market centres with multiple interconnections (NGPL Midcontinent market centre), etc.

Such hubs usually offer various services[35], such as interconnects to different pipelines, storage facilities, gas pooling, nomination, title transfer and balancing services etc.

The distinctive factors that set the American gas market apart are:

Unbundling & gas pooling services: The 1992 FERC order 636 required pipelines to unbundle their sales services from transportation services (FERC)[36]. Several regions developed to become market hubs, and such hubs now offer a host of services to customers. Like in the EU, customers can also enter into pooling agreements with the pipeline company managing the hub. Specific receipt or delivery points do not need to be mentioned for gas bought and sold at the market centre pool. Achieving net zero physical delivery in the gas pool occurs when the amount of gas withdrawn from the pool matches the gas injected into the pool by the time of physical delivery. In such cases, customers are not obligated to purchase entry or exit capacity. However, they are still required to notify the pipeline company of transactions through nominations.

Contract Standardisation: The North American Energy Standards Board (NAESB) has developed the standard contract for the sales and purchases at hubs (NAESB)[37]. Established in 2002 at the urging of US Natural Gas Council, the US department of energy and FERC, NAESB developed the "Base Contract for Sale and Purchase of Natural Gas", which is the most commonly used gas contract. NAESB is composed of 300 corporate members in the energy industry and many more non-member volunteers who contribute to the drafting of its standards and contract (NAESB)[38].

Transparency in Pipeline Operations: Under FERC Order 636, interstate pipelines are required to establish Electronic Bulletin Boards (EBBs) (The Interstate Natural Gas Transmission System)[39]. All information on EBBs is accessible to public, including non-shippers, on an equal basis. The posted information includes pipeline capacity, an index of customers, gas quality requirements, operational flow orders, service outages, etc. EBBs also furnish shipper information, such as the shipper's name , contract start and end dates, maximum quantities for transportation and storage, etc. Interested parties can utilise such data for strategic planning, such as identifying contract end dates.

Nominations: The shipper must electronically submit a nomination to the pipeline company, stating the quantity intended to be moved along with the receipt and delivery points. The capacity scheduling procedure is conducted daily for each gas day, spanning from 9 a.m. to 9 a.m. However, capacity is nominated not as a flow of rate, but rather as a total quantity to be transported at a roughly constant rate over the course of the 24-hour gas day. Thus, the precise rule for contracts is that the total daily nominated gas volume must be transported over a period lasting from 16 to 24 hours (Environmental Defence Fund)[40].

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[32] Gas Market Liberalisation Reforms, IEA; www.iea.org

[33] Gas Market Liberalisation Reforms-Page 45, IEA; www.iea.org

[34] Understanding Henry Hub; www.cmegroup.com

[35] Understanding Henry Hub; www.cmegroup.com

[36] Order No. 636- Restructure of Pipelines; www.ferc.gov

[37] NAESB Contract for the Sale & Purchase of Natural Gas; www.charleslawpllc.com

[38] NAESB; www.naesb.org

[39] Interstate Natural Gas Association of America; www.ingaa.org

[40] The U.S. Gas Pipeline Transportation Market, Environmental Defence Fund; www.edf.org

Adjustment to Nominations: FERC requires pipeline to offer a minimum of three intraday scheduling cycles[41]. The majority of interstate pipelines permit schedule adjustments at only five designated intervals subsequent to the initial timely cycle nomination. These intervals consist of a late cycle in the evening of the day preceding the gas day, three intraday cycles throughout the gas day, and a concluding cleanup cycle toward the conclusion of the gas day[42].

Sale of Interruptible Service: If at any point during the gas day there is unissued space on the pipeline after all the holders of the capacity have made their nominations, the pipeline company can sell the extra capacity as "interruptible service". The pipeline company stops the flow of this gas in case the existing capacity holders increase their nominations.

Grid Balancing: Shipper's contracts are balanced monthly. Shippers are accountable for monitoring imbalances and adjusting their nominations. To maintain their imbalance within a specified tolerance by the month-end. However, in case an imbalance poses an immediate operational issue in the pipeline, an operational flow order is issues to safeguard the integrity of the pipeline.

Regulatory Oversight: FERC establishes rates and services for natural gas pipeline transportation, certifies new facilities[43], and addresses the abandonment of existing facilities falling primarily under the jurisdiction of the Natural Gas Act. Pipeline and Hazardous Materials Safety Administration Office is the regulatory body responsible for implementing a national program to ensure the safe, reliable, and environmentally sound operation of the nation's natural gas and hazardous liquid pipeline transportation system.

