CHAPTER-5
PRESENT EXPERIENCE IN GAS PIPELINES AND GAS GRID

5.1 ECONOMICS OF NATURAL GAS TRANSPORTATION

Natural gas is a low energy-concentration fuel. In comparison, crude oil contains a thousand times more energy than that of Natural gas for the same volume. Packed with concentrated energy, oil is convenient and economical to transport by any mode in any quantity over any distance. Natural gas, on the other hand, requires a costly and widespread infrastructure for its transportation. It can be transmitted through pipelines or by ships in the liquefied state.

Transportation of LNG

Natural gas liquefies into liquefied natural gas (LNG) at a temperature of minus 160 degrees centigrade and atmospheric pressure of about 1/600th of its gaseous volume. Specially designed refrigerated sea vessels can transport LNG to a receiving terminal over any distance. It is then regasified to natural gas and connected to the pipeline network for onward transmission and distribution. Liquefaction is the most expensive part of the LNG chain, the capital and operating costs constitute about 50 per cent of the LNG delivery price. LNG chains comprising liquefaction, shipping and regasification facilities are capital intensive and subject to the economies of scale considerations. Larger trains offer lower unit costs, which render LNG a competitive mode of gas transportation. A typical module of LNG train is of 2.5 million metric tonnes per annum (MMtpa) capacity. This is equivalent to a supply of around 334 million cubic feet of natural gas per day for one year. An economical size of 5.0 MMtpa may require an investment of US $2 to $2.5 billion, (based on liquefaction cost by Fleisch, Quigley, 2000) and committed reserves of around 6.5 TCF for supply of 668 million cubic feet of natural gas per day for 25 years.

Shipping is the least expensive component of the LNG train. Shipping cost constitutes about 10 per cent of the LNG delivery price. Shipping cost is less sensitive to the distance of travel; the marginal cost decreases as the distance increases. It might, therefore be economical to transport natural gas as LNG over longer distances. There are, however, some evaporation losses during shipping, which may increase with travel time. LNG trade requires long-term "Take or Pay" commitments between suppliers and buyers. The suppliers generally deliver LNG though own shipping arrangements. The buyers have to develop the receiving terminals and the regasification facilities, which are peculiar only to the import of LNG. There is a saving of this investment in the case of pipelines. The requirement of internal infrastructure for transmission and distribution of the imported gas downstream from the receiving terminal may also be higher for LNG.

Worldwide LNG trade has been growing by over 7 percent per year since 1993. In 1993, total trade equaled a gas volume of 3.0 TCF, which was about 4 percent of the total gas consumed in the world. In 2001, it increased to 5.2 TCF constituting over 5.5 percent of the gas consumed. During this period the world gas consumption grew by 2.4 percent and the LNG component increased nearly three times as fast, by 7.2 percent. Growth in LNG trade and development of its technology is resulting in ongoing reduction in the price of LNG. The liquefaction cost has gone down by over 30 percent during the last ten years. A similar reduction has taken place in the cost of LNG ships as well.

Gas Transmission by Pipelines

Pipelines have long been the primary means of transportation of gas over land or under water. Gas pipelines vary in size from a couple of inches of diameter for local distribution, to over 60 inches diameter for large capacity transmission. The technology for installation and operation of onshore gas pipelines is long matured, and maximum reduction in onshore pipeline costs has already been achieved. Offshore gas pipeline installation technology, however, is continuing to develop and is expected to lead to reduction in the cost offshore pipelines.

Gas pipelines are intensive in capital costs. The operating and maintenance costs per year of gas pipelines are only around 1.5 percent of capital costs. The operating and maintenance costs of compressor, installed along the pipeline to increase the throughput capacity and to deliver the gas at the contractual pressure, are also about 4.0 percent of the capital costs (*Tongia, 1998*). Because of high capital and low operating cost, gas pipelines are strongly governed by the economies of scale in terms of unit cost of transportation. The higher the throughput capacity, the lower is unit cost of transportation. The capacity of a pipeline is a function mainly of its diameter and to a limited extent that of the compression.

The inherent benefits of the economies of scale result from the following factors:

a) Doubling the diameter of a pipeline may, at the most, double its cost, but the capacity is increased by a factor of 5 to 6 (the capacity of a gas transmission pipeline varies as the diameter raised to the power 2.53, given by the Modified Panhandle Equation), (*Talachi, 1986, Tongia 1998*)

b) Increasing the compression increases the throughput capacity by a factor more than the proportion of compression increase.

c) Certain capital costs of a pipeline project like those of the right of way, engineering, management etc. are insensitive to the throughput capacity.

d) Operating costs are insensitive to increase in throughput capacity.

Onshore Versus Offshore Pipelines

Economies of scale benefits are common to both onshore and offshore pipelines, Offshore pipelines, however, are two (*Tongia, 1998*) to three (*Zhao, 2000*) times more expensive than the onshore ones of the same capacities. Therefore, the offshore pipelines are amortized over longer periods of time. As a result, unit transportation cost is over 50 percent higher for offshore pipelines as compared to that of the onshore ones. Offshore pipelines will remain more expensive than the onshore ones, but the difference may keep reducing with learning and developments in offshore pipeline technology.

Transportation of LNG versus Pipelines

An estimate of gas delivery costs by alternative transport options (onshore and offshore pipelines, and as LNG) as a function of transport distance, in US $ per 1000 cubic meters (based on values read off the IEA, 1994 chart) is given in Table 5.1. Even though the data is of 1994, the interrelationship holds true.

Distance (km)	Onshore Pipeline	Offshore Pipeline	LNG
800	16	25	60
1600	38	70	62.9
2400	50	90	65.8
3200	62	110	68.7
4000	74	130	71.6
4800	86	150	74.5
5600	98	-	77.4
6400	110	-	80.3
7200	-	-	83.2

Table:5.1 Gas Transportation Cost: (US$/1000 Cubic Meters)

Exhibit 5.1 & 5.2 show transportation cost under various modes of transport. LNG supply chain is more capital intensive than onshore pipelines for the same capacity. The unit transportation cost is consequently higher for LNG over shorter distances. For longer distances, unit transportation cost of LNG is lower than that of onshore pipelines owing to the fact that LNG shipping cost is less sensitive to increase in distance. There is a trade-off point at about 4000

kilometers between onshore pipelines and LNG. Below 4000 kilometers it is economical to use onshore gas pipelines, but above this distance, LNG offers an advantage. The trade-off point between LNG and offshore gas pipelines is at around 1500 kilometers. LNG is more economical than offshore gas pipelines for distances greater that 1500 kilometers. This means that if India and Pakistan want to import gas, either separately or jointly, through an offshore pipeline over a distance of 1500 kilometers or more, it would not be as economical as LNG.

The trade-off point is shifts downward due to ongoing reduction in LNG transportation costs. LNG might now offer an advantage over onshore gas pipelines for distances beyond 2500 to 3000 kilometers and for offshore pipelines beyond 1000 to 1200 kilometers

