

## **Natural Gas Trade between Turkmenistan and China in the Context of the BRI**

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**Abstract:** *The main goal of this research is to analyze natural gas trade between Turkmenistan and China. This research employs various methodologies, including web information assortment, regression, Gravity analysis, and statistical methods. Accessing books, articles, expert analyses, journals, and online sources has worked with a comprehensive understanding of the Belt and Road Initiative's effect on Sino-Turkmen energy relations. Investigating Turkmenistan's vast natural gas resources, China's increasing demand, and the multifaceted China-Central Asia Gas Pipeline. It delves into the significance of the Belt and Road Initiative in bolstering energy infrastructure, improving social commitment, and ensuring shared benefits, featuring the potential for development in Turkmen-Chinese relations. By assessing the trade of natural gas between China and Turkmenistan by using Gravity analysis, this research aims to give insights into the dynamics, challenges, and prospects of energy cooperation. The study concludes with recommendations for strengthening bilateral energy collaboration and emphasizes the significant job of the Belt and Road Initiative in fostering respective relations.*

**Keywords** - *Belt and Road Initiative, China, Natural gas, Trade, Turkmenistan*

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### **I. Introduction**

The People's Republic of China in the Central Asian international strategy vector is interested in tracking down sources of fuel resources. China consumed 8.7 percent of worldwide natural gas consumption in 2020, and China's evident natural gas consumption in 2022 was 380 billion cubic meters, increasing by 1-3 percent yearly, according China Natural Gas Development Report, jointly published by the National Energy Administration, the State Council and the Ministry of Natural Resources. Turkmenistan, which possesses 7.2 percent of the world's natural gas reserves, is the most suitable accomplice for China because of its approach of neutrality. The significance of the subject is that energy resources are perhaps of the most significant consider international relations.

One of the biggest suppliers of natural gas to China and a critical nation of the China-Central Asia gas pipeline project is Turkmenistan. As China's first transnational gas pipeline, the China-Central Asia gas pipeline runs from the boundary of Turkmenistan and Uzbekistan, passes through Uzbekistan and Kazakhstan. With an all-out length of 1,833 km and a designed yearly gas transmission limit of 60 billion cubic meters, the pipeline was placed into service in December 2009, and its highest everyday transport volume has surpassed 160 million cubic meters. The pipeline has delivered in excess of 334 billion cubic meters of natural gas to China since it went into activity in 2009, carrying warmth to Chinese households with natural gas from Turkmenistan.

This research will be significance among with the other articles expounded on BRI and respective relations and exchange energy sector. On the basis of data of this research later on researchers can understand that Turkmen-Chinese relations will foster significantly more and BRI will assume a gigantic part in these relations. Therefore, later on, those wishing to work on at this subject can use this data.

### **II. Natural gas resources of Turkmenistan and Role in Turkmenistan's economy**

Turkmenistan, with a rich history and diverse social legacy, is also known for its vast reserves of natural gas. The country's natural gas resources have been a significant driver of its economy and international significance.

Turkmenistan natural gas reserves is estimated to have the fourth-largest demonstrated natural gas reserves universally, which is an important asset in the energy landscape. Most of these reserves are situated in the South Yolotan-Osman field, also known as Galkynysh, in the eastern part of the country. This field alone is accepted to hold massive amounts of natural gas, making Turkmenistan a significant player in the worldwide energy market.

