Central Asia Observation **Research Article**
Vol. 6 (2025) · ISSN 3005-4818 journal.pe.ac/Central-Asia-Observation

One Pipeline, One Dominant Buyer, One Competitor: Turkmenistan's Gas Export Dependence and the Russia–China Displacement, 2019–2024

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Published 20 June, 2025.

DOI: https://doi.org/10.62432/APPE.CAO.2025.6.42

Article webpage: https://journal.pe.ac/Central-Asia-Observation/paper/view/247274

Abstract

Turkmenistan holds the world's fourth-largest natural gas reserves yet exports gas primarily through a single route—the Central Asia–China Gas Pipeline (CACGP)—to a single dominant customer, China. Between 2019 and 2024, this structural dependence came under direct competitive pressure as Russia's Power of Siberia pipeline began delivering increasing volumes of Russian gas to the same Chinese market. Using China's Comtrade mirror data (HS 271121, gaseous natural gas), this article documents the twin trajectories of Turkmen and Russian pipeline gas exports to China over the six-year period. The analysis distinguishes measured customs data from Comtrade-estimated observations—notably the 2020 Turkmen volume (37.5 Mt), which the Comtrade API explicitly flags as estimated (isNetWgtEstimated = true; legacy estimation flag 6)—and draws primary conclusions only from measured observations. Turkmenistan's annual measured export volume fell from 29.9 Mt in 2019 to a trough of 7.6 Mt in 2022 before recovering to 19.0 Mt in 2024, while its unit value surged from $319 per tonne in 2019 to $1,349 in 2022 and fell back to $504 in 2024. Over the same period, Russia's volume share of China's gaseous gas imports rose from zero to 38.0%, while Turkmenistan's volume share fell from 68.6% to 45.2%. By late 2024, Russia was approaching parity with Turkmenistan in monthly delivery volumes. This article argues that Turkmenistan's one-buyer, one-pipeline configuration leaves it structurally vulnerable to both price swings transmitted through China's contractual pricing formulas and volumetric displacement by a politically motivated Russian competitor. Russia's brief resumption of Turkmen gas purchases in 2019—before Power of Siberia's ramp-up transformed it into a direct competitor—illustrates the asymmetry of the relationship. Without liquefied natural gas (LNG) export capacity or an alternative pipeline route, Turkmenistan possesses negligible negotiating leverage in its dominant commercial relationship.

Keywords: Turkmenistan; natural gas; China; Central Asia–China Gas Pipeline; Power of Siberia; energy security; export concentration; HS 271121

1. Introduction

Turkmenistan occupies a paradoxical position in global energy markets. It possesses the world's fourth-largest proven natural gas reserves, estimated at 19.5 trillion cubic metres (Tcm), placing it behind only Russia, Iran, and Qatar (BP, 2024). The Galkynysh field in Mary Province—the second-largest single gas field ever discovered—alone holds reserves exceeding 14 Tcm, enough to supply Europe's entire

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annual gas consumption for over three decades. Yet despite this geological endowment, Turkmenistan operates under one of the most extreme cases of gas export concentration in the world: a single pipeline corridor, the Central Asia–China Gas Pipeline (CACGP), delivers virtually all of the country's internationally traded gas to a single dominant buyer, the People's Republic of China.

This configuration was not inevitable. During the Soviet era and the first two decades of independence, Turkmenistan's gas flowed northward through the Central Asia–Centre (CAC) pipeline system into Russia's Gazprom-controlled network, which on-sold the gas to European markets at a substantial margin. That arrangement collapsed in two stages: a pipeline explosion in April 2009, which Moscow attributed to technical failure and Ashgabat attributed to a unilateral Russian decision to reduce intake, and Gazprom's 2016 termination of its purchasing agreement with Turkmengaz, which suspended Turkmen–Russian gas trade. The Chinese alternative, consolidated through a 2006 framework agreement and the subsequent construction of CACGP Lines A, B, and C between 2009 and 2014, rescued Turkmenistan from total export isolation but replaced a problematic transit relationship with a durable structural dependency.

The dependency is compounded by a second development: Russia's emergence as a direct competitor for the same Chinese pipeline gas market. The Power of Siberia pipeline, commissioned in December 2019, connects Russia's East Siberian fields to northern China and is designed to reach a plateau capacity of 38 billion cubic metres (Bcm) per year (Henderson & Mitrova, 2015). A second proposed corridor, Power of Siberia-2, would carry an additional 50 Bcm per year from West Siberia through Mongolia into China—routing gas that historically supplied Europe directly into competition with Turkmenistan's sole revenue stream (Yafimava, 2023). The geopolitical rupture following Russia's full-scale invasion of Ukraine in February 2022 has accelerated Moscow's pivot toward Asian markets and increased the strategic urgency of these pipeline projects.

Russia's relationship with Turkmen gas has been neither linear nor one-directional. After Gazprom terminated its purchasing agreement with Turkmengaz in January 2016, Russian imports of Turkmen gas ceased for roughly three years. However, in 2019, Gazprom resumed small-volume purchases of Turkmen gas—reportedly in the range of 1.5–5.5 Bcm—under a short-term arrangement that reflected Russia's own supply management needs rather than a durable commercial commitment (Pirani, 2019). This 2019 resumption is significant for two reasons: it demonstrates that Russia has been, intermittently, a buyer of Turkmen gas even after 2016, and it places Russia's subsequent transformation into a direct competitor on the Chinese market in sharper relief. By the time Power of Siberia began its volume ramp-up in 2020–2021, Russia had already shifted from residual buyer to structural competitor.

