INDIAN NATURAL GAS SCENARIO- OPTIONS TO MEET CHALLENGES

A Project Report submitted in partial fulfillment of the requirements for the Degree of
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by

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CERTIFICATE

This is to certify that the Project Report on *"Indian Natural Gas Scenario-Options to meet Challenges"* submitted to University of Petroleum & Energy Studies, Dehradun, by **Mr. Aditya Penjarla.** in partial fulfillment of the requirement for the award of Degree of Master of Technology in Gas Engineering (Academic Session 2003-05) is a bonafide work carried out by him under my supervision and guidance. This work has not been submitted anywhere else for any other degree or diploma.

Date: 24.5.2005

Himmat Singh

Dr.Himmat Singh

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EXECUTIVE SUMMARY

Natural gas is predicted to be the fastest growing source of the world's primary energy supply over the next 25 years, more than doubling total consumption by 2020. India's population recently exceeded one billion, and it is expected to surpass China as the world's most populous country in the coming decades. This immense population, combined with very low per capita measures, evinces two opposing angles from which to view India's development picture. From one angle India is a country of immense poverty, containing 40% of the world's poor. So looking at this whether it would be a better option for India to go with LNG or pipelines from the middle east and Bangladesh is what the report deals with. Covering the natural gas scenario and focusing on India's and Pakistan's demand and supply would be the initial part. A brief discussion on the different energy sourcing options that India has with respect to pipeline and LNG has also been discussed in the report. A thorough analysis of Iran-Pak-India pipeline in the political, economic issue involved in taking up the project have been conversed.

INTRODUCTION

Although oil and gas were discovered in India 100 years ago, it was not until the mid 1980s that gas came to be appreciated as an excellent future source of energy capable of replacing the traditional fuels like coal and oil. Since the early 1990s the Indian government has also intentions o taking positive steps to enhance the use of gas. Taking account of the problems in importing natural gas through pipelines to India the public sector companies announced their intention to build LNG terminals. It must however be kept in mind that the gas industry as such is in nascent stage in INDIA.

Oil and gas were 1st found in India in 1886 through a non-commercial discovery in Upper Assam. Despite its long history of hydrocarbon production until the mid 1980s India lacked the industrial infrastructure to utilize the gas being produced and much of it was flared. Gradual awareness of its benefits as an excellent energy source came in the mid 1980s. A pipeline has been entirely responsible for creating the true appreciation of gas as a clean reliable source of energy with obvious advantages over coal.

Natural gas is predicted to be the fastest growing source of the world's primary energy supply over the next 25 years, more than doubling total consumption by 2020. Globally, the increased demand for natural gas is driven by the clean burning characteristics of the fuel, its usefulness as a feedstock in petrochemical processes, and particularly, new combined cycle power generation technologies that make gas, in many cases, the most economically attractive fuel for new electric power plants. Conditions exist in India that stands to make the country a major beneficiary of increased gas consumption. However, expansion of gas supplies in India is contingent on overcoming two key obstacles: (1) reforming the country's regulatory policies; and (2) securing gas imports.

India's population recently exceeded one billion, and it is expected to surpass China as the world's most populous country in the coming decades. This immense population, combined with very low per capita measures, evinces two opposing angles from which to view India's development picture. From one angle India is a country of immense poverty, containing 40% of the world's poor (World Bank 2001). Conversely, recent economic reforms have increased economic growth to 7-8% per year. If economic growth continues at these high rates, India will become a major player in global markets.

DEMAND OF NATURAL GAS

The use of NG has increased rapidly but stills accounts for only around 8% of the primary energy used. Till 1980s the demand for gas lagged the behind the production potential primarily because of the infrastructure to bring the gas to market. However in 1990s the demand exceeded supply and, in view of this shortage of gas the government developed a system for gas allocation.