United Kingdom

Earlier one of the most liquid gas trading hubs in the world, UK's NBP's (National Balancing Point) liquidity is one a decline. Total traded volumes declined from 10060 TWh in 2020 to 6640 TWh in 2021 and 6335 TWh in 2022 (The Oxford Institute for Energy Studies, 2023)[44]. One of the main reasons behind this decline is that contracts on NPB are priced in pence/therm, while European traders prefer to hedge and risk manage in euros/MWh (European Gas Hub, 2019)[45]. Nevertheless, the UK gas model remains one of the most mature ones in the world.

The UK gas market is modelled around the European GTM vision. UK has achieved the target of a single TSO, with National Grid Plc managing the gas transmission and distribution networks (Offshore Technology, 2021)[46]. UK follows the EU entry-exit model, meaning that the gas can be transported anywhere within UK with the purchase of entry and exit capacity contracts. Ofgem, UK's gas regulator, clearly states that unbundling is mandatory and bundled gas contracts are not allowed (Ofegm, 2021)[47].

The key features of the UK gas market are:

Unified Network Code: The Unified Network Code (UNC) contains the contractual framework for the onshore gas transportation in the United Kingdom. Its aim is to establish a comment set of rules to create a level playing field for all the stakeholders involved (Natural gas pipeline transportation and storage in United Kingdom)[48]. It defines the rights and responsibilities for the users of gas and provides for all system users to have equal access to transportation services (Joint Office of Gas Transporters, 2006)[49].

Virtual Gas Trading Hub: NBP is UK's virtual trading hub, meaning that gas anywhere within the transmission system will be priced as NBP gas. The NBP gas market allows prices to be set for same day delivery, day-ahead, months, quarters, summers, winters, and annual contracts (Powerstar)[50]. NBP is used as the pricing and delivery point for ICE Futures Europe gas future contracts. Thus, it has significant impact on gas prices across UK and Europe.

Nominations: Shippers are required to electronically submit nominations to the pipeline company. Nominations state the quantity of gas intended to be moved, along with the exact receipt or delivery points within or outside of the UK. Nominations are required to be finalized by 12 p.m. one day before the gas day (World Bank)[51]. Nominations are then approved, and renominations can be filed for the unapproved nominations. Renominations can be made between 6 p.m. one the day before the gas day and 3.59 a.m. on the gas day. Shippers are responsible for maintaining the balance between offtake and intake, and shippers with imbalance beyond specified tolerances are charged imbalance penalties.

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[41] FERC Order; www.ferc.gov
[42] The U.S. Gas Pipeline Transportation Market, Environmental Defence Fund-Page; www.edf.org
[43] www.ferc.gov
[44] European Traded Gas Hubs, OIES; www.oxfordenergy.org
[45] The decline of NBP, OIES; www.europeangashub.com
[46] National Grid Gas System, UK; www.offshore-technology.com
[47] Ofgem order on unbundling; www.ofgem.gov.uk
[48] natural gas pipeline transportation and storage in United Kingdom; www.lexology.com
[49] The Unified Network Code- Summary; www.gasgovernance.co.uk
[50] National Balancing Point (NBP); www.powerstar.com
[51] Market Development in the UK Natural Gas Industry, World Bank; www.documents.worldbank.org

Grid Balancing (Joint Office of Gas Transporters, 2006)[52]**:** In the UK, shipper's contracts are balanced on a daily basis. Shippers are incentivised to achieve daily balances. Any user with imbalance is required to pay an imbalance charge (or a clearing charge). National Grid undertakes the grid balancing activities, also making sure the transmission system remains within efficient operational limits (NationalGrid, 2017)[53].

Transparency Requirements: Much like the EU and US, all information pertaining to gas supply such as capacity, gas quality requirements, operational flow orders, service outages, etc. are posted and made freely available to the public, including non-shippers. Shipper information, such as when the contract of a shipper ends, is also provided to enable interested parties to identify primary parties from which to request capacity release. On the website of UK grid, the flow of each entry and exit point is updated every two minutes.

Regulatory Oversight: Ofgem regulates the gas market in the UK, and no shipper can operate without obtaining a license[54]. Ofgem establishes price controls on the prices charged by monopoly network operators, providing it with direct influence over network charges. Various requirements such as gas possession, payment guarantee, etc. are set by Ofgem for the market. Ofgem possesses the authority to conduct investigations into companies suspected of engaging in anti-competitive behaviour. Ofgem also collaborates with Consumer Focus, an entity with the authority to investigate and report on complaints regarding actual or threatened disconnection, as well as complaints from vulnerable consumers.

