"Transport of Oil & Gas for Asia by Pipelines"

A DISSERTATION REPORT

Submitted by

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in partial fulfillment for the award of the degree

Of

MBA (Upstream Asset Management)

To

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Asst. Professor

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

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(ISO 9001:2000 Certified)

CERTIFICATE

This is to certify that the dissertation project report on **"Transportation of Oil and Gas for Asia by Pipelines"** has been completed and submitted by **Abhijeet Vikram Singh** in partial fulfilment of the requirements for the award of degree of **Master of Business Administration** in **Upstream Asset Management**, is a bonafide work carried out by him under my supervision and guidance.

To the best of my knowledge and belief the work has been based on investigation made, data collected, and analyzed by him and this work has not been submitted anywhere else for any other University or Institution for the award of any Degree/Diploma.

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DECLARATION

I, **Abhijeet Vikram Singh,** student of **M.B.A. (Upstream Asset Management)** at UPES declare that work done on "***Transport of Oil & Gas for Asia by Pipelines***" is original.

Any references made in this project are duly acknowledged.

To the best of my knowledge and belief the subject matter here is original and has not been submitted to any other university till date.

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ACKNOWLEDGEMENT

I would like to take this opportunity to extend my sincere thanks to my project guide **Dr. Mandira Agarwal,** *Asst. Professor* for guiding me through this project.

I am also indebted to the valuable suggestions and enlightening discussions with my friends. I also take this opportunity in expressing my sincere gratitude within a few words, to tell our Faculties, seniors, friends from the oil and gas industry and our colleagues for their earnest help and guidance, which otherwise would have run into a long list.

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EXECUTIVE SUMMARY

Pipeline transport was pioneered by Vladimir Shukhov and the Branobel company in the late 19th century. Others say oil pipelines originated when the Oil Transport Association first constructed a 2-inch wrought iron pipeline over a 6-mile track from an oil field to Pennsylvania to a rail road station in Oil Creek, in the 1860s. No matter, piplines are generally the most economical way to transport large quantities of oil or natural gas over land. Compared to railroad, they have lower cost per unit and also higher capacity. Although pipelines can be built even under the sea, that process is both economically and technically very demanding, so the majority of oil at sea is transported by tanker ships.

In early 1860 attempts made to lay crude pipeline using gravity principle by Mr. James L. Hutchings. The cast iron pipes used in oil transportation posed problems of leakage in the system during year 1863-64. The first successful crude oil pipeline was constructed using wrought iron pipes for a total length of 32,000 feet in Pit Hole Creek Ohio. Subsequently in 1867, 62 mile long, pipeline constructed in Columbia. *First trunk crude oil pipeline (1960-62):* 1156 km long pipeline from Naharkatiya and Moran oil fields to the refineries at Guwahati and Barauni for transporting 5.5 MMTPA crude oil. *First cross country product pipeline (1962-64):* Guwahati refinery to Siliguri with a capacity to transport 0.48 Million metric tones of product through 435 kms. 8" line. Subsequently number of petroleum pipelines has been laid.
the list of major oil and gas pipelines, existing and proposed, which will be covered in this study:

Existing:

- Kazakhstan-China oil Pipeline
- Alashankou-Dushanzi Crude Oil Pipeline
- Baku-Tbilisi-Ceyhan Pipeline
- Blue Stream Pipeline
- Druzhba Pipeline
- Iran-Armenia Natural Gas Pipeline
- Odessa-Brody Pipeline
- Trans-Israel Pipeline
- West-East Gas Pipeline

Proposed:

- Baltic Gas Interconnector
- Eastern Siberia-Pacific Ocean oil pipeline
- Nabucco Pipeline
- Trans-Caspian Gas Pipeline
- Trans-Caspian Oil Pipeline
- Transnational Pipeline projects for India

Flanked by large gas reserves to its east, north-west and west, India is strategically located to meet its natural gas requirements through transnational pipelines. These sources include the world's leading supply sources in terms of proven gas reserves, viz., Iran (15%), Qatar (9%), Saudi Arabia (4%) and UAE (4%). To the North-West, Turkmenistan (particularly the Dauletabad field), holds potential. Bangladesh and Myanmar to the east hold substantial reserves. There could be a price advantage of around $1-1.50 per Million British Thermal Unit (MMBTU) in favour of the delivery price of a high volume of gas through on-land pipelines against LNG or deep-sea pipelines. An annual import of, say, 100 MMSCMD by pipelines would thus, constitute savings of about US$1.5-2.0 billion/annum as compared to LNG.

Looking at the struggle between Iran, Russia, China, and the US over their preferred pipeline routes for Central Asian oil and gas gives a good glimpse as to the world's future geopolitical order. Despite the formidable difficulties in building pipelines, those four powers are converging upon the region with an eagerness that is almost desperate.

CHAPTER : 1

INTRODUCTION TO PIPELINE TRANSPORT

Introduction

There is some argument as to when the first real oil pipeline was constructed. Some say pipeline transport was pioneered by Vladimir Shukhov and the Branobel company in the late 19th century. Others say oil pipelines originated when the Oil Transport Association first constructed a 2-inch wrought iron pipeline over a 6-mile track from an oil field to Pennsylvania to a rail road station in Oil Creek, in the 1860s. No matter, piplines are generally the most economical way to transport large quantities of oil or natural gas over land. Compared to railroad, they have lower cost per unit and also higher capacity. Although pipelines can be built even under the sea, that process is both economically and technically very demanding, so the majority of oil at sea is transported by tanker ships.

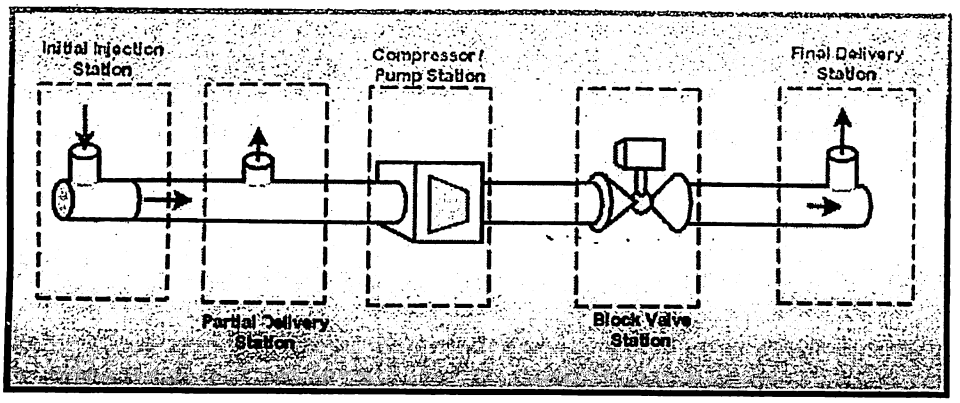
Oil pipelines are made from steel or plastic tubes with inner diameter typically from 10 to 120 cm (about 4 to 47 inches). Most of the pipelines are buried underground at a typical depth of about 1 - 2 metres (about 3 to 6 feet). The oil is kept in motion by a system of pump stations built along the pipeline and usually flows at speed of about 1 to 6 m/s. Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline. Usually in multi-product pipelines there is no physical separation between the different products. Some mixing of adjacent products occurs, producing interface. This interface is removed from the pipeline at receiving facilities and segregated to prevent contamination.

Crude oil contains varying amounts of wax, or paraffin, and in colder climates wax buildup may occur within a pipeline. Often these pipelines are inspected and cleaned using pipeline inspection gauges *pigs*, also known as, *scrapers* or *Go-devils*. These devices are launched from pig-launcher stations and travel through the pipeline to be received at any other station down-streams, cleaning wax depositions and materials that may have accumulated within the line.

For natural gas similarly constructed of carbon steel and varying in size from 2 inches to 48 inches in diameter depending on the type of pipeline. The gas is pressurized by compressor stations located along the pipelines and is odorless unless mixed with a mercaptan odorant where identified by the proper regulating body.

Pipeline components :

Pipeline networks are composed of several pieces of equipment that operate together to move products from location to location. The main elements that conform a pipeline system can be summarized as follows:



- **Initial Injection Station** - Known also as Supply or Inlet station, is basically the beginning of the system, this is where the product is injected into the line. Storage facilities, such as tank terminals, as well as other devices to push the product through the line, like pumps or compressor are usually located at these locations.
- **Compressor/Pump Stations** - Pumps for liquid pipelines and Compressors for gas pipelines, are located along the line to help move the product through the pipeline. The location of these stations is defined by the topography of the terrain, the type of product being transported, or operational conditions of the network.
- **Partial Delivery Station** - Known also as Intermediate Stations, these facilities allow the pipeline operator to deliver part of the product being transported.
- **Block Valve Station** - These are the first line of protection for pipelines. With these valves the operator can isolate any segment of the line to perform some specific maintenance work or isolate a rupture or leak. Block valve stations are usually located every 20 to 30 miles, depending on the type of pipeline. Even though it is not a design rule, it is a very usual practice in liquid pipelines. Overall the location of these stations depends exclusively on the nature of the product being transported, the trajectory of the pipeline and/or the operational conditions of the line.
- **Regulator Station** - This is a special type of valve station, where the operator can release some of the pressure built into the line. Regulators are usually located at the downhill side of a peak.
- **Final Delivery Station** - Known also as Outlet stations or Terminals, this is where the product will be distributed to the final consumer. It could be a tank terminal for liquid pipelines or a connection to a distribution network for gas pipelines.

Types of pipelines:

In general, pipelines can be classified in three main categories depending on its main purpose, the categories are as follows:

1. **Gathering Pipelines** - Group of smaller interconnected pipelines forming complex networks with the main purpose of bringing crude oil or natural gas from several nearby wells to a treatment plant or processing facility. In this group, pipelines are usually short, couple of hundred of meters, and with small diameters. Also sub-sea pipelines for collecting product from deep water production platforms are considered gathering systems.
2. **Transportation Pipelines** - Mainly long pipes with large diameters, moving products (oil, gas, refined products) between cities, countries and even continents. These transportation networks include several compressor stations in gas lines or pump stations for crude and multiproducts pipelines.
3. **Distribution Pipelines** - Composed of several interconnected pipelines with small diameters, used to take the products to the final consumer. Basically, feeder lines to distribute gas to homes and businesses downstream, or pipelines at terminals to distribute final products to tanks and storage facilities are included in this group.

Pipeline regulation:

In the U.S. pipelines are regulated by the Pipeline and Hazardous Materials Safety Administration (PHMSA); offshore pipelines are regulated by the Minerals Management Service (MMS). In Canada pipelines are regulated by either the provincial regulators or, if they cross provincial boundaries or the Canada/US border, by the National Energy Board (NEB). Government regulations in Canada and the United States require that buried fuel pipelines must be protected from corrosion. Often, the most economical method of corrosion control is by use of pipeline coating in conjunction with cathodic protection and technology to monitor the pipeline. Above ground, cathodic protection is not an option; the coating is the only external protection.

Pipeline operation:

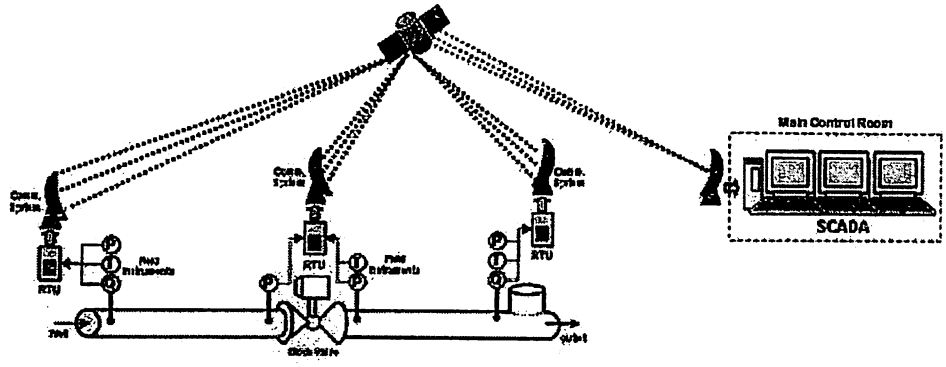
When a pipeline is built, the construction project does not only cover the civil work to lay down or bury the pipeline and build the pump/compressor stations, it also has to cover all the work related to the installation of the field devices that will support the remote operation of these networks.

Field devices are basically instrumentation, data gathering units and communication systems. The field Instrumentation includes flow, pressure and temperature gauges/transmitters, as well as other devices to measure the relevant data required to operate. These field instruments are installed along the pipeline on some specific locations, such as injection or delivery stations, pump stations (liquid pipelines) or compressor stations (gas pipelines), and block valve stations.

The information measured by these field instruments is then gathered in local Remote Terminal Units (RTU) that transfer the field data to a central location in real time using communication systems, such as satellite channels, micro wave links or cellular phone connections.

Pipelines are then controlled and operated remotely, from what is usually known as *The Main Control Room.* In this specific center, all the data related to field measurement is consolidated in

one central database. The data is received from the multiple RTUs installed along the pipeline. It is common to find RTUs installed at every station along the pipeline.



SCADA System for Pipelines

The SCADA system at the Main Control Room, then receives all the field data and presents it to the pipeline operator through a set of screens or SCADA#Human_Machine_Interface, showing the main operational conditions of the pipeline. The operator can monitor the hydraulic conditions of the line, as well as remotely manipulate pumps, compressors, valves, deliveries, etc. sending operational commands (open/close valves, turn on/off compressors or pumps, change setpoints, etc.) through the SCADA system to the field.

To optimize and secure the operation of these assets, some pipeline companies are using what is called *Advanced Pipeline Applications*, which are software tools installed on top of the SCADA system, that provide extended functionality to perform leak detection, leak location, batch tracking (liquid lines), pig tracking, composition tracking, predictive modeling, look ahead modeling, operator training and more.

Leak detection systems:

Since oil and gas pipelines represent one of the most important assets for the current economic and social development of almost any country, it has been required either by government regulations or internal policies to ensure the safety of the assets as well as of the population and the environment where these pipelines run across.

Pipeline companies face different operational challenges depending on three main factors; government regulation, environmental constrains and social situations. As mentioned above, agencies such as the Pipeline and Hazardous Materials Safety Administration from the Department of Transportation (DOT) in US, regulates the operation of pipelines all over the country; similar agencies or Ministers play the same role in different countries, establishing all the norms and restrictions to operate these networks. Pipeline companies should comply with these regulations which may define from basics such as minimum staff to run the operation, operator training requirements, up to very specifics including pipeline facilities, technology and applications required to ensure operational safety of the lines. As an example of these

regulations, in the State of Washington, it is mandatory for all pipeline operators to be able to detect and locate leaks of 8 percent of maximum flow within 15 minutes or less.

The social situation also affects directly the operation of pipelines. In third world countries, product theft is a critical problem for pipeline companies. It is very often to find unauthorized extractions in the middle of the pipeline, then it is required to have the technology to detect and locate these controlled leaks. In this case, the detection levels should be under 2 percent of maximum flow, with a high expectation for location accuracy.