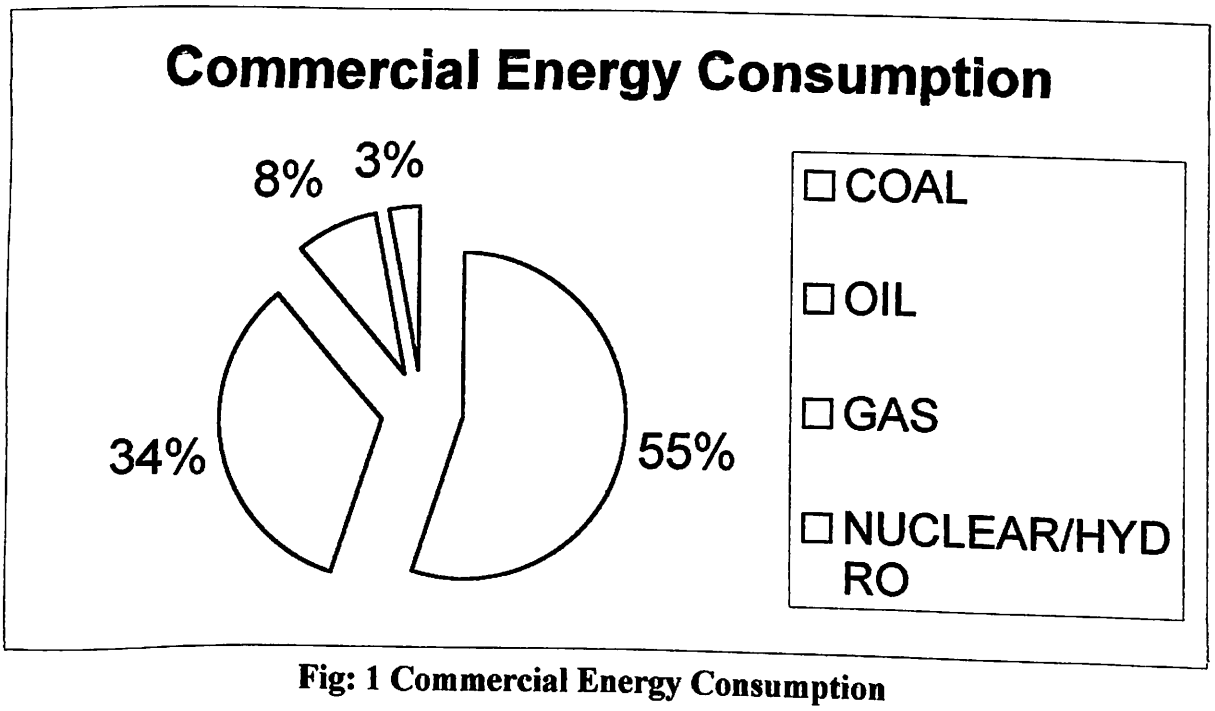

Fig: 1 Commercial Energy Consumption

India's vast rural population remains largely dependent on traditional energy sources. As their incomes grow, Indian consumers will move from traditional energy sources such as crop waste, animal waste, and wood (collectively CRW) toward commercial sources of energy such as kerosene, liquefied petroleum gas, and electricity. Securing energy supplies to meet expanding demand is a critical issue for India, as it is not well endowed with viable commercial energy resources, other than coal. Oil and gas production in India are projected to begin to decline over the next decade, India already depends on imports to meet two-thirds of its oil demand. If oil consumption continues to grow at 5% per year, as it did throughout the 1990s, by 2025 it will consume output equivalent to 75% of Saudi Arabia's current production. India does possess large coal deposits. Existing reserves would last 200 years at current rates of consumption. However, most of India's coal reserves are high in ash content and thus increasing the share of coal in the energy supply would worsen already poor local air quality conditions. Furthermore, technical limitations prevent coal from being a viable alternative to meet transportation or peak power demands.