Summary of Case Studies

Basis	EU	US	UK
Market Configuration	Limited number of liquid virtual hubs connected by entry-exit gas transmission system.	Several non-state-owned investor entities operating in multiple pipeline centres.	Single liquid market hub (National Balancing Point) with entry-exit system in place.
Transparency Requirements	All information on pipeline operations, gas quality requirements, operational flow orders, etc. are made available to the public.	FERC mandates interstate pipelines to establish Electronic Bullet Boards accessible to public on an equal basis.	All information on pipeline operations, gas quality requirements, operational flow orders, etc. are made available to the public.
Regulatory Oversight	FERC regulates interstate pipelines. State public utility commissions regulate interstate pipelines.	For EU, Agency for the Cooperation of Energy Regulators issues recommendations to TSOs and NRAs (National Regulatory Authorities). For individual countries, NRAs overlook functioning of TSOs and other participants.	Ofgem overlooks gas transmission system and sets out various requirements such as payment guarantee.
Nominations	Electronic platforms are used for sending nominations. EU network Code mandates TSOs to develop communication standards.	Nominations are registered through EBBs. Seller's nominations must match with buyer's nomination.	Electronic platforms can be used to register nominations up to 30 days in advance.
Contract Standardization	EEFT has developed standardized contracts for sale and purchase of gas at European gas hubs. ENTSOG has developed a template contract for transportation agreements.	Pro-forma contract developed by NAESB serves as standard for gas contracts for sale and purchase of gas. Buyers and sellers can agree on mutual exceptions to this standard.	OEUK (Offshore Energies UK) has developed a standard contract for sale and purchase of gas.
Grid Balancing	Shippers are incentivized to balance contracts by the end of gas day.	Shipper's contracts are balanced monthly. Imbalances must be within a specified tolerance by month-end.	Shippers are incentivized to balance contracts by the end of gas day.
Unbundling	Bundled gas contracts are not allowed.	Bundled gas contracts are not allowed.	Bundled gas contracts are not allowed.
Capacity Hoarding	"Use it or lose it" principle is implemented to prevent capacity hoarding.	Shippers cannot hoard capacity.	"Use it or lose it" principle is followed.

[52] Uniform Network Code – Transportation Principal Document; www.gasgovernance.co.uk

[53] End-to-end balancing guide, National Grid; www.nationalgrid.com

[54] www.ofgem.gov.uk

5. HOW MAY INDIA MOVE TOWARD A LIQUID MARKET?

Policy reforms are needed to support development of a liquid gas market

Synchronous operation of gas pipelines: The three major operators- GAIL, GSPL and PIL need to collaborate and harmonize the rules and processes guiding their operations. Combination of operations of these companies is required to allow non-discriminatory access to the whole pipeline infrastructure. Standardized GTAs are needed to ensure fair and transparent transportation of gas.

'Vision 2030' report by PNGRB- Robust Open Access Code

"There is a need for a robust open access code for the natural gas pipelines as it is expected to facilitate access to pipeline infrastructure and benefit market participants."

Regulatory reforms across the board are needed to ensure fair and transparent gas sales.

Unbundling regulations: Unbundling is required to enable a competitive market. Companies need to identify suitable methods for segregating their commodity sales function from their transportation and other logistical services. Segregation of functions should also involve creation of different boards for each function, and no two boards should be allowed to have common members. Separation of sale of gas and transmission services by unbundling will enable anybody to reserve pipeline capacity.

'Vision 2030' report by PNGRB- Unbundling of Transportation and Marketing of natural gas

"The unbundling of these two activities prevents cross subsidies between the two activities and creates a level playing field for all shippers, avoiding favors by transporters to its supply affiliate. The development of a large number of supply companies also gets facilitated by the act of unbundling. An increase in the number of such companies pushes down their resale markups due to competition thereby passing through cost savings from the production segment to the end users."

Implementation of unbundling will require a code to define a legal and conceptual framework acceptable to transmission business stakeholders. Independent authority's support in this implementation can be a key to unlocking progress.

Unbundling – EU's third energy package

As per EU's 3rd Energy Package, unbundling is the separation of energy supply and generation from the operation of transmission networks[55]. The said directive also required the setting up of a regulatory body independent of industry interests and government, which can issue binding decisions to companies and impose penalties on those who do not comply.

