Doability of Trans-Caspian Pipeline and deliverability of Turkmen gas to Turkey & EU

by Oğuzhan Akyener

Due to increasing demand, gas supply is one of the most strategic energy security issues for huge importers. By taking this into consideration, Caspian region -where important gas supply potentials exist- is directly related with the huge importers’ energy security issues, mainly which are EU, China, India and Turkey. As an important gas supplier country locating in Caspian Region, Turkmenistan and her future gas supplies are becoming more important for the importers mentioned above. As a result, each importer is preparing long term plans and developing new projects to import the gas resources from Turkmenistan. One of the most popular projects -related with Turkmen gas resources- is Trans Caspian gas pipeline, which is planned to transport Turkmen gas through Caspian Sea to Azerbaijan and then with other available pipelines to Turkey and Europe. Naturally, this pipeline is an important energy security issue for Turkey-Azerbaijan and EU. However, there are important political, technical and economic challenges to overcome. In this study, after a short outlook into the gas politics in the Caspian Region -mainly Turkmenistan related issues-, importance of Trans Caspian gas pipeline project will be described. Then, doability of this popular project will be evaluated from the technical-political and economic perspectives. Additionally, Iran’s claim to transport Turkmen gas through Iran to Turkey instead of Trans Caspian project will economically be compared.

1. CASPIAN REGION GAS POLITICS & IMPORTANCE OF TURKMENISTAN

After oil and coal, natural gas is the most important energy resource in the world. Moreover, since being clean & easy to use and shale gas effect on prices, natural gas is expected to be the second world’s leading consumed fuel in the future.

Caspian, involving Russia-Turkmenistan-Kazakhstan-Uzbekistan-Azerbaijan-Iran, is the most important region according to her proved gas reserves potential in the world (%46.7 of world share [1]). Moreover, due to the geographical properties (locating in the middle of the important consumers; China-India-EU & Turkey), importance of Caspian region for world gas politics is increasing.

Majority of gas is exported to Russia and some portion of gas is exported to China and Iran. Important portion of gas reserves, are high pressure and temperature reservoirs and have high percentages of H2S and CO2 means not easy to develop due to economical & technical aspects.

Due to important gas reserves attract all other players in the region.

Main energy security targets are:

- To get attraction of new foreign investors and develop more gas fields.
- To continue to securely access to Russia, Iran and China gas markets.
- To increase the capacity of transportation to access China gas markets.
- To access Pakistan, India and European gas markets via planned pipelines.
- To complete the construction of these relevant pipelines (TAPI & Trans Caspian).
- To reach gas export capacity of 230 bcm in 2035 (expected to be more than 140 bcm).
- To reach oil export capacity over 1 million bbld in 2035 (expected to be more than 250,000 bbld due to increased condensate production; but new infrastructures for transportation will be needed).
- To complete East-West pipeline inside Turkmenistan and have the ability to transport South East resources to the Caspian Sea markets (Then from Trans Caspian to EU).

Table 1 below gives numerical information about the reserves-production & consumption values of Caspian and Caspian gas demanding countries.

From the table above, it is observed that; there is an important volume of gas supply potential (such as 250 bcm) in Caspian region and an important demand volume (such as 400 bcm) in nearby areas.

Due to difficulties faced during transportation, storage and marketing procedures of natural gas, long term plans and forecasts are much more important than any other energy resource. That’s why, for coherent gas politics, long term estimations are very important. Forecasts for the 2035 supply and demand potentials of these countries are given in the table above (table 2).

In this scenario to focus on Turkmenistan; she has the 3rd important gas reserves and 2nd (except Iran-no logical estimations due to sanctions) supply potential for the demand markets. Besides, India-China-Turkey and EU are the possible future buyers.

A brief insight into the Turkmenistan energy market:

- An important gas exporter in the region (2nd).
- Today has an oil exporting capacity more than 100,000 bbld.
- Today has a gas exporting capacity more than 40 bcm.
- Lacks of sufficient foreign investment.
- Lacks of sufficient oil export pipeline infrastructure.