Different types of technologies and strategies have been implemented, from walking the lines every so often up to satellite surveillance. However the most common technology to protect these lines from occasional leaks is know as Computational Pipeline Monitoring Systems or CPM. CPM takes information from the field related to pressures, flows and temperatures to estimate the hydraulic behavior of the product being transported. Once the estimation is done, the results are compared to other field references to detect the presence of an anomaly or unexpected situation, which may be related to a leak incident. These CPM systems are the foundation to ensure the operational security of these pipelines.

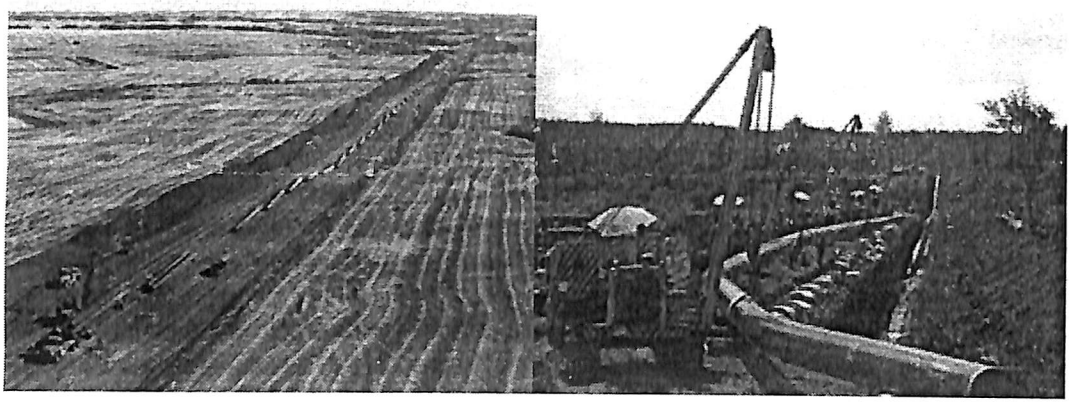
The American Petroleum Institute has published several articles during the last 20 years related to the considerations to implement and evaluate the performance of a CPM in liquids pipelines, the API Publications are:

- API 1130 – Computational pipeline monitoring for liquids pipelines
- API 1155 – Evaluation methodology for software based leak detection systems
- API 1149 – Pipeline variable uncertainties & their effects on leak detectability

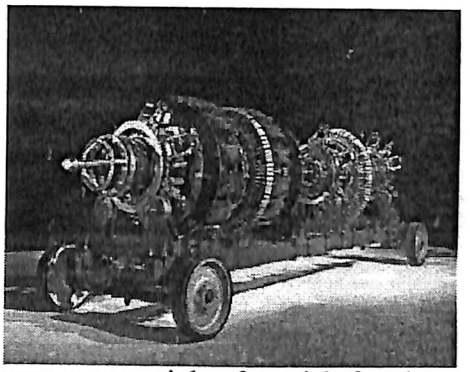
Strength of Pipeline Infrastructure:

- Negligible transit loss
- Cost effective- depending upon capacity utilization
- Energy efficient-Only the product moves whereas the container remains stationery
- Reliable, Safe, environment friendly
- Improved Air Quality: Arrests pollution due to emission from vehicles transporting the Petroleum Products.
- Also, no Product evaporation (during loading / unloading as in Road / Rail transportation).
- Efficient Land Use: With buried underground pipelines, no disturbance to Land from use.
- Multi-product Transportation: More than one Product can be transported without purging / cleaning procedures.
- No impact on supply from Strikes, *Rasta Roko*, Floods, Cyclones, Monsoon etc.
- Pipeline can traverse most difficult terrains not reachable by Rail / Road.
- Flexibility in capacity increase at a short notice – Drag reducer, addition of Pumps / Pumping stations.

- Over all clear edge for pipelines especially crude oil due to: high volumes, less uncertainty on throughputs and in Indian context, mostly inland movement not competing with Tankers.



Pipeline Inspection and Safety



In order to ensure the efficient and safe operation of the extensive network of natural gas pipelines, pipeline companies routinely inspect their pipelines for corrosion and defects. This is done through the use of sophisticated pieces of equipment known as pigs. Pigs are intelligent robotic devices that are propelled down pipelines to evaluate the interior of the pipe. Pigs can test pipe thickness, and roundness, check for signs of corrosion, detect minute leaks, and any other defect along the interior of the pipeline that may either impede the flow of gas, or pose a potential safety risk for the operation of the pipeline. Sending a pig down a pipeline is fittingly known as 'pigging' the pipeline.

Few of the safety precautions associated with natural gas pipelines include:

- **Aerial Patrols** - Planes are used to ensure no construction activities are taking place too close to the route of the pipeline, particularly in residential areas. Unauthorized construction and digging is the primary threat to pipeline safety.
- **Leak Detection** - Natural gas detecting equipment is periodically used by pipeline personnel on the surface to check for leaks. This is especially important in areas where the natural gas is not odorized.
- **Pipeline Markers** - Signs on the surface above natural gas pipelines indicate the presence of underground pipelines to the public, to reduce the chance of any interference with the pipeline.
- **Gas Sampling** - Routine sampling of the natural gas in pipelines ensures its quality, and may also indicate corrosion of the interior of the pipeline, or the influx of contaminants.

- Preventative Maintenance - This involves the testing of valves and the removal of surface impediments to pipeline inspection.

Pipeline Industry History:

In early 1860 attempts made to lay crude pipeline using gravity principle by Mr. James L. Hutchings. The cast iron pipes used in oil transportation posed problems of leakage in the system during year 1863-64. The first successful crude oil pipeline was constructed using wrought iron pipes for a total length of 32,000 feet in Pit Hole Creek Ohio. Subsequently in 1867, 62 mile long, pipeline constructed in Columbia. *First trunk crude oil pipeline (1960-62):* 1156 km long pipeline from Naharkatiya and Moran oil fields to the refineries at Guwahati and Barauni for transporting 5.5 MMTPA crude oil. *First cross country product pipeline (1962-64):* Guwahati refinery to Siliguri with a capacity to transport 0.48 Million metric tones of product through 435 kms. 8" line. Subsequently number of petroleum pipelines has been laid.
As far as the Asian continent is concerned, following is the list of major oil and gas pipelines, existing and proposed, which will be covered in this study:

Existing:

- Kazakhstan-China oil Pipeline
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- Eastern Siberia-Pacific Ocean oil pipeline
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- Trans-Caspian Gas Pipeline
- Trans-Caspian Oil Pipeline
- Transnational Pipeline projects for India

CHAPTER : 2

EXISTING PIPELINE PROJECTS IN ASIA

Kazakhstan-China oil pipeline

The Kazakhstan-China oil pipeline is China's first direct oil import pipeline. When fully completed, the 3,000 kilometers (1,900 mi) long pipeline will run from Atyrau in Kazakhstan to Alashankou in China's Xinjiang Uygur Autonomous Region. The pipeline is being developed by the China National Petroleum Corporation (CNPC) and the Kazakh oil company KazMunayGas.

The construction of pipeline was agreed between China and Kazakhstan in 1997. The first section of pipeline from the Aktobe region's oil fields to the Atyrau was completed in 2003. Currently the flow along the pipeline is from East to West while the remaining section of the pipeline is completed, as this allows oil from the Kenkiyak field to be exported through the Caspian Pipeline Consortium (CPC). Once the third section is completed the flow will reverse allowing oil from the Precaspian Basin to be exported to China. The construction of the 987 kilometers Atasulong second section of pipeline from Atasu to Alashankou started in September 2004 and was completed in December 2005.

The Kenkiyah-Atyrau section of the pipeline is 449 km long and has a capacity of 120,000 bbl/d. Capacity of the pipeline maybe upgraded to 180,000 bbl/d in the future. The pipeline was built and is operated by MunaiT as a joint venture between CNPC and KazMunaiGaz.

The Atasu-Alashankou section of the pipeline is 1000 km long and has a capacity of 20,000 bbl/d. Capacity of the pipeline might be upgraded to 400,000 bbl/d by 2011. The pipeline was built and is operated by a joint venture between CNODC and KazTrans Oil JSC.

The Atasu-Alashankou pipeline cost US$700 million, and its capacity is 10 million tons a year, which will increase later to 20 million tons. The pipeline includes an oil metering station at the Alataw Pass. In Alashankou this section is connected with the Alashankou-Dushanzi Crude Oil Pipeline.

Advantages: This KCP is advantageous for Kazakhstan as well as China. As opposed to every other existent or proposed pipeline route for Central Asian oil, the KCP provides a direct transport route. Transit fees do not need to be paid, and no country can hold Kazakhstan's oil hostage by arbitrarily raising fees or closing the pipeline. Additionally, China has shown a willingness to overpay for natural resources and its demand for oil should not abate anytime in the near future, so Kazakhstan is guaranteed a purchaser. It is also unlikely that the fairly opaque Chinese government will care much about the corruption of its Kazakh partners, so long as the oil is delivered on time and at the agreed-upon price. As the pipeline is already mostly

constructed and has only two developers, there is little chance that it will not be completed or that it will have difficulty in providing reliable transport.

Disadvantages: Even though the terrain is fairly flat, 3000 km is a long way to run a pipeline. The added cost of transit due to this length somewhat offsets the transit fees of shorter routes for Caspian oil. Additionally, the extreme cold of the Kazakh steppe during the winter months means that with the relatively low quality of the oil, which has high paraffin content (and thus lower viscosity), the oil in the pipelines may completely stop if the pumping stations temporarily stop, as happened in the winter of 2005-2006. Both the length and harsh weather increase the cost of maintenance and repairs for the pipeline. Also, the KCP is strictly for oil. China has comparatively much larger gas reserves than it does oil, and it already receives a steady supply of gas from the Russian fields. While there have been feasibility studies of a Kazakhstan-China gas pipeline, the estimated $4 billion price tag has so far proven prohibitive. Therefore, another route must be found for Kazakhstan's gas.

Alashankou-Dushanzi Crude Oil Pipeline

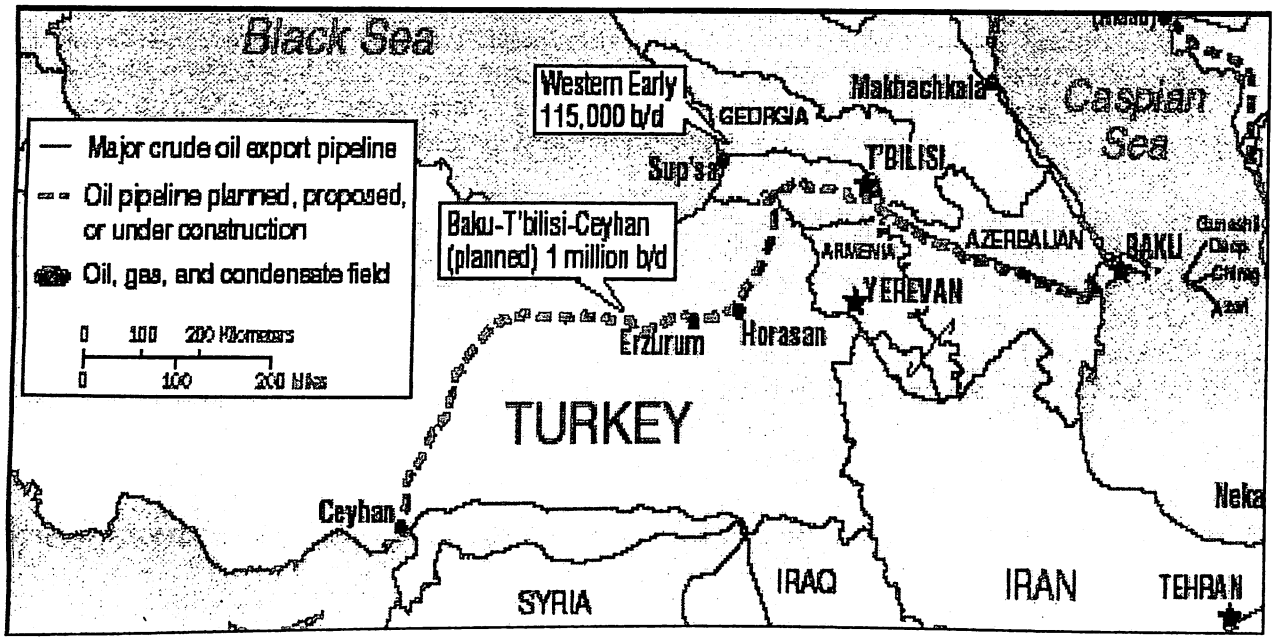
The Alashankou-Dushanzi Crude Oil Pipeline is a 246 kilometer long pipeline in Xinjiang Uygur Autonomous Region in China, which connects the Kazakhstan-China oil pipeline (Atasu-Alashankou pipeline) with Dushanzi District. The capacity of pipeline is 10 million tons of oil per year and it's supplying mainly the Dushanzi refinery. The pipeline became

operational on 21 December 2005 and the first oil through this pipeline reached to the refinery in August 2006. The pipeline is constructed and operated by the China National Petroleum Corporation (CNPC).

The third section of the Kazakhstan-China oil pipeline will be Kenkiyak-Kumkol is under construction. The construction was agreed between Kazakhstan and China on 18 August 2007. This section is expected to be completed in October 2009 and to reach full capacity in 2011.

Baku-Tbilisi-Ceyhan pipeline

The Baku-Tbilisi-Ceyhan pipeline (sometimes abbreviated as BTC pipeline) is a crude oil pipeline that covers 1,768 kilometers (1,099 mi) from the Azeri-Chirag-Guneshli oil field in the Caspian Sea to the Mediterranean Sea. It connects Baku, the capital of Azerbaijan; Tbilisi, the capital of Georgia; and Ceyhan, a port on the south-eastern Mediterranean coast of Turkey, hence its name. It is the second longest oil pipeline in the world after the Druzhba pipeline. The first oil that was pumped from the Baku end of the pipeline on May 10, 2005 reached Ceyhan on May 28, 2006.



History:

Planning

The Caspian Sea lies above one of the world's largest groups of oil and gas fields. As the Caspian Sea is landlocked, the transportation of oil to Western markets is complicated. During Soviet times, all transportation routes from the Caspian region were built through Russia.

The collapse of the Soviet Union started a search for new routes. Russia first insisted that the new pipeline should pass through Russian territory, then declined to participate. A pipeline across Iran from the Caspian Sea to the Persian Gulf would have provided the shortest route, but Iran was considered an undesirable partner for a number of reasons: its theocratic government, concerns about its nuclear program, and United States sanctions that greatly restrict Western investment (especially by American companies) in the country. The United States government opposed any route that would pass through Iran.

At the time, Turkey called for energy transit through Turkey, insisting that this would be the safest and most economic route for export. In the spring of 1992, the Turkish Prime Minister Süleyman Demirel made this proposal to Central Asian countries and Azerbaijan. The first document on the construction of the Baku-Tbilisi-Ceyhan pipeline was signed between Azerbaijan and Turkey on 9 March 1993 in Ankara.