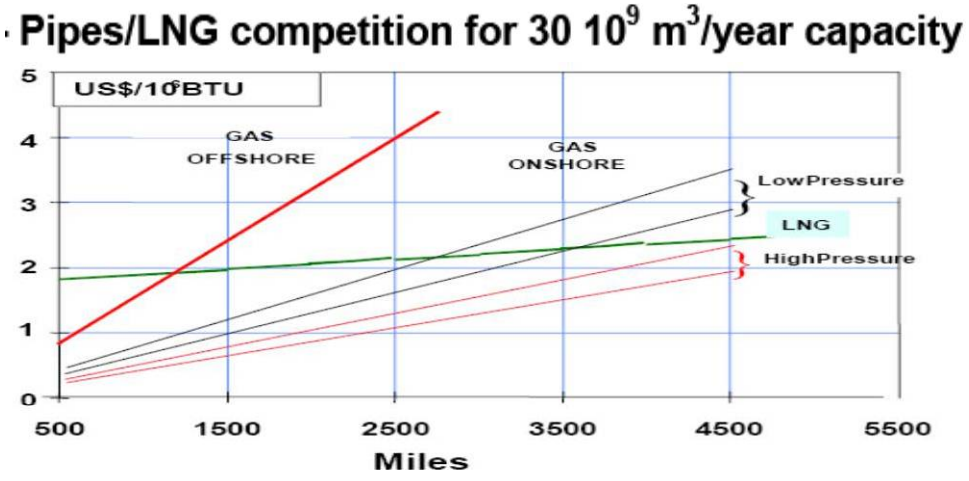

Exhibit:5.1

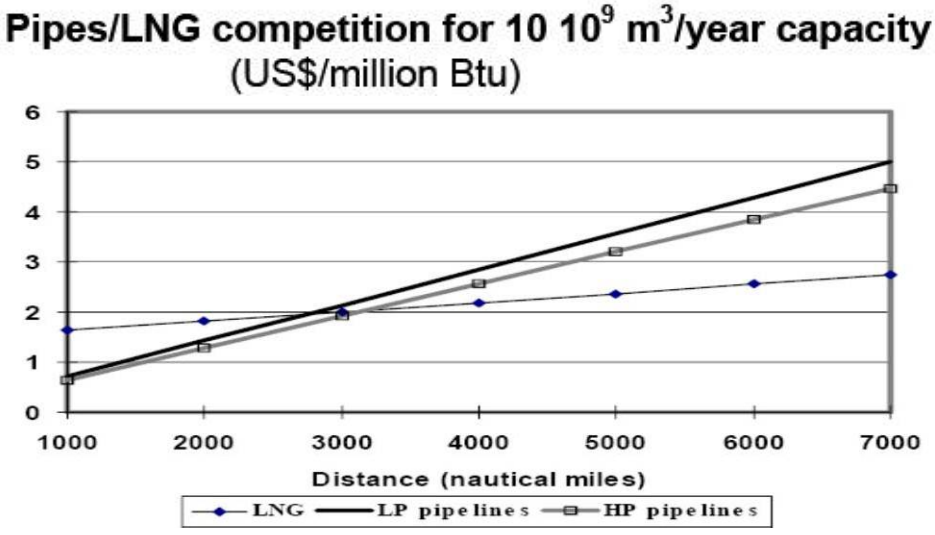

Exhibit: 5.2

5.2 NORTHWESTERN GAS MARKET

The northwestern market is located within 3000 kilometers from a number of sources of natural gas in Turkmenistan (Daulatabad field), Iran (South Pars field), Qatar (North field) and possibly Oman through extension of the Dolphin project. A provision of at least 2.0 BCFD (56.64 MMSCMD) of gas supply (commencing from 2008/ 2009) to this market has been taken as the basis for analyzing the economies of India's gas import options.

India enjoys multiple options of sources and transportation modes for import of natural gas from its northwestern market. These may be divided into two broad categories.

- Trans Asia Pipeline System (TAPS)

- System of LNG exporting/receiving terminals

Trans Asia Pipeline System (TAPS) or trains of LNG can transport natural gas from any source (Turkmenistan, Iran, Qatar or Oman) that offers the lowest priced gas. Turkmenistan's gas is not located close to a sea terminal for export as LNG. Transporting Turkmenistan gas from Daulatabad gas field (dedicated for export to Pakistan and India) by over a thousand kilometers long interstate pipeline, to the nearest port of Gawadar, in Pakistan, and then liquefying it into LNG, would render it too expensive to compete with the international market. Daulatabad gas is therefore, a very competitive source for piped gas. It is therefore not considered as an economical source of LNG supply to India.
Iran and Qatar are appropriate sources for piped gas as well as for LNG. They could supply India's gas markets through pipelines or LNG, or a combination of both. A TAPS pipeline could take 5 years to start delivering about 1.0 BCFD gas (0.36 TCF per year) to India at half the committed quantity. It could take 2 to 3 more years for installation of compressors and delivery of the design capacity of 2.0 BCFD to 2.5 BCFD. That would still leave a shortfall of around 5.0 bcfd in the rest of the country to be supplied by eastern pipelines and multiple LNG chains. As an alternative to the piped gas of 2.0 BCFD to 2.5 BCFD capacity from the northwestern market, LNG trains of 15-18 million tons per year would be needed to deliver the equivalent volume. LNG infrastructure of liquefaction, shipping and regasification is nearly fifty percent higher in capital cost than the pipelines. It would seamless likely that the required capacity of LNG would come about in the required timeframe in lieu of the pipeline option.

Another source of import of Qatar gas is by an extension of the Dolphin project from Oman to northwestern coast of India. A consortium led by a UAE state owned corporation is developing one block (with an option for a second block) of Qatar's North field for transporting gas through an integrated system for supply to UAE and Oman with a possible deep-sea connection linking Oman

with Pakistan or India. The Government of Qatar has guaranteed minimum gas reserves of 35 TCF to 40 TCF for each block. There would be no limitation of either the size or the production capacity of the source of gas for this project. The consortium is laying an offshore gas pipeline under shallow water of the Persian Gulf with a capacity of 3.0 BCFD to 4.0 BCFD to UAE.

Qatar Gas

Qatar has the third largest gas reserves (after Russia and Iran) and the largest non-associated gas field (offshore North field) in the world. Its proven reserves stand at 509 TCF of gas, most of which are located in the North field alone. This field is well located for supply of gas through offshore and onshore pipelines to India, Oman, Pakistan and UAE. Qatar is emerging as a major exporter of LNG. Vast reserves, unlimited production capacity and low production cost of gas enable Qatar to be a very competitive source of export of gas a LNG or by pipelines. It is supplying LNG to Japan and South Korea and has entered into an agreement for supply of LNG to Dahej terminal on the western coast of India. There are some indications that reserves in the North field maybe as high as 900 TCF, which could make Qatar as the second richest in gas in the world.

North field of Qatar and South Pars field of Iran are parts of once gigantic gas field with the international border running across it. Iran and Qatar therefore have unlimited capacity of low cost gas with identical economics as well as location for export as LNG or by pipelines. This increases the competition between the two Persian Gulf gas giants for gaining an access to the combined gas markets of Pakistan and India. The shared pipelines will offer higher benefits to Qatar because of more economical production and processing of gas, which may enable it to further lower the price at the entry to the pipeline.

Dolphin Gas

The economics of this pipeline become interesting as only about 1000 km of additional pipeline is needed from Oman to India or Pakistan. The pipeline will have to cross a couple of deep-sea trenches of water depth in excess of 3 km, which may present technological problems in laying and subsequent repairs, besides adding to the cost of this segment. Dolphin project aims at exploiting the economies of scale through integration of multiple markets of UAE, Oman and possibly of Pakistan or India. The project is also based on economies of scope through integration of field development, gas production/processing and the pipeline operation. This provides Dolphin gas a grater flexibility to complete for the gas markets in Pakistan and/or India in price. Supply of Dolphin gas to Pakistan and/or India would lead to greater economic integration between the countries of West and South Asia.

5.3 BENEFITS OF SHARED PIPELINES TO GAS PRODUCING AND TRANSIT COUNTRIES

Development and production of large gas fields, with reserves in excess of 25 TCF, typically required for an interstate pipeline with 2.0 BCFD to 3.0 BCFD capacities, are also governed by the economies of scale. The producing countries/companies can minimize the unit cost of production through optimal development. A gas pipeline shared between India and Pakistan will allow optimal field development and minimize the unit cost of production. This will yield greater benefits to the producing countries/companies, which will also give them a cushion and flexibility for lowering the price of gas at the entry to the pipeline.

The transit fee is based on gas volume as well as distance. Large throughput volumes of gas yield greater benefits to the countries through which the pipelines traverse. The increased stakes of the transit countries will improve the stability and security of the interstate gas trade.