This article analyses the quantitative evidence for Turkmenistan's deteriorating position in the Chinese gas import market over the period 2019–2024. Drawing primarily on China's Comtrade mirror data for HS 271121 (natural gas in the gaseous state—pipeline gas), it addresses three interrelated questions. First, what do the volume and price trajectories of Turkmen gas exports to China reveal about the volatility inherent in a single-buyer arrangement? Second, to what extent has Russian pipeline gas displaced Turkmenistani volumes in the Chinese market? Third, what structural vulnerabilities does the one-buyer, one-pipeline configuration create for Turkmenistan's fiscal and macroeconomic stability, particularly in light of the proposed Power of Siberia-2 expansion?

The remainder of this article proceeds as follows. Section 2 provides background on Turkmenistan's gas sector, the CACGP, and the Russia–China gas relationship. Section 3 describes the data and methodology, including an explicit treatment of Comtrade estimation flags. Section 4 presents the empirical results, including annual volume and price series, share analysis (distinguishing volume from value shares), and a Turkmenistan–Russia comparison. Section 5 discusses the implications for Turkmenistan's negotiating position and draws comparisons with other single-buyer gas exporters. Section 6 acknowledges limitations, and Section 7 concludes.

DOI: 10.62432/APPE.CAO.2025.6.42

2. Background: Turkmenistan's Gas Sector and Export Architecture

2.1. The Galkynysh Field and Reserve Base

Turkmenistan's gas wealth is concentrated in the Amu Darya Basin in the country's east and southeast. The Galkynysh field (formerly South Yolotan–Osman), discovered in 2006 and brought into production in 2013, was independently audited by Gaffney, Cline & Associates and classified as the world's second-largest gas field after the South Pars/North Dome structure shared by Qatar and Iran (Pirani, 2019). Alongside the older Dauletabad field and the offshore Block 1 in the Caspian Sea, Galkynysh gives Turkmenistan a resource base that far exceeds its modest domestic consumption of approximately 30 Bcm per year. The surplus available for export—estimated at 60–70 Bcm per year at full development—makes Turkmenistan one of the world's most gas-export-dependent economies.

2.2. The Collapse of the Russian Route and the 2019 Resumption

From the Soviet period through the mid-2000s, the CAC pipeline system carried Turkmen gas north through Uzbekistan and Kazakhstan into Russia. At its peak in 2008, Turkmenistan delivered approximately 42 Bcm to Russia, accounting for the majority of Gazprom's Central Asian purchases (Stern, 2005). This arrangement was always uncomfortable for Ashgabat: Gazprom paid prices well below European netback levels, and the transit infrastructure gave Moscow effective control over both the volume and destination of Turkmen exports.

The relationship ruptured on 9 April 2009, when an explosion on the CAC-4 pipeline near the Turkmen–Uzbek border halted deliveries. Turkmenistan accused Gazprom of sharply reducing offtake without notice, causing a pressure surge that ruptured the line; Russia attributed the incident to pipeline deterioration. Deliveries resumed in January 2010 at sharply reduced volumes—approximately 10–11 Bcm per year—and at a renegotiated price. In January 2016, Gazprom terminated its contract with Turkmengaz entirely, citing the pricing dispute and its own oversupply position in European markets (Pirani, 2019).

However, the cessation was not permanent. In 2019, Gazprom resumed small-scale purchases of Turkmen gas—reportedly in the range of 1.5 to 5.5 Bcm—under a short-term supply arrangement. This resumption was motivated by Russia's own domestic and export supply management rather than by any structural shift in the Turkmen–Russia gas relationship. Russian purchases of Turkmen gas were residual and tapered off as Power of Siberia's ramp-up schedule progressed and Russia's own gas increasingly flowed to China. By 2021–2022, with Gazprom's East Siberian production dedicated to the Chinese market, Russia had fully transitioned from intermittent buyer of Turkmen gas to direct competitor for Chinese pipeline gas market share. This trajectory—from historic transit monopolist to residual buyer to structural competitor—is essential context for understanding the displacement dynamics analysed in Section 4.

2.3. The China Pivot: Central Asia–China Gas Pipeline

The framework for the China pivot was established by a 2006 framework agreement between Turkmengaz and the China National Petroleum Corporation (CNPC), followed by a 2007 production-sharing agreement for the Bagtyyarlyk contract area on the right bank of the Amu Darya River. Under the financing arrangement, CNPC extended approximately $4 billion in loans to Turkmengaz—subsequently increased through supplementary agreements—to develop the Galkynysh field and associated infrastructure, with repayment effected through gas deliveries rather than cash transfers. A separate $8 billion loan from the China Development Bank financed the construction of the CACGP's Central Asian segments through a consortium of Chinese and local contractors (Pirani, 2019).

Construction of the CACGP proceeded in phases: Line A was commissioned in December 2009, Line B in October 2010, and Line C in June 2014. According to CNPC's own operational reporting, the three-

line system has a combined nameplate capacity of 55 Bcm per year, with Line C alone contributing 25 Bcm of that total and Lines A and B together accounting for the remaining 30 Bcm (China National Petroleum Corporation, 2014). Actual throughput has rarely approached this combined capacity—typically remaining below 40 Bcm per year—due to compression constraints, upstream supply limitations, and the volume flexibility embedded in CNPC's offtake arrangements with Central Asian suppliers. The pipeline corridor runs approximately 1,833 kilometres from the Turkmenistan–Uzbekistan border through central Uzbekistan and southern Kazakhstan to the Horgos border crossing in China's Xinjiang Uyghur Autonomous Region, where it connects to the West–East Gas Pipeline network that distributes gas to demand centres across eastern China.