The choice of a Turkish route meant oil export from Azerbaijan via either Georgia or Armenia. For several reasons a route through Armenia was politically inconvenient, mainly because of the unresolved military conflict between Armenia and Azerbaijan over Nagorno-Karabakh. This left the Azerbaijan-Georgia-Turkey route as politically most expedient for the major parties, although it was longer and more expensive to build than the other options.

The BTC pipeline project gained momentum following the Ankara Declaration, adopted on 29 October 1998 by President of Azerbaijan Heydar Aliyev, President of Georgia Eduard Shevardnadze, President of Kazakhstan Nursultan Nazarbayev, President of Turkey Süleyman Demirel, and President of Uzbekistan Islom Karimov. The declaration was witnessed by the United States Secretary of Energy Bill Richardson, who expressed strong support for the BTC pipeline. The intergovernmental agreement in support of the BTC pipeline was signed by Azerbaijan, Georgia, and Turkey on 18 November 1999, during a meeting of the Organization for Security and Cooperation in Europe (OSCE) in Istanbul, Turkey.

Construction

The Baku-Tbilisi-Ceyhan Pipeline Company (BTC Co.) was founded during a document signing ceremony in London on 1 August 2002. The official ceremony launching construction of the pipeline was held on 18 September 2002. Construction began in April of 2003 and was completed in 2005. The Azerbaijan section was constructed by Consolidated Contractors International of Greece, and Georgia's section was constructed by a joint venture of France's Spie Capag and US Petrofac Petrofac International. The Turkish section was constructed by BOTAŞ. Bechtel was the main contractor for engineering, procurement and construction.

Inauguration

All together, three official inauguration ceremonies were held. On 25 May 2005, the pipeline was officially inaugurated at the Sangachal terminal by President Ilham Aliyev of the Azerbaijan Republic, President Mikhail Saakashvili of Georgia and President Ahmet Sezer of Turkey, joined by President Nursaltan Nazarbayev of Kazakhstan, as well as United States Secretary of Energy Samuel Bodman.[9] The inauguration of the Georgian section of the pipeline was hosted by President Mikheil Saakashvili at the BTC pumping station near Gardabani on 12 October 2005. The inauguration ceremony at the Ceyhan terminal was held on 13 July 2006.

Oil that was pumped from the Baku end of the pipeline on May 10, 2005 reached Ceyhan in May 28, 2006 after a journey of 1,770 km. The first oil was loaded at the Cheyhan Marine Terminal (Haydar Aliyev Terminal) onto a ship named British Hawthorn.[12] The tanker sailed away from the port on 4 June 2006 with about 600,000 barrels of crude oil. This marked the start of export of Azerbaijan's oil via the BTC oil pipeline to world markets.

Description of the pipeline:

Route

The pipeline starts from the Sangachal Terminal near Baku in Azerbaijan. The route of the pipeline crosses Azerbaijan, Georgia and Turkey to Ceyhan. The pipeline's destination is the Ceyhan Marine Terminal (Haydar Aliyev Terminal) on the south-eastern Mediterranean coast of Turkey. Of its total length of 1,768 kilometers (1,099 mi), 443 kilometers (275 mi) lie in Azerbaijan, 249 kilometers (155 mi) in Georgia and 1,076 kilometers (669 mi) in Turkey. It crosses several mountain ranges at altitudes to 2,830 metres (9,300 ft). It also traverses 3,000 roads, railways, and utility lines—both overground and underground—as well as 1,500 watercourses of up to 500 metres (1,600 ft) wide (in the case of the Ceyhan River in Turkey). The pipeline occupies a corridor eight meters wide, and is buried along its entire length at a depth of no less than one meter. Parallel to the BTC pipeline runs the South Caucasus Gas Pipeline, which transports natural gas from the Sangachal Terminal to Erzurum in Turkey. Between Sarız and Ceyhan, the Samsun-Ceyhan oil pipeline will be laid along the same corridor.

Technical features

The pipeline has a projected lifespan of 40 years, and when working at normal capacity, beginning in 2009, will transport 1 million barrels (160 000 m^3) of oil per day. It has a capacity of 10 million barrels of oil, which will flow through the pipeline at 2 metres (6.6 ft) per second. There are 8 pump stations through the pipeline route (2 in Azerbaijan, 2 in Georgia, 4 in Turkey). The project includes also the Ceyhan Marine Terminal, two intermediate pigging stations, one pressure reduction station, and 101 small block valves. It was constructed from 150,000 individual joints of line pipe, each measuring 12 metres (39 ft) in length. This corresponds to a total weight of approximately 655,000 short tons (594,000 metric tons). The pipeline is 1,070 mm (42 inches) diameter for most of its length, narrowing to 865 mm (34 inches) diameter as it nears Ceyhan.

Cost and financing

The pipeline cost US$3.9 billion. Around 15,000 people were employed during the construction of the pipeline. Approximately 70% of BTC costs are being funded by third parties, including the World Bank's International Finance Corporation, the European Bank for Reconstruction and Development, export credit agencies of seven countries and a syndicate of 15 commercial banks.

Source of supply

The BTC pipeline is supplied by oil from Azerbaijan's Azeri-Chirag-Guneshli oil field in the Caspian Sea. In this pipeline may also transport oil from the Kazakhstan's Kashagan oil field as well as from other oil fields in Central Asia. The government of Kazakhstan had announced that it would seek to build a trans-Caspian oil pipeline from the Kazakhstani port of Aktau to Baku and in turn to the BTC pipeline. However, due to opposition to a Caspian offshore pipeline by both Russia and Iran, the oil pipeline is doubtful. Therefore Kazakhstan has announced a new project named Kazakh-Caspian Transportation System, which is scheduled to come into operation in 2010. The project includes a pipeline from Iskene to the Caspian port of Kuryk, terminals in Kazakhstan and Azerbaijan, and construction of oil tankers. The project is at the pre-feasibility stage.

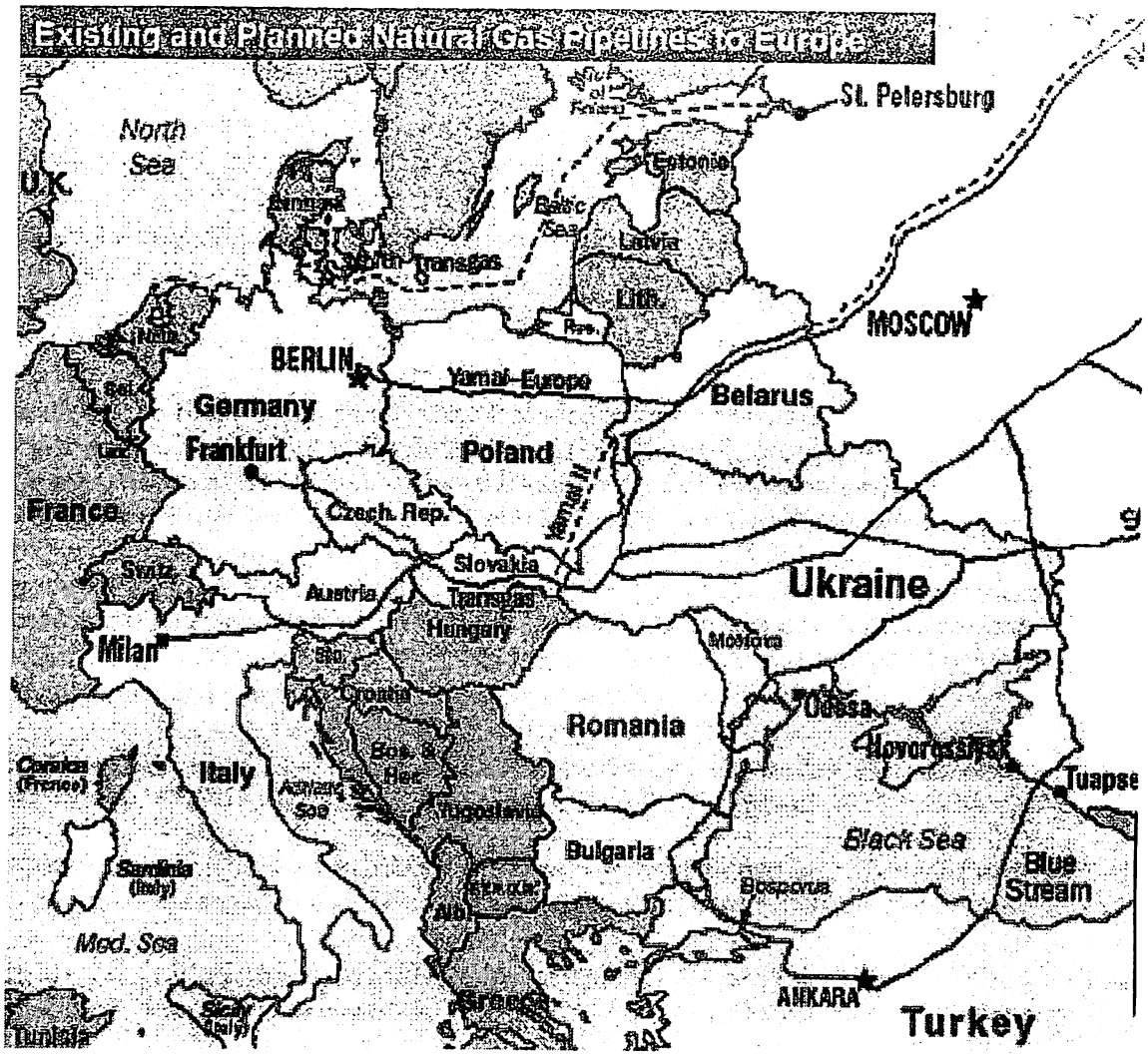
Possible transhipment via Israel

It has been proposed that oil from the BTC pipeline may be transported to eastern Asia via the Israeli oil terminals at Ashkelon and Eilat, the overland trans-Israel sector being bridged by the Eilat-Ashkelon Pipeline owned by the Eilat Ashkelon Pipeline Company (EAPC).

Blue Stream Pipeline

Blue Stream is a major trans-Black Sea gas pipeline that carries natural gas from Russia into Turkey. The pipeline has been constructed by the Blue Stream Pipeline B.V. , the Netherlands based joint venture of Russian Gazprom and Italian ENI. The Blue Stream Pipeline B.V. is an owner of the sea section of pipeline, including Beregovaya compressor station, while Gazprom owns and operates the Russian land section of the pipeline and the Turkish land section is owned and operated by the Turkish energy company BOTAŞ. According to Gazprom the pipeline was built with the intent of diversifying Russian gas delivery routes to Turkey and avoiding third countries.

The Blue Stream pipeline has been officially inaugurated at the Durusu gas metering station in November 2005



Technical features

By 2010, Blue Stream is expected to be operating at full capacity, delivering 16 billion cubic meters of gas per year. Total length of the pipeline is 1213 km. The Russia's land section is 373 km-long from the Izobilnoye gas plant, Stavropol Krai, up to Arkhipo-Osipovka, Krasnodar Krai. The land section consists the Stavropolskaya and Krasnodarskaya compressor stations. The offshore section is 396 km-long laying from the Beregovaya compressor station in Arkhipo-Osipovka to the Durusu terminal locating 60 kilometers from Samsun (Turkey). Turkey's land section is 444-kilometers up to Ankara.

The pipeline uses pipes with different diameters: mainland section 1400 mm, mountainous section 1200 mm and submarine section 610 mm. The gas pressure in submarine section is 250 atm.

Financing

The total cost of the Blue Stream pipeline came to $3.2 billion, including $1.7 billion spent on building its underwater segment.

Political background

Building the Blue Stream pipeline was intended to be the foundation for a "strategic partnership" between Russia and Turkey, with joint participation in oil, energy, and transport projects. The political decision to sell Russian gas to Turkey was made in December 1997, when the two sides signed a corresponding inter-governmental agreement in which Russia undertook to supply 364.5 billion cubic meters of gas to Turkey between 2000 and 2025. The existing gas transit route went through Ukraine, Moldova, Romania, and Bulgaria. But this land route made the gas substantially more expensive, and there were continual reports of gas being illicitly siphoned off while being transported through Ukraine and Moldova. Russia considered that these problems could be solved by building a pipeline across the Black Sea floor.

The construction of Blue Stream was accompanied by environmentalist protests; but these had no significant effect, since the official environmental impact assessment found no transgressions.

Meanwhile, some Russian economic analysts objected that building a pipeline to Ankara meant tying Russia to a monopolist consumer, and Turkey was not a reliable partner.

In the lead-up to Blue Stream's opening ceremony, the United States publicly criticized the pipeline, calling on Europe to avoid becoming any more dependent on Russia for energy.

Importance

The Russia-Turkey gas pipeline (Blue Stream) is a unique gas transmission network. Thousands of specialists from Russia, Italy and Turkey have been involved in the pipeline construction using domestic as well as western (Italian, German and Japanese) materials and equipment.

Blue Stream is aimed at Russian natural gas supply to Turkey via the Black Sea offshore area avoiding third countries. The project is an additional way for the existing gas transmission corridor from Russia to Turkey crossing the territory of Ukraine, Moldova, Romania and Bulgaria. Gas deliveries via Blue Stream will significantly increase gas supply reliability in the aim of developing Turkey's gas market and infrastructure.

Druzhba pipeline

The Druzhba pipeline (Russian: нефтепровод «Дружба»; also had been referred as the Comecon Pipeline) is the world's longest oil pipeline, it carries oil some 4,000 kilometers (2,500 mi) from southeast Russia to points in Ukraine, Hungary, Poland, and Germany. The name "Druzhba" means "friendship", alluding to the fact that the pipeline was intended to supply oil to the energy-hungry western regions of the Soviet Union, to its "fraternal socialist allies" in the former Soviet bloc, and to western Europe. Today, it is the largest principal artery for the transportation of Russian (and Kazakh) oil across Europe.

History

On 18 December 1959, the 10th session of the Council for Mutual Economic Assistance (Comecon), held in Prague, adopted a decision and an agreement was signed on construction of a trunk crude oil pipeline from the USSR into Poland, Czechoslovakia, GDR and Hungary. Each country was to supply all necessary construction materials, machinery and equipment. In 1962, first oil reached to Czechoslovakia, in September 1963 to Hungary, in November 1963 to Poland, and in December 1963 to GDR. The whole of the pipeline was put into operation in October 1964. The first oil pumped through the Druzhba pipeline originated from the oil fields in Tatarstan and Samara (Kuybyshev) Oblast. In 1970s the Druzhba pipeline system was further prolonged at the expense of parallel lines.

Route

The pipeline begins from Almetyevsk in Tatarstan, southeastern Russia, where it collects oil from western Siberia, the Urals, and the Caspian Sea. It runs to Mozyr in southern Belarus, where it splits into a northern and southern branch. The northern branch crosses the remainder of Belarus across Poland to Schwedt in Germany. It supplies refineries in Płock and in Schwedt. The northern branch is also connected by the Płock-Gdansk pipeline with the Naftoport terminal in Gdansk, which is used for oil re-exports. In Schwedt the Druzhba pipeline is connected with the MVL pipeline to Rostock and Spergau.