Ensure TPA to pipeline capacity: Third-party access (TPA) benefits the industry over the long term with more efficient pricing and a wider choice of contracts. It allows transparent infrastructure access, even for short periods of time. For India, which has multiple pipeline operators, TPA requires clear rules and a strong independent regulator to act against any infringement.

EU Gas Directive for Third Party Access

In the EU, the Gas Directive 2003/55/EC mandates that, where technically and/or economically necessary, third-party access (TPA) to storage and line pack services must be provided. Member states are required to designate one or more regulatory authorities to ensure TPA. Regulatory authorities monitor the access conditions to storage, line pack and other ancillary services.

Making daily pipeline capacity data available: To promote a truly competitive gas market, real-time pipeline capacity must be made available to customers. Operators need to submit their data daily to price reporting entities, who will then aggregate the sales and report average prices and volume clearly. Regulators shall also be responsible for ensuring the accuracy and reliability of the capacity and prices reported.

In India, similar Electronic Bulletin Board may be implemented where pipeline data is available real time on PNGRB site, including scheduled capacity, available capacity, imbalance information etc. The pipeline operators such as GAIL, GSPL and PIL will provide real-time data based on SCADA information available without any manual intervention.

Electronic Bulletin Board

In mature gas markets such as TTF and NBP, daily pipeline capacity data is made available and regularly updated. On the website of UK grid, the flow of each entry and exit point is updated every two minutes. In the Electronic Bullet Boards (EBBs) in the US, features like posting and bidding of capacity, tariff information, available and historical capacity, operational and customer information are provided.

Ensuring fairness in the tariff structure: India follows a toll-based system, wherein tariffs are charged based on the distance. As a result, gas markets have developed nearer to the source and hinterlands need to pay more for the gas transmission cost. Recent regulations for unified pipeline tariff provide some support to ensure that customers far away from the source are not disadvantaged. Additionally, India may also consider the entry/exit model, similar to what is followed in Europe. The entry/exist model provides greater flexibility and accessibility for network users and also opens the door to secondary trading in pipeline transfer capacity.

'Vision 2030' report by PNGRB- Entry-Exit: Tariff recovery mechanism

"As a national gas grid with multiple sources and destinations for natural gas, is emerging in India, a switch could be attempted to the mature tariff system which not only provides access to the customers located geographically disadvantageous locations but also provide platform for a competitive market to develop. One of such system called "entry–exit" tariff system."

[55] Unbundling regulations, EU 3rd Energy Package; www.energy.ec.europa.eu

Enabling regulated, open access to LNG terminals: LNG is one of the most important sources for gas supply constituting almost 50% of natural gas supply in India. Thus, third party access to the LNG regasification terminal becomes critical in enabling India's liquid gas market. While India has opened its LNG terminals to third parties through negotiated pricing, there is a need to allow greater access. This will allow energy traders to supply gas into the short-term market, which will keep the prices low.

Third party access to LNG terminal

EU's 3rd Energy Package[56] mandates all member states to ensure implementation of a system of third-party access to all LNG facilities based on published tariffs. All member states must also ensure a compliance program to ensure prevailing conditions for third party access to network as defined in the directive.

Secondary capacity selling should be enabled: Effective Use-It-Or-Lose-It (UIOLI) provisions should be implemented for decoupling physical and contractual flows. In case contract or common carrier capacity is not utilized on a day ahead basis, that should be made available to third party. The present 2–3 day lead time for capacity tranche booking makes it impossible to meet the demand of grid. Such release of pipeline capacity should be allowed to happen for both long-term and short-term. Buyers should be allowed to resell gas if they no longer need it or see a market opportunity.

NGG Technical Assessment for PNGRB, 2022- Capacity trading

"A secondary market for pipeline capacity and implementation rules should be established to ensure a fair and efficient market; phase out of the common carriage principles of pipelines and such volumes should be based on the unutilized contract carriage capacities; and common carriage should be at a premium relative to contract carriage. "

Scheduling charges: These are charges due for capacity booking[57]. There are, in essence, incentives to the shippers to make additional investments in scheduling software. These charges are to compensate Pipeline Operators/TSOs to invest in manpower and IT services for large number of expected transactions through exchange and otherwise. It would be prudent that Pipeline operators are allowed to charge scheduling charges in India.