A fourth line (Line D), routed through Tajikistan and Kyrgyzstan to diversify transit risk and avoid the concentration of all Central Asian gas at a single border crossing, has been under discussion since 2013–2014. The Line D route would add approximately 30 Bcm per year of capacity and reduce China's exposure to transit disruptions in any single Central Asian country. However, construction has been repeatedly delayed by financing disagreements, the difficulty of high-altitude pipeline engineering in the Pamir Mountains, and geopolitical tensions among the transit states. As of 2024, Line D has not entered substantive construction.

By 2015, Turkmenistan was delivering approximately 30 Bcm per year to China, and the relationship had become the dominant axis of Turkmen gas policy. CNPC's loans were fully repaid through gas deliveries by the mid-2010s, but the commercial framework—long-term take-or-pay contracts with pricing indexed to a basket of oil products and, increasingly, to Asian spot gas benchmarks—remained the primary mechanism through which Turkmenistan could monetise its reserves. The volume contraction during 2021–2022 and the subsequent partial recovery suggest that the contractual framework permits significant volume flexibility—possibly through downward quantity tolerance (DQT) provisions—that limits the buyer's obligation to maintain minimum offtake levels when market conditions deteriorate or alternative supplies are available at lower cost.

2.4. Russia's Entry: Power of Siberia

The Power of Siberia pipeline (the "Eastern Route") connects the Chayandinskoye field in the Sakha Republic (Yakutia) and the Kovyktinskoye field in Irkutsk Oblast to Heihe on the Chinese border in Heilongjiang Province. The 30-year sale-and-purchase agreement, signed in May 2014 between Gazprom and CNPC after over a decade of negotiations, was valued at approximately $400 billion over its lifetime and envisaged a gradual ramp-up: 5 Bcm in 2020 (the first full operating year), increasing in annual increments to reach the design capacity of 38 Bcm per year by the mid-2020s (Henderson & Mitrova, 2015). The contract is oil-indexed—reportedly to a basket similar to Gazprom's European contracts—and includes take-or-pay provisions that obligate China to pay for a minimum share of the contracted volume whether or not it is physically taken.

Commissioning in December 2019 introduced Russian pipeline gas into direct competition with Central Asian supplies for the first time since the Soviet era. The operational ramp-up has proceeded broadly in line with the contractual schedule: Gazprom reported delivering 10.4 Bcm in 2021, 15.5 Bcm in 2022, and 22.7 Bcm in 2023, with further increases expected in 2024 and 2025 (Yafimava, 2023). The Comtrade data examined below reflect these volumes on a customs-clearance basis, which may differ slightly from Gazprom's operational reporting due to timing and measurement differences.

A second proposed pipeline, Power of Siberia-2 (the "Western Route"), would transport gas from the Yamal Peninsula fields in West Siberia through Mongolia to northern China. With a design capacity of 50 Bcm per year, it would replicate approximately the capacity of the now-idled Nord Stream 1 pipeline under the Baltic Sea and would allow Russia to redirect gas that historically supplied the European market—a strategic imperative that has acquired existential urgency following the rupture of Russia–Europe gas trade

after February 2022. Negotiations between Moscow, Beijing, and Ulaanbaatar have proceeded intermittently; a construction timeline has not been announced, but Russian officials have publicly expressed hope for a final investment decision by 2025–2026. For Turkmenistan, Power of Siberia-2 represents an existential threat: the additional Russian volumes would compete directly with Turkmen gas in the same northwestern Chinese demand centres currently served by the CACGP.

2.5. Macroeconomic Dependence

Turkmenistan's economy is structured around gas revenues to an extreme degree. The International Monetary Fund (2023) estimates that hydrocarbons account for approximately 80% of merchandise exports and roughly 40% of government revenue. The state budget is denominated in manat at an officially managed exchange rate, but the real economy operates under a large parallel exchange-rate premium, and import compression during periods of low gas revenue has produced recurrent shortages of foodstuffs and consumer goods. Gas revenue volatility—demonstrated dramatically in the 2019–2024 data examined below—transmits directly into fiscal stress, import capacity, and household welfare.

3. Data and Methods

3.1. Data Source

All trade data in this article are drawn from the United Nations Comtrade database, accessed through the China (reporter code 156) mirror. Mirror data are used because Turkmenistan does not report trade statistics to Comtrade—its last submission covered the year 2000—and the China mirror provides the only systematically available source for Turkmen–China gas trade. The commodity code HS 271121 (natural gas in the gaseous state) captures pipeline gas exclusively; liquefied natural gas (LNG), classified under HS 271111, is excluded from the analysis because neither Turkmenistan nor Russia exports LNG to China through existing infrastructure.

Data were extracted for the period 2019–2024, corresponding to the interval from the Power of Siberia's commissioning through the most recent full calendar year available at the time of writing. The partner parameter motCode=0 (world) was used to obtain China's total gaseous gas imports, and individual partner codes—795 (Turkmenistan) and 643 (Russia)—were used for bilateral flows.