5.4 CASE STUDIES

5.4.1 CASE STUDY–I: IRAN-PAKISTAN-INDIA PIPELINE

Length: 3000 km, Flow: 90 MMSCMD, Size: 56")

Exhibit: 5.3 Iran-Pakistan-India Pipeline Route

In pursuance of the Cabinet decision of February 9, 2005, the Indian Government is discussing the details of the Iran - Pakistan - India (IPI) Gas

Pipeline Project with the Governments of Iran and Pakistan. Transnational pipeline of about 3000 km length is proposed to be constructed for transporting gas from Iran to India and Pakistan. 60 MMSCMD of gas is proposed to be supplied in Phase-I, to be shared equally between India and Pakistan. 90 MMSCMD of gas is likely to be supplied in Phase-II.

Two separate Secretary-level Joint Working Groups (JWGs), viz., India Pakistan JWG and India Iran Special JWG, have been constituted. Following a government-to-government MoU between India and Islamic Republic of Iran in 1993, the initiatives for studying the feasibility of gas pipeline from Iran to India were launched.

Though talks on a massive multi-billion dollar 3,000-kilometer pipeline venture involving Iran, Pakistan and India began in the early 1990s, it did not attain any substantial progress due to existing animosity between two receiving parties India and Pakistan.

In the eleventh Joint Commission Meeting between India and Iran held in Tehran in May 2000, the two sides decided to examine the three options for evacuation of gas from Iran to India. These three alternatives were overland pipeline, deepwater offshore gas pipeline and LNG. Thereafter, an Indo-Iran Joint Committee (IIJC) was constituted which decided to set up a Joint Technical Sub-Committee (JTSC) to periodically review the progress on the above three modes of transfer of gas to India. After that many parleys has been held between the participating countries. In December 2004, India's oil ministry emphasized the possibility of supplying gas at the India-Pakistan border under a bilateral agreement between India and Iran. A penalty clause was proposed that Iran would deliver gas at the Indian border on a "take or pay" and "deliver or pay" basis. The responsibility of delivering gas at the India-Pakistan border would be that of Iran. It was indicated that India will require 60-70 MMSCMD of Iranian piped gas. Pakistan will require about 50 MMSCMD of gas from Iran by 2010-15. In February 2005, the cabinet authorized the oil ministry to negotiate directly with Iran, Pakistan, Bangladesh and other countries for facilitating the laying of transnational pipelines for import of natural gas to India.

The proposed pipeline would originate from Iran's southern port city of Asalouyeh and the rugged and restive provinces of Balochistan and Sind in Pakistan. The US$7 billion (a re-estimated project cost) pipeline would see its final destination in India.

India has been bogged down by two important factors: High gas price demanded by Iran, and growing proximity to USA. As compared to Pakistan which has most of its gas fields in decline, India had many gas finds in recent years after its policy of NELP brought in private participation. There have been major gas finds especially in KG Basin by various exploration companies. India wants the Iranian gas to be competitive to the KG gas that will flow in the Indian

market by the end of this decade. This has made India reluctant to pay high prices.

Further, increasing proximity between USA and India is having repercussions on the pipeline. USA is against the pipeline due to the economic benefits that Iran would have from the pipeline. USA supports TAPI (Turkmenistan-Afghanistan-Pakistan-India) pipeline as an alternative to the pipeline from Iran.

Several meetings have been held to resolve issues related to the project.

Quantity of Gas to be Imported

The present Iranian proposal is to supply gas through a single 56 inch diameter pipeline which is already under construction by Iran. The total indicated volume for export is 60 MMSCMD. Iran also proposes to transport 50 MMSCMD of gas for their domestic use through the same pipeline. As per the discussions held at the 4th India - Pak JWG Meeting held at Islamabad on 22 and 23 February 2007, it was agreed that the total Phase - I volume of 60 MMSCMD would be shared equally between India and Pakistan, i.e 30 MMSCMD each.

For imports beyond 60 MMSCMD of gas, as envisaged earlier, i.e. 90 MMSCMD for India & 60 MMSCMD for Pakistan, a second 56 inch pipeline would have to be constructed in Iranian territory. Iran has maintained that the second pipeline will be discussed after the successful implementation of the first pipeline.

Alignment of Pipeline

The pipeline length within Iran, from Asalouyeh to Iran-Pak Border would be approximately 1100 km. The pipeline will follow the southern route within Pakistan territory and would enter India in Rajasthan near Barmer. The overall length of pipeline up to the Indian border would be approximately 2135 km. This consists of 1100 km within Iran and approximately 1035 km within Pakistan territory. Earlier a comparatively shorter central route for the pipeline, passing through Baluchistan in Pakistan, and terminating at Jaisalmer in Rajasthan was also discussed. However, during the 4th Bilateral JWG Meeting on 22 and 23 February 2007 at Islamabad, Pakistan informed that the southern route passing through the vicinity of Chakhbahar, Hyderabad, Munnabao and Umarkot to Barmer is preferable on account of safety and ease of construction.

Price Formula

During the 4th Trilateral Joint Working Group Meeting held at Tehran on 24 and 25 January 2007, net back calculations and price derivation done by consultant M/s Gaffney Cline & Associates was discussed. Both India and Pakistan had reservations on the report. To break the impasse, Iran subsequently suggested

a formula for gas price up to the Pakistan-Iran border. After modification, the same was agreed to by Iran and Pakistan, subject to approval by their respective governments. India agreed to respond to the pricing formula shortly. The formula agreed by Iran and Pakistan is as under:

1. **Japan Custom cleared Crude (JCC) less than $30/bbl**

Gas Price ($/MMBTU) = 0.05*JCC ($/BBL) +1.54

2. **Japan Custom cleared Crude (JCC) in the range $30 - $70/bbl**

Gas Price ($/MMBTU) = 0.0633*JCC ($/BBL) +1.15

3. **Japan Custom cleared Crude (JCC) greater than $70/bbl**

Gas Price ($/MMBTU) = 0.05*JCC ($/BBL) +2.06

Indicative gas price at Iran-Pakistan Border based on above formula is shown in Table 5.2

JCC	Natural Gas price
($/BBL)	$/MMBTU
20	2.54
40	3.67
60	4.93
80	6.06
100	7.06

Table: 5.2 Indicative Gas Price

Later during the 5th Trilateral Joint Working Group meeting held in Tehran in May 2007 Iran raised the issue of price review mechanism. India and Pakistan had the view that price review was not required, since the pricing formula is an open ended one. Iran, however, insisted on the price review clause, giving the examples of their recent contracts with Turkey, Kuwait, Emirates and Armenia. After detailed deliberations during the 6th Trilateral Joint Working Group meeting, Pakistan and India indicated that they could consider the price review with certain pre-conditions, viz. the price should be dependent inter alia on the buyers' market, the project should continue to be financially viable, and there should be no disruption of supplies during the period of discussion of price review. Iran agreed only to the last pre-condition, i.e. non-disruption of supply

during discussions. The issue remained unresolved in spite of detailed discussions.

Project Structure

Iran has already intimated that it would build the pipeline in its own territory and not allow participation of India or Pakistan in their project. This position has been de-facto agreed to by Pakistan, with the two sides reaching agreement on pricing formula. India does not have much option but to agree to the same. It is understood that Pakistan also wants to build the pipeline in their territory and so does India.

With this approach there will be three different projects in three countries to be implemented by their nominated agencies and there will not be any cross holdings.

Transportation Tariff for Indian Gas through Pakistan

Pakistan has zeroed down on the southern route in Pakistan, which is approximately 1036 km long through the country. Pakistan also informed that its gas offtake point will be near Hyderabad at an approximate distance of 795 km from the border with Iran, and that there would be a dedicated line of 241 km for gas supply to India. The shortest route in Pakistan would have been the central route which is approximately 750 km long.