The southern branch runs south through Ukraine. In Brody the Druzhba pipeline is connected with the Odessa-Brody pipeline, which is currently used to ship oil from the Druzhba pipeline to the Black Sea. In Uzhgorod the pipeline splits into lines to Slovakia (Druzhba-1 - original Druzhba route) and to Hungary (Druzhba-2). The line trough Slovakia is divided once again near Bratislava: one branch leading in a northwest to Czech Republic and the other going southward to Hungary. The Druzhba-1 pipeline branches off toward Hungary at Ipeľ, crosses the Hungarian border at Dregelypalank and leads to Százhalombatta. In Hungary, the Druzhba-1 pipeline supplies Duna refinery while Druzhba-2 supplies Duna and Tisza refineries.

The Mažeikių refinery in Lithuania and Ventspils oil terminal in Latvia are connected to the main pipeline by the branch pipeline from Unecha junction in Bryansk Oblast. This branch has ceased operation in 2006 and is not likely to become again operational.

The part of Druzhba pipeline system, which runs via Belarus, is 2,910 kilometers (1,810 mi) long. The length of the pipeline in Ukraine is 1,490 kilometers (930 mi), in Poland in 670 kilometers (420 mi), in Hungary 130 kilometers (80 mi), in Lithuania 332 kilometers (206 mi), in Latvia 420 kilometers (261 mi), and in Slovakia and in the Czech Republic together around 400 kilometers (250 mi).

Techical features

The Druzhba pipeline currently has a capacity of 1.2 to 1.4 million barrels per day. Work is currently underway to increase this in the section between Belarus and Poland. The pipes of the pipeline varies from 420 millimetres (17 in) to 1,020 millimetres (40 in). It uses 20 pumping stations.

Operators

The Russian part of the pipeline is operated by the oil company Transneft through its subsidiary OAO MN Druzhba. In Belarus the operator is Gomeltransneft Druzhba, in Ukraina UkrTransNafta, in Poland PERN company, in Slovakia Transpetrol, in the Czech Republic Mero and in Hungary MOL.

Iran-Armenia Natural Gas Pipeline

The Iran-Armenia Gas Pipeline is a 140 km pipeline from Iran to Armenia. The 100 km Iranian section runs from Tabriz to Iran-Armenia border. The Armenian section runs from the Meghri region to Sardarian, and another 197 km of pipeline is planned to reach the center of the country, where it will link up with the existing distribution network. The diameter of pipeline is 700 mm and it cost about 220 million USD. The initial capacity of pipeline is 1.1 bcm of natural gas annually, which will be increased up to 2.3 bcm by 2019. The contract was signed for 20 years. For each cubic meter of the Iranian gas, Armenia is supposed to return 3 kwh of electric energy to Iran. The pipeline started operation on 20 December 2006, and was officially inaugurated by the Presidents Mahmoud Ahmadinejad of Iran and Robert Kocharyan of Armenia on 19 March 2007. There are discussions to build a second pipeline from Iran to Armenia.

Many suspect that the pipeline's diameter was reduced from 1,420 mm to 700 mm under pressure from Gazprom, which purchased a majority share in the Armenian section of the pipeline through its subsidiary, Armrosgazprom. If the pipeline had been built at the initial diameter, it would have allowed Iran to export to markets in Europe, thereby competing with Russia's own natural gas industry.

Odessa-Brody pipeline

The Odessa-Brody pipeline is a crude oil pipeline between the Ukrainian cities Odessa at the Black Sea, and Brody near the Ukrainian-Polish border. There are plans to expand the pipeline to Płock, and furthermore to Gdańsk in Poland. The pipeline is operated by Ukrtransnafta, the Ukraine's state-owned oil pipeline company.

History

The usage and direction of Odessa-Brody pipeline is considered to be of considerable geopolitical significance and has thus been the subject of both political disagreement and international pressure. The pipeline was originally intended to reach Gdańsk in order to transfer oil from the Caspian Sea (mainly from Kazakhstan) to the Polish Baltic Sea port and from there to the rest of Europe. The Pivdenny maritime terminal in Odessa and the pipeline between Odessa and Brody were built in 2001 and the state oil transport company Ukrtransnafta was established to develop the commercial attractiveness of the Odessa-Brody pipeline. However, the pipeline remained unused until 2004.

However, as sufficient capacities of oil supplies were not agreed, on 5 July 2004 the Ukrainian cabinet accepted proposal of Russian oil companies to reverse the pipeline flow, and thus making it transfer Russian oil southwards to the Black Sea and from there to Mediterranean destinations. Currently the oil is shipped to the pipeline from the junction of the southern branch of Druzhba pipeline.

Technical features

The current length of the pipeline is 674 kilometers (419 mi). The pipeline is operated by Ukrtransnafta, and the oil is shipped by TNK-BP. In 2006 TNK-BP pumped 3.42 million tons of oil through the pipeline. In 2007, this volume was exceeded as already during seven month in January-July almost 5.3 million tons of oil were pumped transported.

There are ongoing intentions to implement original project. On 13 May 2003, the European Commission declared the Odessa-Brody-Płock oil transportation project as a project of Pan-European interest and the trilateral EU-Ukraine-Poland Joint Expert Working Group (OBP JEWG) was created.

In 2005, after the success of Viktor Yushchenko in the 2004 Ukrainian presidential election and the Orange Revolution, the new government has shown interest in using the pipeline in the direction originally intended, in order to transfer oil from the Caspian to Europe. The pipeline is planned to be prolonged to Płock in Poland, and from there through the existing branch off of the northern branch of Druzhba pipeline to Gdańsk. For developing this project, Ukrtransnafta and Poland's pipeline operator PERN formed a joint venture Sarmatia sp.z.o.o. on 12 July 2004.

On 27 October 2006 at the European Union-Ukraine summit, the President of Ukraine Viktor Yushchenko proposed to build an extension via Slovakia to Kralupy refinery in the Czech Republic. On 15 November 2006, the idea was supported by Ukraine's prime minister Viktor Yanukovych.

On 11 May 2007 the presidents of Poland, Ukraine, Lithuania, Georgia and Azerbaijan, and the special envoy of the president of Kazakhstan agreed on the construction of a pipeline linking existing pipeline with Gdansk.

On 5 June 2007, at the Gdańsk meeting the intergovernmental working group of the project agreed to expand the composition of shareholders of Sarmatia sp.z.o.o. by companies from Azerbaijan, Georgia and Lithuania.[6] New shareholders probably will be Lithuania's Klaipedos Nafta, Georgian Oil and Gas Corporation (GOGC) and the State Oil Company of the Azerbaijani Republic (SOCAR). According to the agreements between the companies, Ukrtransnafta, PERN, SOCAR and GOGC will each own 24.75% of the shares, while Klaipedos Nafta will own 1% of shares.

On 10 October 2007, the agreement forming a pipeline consortium was signed by the presidents of Poland, Ukraine, Lithuania, Georgia and Azerbaijan at the energy security conference in Vilnius.

Trans-Israel pipeline

The Trans-Israel pipeline also known as the Tipline or the Eilat-Ashkelon Pipeline was built in 1968 to transport crude oil from the Shah's Iran to Europe. The 254km, 42" pipeline's capacity from special pier in Ashkelon to Eilat's port on the Red Sea is 400,000 barrels per day and 1.2 million barrels per day (190,000 m^3/d) in the opposite direction. The pipeline is owned and operated by the Eilat Ashkelon Pipeline Company (EAPC) which also operates several other oil pipelines in Israel.

In 2003, Israel and Russia made an agreement to supply Asian markets with Russian oil delivered by tankers from Novorossiysk to Ashkelon and then reloaded onto tankers in Eilat for shipment to Asia. This route is shorter than the traditional one around Africa, and cheaper than via the Suez Canal.

West-East Gas Pipeline

The West-East Gas Pipeline is a 4,000 kilometers (2,500 mi) long pipeline, which runs from Lunnan in Xinjiang to Shanghai. The pipeline pass through 66 counties in the 10 provinces in China. Natural gas transported by the pipeline is used for electricity production in the Yangtze River Delta area. There is a plan to replace use of coal by gas in Shanghai by 2010.

History

The construction of the West-East Gas Pipeline started in 2002 and it was put into operation on 1 October 2004. The pipeline is owned and operated by the Natural Gas and Pipeline Company, subsidiary of PetroChina. Originally was agreed that PetroChina would have had 50% of the pipeline, while Royal Dutch Shell, Gazprom and ExxonMobil had been slated to hold 15% each and Sinopec 5%. However, in August 2006 this agreement was terminated by PetroChina.

Technical features

Capacity of the pipeline is 12 bcm natural gas annually. The cost of pipeline was $5.7 billion. By the end of 2007 the capacity is planned to be upgraded up to 17 bcm. For this purpose 10 new gas compressor stations will be built and 8 existing stations will be upgraded.

Connections

The West-East Gas Pipeline is connected to the Shaan-Jing Parallel Pipeline by the 886 kilometers (551 mi) long Ji-Ning branch between the Qingshan Distributing Station and the Anping Distributing Station, operational since 30 December 2005.

Source of supply

The pipeline is supplied from the Tarim Basin gas fields in Xinjiang province. The Changqing gas area in Shaanxi province is a secondary gas source. In future, the planned Kazakhstan-China gas pipeline will be connected to the West-East Gas Pipeline.

Construction of the second west-east gas pipeline started on 22 February 2008. The pipeline with the total length of 9,102 kilometers (5,656 mi), including 4,843 kilometers (3,009 mi) of main line and eight sub-lines, will run from Khorgos in northwestern Xinjiang to Guangzhou in Guangdong. Up to Gansu, it will be parallel and interconnected with the first west-east pipeline. The western part of the main line is expected to be commissioned by 2009 and the eastern part by June 2011.

The capacity of the pipeline would be 30 bcm of natural gas per year. It will be mainly supplied by the Central Asia-China gas pipeline. The pipeline is expected to cost US$ 20 billion. It will be developed by China National Oil and Gas Exploration and Development Corp. (CNODC), a joint venture of China National Petroleum Corporation and PetroChina.

CHAPTER : 3

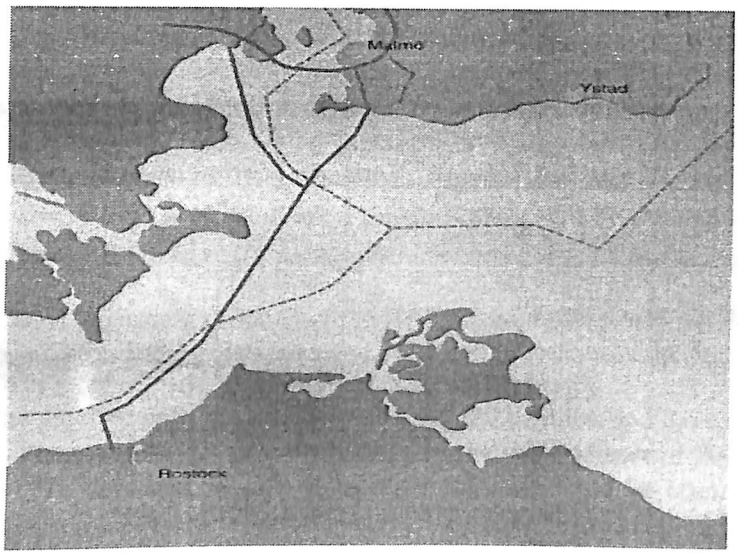
PROPOSED PIPELINES: SPECIFICATIONS AND ANALYSIS

Baltic Gas Interconnector

The Baltic Gas Interconnector is a planned natural gas submarine pipeline between Germany, Denmark and Sweden. In Germany, landfall of the pipeline will be in Rostock area. The German onshore section includes a compressor station and a connection to the existing gas network. The length of offshore section is planned to be around 200 kilometers. The Danish landing point will be in Avedøre, and the pipeline will be connected with the Avedøre power plant. In Sweden, the landing point will be in Trelleborg and the Swedish onshore section will continue approximately 20 kilometers to the existing gas grid.

The pipeline will be designed for a pressure of 150 bar (15 MPa) with a diameter of 28 to 32 inches (457 to 813 mm). The annual capacity is planned to be 3 billion cubic meter (bcm). The consortium to build the Baltic Gas Interconnector consists of DONG Energy (originally Energi E2), Hovedstadsregionens Naturgas (HNG), Verbundsnetz Gas AG (VNG), E.ON Sverige AB, Göteborgs Energi, Lunds Energi and Öresundskraft.

The feasibility study was completed in 2001 and the environmental impact assessment started in 2002. However, the Swedish government approved the plan only in 2005. The pipeline is expected to be completed in 2009.



Eastern Siberia-Pacific Ocean oil pipeline

The Eastern Siberia – Pacific Ocean oil pipeline (ESPO pipeline) is a 4,130 kilometers (2,570 mi) long pipeline system to export Russian crude oil to the Asia-Pacific markets (Japan, China, Korea). The pipeline is being laid by the route of Taishet-Kazachinskoe-Skovorodino-Perevoznaya–(Nakhodka). From Skovorodino the branch pipeline would extend to Daqing, China.

Because of protests of environmental organizations, the pipeline route was moved 40 kilometers north of Lake Baikal. The pipeline will be operated by Russian pipeline company Transneft.

Technical features

The capacity of 1,220 millimetres (48 in) diameter pipeline will be 80 millions tons of crude oil. The pipeline will consist 32 pumping stations, including 13 with tank farms with total capacity of 2.67 million cubic meter. Transneft also has plans to construct the second pipeline within seven to eight years after commissioning the first one.

For feeding pumping stations with electricity, a 35 MW power station will be build near the town of Olyokminsk in the Sakha Republic. It will be fired by the crude oil from the ESPO pipeline. The power station will be designed for independent operation in demanding arctic temperature conditions.

Construction

The construction of 2,694 km (1,674 mi) long first stage of the pipeline started in April 2006. This first section will run from Taishet in Irkutsk Oblast to Skovorodino in Amur Oblast. From Skorovodino, an extension will be built to China. The first stage consists also construction of an export terminal in Primorsky Krai. The pipeline is being built by Systema SpecStroy, Krasnodarstroytransgaz, Vostok Stroy, Promstroy, Amerco Int. and IP Set Spb. Five 16V32 crude oil-fired engines for the pipeline-related power station will be delivered in summer 2008 by Wärtsilä.

On 22 November 2007, Transneft announced the first phase pipeline was 41 % complete instead of a projected 60%, while pumping stations were 24 % ready instead of 56 %.

The first stage of the pipeline with the total cost of US$12.27 billion and the export terminal with cost of US$1.74 billion are planned to be completed in the third quarter of 2009.Construction of the second stage would start after launch of the first stage. It could be commissioned between 2015-2017.