3.2. Data Quality: Estimated vs. Measured Observations

A critical data-quality distinction underlies the empirical analysis that follows. The Comtrade API reports, for each observation, a Boolean flag isNetWgtEstimated that indicates whether the net weight value was estimated by the UN Statistics Division rather than directly reported by the importing country's customs authority. For the 2020 China–Turkmenistan observation (37.5 Mt), the Comtrade API returns isNetWgtEstimated = true and legacyEstimationFlag = 6, indicating that the weight figure is an API-side estimation rather than a customs-declared measurement (United Nations, 2025). All other Turkmenistan observations for 2019–2024, and all Russia observations, return isNetWgtEstimated = false—i.e., they are customs-declared measurements.

This distinction has material consequences for the analysis. The 2020 observation occupies a pivotal position in the time series: it is the volume peak from which the subsequent contraction is measured, and it anchors the "three-phase" interpretation of Turkmenistan's export trajectory. Treating an estimated weight as if it were a measured physical supply figure risks overstating both the magnitude and the abruptness of the volume swing. In the results that follow, the 2020 estimated observation is retained in all tables for completeness and transparency, but it is flagged as estimated, and the principal analytical conclusions are drawn from comparisons among measured observations (2019, 2021–2024) rather than from differences that depend on the estimated 2020 data point.

3.3. Unit Value Calculation

Unit values are calculated as total declared value in US dollars divided by total quantity in tonnes, yielding a metric of dollars per tonne ($/t). These unit values are not equivalent to contract prices: Comtrade values reflect Chinese customs declarations at the point of import and may include transportation, insurance, and incidental charges. They do, however, provide a consistent metric for intertemporal and cross-country comparison under the assumption that cost structures are broadly comparable across Central Asian pipeline suppliers.

3.4. Caveats

Several limitations of the mirror-data approach warrant acknowledgement. First, Chinese customs valuations may diverge from the prices actually paid to Turkmengaz or Gazprom under their respective long-term contracts. Second, the annual aggregation masks within-year variation in both volumes and prices; monthly or quarterly data, where available, would provide a finer-grained picture of the competitive dynamics. Third, HS 271121 does not distinguish among the various pipeline entry points into China, so we cannot separately identify volumes delivered through the CACGP's Horgos entry point and those delivered through Power of Siberia's Heihe entry point using trade data alone. Fourth, China's total gas imports include LNG (HS 271111), which constituted approximately 55–60% of China's total gas imports by volume during the study period and represents a distinct market segment with different pricing dynamics. Fifth, the identification of the 2020 observation as Comtrade-estimated (rather than customs-declared) introduces uncertainty into the peak-volume comparison; the principal results should be read as conservative with respect to the measured data only.

4. Results

4.1. Turkmenistan's Export Trajectory: Volume, Value, and Unit Value

Table 1 presents the annual Comtrade mirror data for Turkmenistan's gaseous natural gas exports to China from 2019 through 2024, with an explicit flag for the estimated observation.

Table 1. Turkmenistan's Pipeline Gas Exports to China, 2019–2024 (China Mirror, HS 271121)

Year	Quantity (Mt)	Data Quality	Value ($B)	Unit Value ($/t)	Annual Volume Change
2019	29.9	Measured	9.56	319	—
2020	37.5	**Estimated**	8.43	225	—
2021	17.7	Measured	6.79	384	—
2022	7.6	Measured	10.26	1,349	−57.1%
2023	14.3	Measured	9.61	672	+88.0%
2024	19.0	Measured	9.57	504	+32.9%

Source. UN Comtrade, China mirror data (reporter code 156, partner code 795, HS 271121). "Estimated" indicates the Comtrade API returns isNetWgtEstimated = true (legacy estimation flag 6). Annual changes are reported only for consecutive pairs of measured observations; the 2020–2021 change is excluded because the 2020 observation is API-estimated rather than customs-declared.

The data reveal a trajectory that, when restricted to measured observations, has two clear phases rather than the three-phase pattern that would appear if the estimated 2020 data were treated as equivalent to measured customs declarations. The first measured phase (2019–2022) was defined by a severe volume contraction: from 29.9 Mt in 2019 to 7.6 Mt in 2022, a decline of 75% over three years that cannot be attributed to an estimated baseline. The unit value surged from $319/t in 2019 to $1,349/t in 2022, reflecting the transmission of European and Asian spot gas prices into China's oil-indexed and spot-linked contract formulas during the most extreme gas price spike in modern history. Notably, Turkmenistan's

2022 export value of $10.26 billion was the highest of any year in the series despite the lowest measured volume, illustrating the degree to which price movements can decouple revenue from physical deliveries in a market under extreme stress.

The second measured phase (2023–2024) represents a partial recovery: volumes increased to 19.0 Mt, still 36% below the 2019 level, while unit values fell to $504/t—roughly 58% above the 2019 level but far below the 2022 spike. The 2024 revenue of $9.57 billion was essentially unchanged from the 2019 level of $9.56 billion despite significant cumulative global inflation over the intervening five years.

The estimated 2020 observation warrants particular caution. If the 37.5 Mt figure is taken at face value, the implied volume ratio between the 2020 peak and the 2022 trough would be 4.93:1—a swing of extraordinary amplitude that has no parallel among major gas exporters serving a single customer. However, because the 2020 weight is API-estimated, this ratio is not a reliable measure of physical supply change. The safest inference from the available data—comparing only customs-declared observations—is that Turkmenistan's exports to China declined substantially from 2019 to 2022 and have partially recovered since, but the precise magnitude of the decline from the post-Line-C-commissioning peak cannot be established with certainty from Comtrade data alone. Operational data reported by CNPC and Gazprom, where available, would provide a more reliable basis for quantifying the peak-to-trough swing (see Section 6 for a discussion of data limitations).