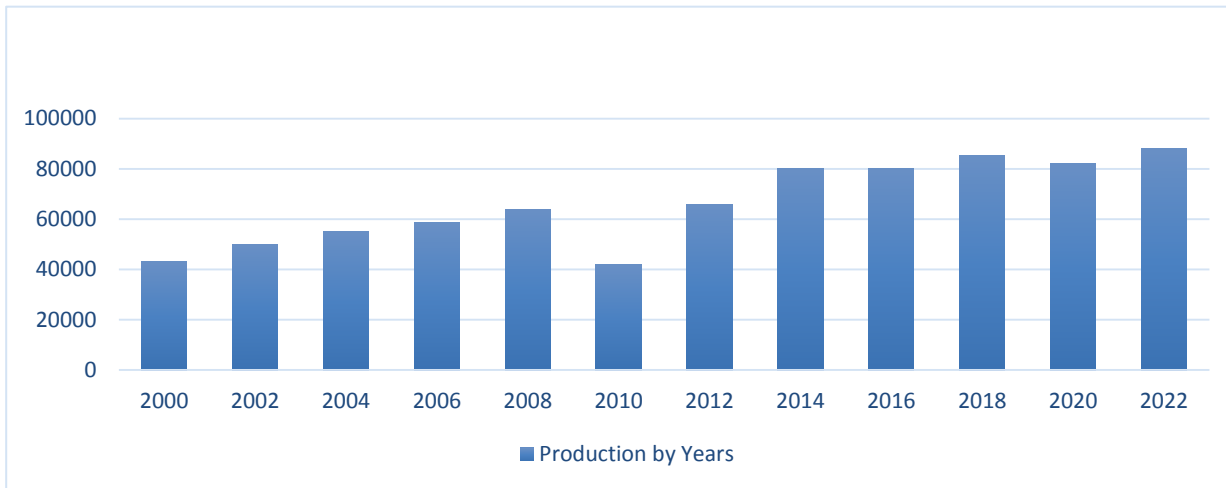


Figure 1 Natural gas production of Turkmenistan

Source: Center for Scientific Studies and Research (CEIC)

According to the market production of OPEC Turkmenistan has produced 87.78 billion Cub m in December 2022. Record production of Natural gas was in 2021 and it was around 87.83 billion Cub meters the lowest production year was 1998 with 12.48 billion Cubic meters.

The perfect geological area of Turkmenistan, with access to significant energy markets in Europe and Asia, enhances its true capacity as an energy exporter. The country’s gas reserves are in high demand, and the Turkmen government has invested in infrastructure projects like pipelines to transport its gas to international markets. The Turkmenistan-China gas pipeline, for instance, is one of the world's longest pipelines and plays an essential role in supplying China with Turkmen natural gas.

The gas complex assumes a vital part in the economy of Turkmenistan, contributing essentially to the country's GDP, government income, and foreign trade profit. Turkmenistan's GDP is essentially impacted by the gas area. The most recent accessible information demonstrates that the hydrocarbon area, including natural gas represents a significant part of the country's GDP. Natural gas exports, specifically, have been a vital driver of economic growth.