Recourse base

The pipeline will be supplied from the oil fields of Tomsk Oblast and the Khanty-Mansi Autonomous Okrug in Western Siberia along the existing Omsk-Irkutsk pipeline that will join the new project in Taishet, as well as oil provinces of Eastern Siberia. At the initial stage 22 million tons of oil will be supplied by Rosneft and 8 million tons by Surgutneftegaz.

Nabucco Pipeline

The Nabucco pipeline is a planned natural gas pipeline that will transport natural gas from Turkey to Austria, via Bulgaria, Romania, and Hungary. It will run from Erzurum in Turkey to Baumgarten an der March, a major natural gas hub in Austria. This pipeline is a diversion from the current methods of importing natural gas solely from Russia which exposes EC to dependance and insecurity of the Kremlin practices. The project is backed by the European Union and the United States

Route

The pipeline will run from Erzurum in Turkey to Baumgarten an der March in Austria with total length of 3,300 kilometers (2,050 mi). It will be connected near Erzurum with the Tabriz-Erzurum pipeline, and with the South Caucasus Pipeline, connecting Nabucco Pipeline with the planned Trans-Caspian Gas Pipeline.

Polish gas company PGNiG is studying the possibility of building a link to Poland with the Nabucco gas pipeline.

Technical features

In early years after completion the deliveries are expected to be between 4.5 and 13 billion cubic meters (bcm) per annum, of which 2 to 8 bcm goes to Baumgarten. Later, approximately half of the capacity is expected to be delivered to Baumgarten and half of the natural gas is to serve the markets en-route. The transmission volume of around 2020 is expected to reach 31 bcm per annum, of which up to 16 bcm goes to Baumgarten. The diameter of the pipeline would be 56 inches (1,420 mm).

Construction

The Nabucco project is included in the EU Trans-European Energy Network programme and a feasibility study for the Nabucco pipeline has been performed under an EU project grant. The FEED services of the pipeline, including the overall management of the local FEED contractors, the review of the technical feasibility study, route confirmation, preparation of the design basis, hydraulic studies, overall SCADA and telecommunications, GIS and preparation of tender packages for the next phase, is managed by UK-based consultancy Penspen.

Construction of pipeline is expected to begin in 2010 and is planned to be finished in 2013. It estimated to cost around €4.6 billion (US$5.8 billion). The company leading the project is OMV from Austria.

Supply sources

The EU currently relies heavily on natural gas from Russia and is eager to diversify its suppliers. Nabucco pipeline may be supplied with gas from Iran, Iraq, Azerbaijan, Kazakhstan, Turkmenistan, Egypt and Syria. The main source of supply will be the second stage of the Shah Deniz gas field, coming on-stream in 2013. There is an agreement for 8 bcm of natural gas per annum with further expansion. Turkmenistan would provide for Nabucco 10 bcm of gas annually. The Iraqi gas would be imported from the Ekas field via the Arab Gas Pipeline. In the long term, Egypt could provide 3-5 bcm of natural gas. There is also option, that Nabucco could be feeded with Russian natural gas through the Blue Stream pipeline

Analysis

Turkey and the European Union blame each other for the lack of progress in overcoming problems that have surfaced about the realization of the Nabucco natural gas pipeline project, linking the Caspian basin with Europe.

The problems in the commercial aspect of the project, which aims at delivering 30 billion cubic meters of gas through a 3,300-kilometer pipeline linking Turkey, Bulgaria, Romania, Hungary and Austria, remain unsolved. Turkey's stance on the pricing mechanism has met with objection from the EU as well as Azerbaijan, which will be the main supplier for the $5.8 billion project. With the argument that it wants to secure its own energy supply, the Turkish government seeks "privileged ownership" over a certain amount of gas that will go through the pipeline.

The EU expects Turkey to change its stance, whereas the Turkish government is still expecting the Union to come up with alternative proposals. But time is running out as the construction of alternative pipelines from Russia to Europe, might jeopardize the realization of the project.

However Turkey's position poses a key challenge for the Nabucco consortium that is subject to EU competition rules which require pipeline operators to grant open access to facilities at regulated prices. Turkish Energy Minister Hilmi Güler said recently that they have cleared the problems and invited the EU's coordinator for Nabucco, Jozias van Aartsen, to Turkey.

The EU claims that it understands Turkey's concerns, but it has not come up with any alternative yet. Hence the pipeline issue is in a dilemma and no result is seen possible in the near future.

Trans-Caspian Gas Pipeline

The Trans-Caspian Gas Pipeline is a proposed submarine pipeline between Türkmenbaşy in Turkmenistan, and Baku in Azerbaijan. By some proposals it will also include connection between Tengiz Field in Kazakhstan, and Türkmenbaşy. The aim of the Trans-Caspian Gas Pipeline project is the transportation of natural gas from Kazakhstan and Turkmenistan to central Europe, circumventing both Russia and Iran.

Description of pipeline

The planned capacity of the pipeline is 30 billion cubic meter (bcm) of natural gas per annum, and the estimated cost will be around US$ 5 billion. In Baku it will be connected with the South Caucasus Pipeline (Baku-Tbilisi-Erzurum pipeline), and through this with the planned Nabucco Pipeline (Turkey-Bulgaria-Romania-Hungary-Austria pipeline). The feasibility study of the pipeline will be carried out by Granherne, a subsidiary of KBR.). However, it is unlikely that the project will go beyond the planning stages in the near future.

History

The project of natural gas import from Turkmenistan through the submarine pipeline was suggested in 1996 by the United States. In February 1999, the Turkmen government entered into an agreement with General Electric and Bechtel Group for a feasibility study on the proposed pipeline. In 1999, while attending the OSCE meeting in Istanbul, Turkey, Georgia, Azerbaijan and Turkmenistan signed a number of agreements on the construction of pipelines. However, because of Russia's and Iran's opposition to the project, the unresolved legal dispute of the Caspian Sea boundaries and the gas discovery on Azerbaijan's Shah Deniz field, the submarine pipeline project was shelved in the summer of 2000 and only the South Caucasus Pipeline project was developed.

In January 2006, as a result of the Russia-Ukraine gas dispute, interest in the Trans-Caspian Gas Pipeline project was rekindled. On 11 January 2006, Azerbaijan's prime-minister Artur Rasizade proposed to his Kazakhstan colleague Danial Ahmetov that Kazakhstan gas be exported through the South Caucasus Pipeline to Turkey and further on to the European market. In March 2006, the Turkmen President Saparmurat Niyazov signaled his intention to rejoin possible negotiations on the pipeline In May 2006, during his visit to Kazakhstan, the European Commissioner for Energy Andris Piebalgs stated EU support for the construction of the Trans-Caspian pipeline. Vladimir Socor, however, had noted that the Ukrainian government seemed to prefer trilateral talks between Turkmenistan, Russia and Ukraine, not taking the Trans-Caspian gas pipeline into consideration. Azerbaijan's Industry and Energy Minister Natig Aliyev, while addressing an international energy conference in Baku, outlined the advantages of the Trans-Caspian gas pipeline for diversifying supplies and restraining prices. On the other hand, Russia's Industry and Energy Minister Viktor Khristenko commented: "Existing technical, legal, environmental and other risks relating to the trans-Caspian project are so great that it would be impossible to find an

investor. Unless this is a political project, and then it does not matter what would be inside the pipeline as long as it exists".

Critics

The project is heavily criticized by Russia and Iran, current export countries of Turkmen gas. Alexander Golovin, special envoy on Caspian issues, has stated that a major gas pipeline would pose a serious, dangerous risk to the prosperity of the entire region. Russia has also taken the legal position that a potential pipeline project, regardless of the route it takes on the seabed, would require the consent of all five Caspian littoral states in order to proceed. Iran has pointed out that treaties signed by Iran and the Soviet Union in 1921 and 1940 are still in force and that any action taken without the consent of all the littoral states will be considered illegal. As a reaction to the 1999 plans for a Trans-Caspian gas pipeline, in 2001 and 2002 Russia and Iran collaborated in calls for a Central Asian gas cartel. There was also some Western concern that closer collaboration between Georgia and Azerbaijan would leave Armenia isolated and tempted to strengthen ties with Russia and Iran

Analysis

Despite numerous agreements, there have been few real signs of progress for a U.S.-backed plan to build a gas pipeline across the Caspian Sea. With the passage of time, the risk may also increase that conditions will not be met for building the trans-Caspian gas pipeline, which is one of the pillars of U.S. policy for the region.

Officials have been optimistic about the prospects for both the trans-Caspian project and a main export pipeline for oil from Baku in Azerbaijan to Turkey's port of Ceyhan. But experts see little evidence of concrete steps that will move either project off the drawing board.Supporters of the U.S. plans believe the trans-Caspian gas line from Turkmenistan to Turkey will be built first. Turkmenistan's President Saparmurat Niyazov states that gas deliveries could start in 2002, a timetable which is viewed as ambitious.

Time may be critical in the competition to supply the Turkish gas market. Both Russia and Iran are working to get their pipelines to the country first. One potential problem for the trans-Caspian scheme is Turkmenistan itself. There are growing concerns that the country's financial troubles may make matters difficult. There are doubts about Turkmenistan's ability to service its debts. Banks may not provide financing or loan guarantees unless it has a reasonable assurance of being repaid. The participation of U.S. lending agencies, such as the Export-Import Bank, is seen as crucial, both for financing and the commitment of political will. But Turkmenistan's grip on fiscal health has been slipping since March 1997, when it lost access to its traditional gas export pipelines after a pricing dispute with Russia.

The government has been hoping for most of the past year to win loans based on future gas sales to Turkey through the proposed Caspian pipeline. The loans are needed just to keep the economy afloat. While the gas sales were agreed upon last month, it is not clear that they will take place unless the new line is built. But the project with an estimated cost of $2.5 billion will also require loans, based on the gas sales.

The pipeline plan may also be endangered by the continuing border dispute between Turkmenistan and Azerbaijan on the division of Caspian oil fields. The United States is trying to settle the issue by sending map experts to determine the dividing line.But it is not clear that there has been any formal agreement to abide by the U.S. findings.

Iran could pose a further challenge for the trans-Caspian pipeline, although consortium officials believe Tehran's objections to dividing the waterway can be safely ignored. The problem is that Iran is one of Turkmenistan's few existing sources of export income. Future projects may bring new income, but Turkmenistan needs cash now.

Trans-Caspian Oil Pipeline

The Trans-Caspian Oil Pipeline is a proposed oil pipeline from the Kazakhstani port of Aktau to Baku in Azerbaijan. A 700 kilometers long pipeline, linked with the Baku-Tbilisi-Ceyhan pipeline in Baku, will allow to transport oil from the major Kazakhstani oilfield at Kashagan to the world market bypassing Russia. Its construction across the environmentally fragile and legally disputed segments of the Caspian Sea is predicated upon the construction of the Trans-Caspian Gas Pipeline.

Currently work for the pipeline is still in the feasibility stage according to an official from the oil company Total. This pipeline though would provide an important export route for oil in Western Kazakhstan. This work runs in parallel with negotiations that have been on going between the Azerbaijani and Kazakh governments concerning supply agreements to the BTC pipeline. The Kazakh government has agreed to supply initially 150,000 b/d with the potential to increase this to 400,000 b/d.

A large push for the project has been coming from the Partners of the Kashagan oilfield project and in particular Total who have a share in both the field and the BTC pipeline. They have estimated that such a project would cost roughly $4 bn dollars and suggested that it could be operational by 2010. However this timetable and cost estimation appears likely to change due to a global rise in cost of services and shortage of equipment in the Petroleum Market. It also faces much larger hurdles from Iran and Russia, both of whom are alternative avenues for Kazakhstan's oil and gas, who would both object to any pipeline being built.

CHAPTER : 4

TRANSNATIONAL PIPELINE PROJECTS FOR INDIA

Import of natural gas to India through transnational gas pipelines.

Energy Security is a key component of the National Common Minimum Program. For realizing the aspirations of sustained higher economic growth of 7-8% per annum, it is imperative to look for cost-effective and long term arrangements to meet country's energy requirements. Natural Gas is the most economic, efficient and environment-friendly fuel. India needs to take bold new initiatives for importing natural gas through transnational pipelines, which are the cheapest mode of transportation for this source of energy.

Consortium formed to build Central Asia gas pipeline

Six international companies and the Government of Turkmenistan formed Central Asia Gas Pipeline, Ltd. (Cent Gas). The group is developing a project to build a 790-mile (1,271-kilometer) pipeline to link Turkmenistan's abundant proven natural gas reserves with growing markets in Pakistan. The group is also considering an extension of the line to the New Delhi area in India.

Unocal was appointed by the Government of Turkmenistan to lead the project development activities and form the gas pipeline consortium. A Unocal subsidiary will serve as development manager for CentGas. "The interest shown by major international companies underscores both the attractiveness of the proposed pipeline and the significant economic benefits it can bring to the region. This project could be the foundation for a new commerce corridor for the region -- often referred to as the Silk Road for the 21st century.
The Cent Gas consortium will initially include the following companies, either directly or through affiliates:

- Unocal Corporation, 46.5%
- Delta Oil Company Limited (Saudi Arabia), 15 %
- The Government of Turkmenistan, 07 %
- Indonesia Petroleum, LTD. (INPEX) (Japan), 6.5 %
- ITOCHU Oil Exploration Co., Ltd. (CIECO) (Japan), 6.5 %
- Hyundai Engineering & Construction Co., Ltd. (Korea), 05 %
- The Crescent Group (Pakistan), 3.5 %
- RAO Gazprom (Russia) 10 % in the project in the near future.

The proposed pipeline will carry natural gas from the Dauletabad Field, in southeastern Turkmenistan at a rate of up to 2 billion cubic feet per day (20 billion cubic meters per year). The Dauletabad Field has independently certified reserves of more then 25 trillion cubic feet (708 billion cubic meters). The Government of Turkmenistan has guaranteed deliverability of 25 trillion cubic feet (708 billion cubic meters) of natural gas exclusively for the Central Asia Gas Pipeline. Much or all of this gas is expected to come from the Dauletabad Field.

The inaugural memorandum of understanding between the governments of Turkmenistan and Pakistan for the Cent Gas project was signed in March 1995. The project still faces significant economic, political and commercial challenges, such as finalizing mutually acceptable commercial agreements and agreements with transit countries. "This project has exceptionally sound economic fundamentals, given the presence of proven gas reserves in Turkmenistan and the market needs of Pakistan and India. The Dauletabad Field has produced well over 2 billion cubic feet per day in the past and is capable of producing that volume today. With the right development program, the Field will continue to be able to produce natural gas at this rate long into the future. No other import project can provide such volumes of natural gas to these markets at a lower price.

The proposed natural gas pipeline would stretch from the Turkmenistan/Afghanistan border in southeastern Turkmenistan to Multan, Pakistan (790 miles, 1,271 kilometers), with a 400-mile (640-kilometer) extension to India under consideration. Estimated cost of the project is US$1.9 billion for the segment to Pakistan and an additional US$600 million for the extension to India.This news release contains forward-looking information, including projections of future business plans and potential capital expenditures. Actual results could differ materially from these projections.