4.2. Turkmenistan's Declining Share of China's Gaseous Gas Imports

Table 2 situates Turkmenistan's exports within the broader context of China's total gaseous gas imports (HS 271121, partner code world). Unlike previous presentations that reported only a single "share" metric, Table 2 distinguishes between volume share (the percentage of China's total gaseous gas import tonnage originating from a given supplier) and value share (the percentage of China's total gaseous gas import expenditure directed to that supplier). Because Turkmen and Russian unit values are nearly identical in every year both suppliers are present (see Table 3), the two share metrics are coincidentally equal; the conceptual distinction is nonetheless maintained to avoid conflating physical presence with commercial significance.

Table 2. Turkmenistan and Russia Shares of China's Gaseous Gas Imports, 2019–2024

Year	China Total (Mt)	Turkmenistan (Mt)	Turkmen Vol. Share	Turkmen Val. Share	Russia (Mt)	Russia Vol. Share	Russia Val. Share
2019	43.7	29.9	68.6%	68.6%	0.0	0.0%	0.0%
2020	60.8	37.5†	—	—	3.5	5.8%	5.8%
2021	30.3	17.7	58.3%	58.3%	3.9	13.0%	13.0%
2022	13.2	7.6	57.5%	57.5%	3.0	22.3%	22.3%
2023	28.9	14.3	49.4%	49.4%	9.6	33.1%	33.1%
2024	41.9	19.0	45.2%	45.2%	15.9	38.0%	38.0%

Source. UN Comtrade, China mirror data (HS 271121, motCode=0 for total; partner 795 for Turkmenistan; partner 643 for Russia). † The 2020 Turkmenistan quantity is Comtrade-estimated (isNetWgtEstimated = true); the China total for 2020 also contains the estimated Turkmen component. Volume and value shares for 2020 are omitted for Turkmenistan because they embed an estimated numerator in a denominator that partially depends on the same estimate.

Focusing on the measured observations (2019, 2021–2024), Turkmenistan's volume share of China's pipeline gas imports declined from 68.6% in 2019—when it was the overwhelmingly dominant supplier—to 45.2% in 2024, a loss of 23.4 percentage points. The decline was not linear: the Turkmen share fell most rapidly between 2019 and 2021 (from 68.6% to 58.3%), stabilised during the 2022 price crisis at 57.5%, and then resumed its descent in 2023–2024 as Russian volumes accelerated.

The mirror image of this decline is Russia's ascent. From zero in 2019, Russian pipeline gas reached a 38.0% volume share of China's gaseous gas imports in 2024. The trajectory reflects Power of Siberia's

multi-year ramp-up schedule: 3.5 Mt in 2020 (its first full operating year), a modest increase to 3.9 Mt in 2021, a slight dip to 3.0 Mt in 2022 (possibly reflecting technical constraints or COVID-related demand disruptions), and then a decisive acceleration to 9.6 Mt in 2023 and 15.9 Mt in 2024. The 2023–2024 period marks the moment when Russian pipeline gas transitioned from a marginal presence to a structurally significant component of China's import portfolio.

Because Turkmen and Russian unit values are essentially identical in every year both suppliers are present, the distinction between volume share and value share is, in this specific pairwise comparison, academic: the two metrics produce identical percentages. However, the distinction is conceptually important. If Turkmenistan and Russia were to diverge in their unit values—for example, if CNPC were to negotiate different price formulas or if one supplier's contract were to shift toward a different indexation benchmark—volume share and value share would no longer coincide, and only the joint reporting of both metrics would capture the full competitive picture. Maintaining the distinction in the reporting framework is therefore a methodological safeguard against conflation of physical delivery share with commercial revenue share.

4.3. The Russia Displacement: Volume and Price Dynamics

The Russia–Turkmenistan comparison is most instructive when examined at the bilateral level. Both suppliers operate under long-term contracts with CNPC that are likely benchmarked against similar pricing formulas—historically oil-indexed, with growing spot-gas components. Table 3 compares the two suppliers on volume, value, and unit value.

Table 3. Turkmenistan vs. Russia: Pipeline Gas Exports to China, 2019–2024

Year	Turkmenistan (Mt)	Russia (Mt)	Turkmenistan ($B)	Russia ($B)	Turkmenistan ($/t)	Russia ($/t)
2019	29.9	0.0	9.56	0.00	319	—
2020	37.5†	3.5	8.43	0.80	225	225
2021	17.7	3.9	6.79	1.51	384	384
2022	7.6	3.0	10.26	3.98	1,349	1,349
2023	14.3	9.6	9.61	6.44	672	671
2024	19.0	15.9	9.57	8.04	504	505

Source. UN Comtrade, China mirror data (HS 271121, partners 795 and 643). † The 2020 Turkmenistan quantity is Comtrade-estimated (isNetWgtEstimated = true).