Scheduling charges in UK

In the UK, input and output scheduling charges are levied on the shippers[58]. Input scheduling charges are fees associated with the entry of gas into the system, while output scheduling charges are associated with the exit of gas from the system.

Pipeline operators to manage imbalance through exchange: All pipeline operators should be required to engage in the transactions involving short-term products through exchange. Grid balancing activities should be done through buying and selling gas in the gas exchange.

Imbalance services in Europe

European Balancing rules, 2013 require TSOs to buy and sell short-term standardized products on a trading platform or use balancing services that are procured in a market-based manner. In Netherlands, Gasunie Transport Services (GTS), the TSO, is required to start balancing its natural gas grid by trading on the TTF market, as part of an agreement between GTS and APX-ENDEX, the Dutch exchange[59].

[56] EU 3rd Energy Package; www.energy.ec.europa.eu

[57] Natural Gas Balancing: Appropriate Framework and Terminology, Page-14; www.mech.kuleuven.be

[58] Uniform Network Code Transportation Principle Document, Section F; www.gasgovernance.co.uk

[59] Dutch TSO to balance natural gas grid, ICIS; www.icis.com

Infrastructure developments are needed to ensure access to gas across the board

India must ascertain the appropriate model to address its increasing requirements for gas infrastructure. Development of new gas infrastructure faces challenges related to business model and supply changes, forcing companies to consider the risks that need to be taken. The government recently adopted one development model- direct government payment to developers (Urja-Ganga Pipeline).

Natural Gas Acts, US

In the US, the Natural Gas Act mandates pipeline companies to hold open seasons. Under the open-season model[60], individual pipelines undertake independent market research and planning. Subsequently, they initiate public open seasons, inviting shippers to commit through signed forms, thereby ensuring a guaranteed return before actual development of infrastructure.

To further the development of gas infrastructure, the government should also release a comprehensive national policy encompassing the entire nation, similar to the state energy policies.

Flexible/intermittent transmission tariff: India should consider a mechanism where flexible capacity is available for consumers in sectors with variable demand, on payment of a premium. Under this approach, customers seeking flexibility would pay higher tariffs or charges, allowing for gas dispatch without a firm commitment to a regular gas supply.

Standardization of GSAs & GTAs: Currently, each pipeline company provides its own Gas Sales Agreement (GSA) & Gas Transmission Agreement (GTA). For gas flow through more than one pipeline, the user has to sign multiple GTAs with each pipeline operator. This leads to time lags and missing of trading opportunities in the market, even when the transmission capacity is available in the pipeline (IGX, 2023)[61]. Moreover, ship-or-pay or imbalance charges embedded in a bundled GSA, can be strategically employed as a tool for gaining a competitive advantage against third-party marketers or shippers during contract negotiations (Shell, 2021)[62]. This may lead to an unfair advantage over other gas suppliers in the market. Standardizing GSAs & GTAs, as has been done in the US and EU, would substantially reduce transaction costs and ensure fairness in the market. GTAs have to be standardized but all pipeline operators shall provision GTA signing by Gas Exchange(s) on behalf of their buyers (tri-partite agreements between the three) till the time we have a system operator in place, managing capacity access.

Interruptible services for gas supply to power sector: Interruptible services, offered by the transmission system operator, refer to gas transmission capacity that may be interrupted when there is high demand for gas by other customers[63]. Interruptible customers usually pay the lowest rates for gas. Such a service would enable the power sector to maintain its profitability and increase its gas consumption.

Interruptible services offering in US

In the US, if a primary shipper does not use or release its capacity to a secondary shipper, then the pipeline company can market this unused capacity as interruptible transportation capacity[64]. In 2018, about 16% of the natural gas used for power generation in the US was purchased using only interruptible contracts[65].

[60] Gas market liberalization reforms, IEA; www.iea.org

[61] IGX comments on PNGRB's Access Code; www.pngrb.gov.in

[62] Shell Comments in PNGRB Regulations, 2021; www.pngrb.gov.in

[63] EU Guidelines on Interruptible Services; www.eur-lex.europa.eu

[64] Gas market liberalization reforms, Page-61, IEA; www.iea.org

[65] US Energy Information Administration; www.eia.gov

Development of transmission system operator with clear role and guidelines

Gas market participants are required to abstain from having any interest in the Transmission System Operator (TSO). Legal and Ownership unbundling of the activities of transportation and marketing of natural gas is required. This is to ensure that TSOs offer their services on a non-discriminatory basis. TSOs should also not be allowed to own gas pipelines. Also, all forms of capacity bookings, even for transporter's own use (for marketing), should be done through TSO.