Regional Benefits

The project offers numerous long- and short-term benefits to the region. It will link plentiful supplies of clean-burning natural gas with growing regional markets, employ thousands of local people, foster regional cooperation, and enhance trade, transportation and communication. The development of pipeline-related infrastructure also will create opportunities for economic growth in other industries. In addition to regional advantages, the pipeline offers specific benefits to the countries involved. Turkmenistan will reach new markets with its plentiful gas reserves, while Pakistan gains a reliable source of clean-burning fuel to drive its economic growth. Afghanistan will earn extensive economic benefits from the pipeline, both during construction and over the life of the project.

Major Producers of Natural Gas

World natural gas reserves are abundant. Much of this natural gas is considered "stranded" as it is located in regions distant from consuming markets (e.g., Russia and Qatar). Liquefying this natural gas and shipping it overseas provides an opportunity for these regions to monetize its natural gas reserves. Twelve countries currently produce and ship LNG: Algeria, Australia, Brunei, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad and Tobago, United Arab Emirates, and the US. The five largest exporters of LNG are: Algeria, Australia, Indonesia, Malaysia, and Qatar. For more than thirty years, small quantities of LNG have been produced in Kenai, Alaska, for export to Japan. Russia and Norway are also scheduled to be exporting LNG by 2006

Natural gas through transnational pipelines: India's geographical advantage.

Flanked by large gas reserves to its east, north-west and west, India is strategically located to meet its natural gas requirements through transnational pipelines. These sources include the world's leading supply sources in terms of proven gas reserves, viz., Iran (15%), Qatar (9%), Saudi Arabia (4%) and UAE (4%). To the North-West, Turkmenistan (particularly the Dauletabad field), holds potential. Bangladesh and Myanmar to the east hold substantial reserves. There could be a price advantage of around $1-1.50 per Million British Thermal Unit (MMBTU) in favour of the delivery price of a high volume of gas through on-land pipelines against LNG or deep-sea pipelines. An annual import of, say, 100 MMSCMD by pipelines would thus, constitute savings of about US$1.5-2.0 billion/annum as compared to LNG.

India's Pipeline Initiative

In the above perspective, MOP&NG approached the Government of India in January 2005 with the proposal to allow pursuing transnational natural gas pipeline project from Iran, Central Asia and South-East Asia. Government considered the proposal on February 9, 2005 and approved the proposal subject to the following conditions:-

- getting natural gas from Iran delivered at Indian borders; and
- Setting up of the pipeline as a commercial venture.

Number of major initiative on Trans-national gas pipelines examined

1. Oman – India gas pipeline
2. Iran – India Shallow water gas pipeline
3. Iran – Indian deepwater gas pipeline
4. Bangladesh Indian- Gas pipeline
5. Myanmar India Gas pipeline

The economic challenges in natural gas trade involve locating direct investment and securing financial arrangements for the construction of the pipeline. According to the World Bank, securing financial arrangements for projects in Asia should not be difficult. The real challenges lie in resolving commercial and political conflicts (World Bank 2000). This is exactly the case in the Iran to India natural gas pipeline. While numerous oil companies are interested in constructing and investing in the pipeline, commercial and political conflicts like sanctions and regional politics have proven to be strong challenges

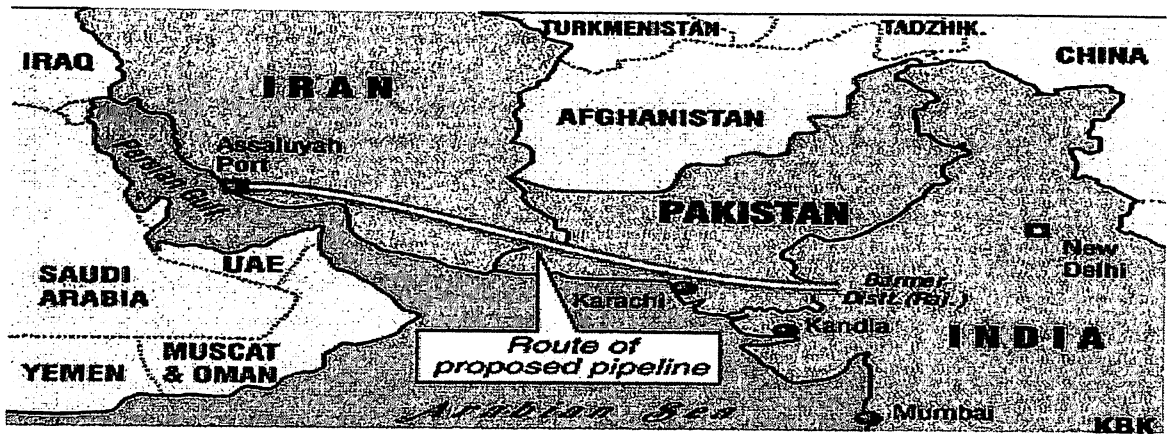
(A) Oman - India gas pipeline – bilateral framework

1993 –Bilateral MOU for studying Oman India gas pipeline

1994/1995–Considerable work done on technical, commercial & contractual framework including bilateral agreement on supply.

1995/1996–Hold up/ stoppage on account of gas reserves issue, technological issues on deep water pipeline, project financing issues.

(B) Iran-Pakistan-India (IPI) Pipeline Project



The following map shows the pipeline's main route. Starting from the left side of the map, the pipeline originates in Asaluyeh, Iran on the coast of the Persian Gulf near the Iranian South Pars fields. It travels to Pakistan through Khuzdar, with one section of it going on to Karachi on the Arabian Sea coast, and the main section traveling on to Multan, Pakistan. From Multan, the pipeline travels to Delhi, where it ends. At this point, India is free to consider and negotiate further domestic routing of the pipeline

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- Getting natural gas from Iran delivered at Indian borders.
- Setting up of the pipeline as a commercial venture.

There are two alternative approaches to the proposed pipeline:-

- A trilateral agreement between Iran, India and Pakistan; or
- Two sets of bilateral agreement.

The first between India and Iran to determine the terms and conditions on which natural gas will be delivered by Iran at the India-Pakistan border.

The second between Iran and Pakistan to determine the terms and conditions of the transit arrangements through Pakistan. If an umbrella agreement on sovereign guarantees is required to achieve financial closure for the Iran-Pakistan agreement that could be considered.

The Ministry of Petroleum & Natural Gas has shown its preference for the second alternative as the question of importing Natural Gas by pipeline from Iran is primarily a domestic matter of energy security.

It has been suggested in the past that Indian involvement might commence from the point the pipeline enters India. Such projects are only possible when the developers and the financers are able to achieve commercially viable project structures supported by adequate guarantees whereby the stringent "supply or pay" commitments could be met. These arrangements might be put in place mainly by Iran, with Iran involving Pakistan to the extent necessary, and possibly through an MNC with external multilateral/commercial funding.

The security and assured supply arrangement might require a tripartite umbrella agreement among the countries concerned, but the arrangements themselves would specifically be addressed in commercial terms between the supplier of the gas, the pipeline company, lenders and the buyer company (GAIL) with adequate guarantees etc.

On Indian side, the country would have a receiving station. Apart from assured supply and guarantees, the quantity, quality and price of gas would have to be competitive. Further, the designated agency GAIL would integrate this system with their storage facilities and pipeline network that in any case is required to be set up to link up domestic gas sources of ONGC, Reliance, etc., various LNG terminals and possible gas supplies from Myanmar, etc.

The most beneficial thing of this proposed pipeline is that in due course of time, the country would be able to develop a pipeline network with storage capacity of one month's supplies and provision for load shedding like in power supplies. In this manner, our dependence on Iranian gas, in the event of any disruption, would be minimized and capital investment for the purpose would also be minimized.

On land pipeline option

Pipeline Route	On land via Pakistan **First Section:** Khuzdar-Karachi-Rann of Kutch-HVJ Pipeline **Second Section:** Khuzdar-Multan-Jodhpur-HVJ Pipeline
Length (km)	2775
Initial Project Cost ($ billion)	2.5
Escalated Project Cost ($billion)	4.16
Completion Date	4 years after clearance

Installed Compression	72548 KW
No. of Compressors	12
Pipeline Diameter	48 inch
Capacity	50-75 mmscmd

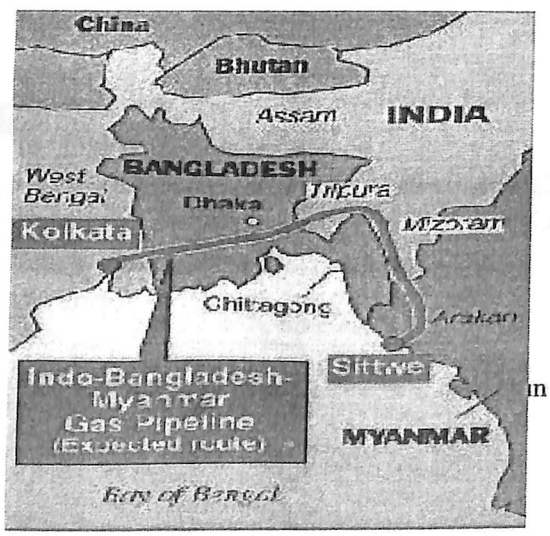
Deepwater Offshore Pipeline

Pipeline Route	Deep Sea (South Pars-Assouliyeh-Persian Gulf-Strait of Hormuz- Rann of Kutch)
Length (km)	1600
Project Cost ($ billion)	4
Completion Date	5-7 years after clearance
Capacity	27.4 MMscmd

(C) Myanmar-Bangladesh-India Gas Pipeline Project.

The growing energy needs of India have prompted it to explore newer sources of supply. In this quest of India, Myanmar has now emerged as an important partner. Huge reserves of oil and gas has been found in that country.

India has been now pursuing a tri-nation pipeline project for nearly a decade since it has a stake in these findings and wants to bring these resources home in a cost-effective manner.



The tri-nation pipeline project was initiated by a Bangladeshi private company, the Mohona Holdings Limited way back in 1997. The pipeline was to run through Arakan state in Myanmar and the Indian states of Mizoram and Tripura before crossing Bangladesh to reach India's West Bengal

capital Kolkata. The governments of India and Myanmar have already approved the Mohona's proposal for the cross-border pipeline. But Bangladesh is yet to approve it. The laying of this 900-km tri-nation pipeline was agreed to in principle by the energy ministers of the three countries in Yangon in January. However a formal signing of the agreement has been delayed up to now.

Dhaka now wants India to first address issues like reduction of trade imbalance, providing a corridor for Nepalese goods to Bangladeshi ports and access to hydropower from Bhutan before moving ahead on the pipeline. India has been opposed to making bilateral issues part of a trilateral agreement.

It is difficult for India to accept any of these demands as it would mean seriously compromising with its strategic interests. Allowing Bangladesh a corridor to trade with Nepal is just not possible in present situation, as it would worsen the problem of illegal immigration and insurgency. The vulnerability of the region to foreign agencies like ISI and DGFI would increase. Allowing this facility to Bangladesh would seriously threaten the internal security of India.

India on the other hand thinks that pipeline should be considered as a standalone project, and Bangladesh is adequately compensated by the $125m that will be getting as transit fee. At the same time, Bangladesh would be able to transfer gas supplies from the east to the western region of the country. Besides, Bangladesh will also benefit as the construction of pipeline would create new jobs in the country.

The new conditions imposed by Bangladesh have made the future of gas pipeline completely uncertain. But a gas pipeline from Myanmar is in India's economic and strategic interests. The economic cooperation between India and Myanmar has brought both these countries close to each other.

Myanmar quickly wants to 'monetize' its new found gas and oil resources. India's state-run Oil and Natural Gas Corporation has a 20 per cent stake in Myanmar's A-1 and A-3 Blocks, while GAIL has a 10 per cent stake in the two sites. The proposed pipeline was one of several options India has been considering to bring gas reserves from the Shwe Field's Block A-1 site in Myanmar.

India is now at a juncture where it has to take a decision on how it wants to transport the gas purchased from Myanmar. It is possible either through a gas pipeline or through ship in LNG form. The gas pipeline is the most cost-effective way and India has been trying for this. The shortest and convenient route of this gas pipeline passes through Bangladesh. But unfortunately, Bangladesh wants to take unreasonable advantage for allowing the gas pipeline pass through its territory.

It has forced India and Myanmar to rethink about the route of the gas pipeline. It has also forced them to explore other possible alternatives to bring gas to India. Both sides have now started considering a proposal to redesign the gas pipeline so that it runs entirely through Indian territory skipping Bangladesh altogether. According to the new plan, the pipeline coming from Myanmar will run through Mizoram and Assam before culminating in West Bengal. Its revised length would be 1400 km. Minister of Energy, said that the techno-commercial group would examine the possibility of laying the pipeline bypassing Bangladesh and importing natural gas through ships in its liquefied (LNG) or compressed (CNG) form.

If the pipeline is constructed through Bangladesh, its length would be 900 km long and cost around Rs 4,500 crore. On the other hand, if it is laid through the Northeast bypassing Bangladesh, the pipeline will have to cover an additional 500 km. The cost would also go up by about Rs 2,500 crore.

Although laying the pipeline through Bangladesh will be cheaper, bringing it through the Indian territory also has its merit. Part of this additional cost will be offset by the transit fee that Bangladesh will charge for allowing the pipeline to pass through its territory.

If the pipeline enters India directly from Myanmar through the northeastern states, it would be a boon as the gas produced in these states cannot be evacuated to the more lucrative markets at present. The region as well as oil exploration companies would gain from higher prices, if the gas can be evacuated. A pipeline is like a road, it benefits the entire territory that it passes through.

Since the gas from Myanmar is expected to flow over a period of 15 to 20 years or even more, the security cover of laying the pipeline entirely through the Indian territory could well be worth the additional cost.

Myanmar would not wait indefinitely for India to buy gas. Moreover, Myanmar, which had banned foreign companies from exploring for oil and gas in on land blocks, has agreed to consider the bid by Oil India Ltd consortium for two blocks as a special case. Yangon was also open to Indian firms bidding for offshore blocks. Hence, India would have to decide on this issue. It should take a decision in favour of pipeline, with or without Bangladesh.

However, if the pipeline is laid through Bangladesh, it will be an example of regional cooperation. The success of this project might encourage the partner countries to contemplate cooperation in other areas. It should make very clear to Bangladesh that it would not entertain bilateral matters when a tri-nation project is being considered for the benefit of all the involved parties.

Interestingly, recently Bangladesh has shown keen interest in exporting the same gas to Nepal through pipeline passing through Indian territory. This clearly shows that there are other factors involved in Bangladesh not exporting gas to India and allowing the laying of pipeline. But, India must take care of its own interest. It should now take a decision on the construction of pipeline. If Bangladesh is willing to consider it as standalone project, well and good, otherwise India should start a feasibility study of laying the pipeline through northeast. It must tap the energy sources available in Myanmar, which might go elsewhere, if India allows Bangladesh to delay this project.