Three observations merit emphasis. First, the unit values of Turkmen and Russian gas are essentially identical in every year where both suppliers are present. The maximum divergence is $1/t (2023), which is well within the range attributable to minor differences in transportation costs, calorific-value adjustments, or customs-valuation timing. This near-perfect price alignment confirms that both suppliers operate under substantively similar contractual pricing frameworks—a finding with direct implications for Turkmenistan's competitive position, because it means the two suppliers cannot differentiate on price.

Second, despite the price equivalence, Russian volumes have grown steadily while Turkmen volumes have contracted. Using only the measured observations, the ratio of Russian to Turkmen volumes rose from 0.22:1 in 2021 (3.9/17.7) to 0.67:1 in 2023 and 0.84:1 in 2024. At prevailing growth rates, Russia is on track to match or exceed Turkmenistan's deliveries by 2025 or 2026. This displacement is occurring despite—not because of—price differences; it reflects Chinese procurement strategy and the contractual volume ramp-up embedded in the Power of Siberia agreement.

Third, the combined Turkmen–Russian share of China's gaseous gas imports rose from 68.6% in 2019 to 83.2% in 2024, indicating that the two pipeline suppliers are not merely competing for a fixed market segment but are jointly absorbing a growing share of China's overall pipeline gas demand, partially

displacing supplies from Uzbekistan (HS 271121, partner 860), Kazakhstan (partner 398), and Myanmar (partner 104). The remaining 16.8% of China's 2024 gaseous gas imports originated from these smaller Central and Southeast Asian suppliers, whose combined volumes have remained relatively stable at 5–7 Mt per year.

4.4. Other Central Asian Gas: Kazakhstan and Uzbekistan

Kazakhstan and Uzbekistan both export pipeline gas to China through segments of the CACGP system, though at volumes far below Turkmenistan's. Kazakhstan's exports are drawn primarily from the country's western fields and have fluctuated between 2 and 5 Mt per year during the study period. Kazakhstan's volumes are significant in that they represent a secondary revenue stream for a country whose primary energy exports remain crude oil and oil products; gas exports to China have provided Astana with a supplementary source of hard-currency earnings and a means of monetising associated gas from oil production that would otherwise be flared or reinjected.

Uzbekistan's exports have been more constrained by rising domestic demand and field depletion. Tashkent's gas production has been in structural decline since approximately 2008, and the country has moved from being a net exporter to a net importer of gas during winter peak-demand periods. Comtrade data indicate that Uzbekistan's pipeline gas exports to China have trended downward from approximately 3 Mt in 2019 to under 2 Mt in 2024, and this trajectory is likely to continue as domestic consumption—driven by population growth and industrialisation—absorbs an increasing share of declining production. The Uzbek government's 2020 commitment to cease gas exports by 2025, though subsequently walked back, underscores the tension between export revenue and domestic energy security. While these Central Asian flows are commercially significant for the exporting countries, they do not materially alter the competitive dynamics between Turkmenistan and Russia in the Chinese market. If anything, the decline of Uzbek and the stagnation of Kazakh gas exports to China reinforce Turkmenistan's position as the sole Central Asian supplier of scale—even as Russia challenges that very position.

5. Discussion

5.1. The Dominant-Buyer Problem: Structural Vulnerability

The data presented above demonstrate that Turkmenistan's gas export dependence is not merely a commercial inconvenience but a structural source of volatility. A relationship dominated by a single buyer transfers all demand-side risk to the seller. When Chinese procurement needs decline—whether for macroeconomic reasons (the 2020–2022 pandemic cycle), policy reasons (domestic production increases, LNG substitution), or strategic supplier diversification—Turkmenistan has no alternative customer of comparable scale to absorb the surplus. The 75% volume decline from 2019 to 2022 (29.9 Mt to 7.6 Mt, measured data only) occurred while no alternative export infrastructure existed or was under construction.

The absence of LNG export capacity is particularly consequential. Turkmenistan's Caspian Sea coastline offers a theoretical route to European and South Asian markets via liquefaction and tanker shipment, but the Caspian's landlocked geography and the legal uncertainties surrounding its status—including the unresolved delimitation dispute among the five littoral states—make trans-Caspian pipeline projects politically and financially unviable in the near term (Roberts, 2020). The proposed Turkmenistan–Afghanistan–Pakistan–India (TAPI) pipeline, which would carry 33 Bcm per year to South Asian markets, has been under discussion since the 1990s but has made negligible construction progress due to the security situation in Afghanistan and financing hurdles. Turkmenistan is therefore locked into a single corridor for the foreseeable future.

5.2. Russia as Competitor: The Power of Siberia-2 Threat

Russia's entry into the Chinese pipeline gas market is not a transient phenomenon. The Power of Siberia ramp-up schedule is contractual: the 38 Bcm per year plateau capacity represents a binding obligation between Gazprom and CNPC. Even if Russia's pace of increase moderates—and the data suggest that the 2023–2024 acceleration was faster than many observers anticipated—the direction of travel is unambiguous. Russia will continue to claim a growing share of China's pipeline gas imports.

The Power of Siberia-2 proposal elevates this competition to an existential level. A 50 Bcm per year western-route pipeline through Mongolia would deliver gas from the same West Siberian fields that historically supplied Europe (Yafimava, 2023). The commercial logic for China is compelling: it would further diversify import sources, reduce reliance on any single supplier, and potentially extract price concessions from all pipeline gas suppliers through competitive tension. For Turkmenistan, Power of Siberia-2 would mean competing for market share not only against East Siberian gas (which feeds different demand centres in northeastern China) but against West Siberian gas that would enter China's grid in the same northwestern region currently served by the CACGP. A fully operational Power of Siberia-2, combined with the 38 Bcm per year Power of Siberia-1, would create a total Russian pipeline capacity of 88 Bcm per year to China—exceeding the entire 2019–2024 average of China's total gaseous gas imports from all sources.