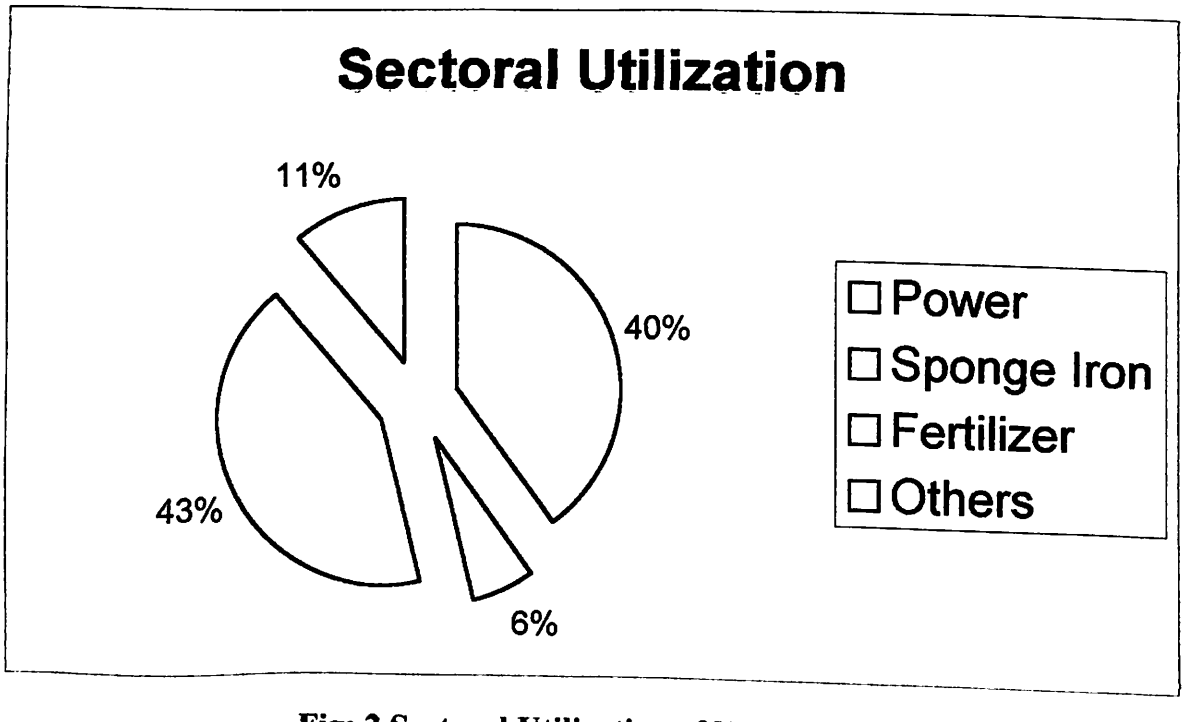

Fig: 2 Sectoral Utilization of Natural Gas

India also possesses significant non-fossil energy resources, but these too are limited by economic and environmental concerns. The country currently has 22 GW of installed hydroelectric capacity, accounting for about 20% of overall generation capacity. Untapped hydro resources are estimated at an additional 72 GW. Expansion of hydroelectric capacity is limited, however, due to the high capital cost of these projects, and social and environmental concerns. India also has a rapidly expanding Base of wind power, with current capacity of over 1 GW, but wind alone will not meet the country's rising energy demand. Finally, India has 2.5 GW of nuclear capacity, with plans to expand to 7.5 GW. The high capital costs and risks of nuclear power make financing further expansion unlikely. Increasing the share of natural gas in India's energy supply is necessary to balance the economy's dependence on oil and coal. The Indian government has recognized this strategic imperative and has pursued a series of policies attempting to increase gas supplies. Foreign investment has been invited into domestic exploration and production since the 1970's. More recently, however, the Indian government has come to realize that domestic gas resources will not be able to meet the country's needs. Opening the domestic gas industry to imports and securing the investment necessary to build gas import and transmission infrastructure will also require the liberalization of gas industry regulation.

In 1995, the Indian government appointed a strategic planning group to make recommendations for the restructuring of the oil and gas sector. The group consists of government officials, economists, and industry representatives. The first set of recommendations from the group led to the raising of natural gas prices in a stepwise fashion, until gas prices met import parity levels. Further recommendations called for opening the gas sector to foreign investment and open access to gas pipelines. In 2000, a group of cabinet members including the Minister of Finance and the Minister of Petroleum and Natural Gas released the Hydrocarbon Vision 2025 Report, a long-term plan for reforms in the oil and gas sectors (GOI 2000). The Vision 2025 Report recognized the importance of securing gas imports, via liquefied natural gas (LNG) and via pipelines from neighboring countries.