The TSO should offer imbalance management services. It should also be responsible for the computation of imbalance charges. The affiliate code of conduct developed should be implemented until full unbundling takes place.

'Vision 2030' report by PNGRB- Independent operator for system discipline and security of supply

"There is a need to consider constituting an independent Pipeline System Operator in order to streamline tariff-sharing among various pipeline system owners as well as ensuring system discipline. The setting up of a System Operator will bring uniformity in access parameters among pipelines and hence ensure system discipline and supply security."

Fiscal reforms from VAT to GST

The current system of VAT followed for natural gas poses a multitude of problems that are inhibiting the growth of the sector. Within the gas sector, VAT implementation remains discriminatory. Natural gas remains outside of GST, while regasification activities attract GST. Similarly, plant and machinery used are covered under GST, but the end-product is not. As a result, a significant portion of the input tax paid on the procurement of such plant and machinery cannot be claimed.

Due to implementation of VAT, availing of input credit across different rates become difficult and cumbersome.

To further exacerbate the problem, VAT rates vary across different states. As a result, there is inconsistency in treatment of gas and LNG across the country.

NGG Technical Assessment for PNGRB, 2022- Eliminate discriminatory taxation of natural gas

"In the liberalized energy economies natural gas is treated like any other fuel. Use of gas is based solely on consumers' choices as determined by availability and cost. In India, no policies are designed to encourage the use of natural gas; indeed, several policies discriminate against gas use. Thus, including natural gas in the goods and services tax (GST) regime so industries can take input tax credits. Other industrial fuels are in the ambit of GST."

Communication and stakeholder management are key for any transformative changes

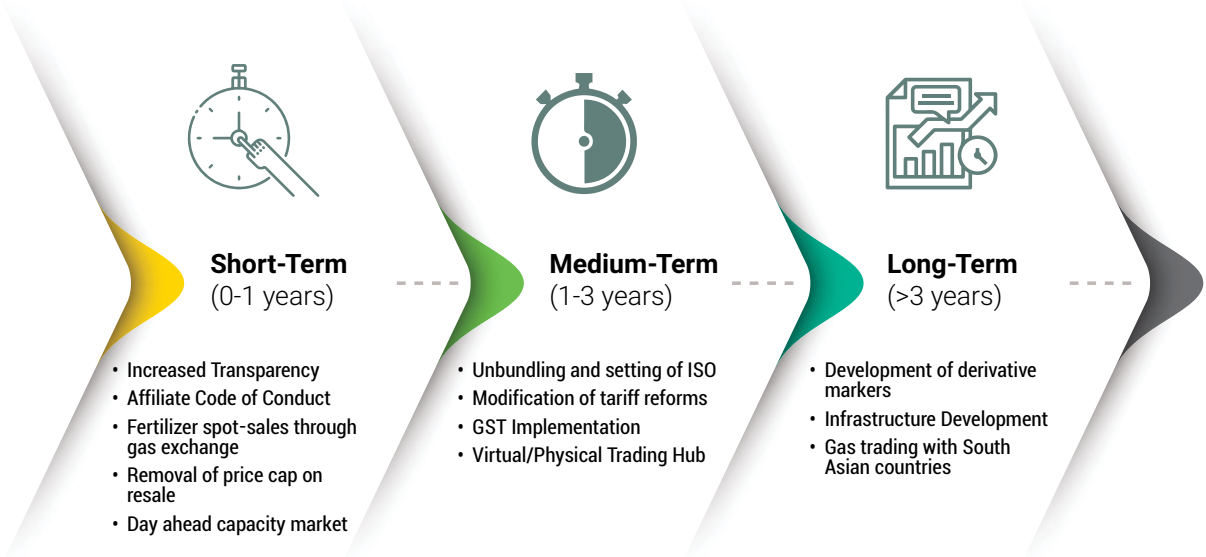
A formal analysis of the anticipated impact on each stakeholder group resulting from distinct regulations, structures, contracts, and operational methodologies is imperative to drive changes in the market. Clear and targeted communication during the transformation process can help stakeholders understand the necessity of change, its long-term benefits, and the preparations required for involvement in the new hub.

For instance, in the EU, TSOs resisted cooperating with capacity trading since they did not desire to see new entrants in the market. However, development of legislation leads to a change in perspective, and TSOs started focusing more on providing hub services to consumers. In the US too, pipeline operators who were initially sceptic started developing a host of services to satisfy the consumers' needs. Third-party service providers also emerged with various offerings.