1.3 Proved Gas Reserves (bcma)

<table>
<thead>
<tr>
<th>Country</th>
<th>US</th>
<th>EU</th>
<th>Asia</th>
<th>Russia</th>
<th>Turkmenistan</th>
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1.4 Gas Production (bcm)

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<th>Asia</th>
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<th>Turkmenistan</th>
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1.5 Gas Consumption (bcm)

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<thead>
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<th>Asia</th>
<th>Russia</th>
<th>Turkmenistan</th>
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1.6 Demand Volume (bcm)

<table>
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<th>Russia</th>
<th>Turkmenistan</th>
</tr>
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<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2. 2035 Gas supply-demand potentials of main energy players in Caspian region.

<table>
<thead>
<tr>
<th>Country</th>
<th>US</th>
<th>EU</th>
<th>Asia</th>
<th>Russia</th>
<th>Turkmenistan</th>
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<td>1,5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3. Gas export pipelines of Turkmenistan.

<table>
<thead>
<tr>
<th>Name of Pipeline</th>
<th>From (Supply Country)</th>
<th>Through (Countries)</th>
<th>To (Markets)</th>
<th>Capacity (bcma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAC</td>
<td>TURKMENISTAN</td>
<td>TURK-UZB-KAZ</td>
<td>RUSSIA</td>
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</tr>
<tr>
<td>KORPEZHE KK</td>
<td>TURKMENISTAN</td>
<td>TURK</td>
<td>IRAN</td>
<td>13</td>
</tr>
<tr>
<td>DAULETABAT-KANGIRAN</td>
<td>TURKMENISTAN</td>
<td>TURK</td>
<td>IRAN</td>
<td>6</td>
</tr>
<tr>
<td>CENTRAL ASIA-CHINA</td>
<td>TURKMENISTAN</td>
<td>TURK-UZB-KAZ</td>
<td>CHINA</td>
<td>40</td>
</tr>
<tr>
<td>BUKHARA-URALS</td>
<td>TURKMENISTAN</td>
<td>TURK-UZB-KAZ</td>
<td>RUSSIA</td>
<td>20</td>
</tr>
<tr>
<td>EAST-WEST</td>
<td>TURKMENISTAN</td>
<td>TURK</td>
<td>CASPIAN</td>
<td>30</td>
</tr>
<tr>
<td>TAPI</td>
<td>TURKMENISTAN</td>
<td>TURK-AFG-PAK</td>
<td>INDIA</td>
<td>34</td>
</tr>
<tr>
<td>TRANSCASPAIN</td>
<td>TURKMENISTAN</td>
<td>TURK</td>
<td>TURKEY-EU</td>
<td>30</td>
</tr>
<tr>
<td>CENTRAL ASIA-CHINA</td>
<td>TURKMENISTAN</td>
<td>UZBEK</td>
<td>CHINA</td>
<td>+18</td>
</tr>
</tbody>
</table>
Thermal Isolation Material Quality: Middle Quality

Start Point: Turkmenbasy / Turkmenistan

Inlet Pressure: 10 bar

Operating Capacity: 30 bcma

Outlet Pressure: 10 bar

Pipe Diameter: 60"

End Point: Turkish Border

To solve conflicting claims over the maritime and sea-bounded boundaries of Caspian Sea with Iran & Azerbaijan.

Note that, items 4-5-6 & 9 are directly related with the transcaspian pipeline project.

2. GAS EXPORT INFRASTRUCTURE OF TURKMENISTAN

Table 3 summarizes existing and planned gas export infrastructure of Turkmenistan. As highlighted with yellow, Trans-Caspian gas pipeline project is the planned infrastructure to transport Turkmen gas to TR and EU.

3. TRANS-CASPIAN GAS PIPELINE PROJECT

3.1 Introduction

The idea to transport Turkmen gas to Europe continues to be popular since the independence days of Turkmenistan. This idea has developed as the Trans-Caspian gas pipeline project. Many changes in the structure and strategies of this pipeline occurred. For instance, the plan used to include NABUCCO and SCP pipeline however political and commercial decision makers have changed the roots and projects.

With the last updates, Trans-Caspian gas pipeline is planned to run under the Caspian Sea from Turkmenbasy to the Shangachal Terminal (see Figure 1), then to connect to EU and Turkey via SCPFX and TANAPX and will carry 30 bcma gas annually.