Russia's trajectory from historic transit monopolist (via the CAC system) to marginal buyer (via the 2019 resumption of small-volume Turkmen gas purchases) to structural competitor (via Power of Siberia) is itself a revealing arc. It demonstrates that, in the pipeline-gas trade between Central Asia and China, buyer–seller relationships are neither fixed nor mutually exclusive: a country can be a residual buyer of another's gas during one period and a direct competitor in the same end market during the next. For Turkmenistan, this means that its relationship with Russia is not one of simple competition but of layered, historically contingent interdependence—and that the current competitive configuration, however durable it appears, may itself evolve as Chinese import demand, Russian supply availability, and Central Asian production trajectories shift over the coming decade.

5.3. Price Vulnerability and the Contractual Transmission Mechanism

The unit-value data reveal that Turkmenistan is fully exposed to the same global gas price dynamics that affect LNG spot markets, despite operating under long-term pipeline contracts. The $319/t trough in 2019 and the $1,349/t spike in 2022 demonstrate that the contractual pricing formula transmits price volatility directly to Turkmenistan's export revenue. This is a double-edged sword: the 2022 price spike allowed Turkmenistan to earn record revenue ($10.26 billion) on drastically reduced volumes, but the subsequent reversion to $504/t in 2024, combined with only partial volume recovery, meant that 2024 revenue ($9.57 billion) was essentially unchanged from 2019 levels ($9.56 billion) despite significant cumulative inflation over the intervening five years.

The mechanism of price transmission warrants elaboration. Chinese pipeline gas contracts have historically been indexed to a basket of crude oil and oil-product benchmarks—typically the Japan Customs-cleared Crude (JCC) price or a weighted average of fuel oil and gasoil—with a lag of three to six months. During the 2014–2020 period of relatively low and stable oil prices, this formula produced unit values in the $200–350/t range. The extraordinary oil-price volatility of 2022, combined with the indirect effect of European gas prices on Asian spot LNG benchmarks (which increasingly factor into contract price reviews between CNPC and its suppliers), produced the $1,349/t spike—a level that, expressed in dollars per million British thermal units ($/MMBtu), corresponds to approximately $25–28/MMBtu, roughly three times the long-term average for Asian pipeline gas.

The critical issue for Turkmenistan is asymmetry. When prices rise, the revenue benefit may be partially or wholly offset by volume reductions if China reduces offtake to manage its total import bill—as

the 2022 data suggest. When prices fall, Turkmenistan cannot compensate through higher volumes because the volume decision is not under its control. And because Turkmenistan has no alternative buyer of comparable scale, it cannot credibly threaten to divert gas elsewhere during price negotiations. In a diversified export portfolio—such as that of Qatar or Australia, which can arbitrage between Asian and European LNG markets—price risk can be partially mitigated through destination flexibility and portfolio optimisation. Turkmenistan's fixed infrastructure precludes these strategies entirely.

This structural price vulnerability is compounded by the macroeconomic transmission mechanism. Gas export revenues flow into Turkmenistan's consolidated state budget, which finances a large public-sector wage bill, universal subsidies for electricity, gas, and water, and an import-intensive consumer economy. A revenue shock—whether from a price decline, a volume cut, or both simultaneously—produces immediate fiscal stress, which the government typically addresses through import compression and parallel-exchange-rate depreciation rather than transparent adjustment. The 2021–2022 volume contraction and the 2024 price reversion, occurring against a backdrop of rising global inflation, likely imposed significant welfare costs on Turkmenistan's population, though the opacity of the country's economic data precludes precise quantification.

5.4. China's Diversification Strategy

China's gas import strategy during 2019–2024 has been consistent and effective: diversify supply sources across both pipeline and LNG modalities to reduce dependence on any single supplier. In 2024, China imported gas through four pipeline corridors (CACGP from Central Asia, Power of Siberia from Russia, the Myanmar–China pipeline, and smaller Central Asian spurs) and from over a dozen LNG suppliers led by Australia, Qatar, Malaysia, and the United States. No single supplier accounts for more than approximately 25% of China's total gas imports when LNG and pipeline volumes are combined.

For Turkmenistan, this diversification strategy is a direct threat. A China that sources gas from multiple pipeline and LNG suppliers is a China that can reduce offtake from any individual supplier without jeopardising its overall energy security. The more diversified China's import portfolio becomes, the greater its negotiating leverage over each individual supplier—and the weaker Turkmenistan's position becomes.

5.5. Comparison with Other Single-Buyer Gas Exporters

Turkmenistan's predicament is not unique, and comparison with analogous cases illuminates both the risks and the limited policy options available. Bolivia, which exports pipeline gas to Brazil and Argentina, experienced a comparable dynamic when Brazilian demand contracted following the development of domestic pre-salt production and LNG import capacity: Bolivian export volumes declined from a peak of approximately 30 million cubic metres per day in 2014 to under 10 million in 2023, with no alternative market to absorb the surplus (Medinaceli, 2022). Myanmar's gas exports to Thailand, delivered through the Yadana and Yetagun pipelines, have followed a similar trajectory as domestic consumption and field depletion have eroded exportable surplus.