6. ROADMAP AHEAD

To elevate natural gas's share in the energy portfolio from 6% to 15%, India must prioritize enhancing market liquidity. Streamlining reforms and emphasizing transparency are key to boosting gas consumption in the country.

We have categorized the necessary initiatives into short-term, medium-term, and long-term frameworks.



Short-Term Initiatives

Increased Transparency

Transparency measures, such as the establishment of electronic bulletin boards (EBBs), need to be implemented to make gas information accessible to the public, including non-shippers, on an equal basis. Information such as gas capacity, index of customers, service outages, nominations, etc. should be required to be published on such boards. These EBBs must update information on a real time basis available on PNGRB portal.

The implementation of such bulletin boards could be a process where both contract and common carrier capacity of the pipeline are displayed on the bulletin board. The bulletin board should showcase:

- A map of the pipeline showing compressors, receipt points, and delivery points, with installed and current operational capacity along the entire pipeline route
- A list of the contracted shippers on the pipeline, their contracted capacity for each service provided, the tariff rate for that service, whether the shipper is affiliated with the pipeline, and the contract begin and end dates
- Similar information should be provided covering common carriage shippers
- A daily and sub daily statement of available capacity (unnominated) for the following day by zone, receipt, and delivery points
- A list of the capacity shippers' offers for release to other shippers and capacity from the pipeline
- Where capacity has been released to other shippers, the names of those shippers and the price at which the capacity was released
- A complete, searchable, electronic copy of the pipeline's tariff and current rates
- A complete, searchable copy of the pipeline's standard contract forms for each type of service

'Vision 2030' report by PNGRB- Transparency key to develop liquid market

"For the development of liquid trading HUBs in India, it is important to address the issue of transparency associated with trading at such platforms. Mechanisms like the bulletin boards (on the company websites) help in achieving transparency in trading transactions among the participants. Bulletin boards are aimed at providing transparent, real time and independent information to all market participants including market observers on the state of the gas market, system constraints, market opportunities etc. Establishing bulletin boards in India can facilitate gas trading and pipeline capacity trading by providing readily available system and market information."

After the implementation of EBBs, PNGRB may require pipelines to make unused capacity available to other shippers on an interruptible basis.

Development of day ahead capacity market: India may develop day ahead or even 6-hour ahead capacity market after implementation of EBBs. This day ahead market will allow consumers such as power plants to offtake take that may be dispatched on HP-DAM. The trade for gas and power may be linked to allow completion for trade for gas only if there is guarantee of power dispatch in HP-DAM market. The day-ahead market will also include services like flexible transmission tariffs for customers that require gas on short notice such as power sector.

The initiative would require support from PNGRB and pipeline operators and may be executed on IGX.

'Vision 2030' report by PNGRB- Reform and support for power sector

"Proper synchronization needs to be there in power sector and gas sector regulations meant for gas based generating stations."

Spot sales in fertilizer through gas exchange

Fertilizer sector constitutes a significant share of India's natural gas consumption. The government may allow fertilizer sector to procure their spot requirement of gas through the exchanges. The gas exchange may offer flexibility of the terms as well as competitive price for the fertilizer companies. This approach may help in reducing the subsidy burden for the fertilizer sector.

Strict Enforcement of Affiliate Code of Conduct

Until unbundling takes place, the Affiliate Code of Conduct must be enabled and operationalized. This will guarantee a good degree of accounting and legal separation, ensuring that transportation services are provided on a non-discriminatory basis and that access to gas infrastructure remains equitable for all stakeholders involved.

Removal of cap on prices of resale trades

The government capped trading margins on the resale of gas produced from deepwater blocks to cut profiteering by traders during high spot price period in 2022. The trading margin for resales has been set at 16.62 rupees per MMBtu. Now, since the prices have softened to at least half, it makes a case to remove the cap so that normal trading activity can happen. This cap has dissuaded traders from participating in auctions, since they are exposed to risks and risk-reward is upset when the upside is very limited by downside is open.[66]. Such a measure that diminishes market activity, consequently impacting market liquidity, hampers the growth of the natural gas market and should be reconsidered or eliminated.

Medium-Term Initiatives

Unbundling and setting up of ISO

A code should be developed to define a legal and conceptual framework for the unbundling of the gas business. Regulatory boards, such as PNGRB, should fix a time period for entities to unbundle their transportation and marketing business. Transactions currently should be done on arm's length basis, with a focus on establishing operational Chinese walls in the long-term. The regulatory board should also conduct regular checks for companies that have separated their activities.