3.2 Milestones of the project

Before the investment decision of Trans-Caspian pipeline project, there are important milestones and risks to be considered. If these milestones cannot be overcome then this project will not be realized.

3.2.1 Political

The sea border conflict between Caspian countries negatively affects the investment possibilities in the area. As seen from the map below Turkmenistan has disagreements with both Azerbaijan and Iran. But Trans-Caspian pipeline project is directly affected by the conflicts between Azerbaijan and Turkmenistan. This is the first issue that has to be overcome (Figure 2).

This issue is also related with the sharing of some important oil and gas fields around the borders such as ACG & Kepez, therefore the solution will not be easy (also EU & US supports to have a solution).

3.2.2 Commercial

Commercial milestones may be the most difficult steps to overcome. Hence, the commerciality of a pipeline is directly related with the commerciality of gas production projects. Not increasing or decreasing gas prices (due to the changes in agreement types and shale gas affects); huge tariffs are the main elements for gas development projects to be commercial.

Trans-Caspian gas pipeline is planning to transport Turkmen gas to EU & TR markets. For this pipeline to be reasonable, production costs of the fields, tariffs of the related pipelines, EU & TR gas market prices are important. If a more economical way is found for transportation of Turkmen gas (such as India-China or Russia) then there will be no will for Trans-Caspian pipeline project.

3.2.3 Market related

Hence gas and pipeline projects needs long term plans and projections before development investment decision, for evaluation of Trans-Caspian pipeline’s referred markets (TR & EU). Early 2035 projections have to be studied.

Figure 3 shows extra gas supply & demand potentials of the related countries in 2035. According to these estimations there seems enough market potential in EU & TR for 30 bcma (max. capacity of Trans-Caspian) gas of Turkmenistan. However, market potential can change due to other supply possibilities such as Russia – Iran and Western Mediterranean. The most deterministic factor in the market share will be the gas prices. Naturally, Azeri gas is one step forward than the Turkmen gas in the struggle due to less tariff costs. Moreover, if the political situations and sanctions in Iran changes, then due to average gas production unit costs and gas quality parameters, Iran and Iraq will be one step forward than the Turkmen gas in TR & EU markets. As a result, market is another risky milestone for the doability of Trans-Caspian pipeline project.

3.2.4 Financial

The owner of the project will probably be Turkmenistan and the project is supported by EU-US. This shows that both Turkmenistan can finance such an investment with her own resources or easily find credit from western funds. As a result, financial milestones do not contain risk for the project.

Note: Azerbaijan may possibly be a partner of this project but this is a weak probability due to SOCAR’s investment projections around the region.

3.2.5 Technical

Technical milestones are not too crucial to overcome. Caspian Sea and the planned Trans-Caspian pipeline root’s water depth is not so much (i.e. maximum 300 meter in the deepest point). Also the geographical structures and climate effects are not so difficult to overcome. As a result, there are no important technical and technological milestones to overcome.

After the Azerbaijan/Shangachal Terminal point, the transportation of Turkmenistan gas will be another question and will technically and commercially be evaluated again. Hence, SCPX, which is going to transport SD2 gas to TR, and TANAP (through Turkey to EU) capacities and extension possibilities have to be technically and commercially studied.

3.3 Evaluation of these milestones

As described in the previous chapter, financial and technical milestones of the project are not obstacles for the doability of Trans-Caspian gas pipeline project. To evaluate the political & commercial and market issues, initially some technical aspects of the pipeline and the other possible roots those will be used to reach TR & EU markets have to be studied.

3.3.1 Technical properties of transcaspian (estimation)

| Start Point: Turkmenbasy / Turkmenistan |
| End Point: Shangachal Terminal / Baku / Azerbaijan |
| Total Length: 338 km |
| Max. Water Depth: 300 m |
| Operating Capacity: 30 bcma |
| Inlet Pressure: 10 bar |
| Outlet Pressure: 90 bar |
| Pipe Diameter: 60" |
| Thermal Isolation Material Quality: Middle Quality |
| Estimated CAPEX (MDO): 7 billion USD |
| Estimated Tariff (MDO) (%10 IRR based): 75 USD/1000 m3 |

3.3.2 Possible roots for turkmen gas after shangachal terminal

3.3.2.1 From az to tr

Hence Azerbaijan is not a market for Turkmen gas and all gas will have to be transported to TR and then some portion to EU, 30 bcma gas will directly be transported to Turkish border.