Proposed pipeline from Bangladesh

- Route: Silhat – West Bengal – Bihar – Uttar pradesh – Delhi.
- Length : 1,350 km
- Project cost : Rs 45 bn
- Completion date : 4 years after clearance
- Volume capacity : 500 cubic feet of gas/day

Proposed pipeline from Myanmar

Offshore pipeline:

Route : Rakhine coast to Exclusive Economic Zone of Bangladesh to west Bengal

Length: 600 Km.

Inland pipeline:

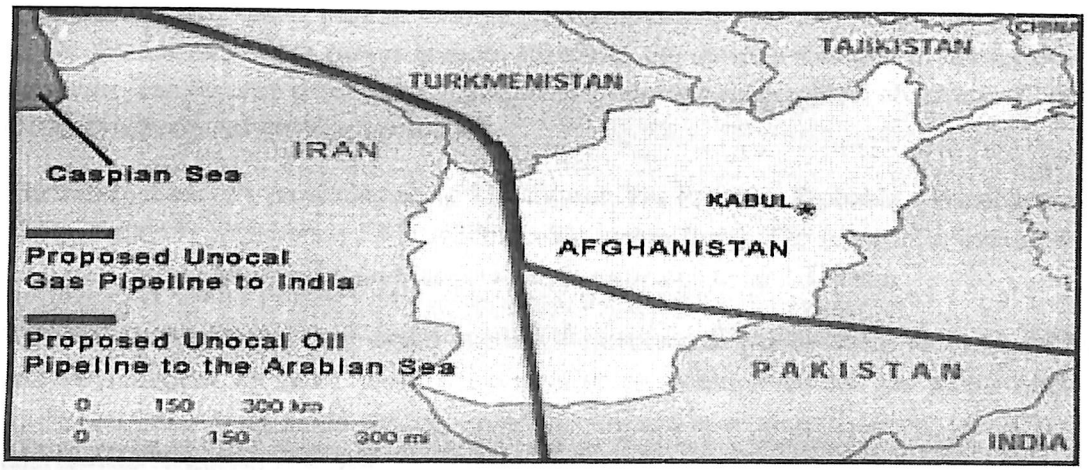
Route 1: Myanmar to Mizoram, Tripura, through Bangladesh bring at Indo-Bengal border to east of Kolkata.

Route 2: Myanmar to North East India to Bihar / Bengal.

But feasibility of this option depends on the more ascertained gas find.

Target market states – West Bengal, Bihar, Jharkhand, Orissa, Chhattisgarh, UP (Eastern Part)
Other Potential Market – Nepal

(D) Turkmenistan-Afghanistan-Pakistan (TAP) pipeline



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 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 had got the pre-feasibility report (PFR) of project prepared in 2003. As per this PFR, the pipeline will be of 56" diameter and 1680 km length with a carrying capacity of 30 billion cubic metres (bcm) per year, entailing a project cost of $ 3.3 billion.

With regard to the routing of the pipeline through Afghanistan and Pakistan, two alternative routes are now under consideration, viz., the Northern route and the Southern route. The Northern route moves from the Dauletabad field in Turkmenistan eastwards into Afghanistan, dips southwards to Kabul, and then enters Pakistan through the Khyber Pas and after crossing the

North-West Frontier Province (NWFP), reaches Islamabad. It then moves southwards to Lahore and reaches the Indian border near Amritsar.

The Southern route moves southwards from Dauletabad and crosses the Afghan provinces of Herat, Helmand and Kandahar, before entering Pakistan through Northern Baluchistan. It moves Eastwards to Multan and then reaches the Indian border at Fazilka. According to the ADB, both, the proposed routes are technically feasible. However, in the Northern route, the pipeline passes through very formidable terrain, both in Afghanistan and Pakistan. While the terrain through which the Southern route passes is more attractive, the security situation in the region remains uncertain. The security situation in Afghanistan as also the geographical obstacles will determine the final selection of the pipeline route.

The field is currently producing about 27bcm/year. The Proven + Probable + Possible reserves as of December 31, 2003 were 1.427 trillion cubic metres (tcm). The report also indicated that the total geological Original Gas-In-Place (OGIP) is estimated to be 2.319 tcm

Pakistan confirmed that they would require 30 mmscmd of gas by 2011, 60 mmscmd by 2014 and 90 mmscmd 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.

The Steering Committee reconfirmed the invitation to India to become an official member of the project. The Committee further indicated that they would appreciate India's submission of its formal request to join the project. 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.

CHAPTER : 5

THE CASPIAN CONFLICT: RACE FOR PIPELINES

Historical Background

Since much of the current geopolitical struggle over the region is colored by the past, it is necessary to provide some of its political history. All of the Central Asian republics, including Turkmenistan and Kazakhstan, were creations of the Soviet Union. What is now Kazakhstan was taken over by Russia in stages but by the early 19th century was entirely under the Czar's control. Present-day Turkmenistan was fully absorbed by the latter part of the same century. Prior to this, both countries consisted of a series of small khanates and local rulers. Historically nomadic, industry and large-scale farming were introduced under the USSR, but self-sufficiency was not. All roads and railroads were built northward into Russia and it was almost impossible to travel between the provinces of East and West Kazakhstan without a stop in Moscow.

In part due to this dependence on Russia, the economies of the Central Asian states atrophied as borders were shut down after gaining independence in 1991. Gaining true independence proved to be an especially trying problem for Kazakhstan, which shares a massive land border with Russia and was, at the time, populated by a Russian majority; it was only recently that the Kazakhs became a majority in their own state. For a while there was even talk of Russia annexing northern Kazakhstan, although this aspiration was effectively squashed when Kazakh moved the capital from Almaty in the south-west to the then tiny steppe town of Astana in the north. However, due to the still-close economic ties (Russia is its biggest trading partner) it has proven exceedingly difficult for Kazakhstan to distance itself too far from Russia.

Kazakhstan and Turkmenistan are landlocked nations. They do not have complete control over the utilization of their natural resources, as they are forced to ship their oil and gas via pipelines that run through other countries in order to reach the global market. Whoever controls the pipelines controls the energy they contain, which is vital to a country's economy and even military strength, as modern militaries, with aircraft, armored vehicles, and gas-powered ships are reliant on oil. The struggle for control of these pipelines is now being waged, quietly but surely, between many countries including Russia, China, Iran, and the United States.

Central Asian oil and gas has historically flowed through Russian pipelines. Of course, maintaining this arrangement will also mean that Russia will receive sizable transit fees as well as have more oil and gas with which to secure greater leverage in international politics. China proposes to build a pipeline of about 3000 km from the Caspian oil fields across Kazakhstan and into China to feed its growing economy. Iran would pump the oil and gas south into its existing network, which would boost its efforts to obtain a regional leadership position in the Middle East. The US, attempting to maintain its position as the world's sole superpower, but without direct geographic access to the region, would like the oil and gas to reach the open market without it falling under the control of Russia, China, or Iran. The remainder of this paper will examine the "grand strategy," or overall foreign policy, of Russia, China, the US, and Iran as they relate to Central Asian energy. An historical analysis of these policies as well as a critical analysis of the pipelines and the strategies will also be provided.

The Logistics of Caspian Oil

Despite the region's isolation, it is surprising that so little regard is paid to Kazakh and Turkmen reserves, for they are truly astounding. Kazakhstan has estimated reserves of 79.6 billion barrels (bbl) of oil and 3 trillion m3 (trm) of natural gas; by comparison Saudi Arabia has 264.3 bbl of oil. Turkmenistan has comparatively little oil at 500 million barrels (mbl) but has estimated proven reserves of 2.9 trm of gas. Furthermore, since a full, public exploration of Turkmenistan's Caspian seabed has not been conducted, we can assume that Turkmenistan's actual gas reserves are almost certainly far greater; the Economist Intelligence Unit has estimated reserves at 10 trm, while the Turkmen government has claimed it is more than 13 trm, which would place the country in the top four countries for natural gas reserves.

A small pipeline network built by the Soviets has long carried Central Asian oil and gas towards Moscow. However, this network is nowhere near sufficient to carry the massive amount of reserves available. A number of pipelines have been built following the fall of the Soviet Union:

- The Caspian Pipeline Consortium Pipeline from the Tengiz oil fields to the Russian port of Novorossiysk on the Black Sea
- The Korpezhe-Kurt Kui gas pipeline from the Turkmen fields to Iran;
- The Kazakhstan-China pipeline from Atasu to Alataw in China.

There are two main problems with transport: **geography** and **international relations.**

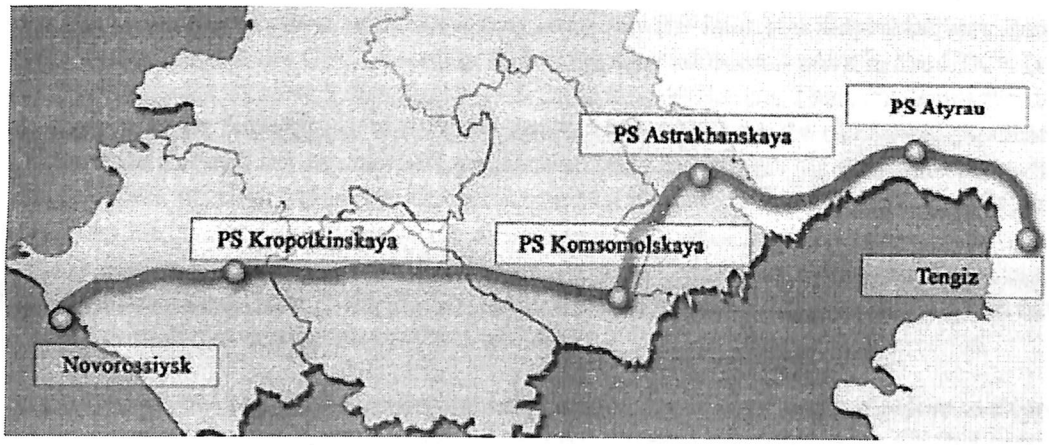
1. From a purely logistical standpoint there is no easy route for the Central Asian oil and gas to reach sea shipping lanes and major markets such as Europe. To head directly west demands either skirting the Caspian, greatly increasing the length of any pipeline, or building an underwater pipeline, which greatly increases the cost of a pipeline. To the east is the Pacific Ocean, but the 6400 miles of pipeline needed to reach it would be a deterrent to construction plans. Running southeast towards the Indian Ocean would mean traversing the mountains of war-torn Afghanistan.
2. Borders and the politics they represent pose an even more serious problem. Each country through which a pipeline passes can demand transit fees and can, theoretically, turn off the flow for any reason – from political to economic. For cross-border pipelines to be built, treaties and agreements must be signed and financial agreements struck, often with numerous nations competing. Signing such agreements is highly political, which is why, for example, Kazakhstan is afraid of sending its oil through Iran and thereby infuriating the US. Complicating the matter further, pipelines tend to be built by consortiums of governments and oil companies, and the desires of a nation's government do not always mesh with those of private companies.
3. Another related issue is the controversy over rights to the Caspian and its seabed, much of which comes down to whether the Caspian should be classified as a lake or a sea under the United Nation's Convention on the Law of the Sea (1982). As a lake, each littoral state would be entitled to an exclusive zone for a given number of miles from its shore, but the center of the Caspian would be a shared zone for all littoral states. However, if declared a sea, the entire Caspian would be divided up according to each state's amount of coastline. Russia and Iran consider it a lake, while Azerbaijan, Turkmenistan, and Kazakhstan prefer a sea classification. Under the current convention, the Caspian could be judged to be logically as either.This issue is further complicated by the 1921 Friendship Treaty between Persia (now Iran) and the USSR. The treaty divided the Caspian between those two states and declared that no changes to the arrangement this treaty established could be made without the agreement of all littoral states. While Russia and Iran consider this treaty valid, Azerbaijan, Kazakhstan, and Turkmenistan, not being signatories, do not feel bound to it.

Although the issue of ownership of the Caspian remains undecided, oil and gas exploration and drilling continue with abandon. Russian and Iranian claims stemming from the treaty are becoming weaker and weaker with each passing year, though the issue is far from settled. In July 2001, Iran deployed a warship and two fighter jets to stop an Azeri research vessel exploring a

gas field near the center of the Caspian, but well within what Azerbaijan considers its territorial water.

Even though Russia agrees with Iran on the issue of Caspian ownership, it has not taken such drastic measures. Also, despite the Friendship Treaty, Russia has proven willing to make bilateral deals with other states, such as when in 2005 it signed a production sharing agreement with Kazakhstan for that country's Kurmangazy offshore oilfield, situated on the northern part of what is generally agreed to be Kazakhstan's Caspian sector.

The Russian Route



Russia has managed to extend petropolitics; and has started to wield power with the oil and gas itself, raising and lowering the rates as a means of political influence. When the newly reformed Ukraine moved closer to the EU and NATO in 2004, Russia responded with markedly higher gas prices. When Ukraine resisted another increase in 2005, Russia shut off the pipeline from January 1-4, 2006.

Russia provides 90% of Western Europe's gas and the majority of its oil. Whereas gas and oil must currently flow through Eastern Europe to reach the West, Russia is in the process of constructing the Nord Stream, a gas pipeline that will extend from Vyborg (near St. Petersburg) under the Baltic Sea and into Greifswald, Germany. By bypassing Eastern Europe, Russia will be freed from transit fees, but more importantly, it will have full vertical control of its gas, from drilling to refinement to transport to sale. This is very important especially considering that Russia's current economic growth is almost entirely the result of its oil and gas sector.

Russia considers Central Asia to be firmly in its sphere of influence, and would loathe losing any of its influence in the area and the benefits, especially the economic ones, which they accrue. Also, by combining the sizable Central Asian reserves with its own, Russia could become a petroleum power to rival the Middle East. Just as in the 20th century the USSR relied on its military for its superpower status, in the 21st century it will rely on its oil and gas.

Out of the four countries being discussed in this paper, only Russia has a completed, operational pipeline – the Caspian Pipeline Consortium (CPC), which started transporting oil in 2001. It runs from Kazakhstan's Tengiz fields to the Russian Port of Novorossiysk and is the largest current export route of Caspian oil, carrying 34 million tons of oil/year. There is talk of almost doubling capacity to 67 million tons/year by adding 10 new pumping stations. An example of the complicated nature of the geopolitics of oil in the region, the CPC has varied shareholders: Russia holds 24%, Kazakhstan 19%, Chevron 15%, and Oman 7%. A variety of oil and gas companies make up the remainder. In addition to Kazakh oil, the CPC also exports for major Russian producers such as Lukoil, Rosneft, Surgutneftegaz, and TNK-BP.