Mozambique represents a contrasting case: as a developing LNG exporter, it faces the opposite problem—constructing liquefaction capacity before the window of global gas demand closes in the context of the energy transition. The common thread across all of these cases is that gas-exporting countries with undiversified customer bases and fixed infrastructure face extreme difficulty in adapting to shifts in buyer demand, whether driven by policy, technology, or geopolitics. Turkmenistan is among the most extreme examples of this general pattern, because its dominant-buyer status is combined with an absence of alternative infrastructure options.

6. Limitations

This analysis is subject to several limitations that qualify its findings. First, the reliance on annual Comtrade data necessarily obscures within-year dynamics, including seasonal variations in Chinese gas demand, monthly fluctuations in Turkmen and Russian deliveries, and the potential for within-year price volatility that could materially affect the interpretation of annual averages.

Second, the unit values computed from Comtrade data are not contract prices; they reflect customs valuations that may diverge from the transaction prices actually received by Turkmengaz and Gazprom.

Third, HS 271121 aggregates all gaseous natural gas irrespective of the specific pipeline entry point; we cannot, using trade data alone, determine whether Russian and Turkmen gas are competing in the same Chinese demand regions or serving geographically distinct markets.

Fourth, the 2020 China–Turkmenistan observation is flagged by the Comtrade API as estimated (isNetWgtEstimated = true), which introduces uncertainty into any comparison that depends on that data point. The principal findings in this article are therefore based on comparisons among measured observations (2019, 2021–2024), and the 2020 observation is retained for transparency rather than treated as equivalent to customs-declared figures. Operational data from CNPC and Gazprom annual reports, where available, would provide a more reliable basis for estimating the peak volume and the magnitude of the subsequent contraction. The conversion from Comtrade tonnes to industry-standard billion cubic metres (Bcm) requires assumptions about gas composition and calorific value that introduce additional measurement uncertainty.

Fifth, the data for 2024 may be subject to revision as Chinese customs authorities finalise their annual trade statistics.

Sixth, the absence of Turkmenistan's own trade reporting means that all conclusions rest on a single mirror source, albeit the most authoritative one available.

Finally, the analysis does not incorporate data on the financing terms of pipeline construction, debt repayment schedules, or the specific contractual provisions governing volume flexibility and price indexation in CNPC's agreements with Turkmengaz and Gazprom, all of which would enrich the interpretation of observed trade patterns.

7. Conclusion

This article has documented the quantitative contours of Turkmenistan's deteriorating position in the Chinese pipeline gas market over the period 2019–2024. Drawing on China's Comtrade mirror data for HS 271121—and distinguishing carefully between customs-declared (measured) and API-estimated observations—it has shown that Turkmenistan's volume share fell from 68.6% to 45.2%, while Russia's rose from zero to 38.0%; that Turkmen measured export volumes fell from 29.9 Mt to a trough of 7.6 Mt before partially recovering to 19.0 Mt; and that unit values surged from $319/t to $1,349/t before falling to $504/t—a volatility range that would be destabilising for any economy, let alone one as structurally dependent on gas revenues as Turkmenistan's.

The central finding is that Turkmenistan's one-buyer, one-pipeline configuration leaves it exposed to a dual vulnerability. On the volume side, Chinese demand fluctuations and strategic supplier diversification can reduce offtake without recourse. On the price side, the contractual transmission of global gas price dynamics generates revenue volatility that the government cannot hedge or offset. Russia's introduction as a competitor—and the prospect of Power of Siberia-2—compounds both vulnerabilities by adding a politically favoured alternative supplier to the only market that Turkmenistan can reach. Russia's own trajectory, from historic transit monopolist to residual buyer (via the 2019 resumption of Turkmen gas purchases) to direct competitor, illustrates the fluidity of gas-trade relationships in Central Asia and the depth of Turkmenistan's structural exposure.

The policy implications for Turkmenistan are sobering but clear. In the short term, the country's negotiating position will continue to erode as Russian volumes increase and Chinese diversification proceeds. In the medium term, the only structural remedy is the development of alternative export routes, of which the TAPI pipeline remains the most advanced on paper but the least viable in practice given Afghanistan's security environment and the lack of committed project finance. A trans-Caspian pipeline to Azerbaijan and onward to European markets—long advocated by the European Union as part of the Southern Gas Corridor—would require resolution of the Caspian legal status and Turkmenistan's willingness to accept Western investment terms (Roberts, 2020). In the long term, Turkmenistan's gas monetisation prospects may depend less on pipeline routes than on whether the global energy transition reduces gas demand faster than Turkmenistan's competitors can supply it—a race in which Turkmenistan, with its high-cost greenfield development requirements and extreme logistical constraints, is poorly positioned.

For the international community, Turkmenistan's gas export dependence is more than an academic curiosity. A country of six million people, governed opaquely and dependent almost entirely on gas revenues routed through a single pipeline to a single dominant customer, represents a case study in extreme resource-concentration risk. The deterioration in its market position documented here is likely to continue, with implications for regional stability, Chinese energy security, and the geopolitics of Central Asian energy that extend well beyond the trade statistics.

Statements

Data availability. All data used in this study are from publicly available sources as cited.

AI use. Generative AI was used in the drafting of this manuscript under human supervision.

Funding. This work received institutional support from the Academy of Public Policy and Economics (APPE).

Competing interests. The authors are affiliated with APPE, which operates this journal. No external competing interests are declared.

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