Initially Pakistan had asked for transportation tariff of $1.57/MMBTU for throughput of 30 MMSCMD of gas to India. However, the hydraulic simulation done by Pakistan and various assumptions taken by Pakistan in the calculation of transportation tariff were discussed in the Technical Sub-group Meeting held at Delhi on 22 and 23 March 2007. The hydraulic simulation done by Indian side showed that with optimum use of compression facilities, the number of compressor stations can be reduced to 3, from the 4 proposed by the Pakistan side, apart from reduction in the power required for compression to 100 MW from 128 MW proposed by Pakistan. These changes were agreed upon by the Pakistan side. Even in project cost assumptions, most of the factors taken by the Indian side were accepted by Pakistan. The financial assumptions were also deliberated upon, and consensus was reached on base case parameters, and the sensitivity to be done with respect to the parameters on which there were differences.

As per calculations done by India for the base case, transportation tariff works out to $ 0.51/ MMBTU, and with the sensitivity for the extreme case the same parameter as $ 0.56/MMBTU. Based on discussions, Pakistan side has calculated the base case tariff of $ 0.63/MMBTU and sensitivities have been worked up to $ 0.91/MMBTU.

Transit Fee

During the JWG meeting at Islamabad in February 2007, Pakistan informed the following principles for transit fee on Indian gas –

- The transit fee of Iranian gas passing through Pakistan to India will be a fixed percentage of the delivered price of gas to India, multiplied by the amount of gas being transmitted.

- The fixed percentage should be around 10 percent of the price of gas at Pakistan-India border.

- Transit fee as per above Pakistan proposal worked out to $0.46/MMBTU, $0.52/ MMBTU, $0.59/ MMBTU and $0.65/ MMBTU, corresponding to JCC price (in $/barrel) of 30, 40, 50 and 60 respectively.

In the technical sub group meeting in Delhi on 22 and 23 March 2007, Pakistan revised their offer of transit fee to 10 percent of the price of gas at Iran-Pakistan border.

India has maintained the following stand on the issue –

i. The entire economic benefit from this project to Pakistan needs to be taken into consideration while computing transit fee levels

ii. Pakistan is not a pure transit country. It is also an off-taker

iii. Benefits to Pakistan on account of lower tariff due to economy of scale because of the volumes transported to India

iv. The transit fees paid by India to the Pakistani side would be in cash against actual delivery of gas across the Indian border

v. The basic premise of transit fee payment is that the country of transit provides assurances / guarantees for safe transit.

vi. The transit agreement would include a security package that ensures safe transit of gas across Pakistani territory. For example, the BTC Inter-Governmental Agreement provides for security being arranged for transit countries at their cost.

Considering the above points, India has offered a transit fee of $ 0.15/MMBTU.

Safety & Security Issues

It has been agreed that pipeline within Iran, Pakistan and India will be constructed as per International standards incorporating all safety features as per the American Standard ASME 31.8. The standard stipulates the safety factors in selecting the thickness of the pipeline, quality of the pipeline steel, the depth at which the pipeline is to be laid below the ground, intermediate sectionalizing valves spacing etc. The pipeline will be externally and internally coated and cathodic protection will be provided to prevent corrosion. State of the art sensor and surveillance technologies will be built into the pipeline system design. Safety distances will be maintained between the underground utilities encountered. Round the clock communication and supervisory control system will be provided all along the pipeline, and online data access of the operating parameters will be available in the control centre in India. Line walk and helicopter patrolling of the pipeline will be carried out periodically. It is expected that security forces will be an integral part of the pipeline system right through the construction and operation phases.

Though India is not a member of the Energy Charter Treaty, it has been agreed that safe and secure transit will be provided by the Pakistan Government in line with the provisions of the Energy Charter Treaty. Safety and security within Pakistan will be provided by the Pakistan Government in lieu of which they have proposed certain Transit Fee on the Indian gas. The discussions regarding the security package by the Pakistan Government and Transit Fee are continuing.

Outstanding issues pertaining to the IPI Project

There are three issues that need to be addressed:

Project Structure: There are two possibilities:

a) The project would be implemented in a segmented manner by each country constructing the pipeline within its own territory; coordination would be provided by tripartite working groups at technical, official and Ministerial-level; or

b) India would be an investor in the project, i.e. the project would have at its apex an international consortium made up of the companies of the three countries.

Both approaches have positive and negative implications for India. The final decision would have to be taken consensually.

Gas Price: There are no standard international norms relating to the pricing of piped gas. Since pipelines have a long lifespan, a formula has to be negotiated

and finalized between the producer and the consumer countries. Decision relating to the final price of the gas at the border will be determined by:

a) the price paid for the gas by the power companies who would be the principal consumers of the piped gas; and

b) the price for competing fuels/energy sources, e.g., coal, hydropower, nuclear power, etc.

Framework Agreement: This is a Government-to-Government agreement which sets out the political commitment of the producer, consumer and transit countries to support the project and to extend to it full protection during the construction and operational phases. The Agreement will cover the following: project structure, project facilitation, test treatment, transit fees, technical standard, security measures, and environment and safety issues.

Possible Project Structure

Two fundamental phases that would impact the Project Structure are as under:

- **Construction Phase -** Involving design, engineering, construction and commissioning of the pipeline

- **Operating Phase -** Involving management of the gas system, day to day operations; maintenance and the commercial transactions related to the GSA

An illustrative project structure is shown in Exhibit:5.4

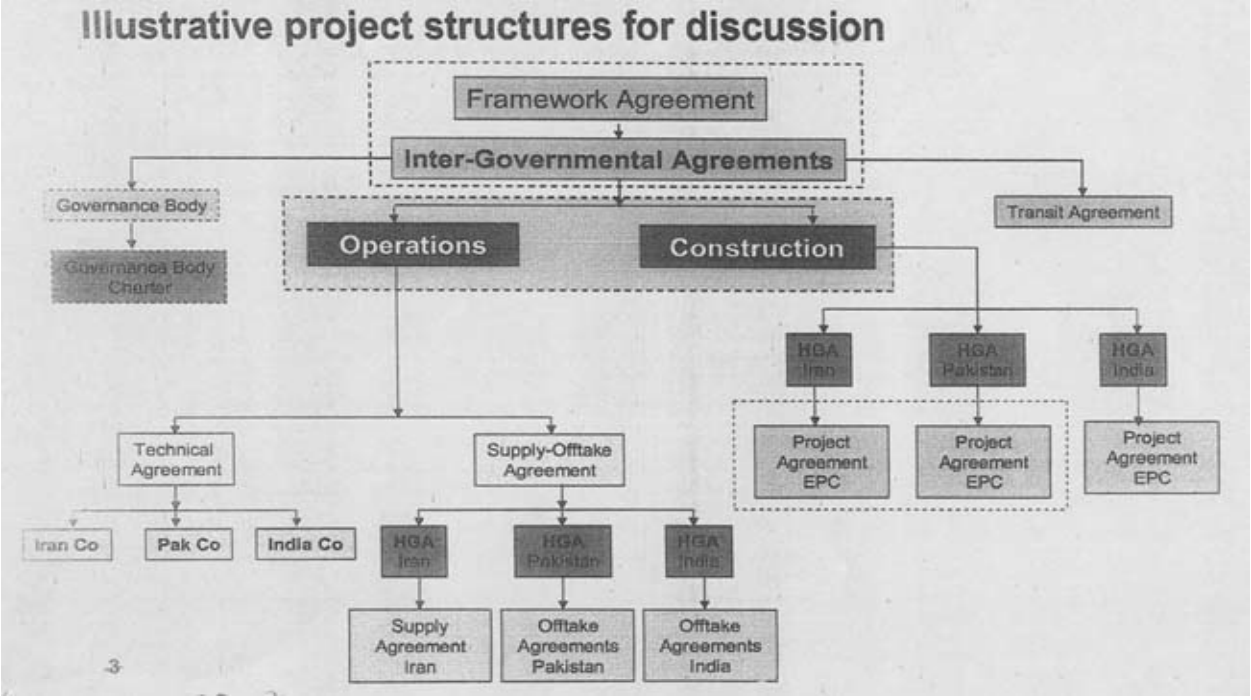

Exhibit: 5.4 Illustrative Project Structure

Latest Status

India, Pakistan and Iran are the original partners of the 3000-kilometer IPI "peace" pipeline that they wanted to complete by 2012 to transfer Iranian natural gas from its South Pars field to India via Pakistan. But, it is apparent now that New Delhi has been dumped, for the time being at least. Iran's deputy minister in charge of the pipeline, Hojatollah Ganimifard, was quoted by the Iranian Oil Ministry's news service Shana as saying, "The content of the peace pipeline contract has been finalized and all the points prepared by the two sides' legal experts have been re-read and agreed by the two sides(Iran and Pakistan)." He said the two sides would ink the contract in December "without a third partner".