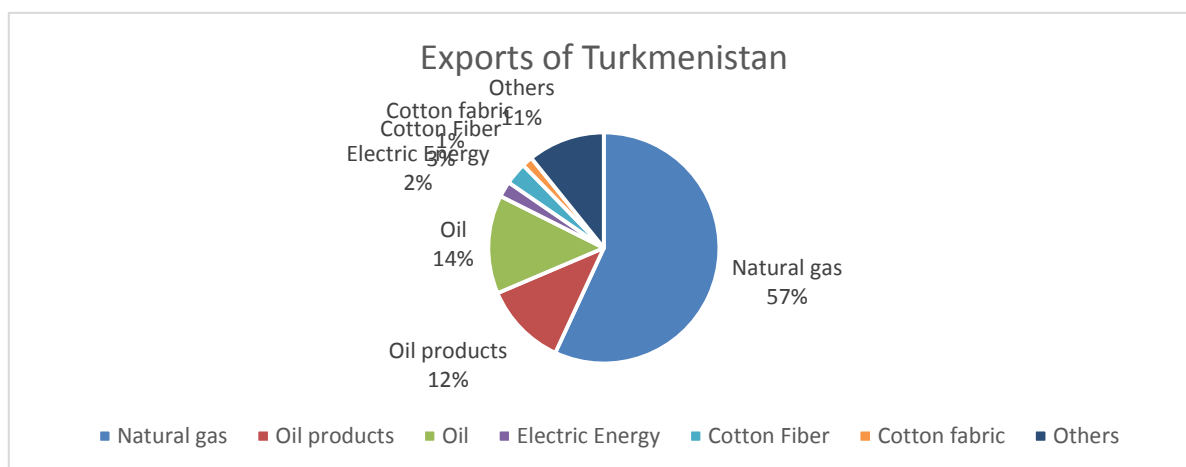


Figure 2 Hydrocarbon exports of Turkmenistan

Source: Statistical Yearbook of Turkmenistan 2022

The GDP commitment of the oil and gas area goes past direct creation and export. It additionally incorporates different downstream enterprises, for example, petrochemicals and energy-related administrations, which add to the generally speaking economic movement of the country. Government investment in infrastructure, financed by natural gas and oil income stimulated economic growth.

The perspectives of oil and gas exports from Turkmenistan are fundamental for the country's economic growth and its part in the global energy market. While Turkmenistan has generally been a significant player in the natural gas area, its oil exports are nearly more modest.

China keeps on being a significant objective for Turkmen natural gas. The Central Asia-China Gas Pipeline (Line D) has been a basic infrastructure project that works with the export of Turkmen gas to China. The drawn-out gas supply arrangements between Turkmenistan and China remained the foundation of the country's gas export technique.

Turkmenistan has been effectively chasing after the expansion of its gas export courses to decrease its reliance on unambiguous business sectors. The Trans-Caspian Gas Pipeline (TCGP), which means to ship Turkmen gas to Europe through the Caspian Ocean, addresses a possible chance for broadening. Nonetheless, progress on this venture has confronted challenges connected with the legitimate status of the Caspian Ocean and geopolitical factors.

Turkmenistan additionally exports natural gas to adjoining countries like Iran and Russia. Keeping up with and reinforcing these regional organizations gives extra choices to gas export. Investigation and development of new gas fields remain vital for expanding Turkmenistan's gas production and export limit. These endeavors are supposed to go on before very long to satisfy developing global needs.

### **III. Oil And Gas Consumption Dynamics In China And Prospects Of Demand Increase**

China, the world's most crowded country and the second-biggest economy, assumes a basic part in forming the global energy landscape. As China keeps on encountering fast industrialization, urbanization, and economic growth, its demand for oil and gas has been in a vertical direction.

China's natural gas consumption has dramatically multiplied in 10 years, with a consumption of 378.8 billion cubic meters in 2021 an increase of roughly 13 percent in comparison to the previous year. Key factors adding to this increment include. China's government has focused on lessening air contamination and fossil fuel byproducts. This has prompted strategies advancing the utilization of natural gas over coal in different areas, like power age and private warming.

As additional provincial regions are urbanized, the demand for natural gas in warming and cooking in local locations has expanded. The modern area has likewise been transitioning to natural gas for warming and powering activities, lessening the ecological effect. Infrastructure Development: The government has put resources into expanding natural gas infrastructure, including pipelines and import terminals, making natural gas more available.

The prospects for increased oil and gas demand in China are influenced by several key factors. China's economic growth is supposed to proceed, yet conceivably at a somewhat more slow rate. As the economy expands, so does the demand for energy, including oil and gas. China has been a forerunner in the adoption of electric vehicles, which might moderate oil consumption over the long term. However, the effect on oil demand will rely upon the pace of EV adoption and supporting infrastructure.

#### **3.1 Joint projects and prospects of Turkmenistan and China in gas sphere in the context of the BRI**

Turkmenistan, with its significant natural gas savings, has been a vital accomplice in China's energy enhancement system. The Belt and Road Initiative (BRI), China's ambitious infrastructure and economic development plan, plays had a pivotal impact in improving participation between the two countries. In this article, we will investigate the cooperative undertakings of Turkmenistan and China in the oil and gas area, inside the framework of the BRI, and examine future possibilities.