The only gas transportation facility from Azerbaijan to Turkey is SCP and new extended looped version SCPX pipeline. Total capacity of SCP & SCPX is around 36 bcma and with some extension works capacity can be increased. However, for 30 bcma gas transportation, a new standalone pipeline will be a better solution. Moreover, Azerbaijan estimated to have extra gas supply potential for SCPX after 2025. So, for any SCPX option, Azerbaijan is going to use that capacity.

From Shangachal Terminal to Turkish border a new standalone gas pipeline is planned to be constructed. With technical properties,

| Start Point: Shangachal Terminal |
| End Point: Turkish Border |
| Total Length: 690 km |
| Operating Capacity: 30 bcma |
| Inlet Pressure: 90 bar |
| Outlet Pressure: 10 bar |
| Pipe Diameter: 56" |
| Thermal Isolation Material Quality: Middle Quality |
| Estimated CAPEX (MDO): 6 billion USD |
| Estimated Tariff (MDO) (%10 IRR based): 85 USD/1000 m3 |
3.3.2.1 From TR to EU

In the Turkish border there are 2 options;
- First: due to commercial and political issues 9/40 of 30 bcm gas is sold in Turkey and 9/60 is transported to EU
- Second: all gas sold in TR market or transported and sold in EU market.

3.3.2.1.1 TR to EU option 1

12 bcma gas is transported & distributed inside TR market via BOTAŞ’s own facilities and other 18 bcma is transported to EU via looped TANAPFX. (However, today BOTAŞ do not have enough capacity to accept 12 bcma gas in the eastern border of Turkey; so BOTAŞ also has to make an investment for such an option. Moreover, TANAPV is going to be constructed with an operating capacity of 23 bcma. Then in 2026 this capacity is planned to be extended (TANAPV2) up to 31 bcma. And this extra volume will be devoted for extra Azerbaijan gas supply potential. So, this option will not be the most probable choice.)
- Start Point: Western Turkish Border
- End Point: Eastern Turkish Border
- Total Length: 1000 km
- Operating Capacity: 18 bcma
- Inlet Pressure: 90 bar
- Outlet Pressure: 10 bar
- Loop Pipe Diameter: 48”
- Thermal Isolation Material Quality: Middle Quality
- Estimated CAPEX (MOD): 10 billion USD
- Estimated Tariff (MOD) (% 10 IRR based): 110 USD/1000 m³

3.3.2.1.2 TR to EU option 2

Similar to TANAP a new 30 bcma capacity standalone gas pipeline will be constructed all gas is transported to EU. Technically this option is similar with the second option, only the average tariff is estimated as 5 USD less (due to transportation all volume up to the western point of Turkey)
- Start Point: Western Turkish Border
- End Point: Eastern Turkish Border
- Total Length: 2000 km
- Operating Capacity: 30 bcma
- Inlet Pressure: 90 bar
- Outlet Pressure: 10 bar
- Pipe Diameter: 48”
- Thermal Isolation Material Quality: Middle Quality
- Estimated CAPEX (MOD): 12 billion USD
- Estimated Tariff (MOD) (% 10 IRR based): 125 USD/1000 m³

3.3.2.1.3 TR to EU option 3

All gas is sold to Turkey. For this option all gas is planned to be sold to BOTAS in the Turkish border and all inside Turkey transportation investments will belong to Turkey. However, situation of Turkish market, demand potential and BOTAS’s infrastructure are other unknowns those make this choice non-probable.
- Start Point: Turkmenbasy / Turkmenistan
- End Point: Eastern Turkish Border
- Total Length: 2000 km
- Pipe Diameter: 48”
- Thermal Isolation Material Quality: Middle Quality
- Estimated CAPEX (MOD): 12 billion USD
- Estimated Tariff (MOD) (% 10 IRR based): 130 USD/1000 m³