Mokhtar Ahmad, advisor to former Pakistani Prime Minister Shaukat Aziz, was also quoted as saying, "As we expected, the text of the peace pipeline has been made ready for the signing by the two states' heads." Pakistan said that any excess gas that would have been destined for India could be transferred to China. Both Tehran and Islamabad have blamed India for delaying progress of the IPI at the behest of Washington, which does not want nations to deal with Iran due to its bid to pursue an independent nuclear program. Among the issues that New Delhi has raised on IPI include security guarantees, transit fees to Pakistan and a price revision clause on which Tehran insists.

Although publicly New Delhi has maintained that it stands by the IPI pipeline, the reality is going to be different. The final deal [on IPI] is not going to happen

in the near future as the project is no longer just about energy security, it's more about India's strategic position in the global community.

Conclusion

Due to longer distances covered, generally in the order of several thousands of kilometers, cross-border oil or gas projects require huge investments. Leaving aside the upstream investments, such projects require investment in the order of billions of dollars for the midstream. In such an investment climate, cross border projects basically require regional co-operation and stability. Most of the time, status of the relations between neighboring countries strongly affects the decision taking on a specific project.

For a project that requires cooperation and coordination at international level, each country involved needs to build an environment of trust, peace and respect. Other bilateral issues should not be allowed to come in the way of project.

5.4.2 CASE STUDY–II: TURKMENISTAN- AFGHANISTAN-PAKISTAN-INDIA GAS PIPELINE

(Length: 1680 km, Flow: 3.2 bcf/day, Size: 56")

Exhibit: 5.5 Turkmenistan- Afghanistan-Pakistan- India pipeline route

Turkmenistan accounts for 2 percent of world's total natural gas reserves. The reserves are estimated to be around 101 TCF and the gas production is in the

range of 2-3 TCF. Turkmenistan is solely dependent on the pipelines owned by the Russian energy firm, Gazprom, for transportation of gas. Apart from Russia, Turkmenistan is exploring other outlets for its gas and is focusing on the western markets including gas markets in Pakistan and India. Turkmenistan has a gas field of over 25 TCF at Daulatabad, which is about 100 km from Afghanistan. The field has capacity to produce about 57 MMSCMD of gas over 35 years and is located at the shortest distance for supply of gas to Pakistan and northwestern markets of India. The field is connected to the Russian pipeline network and was under production up to 1996. Export of Daulatabad gas to Russia was discontinued in 1996 and the field was earmarked for export to Pakistan and possibly to India. Over the last couple of years there has been considerable interest over development of Turkmenistan-Afghanistan-Pakistan project that can transport 2.5 BCF of natural gas up to India.

The Governments of Turkmenistan, Afghanistan, and Pakistan formed a Steering Committee for cooperation in the regional gas pipeline project and Asian Development Bank (ADB) was appointed as the lead development partner for the project in July 2002. A Gas Pipeline Framework Agreement has been concluded among the three countries. They agreed to establish a consortium led by one or more major international oil and gas companies or leading gas transmission companies. The consortium will design, finance, construct and operate the pipeline. The three governments will provide land and free movement of goods, materials and personnel for the construction and maintenance of the pipeline. The consortium will be responsible for transmission of the gas, and will be paid a tariff in accordance with a negotiated gas price.

In April 2003, ADB invited government of India for association with this project and proposed to extend the pipeline to Indian markets. However, the Indian Government declined the offer due to geo-political sensitivities and security concerns of the pipeline segment traversing Afghanistan and Baluchistan. Apart from this, there were doubts over the availability of gas in Turkmenistan to support a project life of 30 years, as major chunk of Turkmenistan's gas has already been committed to Russia. Another problem was that the pipeline will pass through undulating terrain in Afghanistan and thus, would require extensive pumping. ADB then invited offers from international companies for the implementation and operation of the pipeline project with the provision that it may be extended to India. From India, GAIL and IOC submitted offers after obtaining government clearances.

Under ADB's sponsored route studies, the two possible pipeline routes that are being examined are:

- **Northern Route**: Daulatabad -Mazar-e-Sharif - Kabul-Jalalabad - Islamabad - Lahore. This pipeline can enter India from Punjab.

- **The Southern Route**: Daulatabad-Herat-Kandhar-Quetta-Multan. The pipeline can enter into India from northern Rajasthan (Ganga Nagar) or Punjab (Fazilika).

As per some media reports, the government is considering the possibility of linking this pipeline to Iran-Pakistan-India pipeline. This Iran-Pakistan-India pipeline would traverse the southern part of Iran and enter Pakistan in the Baluchistan region. In Pakistan, it will traverse Sui and then enter India from Tannot-Ramgarh area (Jaisalmer) of Rajasthan. Consider the northern route of the Turkmenistan-Afghanistan-Pakistan pipeline and the present route configuration of Iran-Pakistan-India pipeline. The distance between the two pipelines in Pakistan would be in excess of 700 km. The two transnational pipelines may get linked through the domestic north-south pipeline infrastructure of Pakistan. The southern Turkmenistan-Afghanistan-Pakistan route is much closer to Iran-Pakistan-India gas pipeline and linkage between the two pipelines would involve much shorter connectivity than the northern route.
There is another option for connecting Turkmenistan-Daulatabad gas field to Iran-Pakistan-India pipeline - a 1300-km pipeline from Turkmenistan. This pipeline would be shorter as compared to the northern as well as southern routes of Turkmenistan-Afghanistan-Pakistan pipeline. In this option, Turkmenistan pipeline would link with Iranian pipeline in Iran and thereafter, a single pipeline would traverse through Pakistan to supply gas to India.

In February 2005, the cabinet authorized the oil ministry to negotiate directly with Iran, Pakistan, Bangladesh and other countries for facilitating the laying of transnational pipelines for importing natural gas to India.

Progress of TAP Pipeline Project

The proposal to carry gas from the newly developed fields in Turkmenistan across Afghanistan to Pakistan, and possibly India was first conceived in the mid-1990's. The lead role in this regard was played by an American company, UNOCAL. However, the proposal could not be pursued on account of continued civil war in Afghanistan through the late 1990's.

The project was later revived following the removal of the Taliban administration from Afghanistan and the installation of the Karzai Government. In order to pursue the project, the Petroleum/Energy Ministers of Turkmenistan, Afghanistan and Pakistan set up a "Steering Committee" at the Ministerial level. In July 2002, the Steering Committee agreed that the ADB would provide technical assistance for preparation of a feasibility report for the project. Later, the Heads of States/Government of the three countries concluded a "Gas Pipeline Framework Agreement" on December 27, 2002. This agreement affirms the commitment of these Governments to the project during the construction and operational phases.

ADB got the pre-feasibility report (PFR) of the project prepared in 2003. As per this PFR, the pipeline will be of 56 inch diameter and 1680 km length, with a carrying capacity of 30 billion cubic meters (BCM) per year, entailing a project cost of $ 3.3 billion. The issues of certification of adequate gas reserves in Dauletabad gas field in Turkmenistan, which is expected to be the source of supply for this project, security of supplies especially through Afghanistan; tying-up of gas offtake volumes; gas pricing, and appropriate project structure for implementing the project, are yet to be settled.