Several models of unbundling and open access are available. Although the United States and the United Kingdom adopted the complete ownership unbundling, other countries of Europe adopted three unbundling structures: 1) ownership unbundling (OU), as in the United States and United Kingdom; 2) ISO; and 3) independent ITO. India may look at ISO where gas supply companies may still formally own and maintain gas transmission networks but must leave the entire system operations to an independent company. Over long-term India may look to move towards ownership unbundling (OU), especially if government of India intends to disinvest from sector as long-term goal.

Open access should be extended to the LNG terminals insofar as such rules do not inhibit the financing and development of LNG import terminals.

Modifications of tariff reforms

Pipeline tariff rates are designed to recover costs and earn a reasonable profit and to ensure the shippers are paying a just and reasonable rate. PNGRB may consider allowing greater flexibility in tariffs that would encourage more shippers to contract for pipeline capacity. Some of the reforms may include:

- Pipeline should not be tied to a fixed tariff for the life of the project, but tariff may be variable to meet changing market conditions.
- Discounted tariff on non-discriminatory basis to anchor customers

PNGRB may also explore implementation of entry-exit system in long term where tariff will be fixed separately for entry and exit point, instead of the current distance-based pricing. The entry-exit system simplifies the overall gas transportation process, reducing complexities, and brings in efficiency in the system[67]. Entry-exit model also allows for route-agnostic (tariff is based on entry and exit points rather than the specific route taken) and counterparty-independent (tariff is determined by the entry and exit points rather than the identities of the parties involved) tariff.

Pipeline operators may also be encouraged to provide a host of discreet services such as intra-hub transfers.

'Vision 2030' report by PNGRB- Entry-Exit: Tariff recovery mechanism

"In the entry-exit tariff system separate booking of entry and exit capacity allows shippers and new entrants to book capacity without any contractual path and allows shippers to buy and sell freely gas once having paid the tariff to enter into the zone thus creating the conditions for a gas market."

[66] S&P Global, Commodity Insights; www.spglobal.com

[67] IGX on gas pipeline tariff mechanism; www.pngrb.gov.in

Natural Gas under GST

In the gas market, VAT must be replaced with GST to ensure uniform taxation across the country. Accumulation of legacy taxes due to non-availability of input credits under different tax structures should be prevented through GST implementation.

State VAT has created multiple markets across the country, and many economic transactions cannot take place due to high VAT. VAT is not pass-through as GST, and it increases the cost of transactions for most of the customers. The process of C-form issuance also obstructs many transactions. The requirement of VAT registration in the state where Seller wants to sell also causes loss of many trade opportunities.

Virtual Trading Hub

Implementation of entry-exit could pave the way for the development of a virtual trading hub and increase in spot-transactions in the gas market. A single TSO should be made the manager of the grid to oversee energy accounts and ensure balancing of gas volumes.

NGG Technical Assessment for PNGRB, 2022 – Promote development of gas market hubs

"One of FERC's first steps in reforming the gas pipeline system was to require pipelines to develop operational policies and rules that would facilitate gas market hubs. FERC was not specific or prescriptive on what should or should not be done because this arena was new and individual pipelines developed their own solutions (as it was in their interest to encourage more gas throughput on their pipes). Primarily these involved developing services around potential hub locations that would encourage traders to use those locations. Transaction fees were modest, access easy, and custody transfers of gas facilitated."

Long-Term Initiatives

Hedging and Futures: Development of a gas derivatives market in the country will allow participants to exchange gas contracts for forwards and futures, for hedging and efficient risk management. Regulators must develop adequate regulatory infrastructure to support the development of gas hedge markets.

Gas trading with South Asian countries: Formulating a gas index for India will extend a comprehensive gas index for the entirety of South Asia. Gas trade across borders with neighboring countries should also be explored. However, for this to happen, India would require sufficient infrastructure for gas connectivity to other countries. India should conceive a gas index for South Asia for use instead of JKM, as its use is difficult because of seasonality constraints.

Infrastructure development: The development of gas infrastructure in the country is paramount, particularly considering that many regions remain unconnected to the main grid. While infrastructure projects have been initiated in the North-East, comparable expansion efforts are essential for the rest of the country. This is crucial to extend access to gas infrastructure even to the hinterlands, ultimately fostering an increase in gas consumption nationwide.

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