The main advantage to the CPC is that it is already in existence. Due to the enormous cost of pipeline construction, short of some catastrophic shift in international relations, it is doubtful that the pipeline will ever be abandoned in the space of expected lifetime. Additionally, since the pipeline is already in place, and runs across relatively flat land, it will be relatively inexpensive and easy to increase the CPC's capacity if desired. One additional point in the CPC's favor from the Russian point of view is Kazakhstan's dependence on Russia. The CPC is not the only Russian route for Kazakh oil, as a sizable amount flows through the old Soviet pipeline system. Oil pumped through the Atyrau-Samara pipeline links to Russia's pipeline network, while the Kenyak-Orsk pipeline transports Kazakh crude to a Russian refinery in Orsk. Lastly, the CPC stands on fairly safe ground due to the international nature of the consortium. While the US is a natural rival to Russia over control of Central Asian oil and gas, the fact that American companies hold a sizable share (22.5% in total) strengthens the CPC's position as an extension of America's undisputable power on the world stage.

But, the CPC, like the KPC, is solely an oil pipeline. There is no major pipeline to export Caspian gas, and interestingly enough, Russia has shown no inclination to fill this need. Any Caspian gas pipeline would also likely need to connect to Turkmenistan to take advantage of that country's massive gas reserves. Russia's involvement in the region's natural gas markets would be a prudent move, since control of Caspian gas as well as its own would cement Russia's position as the world's preeminent gas supplier. During recent talks concerning a possible Russian-led gas OPEC, one of the experts' criticisms of the idea was that Russia already has such massive reserves that forming such a cartel might be unnecessary. While this is debatable, by obtaining control over Caspian gas, Russia should be able to completely put itself in a position to effectively determine and manipulate the world's natural gas market as it sees fit.

The Iranian Route

The Iranian economy, thanks to its oil and gas, is quite strong, making it more viable in international politics. Since oil and gas are important to Iran's strength, it is imaginable that it will do everything in its power to gain control of as many Central Asian resources as possible. With a population of over 68 million, oil money can become spread thin very quickly, and there are already fears that Iran is spending more than its budget allows. The additional revenue that pipeline(s) would bring would also allow Iran to better withstand Western embargos. Additionally since Iran would control a greater fraction of the world's oil and gas, such an embargo would cause a far more serious shortage of oil and gas and greater price increases for the West, making it less likely.

The Korpezhe-Kurt Kui gas pipeline (KKK), completed in 1997, is currently the major export line for Turkmen gas. It traces the Caspian shore from the Turkmen fields to the northern city of Kurt Kui in Iran. From there, the gas is exported through the internal Iranian pipeline network. However, this is a fairly small pipeline, with a capacity of only 282 billion cubic feet (bcf) per year. Though some Turkmen gas is exported into Russia through the old Soviet pipeline system, the KKK gas is purchased at market rates in cash, while most of the gas to Russia is bartered. While the system is opaque, the overall compensation Turkmenistan receives from the Russians is likely far below market value.

Iran would like to add to the KKK by building a gas pipeline of a far greater capacity. Since all such plans are only in the very basic planning stages there are numerous possible variations, such as a pipeline that would terminate at an Iranian port on the Indian Ocean, or one that would go through Pakistan and into India. One further option would be the construction of a Turkmenistan-Iran-Turkey pipeline (TIT), which could be extended north to include Kazakh gas. The TIT would transport gas from the eastern shore of the Caspian across Iran and into southern Turkey, where it would join the extensive Turkish pipeline network. Iran is also encouraging the construction of a Kazakhstan-Turkmenistan-Iran oil pipeline (KTI), which would have a capacity of one mlb/day, and could be built in conjunction with a gas pipeline.

The Iranian routes are particularly advantageous for gas pipelines. Much of the Caspian oil is in the northeast Kazakh sector closer to Iran, the oil fields tend to be further south. Also, Turkmenistan has hitherto shown a willingness to work with Iran that it has not shown to other countries. Since Russia and China as of now do not plan for any gas pipelines, the only other option is the American-sponsored TCP, which is astronomically expensive and difficult as compared to the simple overland Iranian routes.

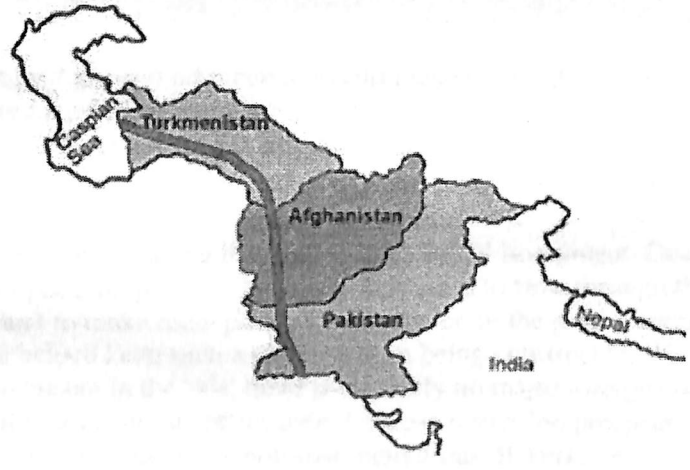
However, a major logistical problem is that any major pipeline needs to be constructed from scratch. The KKK is a small diameter pipeline, and its maximum capacity cannot be increased. Therefore, though the Iranian routes promise fairly short pipelines, they will still be expensive, and cobbling together various actors to agree to pay for such a pipeline would be difficult given the sizable American resistance. It is therefore doubtful that major countries would help build it, or even connect to it for fear of raising American ire. Also, America discourages its oil and gas companies from dealing with Iran, which would hinder the export of Kazakh oil and gas through Iran as Chevron has a share in many of the Caspian fields. Furthermore, if an embargo against Iran is put in place, Kazakhstan and Turkmenistan's oil- and gas-based economies could collapse, creating a very dangerous situation for them.

Of all the proposed pipelines discussed here, the Iranian plans are the least likely to come to fruition. As long as America's animosity towards Iran remains, it will be far too risky for Turkmenistan or Kazakhstan to dedicate a major portion of their reserves to Iran. However, if Iran offers sufficiently enticing deals, it may be possible to get relatively small gas pipelines built, especially from Turkmenistan.

The American Routes

Since at least the oil crisis of the 1970s, cries for independence from Middle Eastern oil have been a constant political refrain in America. Following September 11th, these cries have become particularly strident. This is an even more pressing issue with the increasing animosity between the US and Iran, as well as with the difficulties in Iraq and the general distaste for the US in the greater Middle East. Alternative energy and reduced consumption are two ways that America could reduce its dependence on foreign oil. However, most of the technology for alternative energy is either many years from being fully functional or too expensive without large subsidies (as with corn-based ethanol) and severe consumption reduction seems to be too bitter a medicine for Congress to swallow. Therefore, at least for the near future, the US will likely take the less environmentally friendly path and search for new sources of oil and gas. Places like the Canadian tar sands in Alberta provide one option, but due to extraction costs, this will likely not be economically viable until oil prices rise further. Some of America's oil and gas comes from Russia and Venezuela, but considering the increasing tensions with the former and the open animosity with the latter, it makes sense for the US to look for oil from a new region with pro-American governments, and in this respect the Caspian region shows great potential.

There are two major routes that America is considering: the TAP and the TCP. The Turkmenistan-Afghanistan-Pakistan pipeline (TAP) would travel from the Caspian eastward through Turkmenistan and over the mountains into Afghanistan and on to Pakistan and an open-water port and/or refinery. The TAP could be extended into India to reach the open market there. Since Pakistan and India have rapidly growing economies and expanding manufacturing sectors, those countries should be eager to receive such a pipeline.



Costs for constructing the TAP are high due to Afghanistan's mountains. A greater problem is the fact that Afghanistan is still in the throes of a civil war and the virulently anti-American Taliban is still active. It will be difficult to construct a pipeline in such an environment. If Pakistan and/or India are willing to dedicate resources to ensure security in Afghanistan, then the TAP/TAPI will become a far more viable option. However, for now, it has not proceeded farther

than the planning stage. Neither an exact route, capacity, nor whether it should carry gas, oil, or both has been decided.

The Trans-Caspian Pipeline (TCP), could be a gas, oil, or combined pipeline. It would go from either Aktau, Kazakhstan or Turkmenbashi, Turkmenistan under the Caspian Sea to Baku, Azerbaijan. From there, any oil could link with the existing Baku-Tbilisi-Ceyhan pipeline (BTC) to ultimately access the Mediterranean, while the gas could be transported via the South Caucasus gas pipeline into eastern Turkey and possibly on to Europe from there via the proposed Nabucco pipeline. While the TCP is still in the planning stages, feasibility studies have shown that a gas pipeline would cost $5 billion and have a capacity of 30 bcf/year. An oil pipeline would cost $4 billion and carry 400,000 barrels/day, and thus deliver 40% of the BTC's total export capacity. No feasibility studies have been done for a combined TCP pipeline.

For the TCP, a combined gas and oil pipeline would make the most economic sense. The economies of scale reduce the price of a combined pipeline more when it is underwater than when it is overland, as a large part of the costs of laying down an underwater pipeline comes from digging the trenches on the seafloor and the use of pipe-laying vessels.

One main challenge will be in finding the needed large initial investment. Due to the costs, both Kazakh and Turkmen gas (and possibly oil) will likely need to flow through the pipeline(s) to provide enough product to make them profitable. However, in the past, Turkmenistan's protectionist policies helped keep such a pipeline from being constructed. While BP and Shell were active in Turkmenistan in the '90s, there is currently no major foreign oil company operating there; Shell finally shut its office there because it saw "no prospects for taking part in realistic oil-and-gas projects" due to government regulations. If Turkmenistan still remains opposed to the TCP, its chances of construction remain slim to none.

Issues surrounding ownership of the Caspian seafloor may also negatively impact construction of this pipeline. Lastly, due to the current relative lack of gas pipelines, more interest has been shown in a Trans-Caspian gas pipeline than an oil pipeline. However, if money for a combined pipeline cannot be gathered, the line may prove unprofitable.

Natural Gas Export Routes and Options in the Caspian Sea Region

Name/Location	Route	Natural Gas Capacity	Length	Cost Estimate	Status
Baku-Erzurum	Baku (Azerbaijan) via Tbilisi (Georgia) to Erzurum (Turkey), linking with Turkish natural gas pipeline system	Planned 254 Bcf capacity	540 miles	$1 billion (includes up to $500 million to construct new Azeri section)	November 2000 inspection of existing Gazi pipeline deemed that extensive repairs were necessary; new pipeline will be necessary.
"Centgas" (Central Asia Gas)	Daulatabad (Turkmenistan) via Herat (Afghanistan) to Multan (Pakistan). Could extend to India.	700 Bcf/year	870 miles to Multan (additional 400 miles to India)	$2 billion to Pakistan (additional $500 million to India)	Memorandum of Understanding signed by Turkmenistan, Pakistan, Afghanistan, and Uzbekistan. Project stalled.
Central Asia Center Pipeline	Turkmenistan and Uzbekistan via Kazakhstan to Saratov (Russia), linking to Russian natural gas pipeline system	3.5 Tcf/year	Existing route	N/A	Operational. Turkmenistan is using this pipeline to export a total of 8.83 Tcf to Ukraine (via Russia) from 2002 to 2006, as well as smaller amounts to Russia.
China Gas Pipeline	Turkmenistan to Xinjiang (China). Could extend to Japan.	1 Tcf/year	4,1,61 miles; more if to Japan	$10 billion to China; more if to Japan	Preliminary feasibility study done by ExxonMobil, Mitsubishi, and CNPC
Trans-Caspian Gas Pipeline (TCGP)	Turkmenbashy (Turkmenistan) via Baku and Tbilisi to Erzurum, linking with Turkish natural gas pipeline system	565 Bcf in first stage, eventually rising to 1.1 Tcf/year	1,020 miles	$2 billion to $3 billion	Project stalled; negotiations between Turkmenistan and Azerbaijan over pipeline volumes restarted in October 2001.
Korpezhe-Kurt-Kui	Korpezhe (Turkmenistan) to Kurt-Kui (Iran)	283-350 Bcf/year; expansion proposed to 459 Bcf/year by 2005	124 miles	$190 million; 2005 expansion: $300 million to $400 million	Operational since December 1997.

CHAPTER : 6

CONCLUSION

The Asian continent has got abundant reserves of oil and gases. Also, most of the countries are still in the development stage and as such, have huge amounts of requirement of energy. But since hydrocarbons are not divided equally at all places, they must be transported from the area of high availability to the area of high requirement. Long term energy needs call for the construction and development of oil and gas pipelines.

Pipelines find extensive use because they are cost effective, energy efficient, reliable, safe, environment friendly and involve negligible transit loss.

A number of oil and gas pipelines are running successfully within Asia, making transport of energy convenient. In fact, these pipelines too are in their development stage, and hence most of them are still in expansion stages.

Certain problems which are being faced by proposed pipelines include:

- Environmental concerns
- Uneven terrain
- Political unstability
- Bitter relations amongst participating nations
- Long term supply security concerns
- Increasing dependency amongst nations
- Settlement of transit and other concerns

Despite all these problems, the importance of pipelines cannot be negated and hence all possible efforts are being made to materialize the proposed pipelines. For example, despite huge problems and oppositions against the IPI pipeline, the Indian Government has recently convinced its Pakistani and Iranian counterparts of its full participation and commitment. The IPI pipeline may soon be a reality.

As for the Caspian region is concerned, nothing more than tentative predictions for the future of pipelines and the countries' strategies can be made. However, despite the problems with providing reliable predictions, by looking at the advantages and disadvantages of the various Central Asian pipelines, one can at least make some decent educated guesses. We can assume, for instance, that all pipelines already operating will continue to transport oil and gas, viz. the Iranian Korpezhe-Kurt Kui (gas), and the Russian Caspian Pipeline Consortium (oil). We can

also assume that the pipelines already being constructed will continue and come online in the future, viz. the China-Kazakhstan pipeline (oil).

We know that the export routes for the Central Asian gas face more difficulties than those for oil. Except for the small KKK and a few minor Soviet-era pipelines, there is no way to currently get the Turkmen and Kazakh gas to market. An Iranian route is unlikely, and gas pipelines through Russia face even more serious challenges than oil pipelines. As Russia has a much larger share of the world's gas reserves than of oil reserves, it is more able to play politics with gas. Also, Russia would integrate the Central Asian gas into its existing pipeline network which is dedicated to shipping gas to Europe, as opposed to selling it on the open market, which might further increase the likelihood of political problems with the US. China does not have the same need for gas as it does for oil, and the costs of building a China-Kazakhstan gas pipeline would be prohibitive. If the US follows the strategies laid out by it, then the TCP will most likely be built, and it will carry the majority of Central Asian gas as well as some of its oil.

Looking at the struggle between Iran, Russia, China, and the US over their preferred pipeline routes for Central Asian oil and gas gives a good glimpse as to the world's future geopolitical order. Despite the formidable difficulties in building pipelines, those four powers are converging upon the region with an eagerness that is almost desperate.

But as stated before, the need for energy and scope of huge economic benefits from the region cannot be negated and as such, possible routes will definitely emerge and pipelines will be built. The future of Asia depends on effective development of these pipelines and hence these should be given due importance and consideration.

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