Presentation by ADB on Interim Findings on Security Study

ADB presented the draft report on the security study of the TAP Pipeline. The security study concluded that TAP project is feasible from a security perspective but will require a commitment of resources, innovative physical security measures, a dynamic social outreach programme, and professional management. ADB would further consult the participating countries in the matter. Afghanistan confirmed that security has improved and additional infrastructure is being developed which will ensure security of the pipeline system.

Presentation by ADB on Project Structure and Investment Scenarios

ADB presented its preliminary ideas on the Project Structure. It envisaged a pipeline company sitting in the middle and acting as a transportation vehicle, but not essentially taking input or output risk. The ownership parameters of the pipeline company envisaged economic interest and stake of all concerned parties in the project, viz., the various governments, oil and gas companies, financial Institutions and ADB. The presentation envisaged the need to have one entity with private sector ownership that could drive the pipeline project forward. The suggested financing structure assumes volume based payments for transportation of natural gas, with a minimum guaranteed level, sufficient to cover all operating costs, debt servicing and suitable return on equity, as long as the pipeline is available

Confirmation by India and Pakistan on Gas Offtake Volume

Pakistan confirmed in the meeting that they would require 30 MMSCMD of gas by 2011, 60 MMSCMD by 2014 and 90 MMSCMD d by 2016. India made a brief presentation on its gas sector outlook and confirmed that, subject to satisfactory understanding and resolution of various issues, India could take around 70 MMSCMD of gas. However, the exact volume as also the buildup could be confirmed upon only after India becomes a member of the project.

Steering Committee's Invitation to India to Join the Project

The Steering Committee reconfirmed the invitation to India to become an official member of the project. In order for India to join as a full member of the project, it is required to submit a formal request with ADB's facilitation to the Governments of Turkmenistan, Afghanistan and Pakistan, which is to be approved by those three governments. It was agreed in the meeting that ADB will provide India with copies of key documents, i.e. the Framework Agreement, the original Inter-governmental Agreement and the Draft Host Country Agreement, so as to facilitate India's decision to join the project. The Committee further indicated that they would appreciate India's submission of its formal request to join the project within three months. Further, upon approval of the Governments of Turkmenistan, Afghanistan and Pakistan the project name will be officially changed to Turkmenistan-Afghanistan-Pakistan-India (TAPI) Natural Gas Pipeline Project**.**

Inter-governmental Agreement and Framework Agreement

The Intergovernmental Agreement was executed among the Governments of Turkmenistan, Afghanistan and Pakistan on 30 May 2002. This Agreement, which was initially valid for three years, has been revalidated in the ninth Steering Committee meeting through an amendment which provides for automatic extension of the Agreement for a further period of three years, with the provision that it could be terminated any time after the first 3 years by any party after giving 6 months notice. This is a high level Agreement executed among the Presidents of Pakistan, Turkmenistan and Afghanistan.

Upon approval of the Cabinet for participation in this project, the Ministry of Petroleum & Natural Gas shall finalize appropriate amendments to the Intergovernmental and Framework Agreements in consultation with the ADB and the Governments of Turkmenistan, Afghanistan and Pakistan and the Ministry' of Law.

Host Government Agreements

These Agreements will be signed separately between the Governments of Turkmenistan, Afghanistan, Pakistan and India on the one side and the project participants on the other side. These Agreements will be the key documents for the successful implementation and operation of the project. ADB has prepared a model Host Government Agreement.

Current Status

An Indian delegation led by Dinsha Patel, Minister of State for Petroleum and Natural Gas visited Ashgabat, Turkmenistan to participate as an 'Observer', in the 9th Steering Committee meeting of the Turkmenistan-Afghanistan-Pakistan

(TAP) Gas Pipeline project held on February 14-15, 2006,. The Steering Committee invited India to become an official member of the TAP project. The Ministry of Petroleum & Natural Gas brought the matter before the Cabinet in May 2006 after inter-Ministerial discussions. The Cabinet in the meeting held on 18th May 2006, accorded 'in principle' approval to the proposal for India joining the TAP project. The inter-governmental and frame work agreements entered into earlier by the Governments of Turkmenistan, Afghanistan and Pakistan, were examined. It was found that with India joining TAP pipeline project, there is a need to amend the agreements suitably. Decision of the Government of India to join TAP Gas Pipeline project as an official member was conveyed to ADB in June 2006. ADB has been requested to appropriately take up India's request for joining the project with the Governments of Afghanistan, Pakistan and Turkmenistan. India officially became a party to the project in 2008.

It is worth mentioning here that after conceiving the concept in 1990, the pipeline project is yet to start . Even in 2008, discussions were going on. This indicates that cross border lines need time between from conceptualization and realization.

Conclusion

Energy experts feel that realization of the Turkmenistan-Afghanistan-Pakistan-India (TAPI) project appears doubtful.

Not only would the TAPI pipeline travel through a troubled Afghanistan, experts express lack of confidence in sufficient gas reserves with Turkmenistan to meet all its assurances to China, Russia as well as Pakistan and India.

On the surface, conditions in Afghanistan are the major cause of concern for the TAPI project. Taliban is active in south western part of the country which is near the proposed route for the pipeline. Experts do not expect the security threat to minimize in the near future. But more than unsettled conditions in Afghanistan, experts doubt whether there are enough gas reserves to fill all the pipelines being proposed by Turkmenistan without substantially increasing production.

Current trend in increase of output does not seem to correspond with the number of projects that are on the drawing board. In 2007, Ashkhabad produced 70 billion cubic meters of gas, which was short of the previous year's target by 10 billion cubic meters. This makes it highly unlikely that Turkmenistan would be able to achieve its projected target of 250 billion cubic meters of gas and 110 million tonnes of oil by 2030.

Taking into account these considerations, the resource base of TAPI appears to be at a level that is too low to initiate this project. The volumes may be enough to cover other commitments. There is simply no gas for other markets.

A survey should be carried out by an independent agency for estimation and certification of gas reserve. There should be no ambiguity regarding reserves and supply, this may jeopardize the completion of the project. Also there must be firm commitment from all the parties involved in the project.

5.4.3 CASE STUDY–III: BAKÜ – TIFLIS - CEYHAN PIPELINE

(Length: 1743 km, Flow: 50 MT/ year, Size: 46", 42", 34"

Being a transit country which is well situated between the energy rich countries of the Caspian and the consumer markets in Europe, Turkey is now becoming an energy terminal. It has taken the place of both an investor and as a transit country for the various projects being implemented in the region.

The Baku-Tbilisi-Ceyhan (BTC) Main Export Oil Pipeline Project is an ideal demonstration of how governments could come together for the same purpose and could promote the realization of a specific project. The BTC project, being the first leg of the East-West Energy Corridor, and once treated as a "dream project" by some group of experts, has now almost turned into a physical entity.

Synchronized studies were initialed simultaneously in Azerbaijan/Georgia and Turkey on 15 of November, 2000. Basic Engineering and detail engineering was completed successfully. Detailed project studies confirmed that the project is well within its previously estimated budget of $1.427 billion for the Turkish section of the pipeline. The next phase was the Land Acquisition and Construction. Although BTC pipeline is an oil pipeline project with its certain peculiarities, it would be very appropriate to mention here about its associated project agreements, since they stand for an important benchmark for the role of governments in cross-border gas projects, as well.

The Baku-Tbilisi-Ceyhan (BTC) Main Export Pipeline (MEP) Project has the following characteristics:

- Maximum Capacity : 50 Million tons/year (1 million barrels/ year)
- Total Length: 1,743 km.
- Azeri+Georgian Section : 675 km.
- Turkish Section : 1,068 km.

- Point of Delivery : Sangachal (Baku), Azerbaijan
- Point of Terminus : Ceyhan Marine Port, Turkey
- Pipe Diameter : 46” 42” 34”
- Design Pressure : 100 bar
- Pump Stations : 8 (Turkey : 4)
- Permanent amount of oil in the system
- Pipe line: 1 million m3
- Ceyhan Terminal : 1 million m3
- Total : 2 million m3

The BTC Project Agreements signed by the Turkish Authorities can be divided into four categories: the Inter Governmental Agreement (IGA), the Host Government Agreement (HGA), the Turnkey Agreement and the Turkish Government Guaranty. While the former two agreements were also signed by the other respective governments, the latter two relates only to the Turkish side.