Turkmenistan is one of the world's top natural gas makers, with immense reserves underneath its desert landscapes. This wealth of natural gas resources has made Turkmenistan an alluring accomplice for China, which is trying to differentiate its sources of fuel and lessen its dependence on coal. Turkmenistan's natural gas fields are the foundation of the energy partnership between the two countries.

The Belt and Road Initiative, sent off by China, is an enormous infrastructure and economic development plan intended to interface Asia with Europe and Africa through land and sea organizations. Inside the structure of the BRI, Turkmenistan, and China have laid out broad energy participation, including pipelines, infrastructure development, and energy projects.

Turkmenistan-China gas pipeline: Perhaps one of the main tasks in the energy circle is the Turkmenistan-China gas pipeline, otherwise called Line D of the Central Asia-China gas pipeline. It is one of the world's longest gas pipelines, crossing more than 1,800 miles. The pipeline will empower the transportation of Turkmen natural gas to China, where it will fulfill the rising need for cleaner energy sources.

Turkmenistan has gone into long-term gas supply concurrences with China, guaranteeing a steady and reliable progression of natural gas. These arrangements assume a fundamental part in gathering China's developing energy needs.

The two countries have put resources into energy infrastructure, for example, gas blower stations and the extension of gas pipelines, to work with the smooth progression of natural gas from Turkmenistan to China. Turkmenistan and China have worked together on investigation and production exercises in Turkmenistan's gas fields. These joint endeavors plan to improve production limits and guarantee asset sustainability.

What's to come possibilities of Turkmenistan-China collaboration in the oil and gas circle inside the BRI system are promising. China's demand for energy, especially natural gas, keeps on developing. Turkmenistan's role as a solid provider adds to China's energy security. As China focuses on diminishing greenhouse gas emissions and further developing air quality, the role of cleaner natural gas from Turkmenistan in its energy transition is probably going to increase.

China's investments in Turkmenistan have also worked with infrastructure development, including the construction of pipelines and transportation networks. These infrastructure projects emphatically affect Turkmenistan's availability and territorial exchange.

The strategic significance of Chinese-Turkmen relations extends past energy collaboration. The BRI has worked with closer ties between China and Turkmenistan, as the two nations share a vested interest in advancing local stability and security. Furthermore, Turkmenistan's strategy of positive nonpartisanship has made it an alluring accomplice for China in the unpredictable Central Asian region.

Turkmenistan's status as an impartial entertainer in local geopolitics has made it an optimal accomplice for China, giving a door to Chinese goods and impact into Central Asia and the Caspian area. Turkmenistan's strategic area and stable world of politics are assets for the two nations. As of 2020, China Public Petroleum Organization (CNPC) have invested more than \$10 billion in Turkmenistan's energy sector, empowering the development of oil and gas fields and related infrastructure.

#### **IV. Gravity analysis of the natural resources trade between two countries**

In recent thirty or forty years, economists have gradually introduced knowledge of mathematics, physics, and other disciplines to try to analyze some economic phenomena from a new perspective. The trade Gravity model, the most advanced model in the field of international trade, is an economic application of the law of universal gravitation. This model aims to analyze the factors that affect trade flows between countries. Tinbergen (1962) and Poyhonen (1963) proposed a similar trade flow hypothesis: the trade flow between two economies is negatively correlated with the distance between them, and positively correlated with their own economic size. Since then, many researchers have continuously revised and improved the hypothesis according to the characteristics of economic development, trying to study the factors affecting trade. For example, Bergtrand (1989) has further expanded the traditional Gravity model by adding variables such as population and economic organization. This model is of great significance for studying the level of bilateral and multilateral facilitation and trade potential. At present, there are still many scholars in the field of international trade at home and abroad who use the expanded Gravity model to study the trade.