3.3.2.1.4 TR to EU option 4

All gas is sold to EU. Similar to TANAP a new 30 bcma capacity standalone gas pipeline will be constructed all gas is transported to EU. Technically this option is similar with the second option, only the average tariff is estimated as 5 USD less (due to transportation all volume up to the western point of Turkey)
- Start Point: Western Turkish Border
- End Point: Eastern Turkish Border
- Total Length: 2000 km
- Operating Capacity: 30 bcma
- Inlet Pressure: 90 bar
- Outlet Pressure: 10 bar
- Pipe Diameter: 48”
- Thermal Isolation Material Quality: Middle Quality
- Estimated CAPEX (MOD): 12 billion USD
- Estimated Tariff (MOD) (% 10 IRR based): 135 USD/1000 m³

3.3.2.2 From TR to EU

Similar to TANAP a new 30 bcma capacity standalone gas pipeline is constructed and TR’s portion is transported to western Turkey and EU’s portion is transported to western point of Turkey (end point of Turkey)
- Start Point: Western Turkish Border
- End Point: Agrı / Turkey
- Total Length: 1000 km
- Operating Capacity: 30 bcma
- Inlet Pressure: 90 bar
- Outlet Pressure: 10 bar
- Pipe Diameter: 48”
- Thermal Isolation Material Quality: Middle Quality
- Estimated CAPEX (MOD): 10 billion USD
- Estimated Tariff (MOD) (% 10 IRR based): 125 USD/1000 m³

3.3.3 Evaluation

3.3.3.1 Political evaluation

While transportation of Turkmen gas to EU contains market and commercial risks and this volume of gas is not a vital issue for EU energy security strategies, political border conflict between Azerbaijan and Turkmenistan cannot be solved only for Trans-Caspian pipeline project. Azerbaijan’s aim to be a gas transit country is understandable. However, the solution of the border conflict affects the share of the offshore oil & gas fields such as ACG and Kepez, this aim (being a gas transit country) will not be so much exciting for Azerbaijan. Moreover, Turkmenistan may have other more commercial options to sell her own gas (as India & China)

Russia - Iran’s effect for the solution of this border problem in the Caspian Sea is also important. They may not let such a solution which will be in favor of EU.

3.3.3.2 Market evaluation

Due to higher estimated tariff and unit production costs, Turkmen gas cannot compete with other gas suppliers in Turkey. Therefore all gas will be transported to EU in this scenario. All gas is sold to EU.

3.3.3.3 Commercial evaluation

To start the commercial evaluation, an average gas production cost for western Turkmenistan region has to be estimated. Hence important portion of gas reservoirs are in western Turkmenistan are high pressure and temperature reservoirs and have high percentages of H₂S and CO₂; the unit costs to develop and produce the fields will be high. That’s why an average of 150 USD / 1000 m³ will be taken as the unit cost.

Condensate & gas ratios and condensate sales will not be included into the estimations. Hence usually in condensate rich gas reservoirs, condensate sales are more profitable than gas and sometimes it may be better to inject gas to produce more condensate, so this issue is not included into the scenarios.

For average commercial evaluations, all values are MOD. For average market prices, for EU: 420 USD /1000 m³ and for TR: 450 USD / 1000 m³ is estimated.

The calculated netback prices for only gas sales are given in the table below;

As seen from the Table 4 the only commercial option is option 3 which will not be possible due to Turkish market demand profiles. The most probable scenario, which is option 2, net back value is -55 USD/1000 m³ gas sales. This means it is better to inject gas for more condensate production or to find another market or not to make any investment.

A more optimistic scenario:

If the average gas prices for EU is taken as 420 USD / 1000 m³ and the unit gas production cost for western Turkmenistan is taken as 120 USD / 1000 m³, without changing the tariffs (hence the total investment costs of each pipeline are already optimistic values), then the new commercial summary table is given above. According to the results given in the Table 5, netback values are better than the previous scenario however, for an investor it seems better to take part in a pipeline project instead of an E&P project. Moreover, for the most probable option (option 2), again netback is minus. This means no positive decision for investment of Trans-Caspian.