Intergovernmental Agreement (IGA)

Intergovernmental Agreement relating to the Transportation of Petroleum via the territories of the Azerbaijan Republic, Georgia and the Republic of Turkey through the Baku-Tbilisi-Ceyhan Main Export Pipeline was signed by the presidents of the three aforementioned countries on 18 November 1999 and entered into force by the publication in the official gazette on 10 September 2000.

This agreement, in general, defines the host countries’ mutual responsibilities and principles of their support to the Baku-Tbilisi-Ceyhan Crude Oil Pipeline Project. It sets forth the common principles of the countries regarding free transit of petroleum, reinforces the principle of non-discriminatory treatment, and reinforces harmonization of the legal frame work and implementation of appropriate supranational regulatory rules.

The objective of signing this agreement is to demonstrate political, legal and commercial support for the project and establish a stable and promoted legal and fiscal regime to attract investment to the BTC pipeline and establish prevailing domestic and international law through ratification and other enabling procedures.

Fundamentally, this agreement evidences political, legal and commercial

support on State to State level. It creates various rights and obligations enforceable both by the States and the project investors.

The agreement sets standards for securing the facilities and personnel, and technical, environmental and social concerns for constructing and operating the BTC system.

In addition, this agreement sets forth the establishment of Intergovernmental Commission to facilitate the implementation and supervision of the appropriateness of the project. In this Commission, Deputy Undersecretary of the Ministry of Energy and Natural Resources and Ministry of Foreign Affairs represent the Turkish Government.

Host Government Agreement (HGA)

A host government agreement was signed between the government of the Republic of Turkey (Ministry of Energy and Natural Resources) and MEP participants on 19 October 2000 in Ankara.

A similar host government agreement was likewise signed between Azerbaijan and MEP participants on 17 October 2000 in Baku, and Georgia - MEP participants on 18 October 2000 in Tbilisi.

In common terms, each host government agreement determines the country's representation and warranties to the project; and determines principles to ensure free transit of oil, and how to facilitate implementation of the project.

The Turkish host government agreement provides government commitment to the provision of pipeline security, government assistance and support regarding land acquisition and issuance of necessary permits. It determines the scope of liabilities and compensation for failure to fulfill obligations under Project Agreements.

Turnkey Agreement (TA)

A Turnkey Agreement (TA) was signed between Turkish Petroleum pipeline corporation (BOTAS) and MEP participants on 19 October 2000 in Ankara. It is a Lump Sum Fixed Price Contract for realization of the Turkish portion of pipeline including the Ceyhan Marine terminal. According to this agreement, BOTAS shall commission the Turkish section of BTC pipeline.

The project consists of three phases namely; Basic Engineering, Detailed Engineering, Land Acquisition and Construction Phase. The agreement, in general, sets the performance requirements (all technical, engineering and construction issues) of the MEP System and limits liabilities and sets compensations due to delays.

Government Guarantee (GG)

Government guarantee was signed between the Prime Minister's office of Republic of Turkey, the Undersecretaries of Treasury and MEP participants on 19 October 2000 in Ankara. This guarantee can be referred to as a letter by the Treasury guaranteeing the payment obligation of BOTAS under the Turnkey agreement. It includes the scope of the guarantee, delay, performance, compensation and potential cost overrun, and provides some portion of the total guarantee amount as a liquid instrument. This amount is limited to 30 per cent of the lump sum fixed price of the turnkey contract, which is approximately $400 million in case of BOTAS failure.

Conclusion

The package of Agreements specifically refers to

a) In terms of applicability and securing the realization of the Project:

1) Determination of legal, commercial and fiscal structures

2) Securing the rights provided for the Project Invest

b) In Terms of protecting the Cost Overrun of the Project:

1) Construction of Turkish portion by BOTAS

2) Allocation of the pipeline corridor with fixed or pre-determined price

3) Protection of the Project Investors from the international arbitration in respect of the disputes regarding land costs through realization of such expropriation task by Turnkey Contractor BOTAS

c) In Terms of Overall Security of the Pipeline

1) Designation of BOTAS as the Turnkey Contractor for the construction and operation of the Turkish portion of the pipeline and as such utilization of its experience for the overall benefit in this project

2) Control of any harm during construction and operation phases that could be given to the third parties and the environment through insurance either by the contractor or by the BOTAS.

5.4.4 CASE STUDY - IV : BOLIVIA-BRAZIL GAS PIPELINE

(Length: 3100 km, Flow: 16 MMSCMD)

The Bolivia-Brazil natural gas pipeline, transport natural gas more than 3,000 kilometres, costing US$2.1 billion to construct. Despite the substantial benefits for both Bolivia and Brazil and the involvement of reputable private partners, the perceived risks and complexities of this large project made financing it a major challenge. The pipeline links supply in one country to a potential market in another. Neither of these countries has a tradition of independent regulation or economic pricing of fuels. And the pipeline is the first major gas infrastructure project involving the private sector in Brazil, where the natural gas market is underdeveloped and the gas distribution infrastructure still very limited.

When the pipeline project started to get off the ground in the early 1990s, the Brazilian hydrocarbon sector was dominated by government owned entities and prices were heavily regulated. At the federal level, the oil and gas company Petrobras was the main player in the project. It still had monopoly on exploration, exploitation, refining, and maritime and pipeline transportation. Natural gas distribution was reserved for state owned distribution companies, although petroleum distribution was open to foreign investors. Prices were equalized across regions, and the prices of liquefied petroleum gas (LPG) and fuel oil were subsidized. For Petrobras, exploiting Brazil's modest natural gas reserves had been secondary to producing oil, and the share of natural gas in the energy market in the early 1990s was a mere 2 percent. Petrobras had introduced natural gas only in 1988, supplying small quantities to the existing São Paulo distribution network as associated gas from local oil fields. But with Brazil forecasting strong growth in energy demand, natural gas gained appeal as a means to offset increasing dependence on more expensive fuels. Meanwhile, Bolivia needed to find a new market for gas exports. The country had been exporting gas by pipeline to Argentina since the 1970s. These export sales represented some 80 percent of Bolivia's total gas production. However, new discoveries in Argentina gave notice that this was no longer tenable. The idea for natural gas trade between Bolivia and Brazil had been mooted in the 1930s, and in 1990 the two governments decided to give the idea of gas export pipeline another serious look. After a preliminary feasibility study, the two state monopolies, Petrobras in Brazil and Yacimientos Petroliferos Fiscales Bolivianos (YPFB) in Bolivia, signed a gas sales contract in 1993.

Emergence of Private Investors

Both the governments of Bolivia and Brazil were not in a position to fund the pipeline project. As a first step to raise private finance, Petrobras embarked on a series of road shows in 1994 to choose private equity partners for a new pipeline company on the Brazilian side. Petrobras ultimately selected the BTB

consortium, comprising British Gas, Tenneco (now El Paso Energy), and Broken Hill Proprietary, to form the Brazilian transport company (Transportadora Brasileira Gasoduto Bolívia-Brasil, S.A. [TBG]). This company, with an initial 51 percent ownership by Petrobras, own the Brazilian part of the pipeline. However, the private partners began to signal to the government that fair access to downstream markets and market-based pricing policies would be important for the realization of the project — policies in line with those recommended earlier by the World Bank to the Brazilian government as key for the development of the hydrocarbon sector. In late 1995 an amendment to the Brazilian constitution removed the monopoly by Petrobras, subject to an implementation law that was approved by Brazil's Congress in August 1997.