In the classic Gravity model, the factors that analyzing natural resources trade of the two countries are usually considered as the economic development level, GDP, natural gas consumption, natural gas export and

import and FDI inflows of the importing country. On this basis, this research constructs the following expanded FDI Gravity model of two countries:

To assess the significance of the factors, quantitative data was collected on China’s gas import from Turkmenistan, GDP of Turkmenistan and trade relations with China between 2000 and 2021. The estimated regression equation is as follows:

$$\ln EX_{oNGtChijt} = a_0 + a_1 \ln GDP_{it} + a_2 \ln GDP_{jt} + a_3 \ln PolStab_{ijt} + a_4 \ln Open_{jt} + a_5 \ln FDI_{inflowijt} + a_6 \ln PoExTG_{ijt} + a_7 \ln PPlength_{ijt} + a_8 \ln Gascons_{ijt} + a_9 \ln BRI_{it} + e_{ijt}$$

- i = Turkmenistan
- j = China
- t = years (2000-2021)
- e<sub>ijt</sub> = error term

This article uses the following explanatory variables to analyze BRI effect, with data spanning from 2000 to 2021. The meaning and data sources of variables are shown in the table below:

Variables	Meaning	Data source
FDI <sub>inijt</sub>	FDI inflow from China to Turkmenistan	NBS China, MOCC
GDP <sub>it</sub>	GDP of Turkmenistan (In millions USD)	The World Bank Macrotrends
GDP <sub>jt</sub>	GDP of China (In millions USD)	The World Bank, Macrotrends
PoExTG <sub>ijt</sub>	Price of exported Turkmen gas (per 1000 CM)	Agreement between Turkmenistan and China, 2006. The World Bank
Open <sub>jt</sub>	Trade openness of China	WITS
NGC <sub>it</sub>	Natural gas consumption of Turkmenistan (in CM)	The World Bank, Statistical bureaus of Turkmenistan,
Variables	Meaning	Data source
NGC <sub>ojt</sub>	Natural gas consumption of China (in CM)	The World Bank, NBS China, CEIC data
EX <sub>oNGtChijt</sub>	Export of Turkmen Natural gas to China in (BCM)	CEIC data, Statista
PS <sub>it</sub>	Political stability of Turkmenistan	The World Bank
PS <sub>jt</sub>	Political stability of China	The World Bank
Pipeline length <sub>ijt</sub>	Lenght of Pipeline from Turkmenistan to China	The World Bank
BRI <sub>it</sub>	A dummy variable. value of 1 Turkmenistan is a member of (BRI), and 0 otherwise	Green finance and development center

Table 3 Natural gas variables and data sources

*Regression result and analysis*

The panel least squares method, a statistical method for estimating the relationships between variables by taking into account both the cross-sectional and time-series variations of the data, was used for the analysis.

For natural gas trade between China and Turkmenistan a panel of data was collected from years 2000-2021 for China and Turkmenistan, providing 2 cross-sections and 22 time periods. There were 44 total observations in the panel, which means that there were different numbers of observations for different time periods and cross-sections. For clustering, the standard errors and t-statistic probabilities were modified.