3.3.3.4 Results of the evaluation

As a result the doability of Trans Caspian pipeline is not possible while the gas prices and EU demand will increase unexpected levels.

4. TRANSCASPIAN VS. TRANS-IRAN PIPELINE

As seen in the chapter above, doability of Trans Caspian gas pipeline project is not possible due to commercial-political and market related obstacles in the current projects (Figure 4). However, some Iranian specialists claim that transportation of Turkmen gas through Iran to Turkey instead of Trans Caspian project will have better economics. In this chapter this claim will briefly be evaluated.

4.1 Technical properties of trans-iran pipeline (estimation)

- Start Point: Turkmenbasy / Turkmenistan
- End Point: Agrı / Turkey
- Total Length: 1442 km
- Operating Capacity: 30 bcma
- Inlet Pressure: 10 bar

### Table 4. Evaluation of commerciality - netback prices of the scenarios.

<table>
<thead>
<tr>
<th>Options</th>
<th>TRANSCASPIAN</th>
<th>AZ-TR PIPELINE</th>
</tr>
</thead>
<tbody>
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<td>OPTIONS</td>
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</tr>
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<td>85</td>
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<tr>
<td>REVENUE</td>
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<td>130</td>
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<tr>
<td>NETBACK</td>
<td>420</td>
<td>420</td>
</tr>
</tbody>
</table>

* All values are USD/1000m³ MOD prices
Outlet Pressure: 90 bar  
Pipe Diameter: 56”  
Thermal Isolation Material Quality: Middle Quality  
Estimated CAPEX (MOD): 16 billion USD  
Estimated Tariff (MOD) (%10 IRR based): 180 USD/1000 m³

4.2. Commercial comparison

Hence the unit gas production prices in Turkmenistan and scenarios after the eastern border of Turkey are the same, total tariff values and total investments will be enough for comparison.

As the calculation shown in the Table 6, Iranian transit of Turkmenistan gas will not be the economic choice.

4.3 Political-market-technical-finacial comparisons

On the other side, due to sanctions on Iran all political, financial and market related issues will be more risky and problematic than the trans-Caspian scenario. Only the technical milestones may be easier.

SUMMARY

As described in the related chapters, gas politics and Caspian gas resources are very important energy security issues for huge consumers around the region. Turkmenistan by having the 3rd reserves potential and 2nd supply potential is the shining star of the region. That’s why all huge consumers are planning and developing projects to meet some part of their gas demand from Turkmenistan resources. Such as extension of CAC Pipeline Project of China, TAPI Pipeline Project of India and Trans-Caspian Project of EU.

For such huge pipeline project investments, long term projections, commerciality, politics, market views, and etc. are very important items to consider.

There may be gas resources; however, if those resources cannot be transported to the market via a safe, sustainable and commercial way then, those resources do not mean anything up to the changes in the current conditions.

That’s why in this paper, with the risks and milestones, doability of the popular Trans-Caspian pipeline project is evaluated and as well as an alternative route to transport Turkmen gas to TR and EU through Iran is also compared.

As a result, for the current situation, Trans Caspian pipeline project does not seem to be a logical choice for investment.

REFERENCES


ABBREVIATIONS

TR Turkey
EU European Union
CAC Central Asia China
TAPI Turkmenistan Afghanistan Pakistan India
CAPEX Capital Expenditures
IRR Internal Rate of Return
ACG Azeri Chirag Guneshli Oil Field
MOD Money of the Day
TANAP Trans Anatolia Pipeline
TANAPX Trans Anatolia Pipeline Extension
TANAPFX Trans Anatolia Pipeline Forward Extension
SCP South Caucasus Pipeline
SCPX South Caucasus Pipeline Extension
SCPFX South Caucasus Pipeline Forward Extension

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Table 6. Evaluation of commerciality – netback prices of the scenarios.

<table>
<thead>
<tr>
<th>TRANS-Iran Pipeline</th>
<th>Trans-Caspian + AZ-TR Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariff @ TR Eastern Border (USD/1000m³)</td>
<td>180</td>
</tr>
<tr>
<td>Total CAPEX @ TR Eastern Border (bUSD)</td>
<td>16</td>
</tr>
</tbody>
</table>

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