On the Bolivian side an agreement of association was reached between Enron and YPFB that included the development of the Bolivian section of the pipeline. YPFB was being prepared for capitalization and sale by international tender. A hydrocarbon law passed in 1996 committed Bolivian reserves to the export project and defined a diminished (but still critical) role for YPFB as the aggregator and shipper of future gas exports to Brazil. The capitalization of YPFB followed shortly after, and two private exploration and production companies and one oil and gas transportation company eventually won the international competitive tender. The Bolivian transportation company, Gas Tran boliviano S.A. (GTB) was formed for the gas export project, as a private joint venture among Enron, Shell, and Bolivian pension funds. The project structure allowed a degree of cross border ownership by each sponsor group, and special committees were formed with representation from all sponsors to resolve technical and financial issues and ensure cross-border harmonization of the project. This feature proved effective in helping to speed up project development.

Financing Plan

In 1997 the Bolivia-Brazil natural gas pipeline project still lacked a firm financing plan. The project required a large, bulky, upfront investment with a gradual build up of tariff revenues, and a final gas price that would provide incentives for a speedy uptake of gas by potential customers — industrial users and power plants. Market soundings had indicated a lack of capacity for long-term commercial funding. Commercial debt would be at a high cost with short maturities (eight to ten years) because of perceived Brazilian country risk, regulatory risk, and supply risks, resulting in debt service difficulties and a final gas price that could severely limit market penetration during the critical initial years. Commercial lenders perceived some supply risks, since known Bolivian reserves were only sufficient to meet 80 percent of the gas sales contract. But in the World Bank's view the risks were likely to be small because the capitalization of YPFB had attracted some US$1 billion of private capital for further exploration and development. In 1997 the World Bank and its multilateral counterparts were convinced that both countries were serious about

opening their hydrocarbon sectors to competition and private participation to competition and private participation. They decided to appraise the project on the understanding that transmission tariffs (and private investor rates of return) would be regulated to ensure that any benefits of extended maturities resulting from their loans and guarantees would be passed on to final consumers. A World Bank analysis showed the project to be economically viable with the best of several alternatives, including using different pipeline routes from Bolivia, constructing a pipeline from Argentina to Brazil, and constructing large gas-fired power plants in Bolivia and transporting the power to Brazil using high-voltage transmission lines.

The final pipeline route was selected to minimize environmental impact. The project includes full measures to protect the interests of indigenous people living near the pipeline. On the Brazilian side, multilateral lending and partial credit guarantees offered the prospect of longer loan maturities and a gas price just right to penetrate the market. Thus the World Bank agreed in December 1997 to provide a direct loan of US$130 million and to continue preparing a partial credit guarantee of US$180 million to TBG. Other multilaterals, including the Inter-American Development Bank, provided financing totalling US$380 million. The multilateral financing covered 40 percent of the financing requirements, Petrobras provided another 40 percent sourced from bilateral agencies, and the equity sponsors provided the rest.

On the Bolivian side only 20 percent of financing was available from shareholder equity. With the Bolivian government unprepared to provide sovereign guarantees, little progress was made to close the financing gap. The Brazilian government realized that this threatened to delay the project until a new government was elected. It urged Petrobras to seek a solution quickly. Petrobras responded through two mechanisms. First, it agreed to finance a fixed price turnkey construction contract for the Bolivian section of the pipeline, with repayment to be made through the waiver of future transportation fees. Second, it agreed to repurchase part of the uncommitted upside capacity of the pipeline on both sides of the border, an arrangement that became known as the transport capacity option.

Who Takes the Risks?

Petrobras bear most of the project risks on both sides of the border. YPFB collects gas from the producers, and the gas transported to the border under a ship-or-pay contract with GTB as mentioned in Exhibit 5.6.

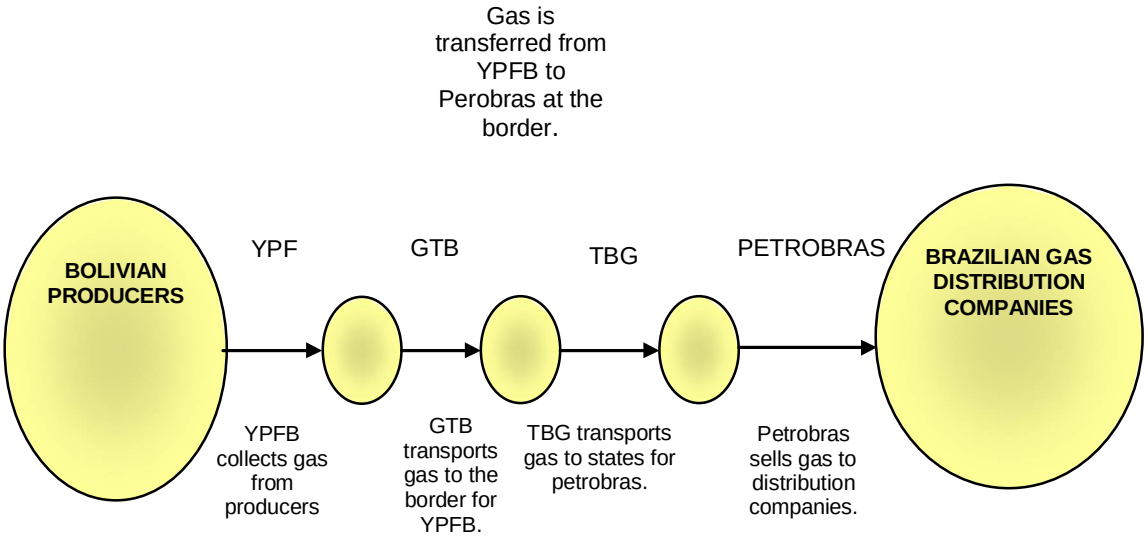

Exhibit 5.6 Bolivia-Brazil Pipeline Arrangement

Petrobras takes ownership of the gas for delivery to the five Brazilian state gas distribution companies under similar transportation arrangements with TBG. The supply risk on the Bolivian side falls on YPFB. But this risk is small because additional supply likely to become available from new discoveries in southern Bolivia and possibly northern Argentina. The biggest risk lies in the market in Brazil. Four of the five distribution companies are paper companies with no pipes in the ground as yet, and gas have to penetrate a market dominated by high-sulfur fuel oil. Petrobras has an equity stake of about one third in several distribution companies. Although the ultimate market risk lies with the distribution companies, it is Petrobras that is contractually obligated to pay YPFB for the gas and the transportation companies for their services. Moreover, through its turnkey construction contract, Petrobras takes the construction risk on the Bolivian side. And if the pipeline in Brazil is not built on time, it is Petrobras which has to incur financial penalties payable to YPFB and the distribution companies.

Conclusion

Many prospective international gas pipeline projects are under consideration in Central and South Asia, from Russia to China and from Turkey to Eastern Europe. Given the large investments required, the main challenge is to design financing schemes that work. There are few blueprints to draw on. The World Bank can play a key transitional role in such projects. But there needs to be demonstrable commitment to open the natural gas industry to competition and private investment and establish sound regulatory and pricing policies.

Following are the key characteristics of the Bolivia- Brazil gas pipeline which can play a vital role in success of any cross border pipeline project

- Partnering with the private investors in project financing
- Unbundling of operation of state oil and gas majors
- Opening of oil and gas sectors for private players
- Market determination of gas price instead of government regulated mechanism for gas pricing
- Risk sharing among all the parties

5.5 OVERALL CONCLUSION

Taking the experience of IPI, TAPI , Bakü-Tiflis-Ceyhan Pipeline and Brazil-Bolivia pipeline, the following are the broad conclusions which need to be taken while executing the AGG.

1) Fructification of cross border pipeline takes minimum 2-3 years
2) Gas reserves to be ascertained before venturing into the project
3) Energy policy favorable to gas development and that reinforces gas market potential
4) Better understanding between sellers, buyers and transit countries through regional co-operation
5) Status of the relations among/between neighboring countries strongly affects the specific project decision taking
6) Bilateral issues should not be let to come in the way of project or mixed together
7) Self –Interest of countries becomes hurdle in cross-border pipeline
8) Higher investments require regional stability
9) Partnering with the private investors in project financing
10) Create a clear and stable investment regime that attracts private (domestic or foreign) investment