Variable	Coefficient	Std. Error	t-ratio	p-value	Significance
const	-5.87519	7.21039 (4.87053)	-0.8148	0.5647	
LN GDP of Turkmenistan	-2.72359	1.01666 (0.705895)	-2.679	0.2274	
LN GDP of China	-5.07996	0.948255 (0.572650)	-5.357	0.1175	
LN Trade openness	12.7586	1.03171 (0.919929)	12.37	0.0514	*
LN Pipeline length	1.24493	0.320246 (0.237360)	3.887	0.1603	
LN price of Turkmen gas	0.376200	0.196535 (0.109359)	1.914	0.3065	
LN gas consumption of Turkmenistan	6.01723	0.567347 (0.314233)	10.61	0.0598	*
LN gas consumption of China	7.31374	1.10881 (0.834517)	6.596	0.0958	*
BRI	-1.38802	0.411893 (0.328179)	-3.370	0.1836	
Political stability of China	-0.230626	0.960938 (0.688055)	4.122	0.1515	
Political stability of Turkmenistan	3.96077	0.304065 (0.247080)	-0.7585	0.5869	
LN FDI inflow to Turkmenistan	0.344301	0.144002 (0.101531)	2.391	0.2522	
<hr/>					
R-squared	0.999842	Adjusted R-squared		0.998104	
F (11, 1)	575.3834	P - value (F)		0.032506	
Log likelihood	34.09856	Akaike criterion		-44.19713	
Schwarz criterion	-37.41774	Hannan-Quinn		-45.59060	
Mean dependant var	2.768605	S .D. dependent var		1.454499	

Table 4 Gravity analysis. OLS method. Natural gas

Source: Author's calculation with Gretl app

The independent variables demonstrate statistically significant coefficients at a 6-16 percent significance level, according to the analysis's findings. The dependent variable is significantly impacted by the natural gas consumption of China, trade openness of Turkmenistan, and Energy consumption of Turkmenistan, all of which show statistically significant coefficients.

The dependent variable's variation is explained by the model 99 percent, according to the R-squared value of 0.999842.

The model is of excellent quality, according to the AIC, SC, and HQC values. The very high F-statistic (4135.588) with a low associated p-value (0.012128), indicating that the overall regression model is statistically significant.

The test statistic LM (LM = 5.710578) follows a chi-square distribution with degrees of freedom equal to the number of explanatory variables in your model (11 in this case).

The p-value associated with the LM test statistic is 0.891961. Since this p-value is greater than a conventional significance level (such as 0.05). This suggests that there is no significant evidence of heteroskedasticity in this regression model based on the Breusch-Pagan test.

*Descriptive statistical analysis*

The descriptive statistical analysis results of the total panel data from 2000 to 2021 are as follows. descriptive statistical analysis results for a panel dataset spanning from 2000 to 2021. The Table below shows the mean, standard deviation, minimum, and maximum values for each variable in the dataset.

The variables included in the dataset are FDI inflow, GDP of the exporting country, GDP of the importing country, level of openness of the importing country, natural gas consumption of countries, import value of natural gas, price of the Turkmen gas, pipeline length, political stability of both countries and involvement in the Belt and Road Initiative.

Variables	Mean	Standard deviation	Min	Max
GDP of Turkmenistan (In million USD)	25171.62554	16149.36772	2904.662605	47887.41806
GDP of China (in Million USD)	7424549.627	5197642.498	1211346.87	17734062.65
Trade openness of China	46.46692055	9.570394173	34.75429578	64.46594
Pipeline length From Turkmenistan To China	2753.863636	2518.921279	0	5511
Price of Turkmen gas per 1000 CM	124.3885455	59.55715072	56.012	280.864
Gas import from Turkmenistan to China (in million USD)	3294.045455	3446.825489	0	8430
Natural gas consumption of Turkmenistan	25.09687741	12.79369109	7.403116147	43.35014164
Natural gas consumption of China	147.3636364	112.1351206	24.7	378.7
BRI	0.227272727	0.428932027	0	1
Political stability China	-0.452303814	0.128999839	-0.657060683	-0.209916875
Political stability Turkmenistan	0.062446206	0.244593822	-0.31902495	0.537688017
FDI inflow From China to Turkmenistan	516.5493851	535.4766937	1.09273423	1459.234678

Table 5 Descriptive statistical analysis

Source: Author’s calculation with excel

The descriptive Statistical analysis suggests that China has high values in some of the variables, such as gas consumption, GDP, level of openness, and geographical distance. The FDI inflow variable has a wide range of values, with a mean of 516.55 and a maximum of 1459.24 million USD, indicating significant variability across the observations. The other variables in the dataset also have varying levels of variability, as shown by their standard deviations.

### V. Conclusions

The cooperation between China and Turkmenistan in the energy sector, especially in natural gas reflects a significant symbiotic relationship that extends past simple resource trade. This cooperation is profoundly installed inside the international and monetary realms, significantly affecting worldwide energy security dynamics. The strategic significance of Turkmenistan as a substantial supplier of natural gas to China and its part in the China-Central Asia Gas Pipeline project features the entwined idea of their energy collaboration.

The utilized research methodologies, including information assortment, regression, Gravity analysis, and statistical methods, have empowered a comprehensive understanding of the Belt and Road Initiative's (BRI)

impact on Sino-Turkmen energy relations. This approach, combined with an extensive writing audit encompassing Turkmenistan's natural resources, China's escalating energy demands, and the China-Central Asia Gas Pipeline, has shed light on the challenges and opportunities innate in their energy cooperation. The Belt and Road Initiative emerges as a transformative stage, offering prospects for bolstering energy infrastructure, improving social commitment, and ensuring common benefits. It underscores the potential for substantial development and a stronghold in the relations between China and Turkmenistan.

This research endeavors to serve as an important resource for scholars and analysts, giving inside and out insights into the multifaceted energy dynamics among China and Turkmenistan. The recommendations below intend to shape and guide future developments, laying the basis for upgraded energy joint effort inside the structure of the Belt and Road Initiative, fostering persevering and commonly advantageous relations between these key nations.

### **Recommendations**

*Infrastructure Development and Trade Facilitation:* Emphasizing the need for hearty infrastructure development tailored to diverse geographical areas and economic phases and strengthening cooperation between China and Central Asian countries to help the development of infrastructure, using foundations like the Asian Investment Bank and Silk Road Fund to provide necessary resources.

Constant investment in infrastructure, including pipelines, ports, and transportation networks, to optimize the efficiency and reliability of oil and gas transportation between Turkmenistan and China. Improvements in infrastructure resilience to mitigate takes a chance with posed by geopolitical tensions or natural disasters that could upset the progression of energy resources.

*Feasibility Review and Planning for Infrastructure Development:* Focusing on key projects along the route, ensuring comprehensive infrastructure development to facilitate smoother data stream and trade and establishing normal rules and a comprehensive transportation coordination mechanism among taking part countries for efficient project management. Pushing for limit building programs that empower nearby communities and enhance their abilities to participate in and benefit from the trade relationship.

Knowledge exchange stages between Turkmenistan and China, working with the sharing of best practices, technological advancements, and experiences in the energy sector.

*Customs Cooperation and Efficiency Enhancement:* Streamlining customs environments to facilitate international trade by reducing the complexity of clearance procedures and enhancing transparency and using internet technology to work on customs processes, for example, pre-declaration, online customs declaration, and establish efficient channels for feedback and oversight.

*Export Structure Improvement and Modern Updating:* Encouraging policies that promote the export of super advanced items, like assessment incentives, to enhance the inspiration of cutting edge enterprises and supporting R&D efforts to create items that line up with the needs of countries along the Belt and Road, thereby increasing international competitiveness and boosting exports.

Turkmenistan could explore diversification beyond petroleum products, investing in renewable energy sources like sunlight based and wind power. Propose joint research and development initiatives focusing in on innovative technologies for cleaner extraction, transportation, and use of energy resources to reduce environmental effect.

*Differentiated Negotiations and Trade Facilitation Efficiency:* Acknowledgment the economic and social differences among taking an interest countries during negotiations and aim for mutually beneficial agreements and fostering social and verifiable exchanges between countries to bridge differences and create a conducive environment for multilateral trade relations.

These recommendations emphasize cooperation, infrastructure development, trade facilitation, and leveraging advancements in technology and finance to improve the natural gas trade between Turkmenistan and China inside the Belt and Road Initiative framework.

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