Despite the stated importance of increasing gas supplies by government policymakers, major reforms of the Indian gas sector have stalled, along with gas import plans. The Gas Authority of India Limited (GAIL) maintains a monopoly on gas transportation and distribution in the country and a downstream reform bill to provide access to GAIL's pipelines has yet to come to fruition. Pricing reforms have also stalled, with wholesale gas prices fixed well below the costs of importing gas to India. Furthermore, the major users of natural gas, particularly the electricity sector and the fertilizer sector are financially unstable and thus not credit-worthy buyers for imported natural gas. Increased gas supplies in India will require that the liberalization of the sector similar to the processes underway in the energy sectors of many developing countries. Brazil, for example, faced a situation very similar to India's.

		2001-02	2006-07	2011-12	2025
Western Demand	M	38	40	57	78
	O	53	55	75	95
Supply		53	47	32	21
Northern Demand	M	27	48	66	97
	O	37	66	94	118
Supply		Nil	Nil	Nil	Nil
Southern Demand	M	38	55	70	108
	O	51	99	113	140
Supply		7	6	10	8
Eastern Demand	M	7	8	23	31
	O	10	11	32	38
Supply		5	5	3	3
Total	M	110	151	216	314
	O	151	231	314	391
Supply		65	58	45	36

Table: 1 Region-wise Distribution of Natural gas Demand and Supply

Facing energy shortages and fiscal constraints Brazil looked to import gas via pipeline from its neighbor, Bolivia. As in India, state-owned companies dominated the production, transport and distribution of natural gas, and the government controlled

pricing and allocation of gas supplies. In order to attract outside investment, Brazil ended the legal monopoly on gas sales, and introduced market-based pricing. These reforms opened the door to private investment necessary to complete the country's first gas import pipeline. However, economic reforms alone will not bring natural gas to India. Hostile relations with Pakistan make India reluctant to source natural gas from Iran or Turkmenistan, as routes from either of these countries would cross Pakistani territory. Bangladesh also possesses significant gas resources, but that country's internal politics challenge any proposal to deliver gas to India. The difficulty in negotiating gas import pipelines has led policy makers and investors to favor import via LNG in the near term. Transport via ship allows India to source gas independent of its immediate neighbors. Early attempts to bring LNG to India have been stalled by the slow progress on gas sector reforms. he historical development of the Indian natural gas market, and then examine options and obstacles to policy reforms. Finally, I will summarize the major supply sources for India and the issues associated with each import option.

DOMESTIC PRODUCTION

Barring any new major discoveries, domestic natural gas production in India is expected to begin to decline over the next ten years. Reserves in the Bombay High, which currently account for over 75% of production, have declined from 480 bcm in 1990 to less than 370 bcm by year-end 1999 (TERI 2000a). At current rates of production these supplies will last only another 20 years. The only other significant reserves in the country are in the northeastern states of Assam and Tripura, totaling approximately 180 bcm. The geographically isolation of these gas fields poses challenges for delivering them to the major demand centers. Regardless, none of the currently proved reserves are substantial compared to the demand potential for natural gas in the country. There are some limited possibilities for additional gas discoveries to stave off this imminent decline. The vast majority of current exploration and production to date has been carried out by two public sector undertakings, ONGC and Oil India Limited (OIL). ONGC dominates production in the Bombay High region and western onshore areas, accounting for 82% of all gas production in 1999. OIL operates mostly in the east, including Assam and Tripura, and accounts for 6% of current production. Both companies lack the capital and technology to

employ the latest exploration techniques. According to the Vision 2025 report, only 33% of the total 3.14 million square kilometers of sedimentary basins has been explored up to a moderate level (GOI 2000). The Indian government has long sought to attract foreign investment to oil and gas exploration to augment production by ONGC and OIL. The political reluctance to cede any control of oil markets to foreign companies and the entrenched position of ONGC and OIL has impeded these efforts. In the 1980's the government began offering select blocks for exploration and production. Private investors were stifled, however, by the lack of access to the retail markets. Private companies were only allowed production-sharing contracts with ONGC and OIL.

Through most of the 1990's the energy sector remained largely untouched by the wave of economic reforms sweeping the country. The oil and gas sector was deemed too important to security to open to private investment. Lowering the steep subsidies on petroleum products was also politically infeasible. In 1997, under the New Export Licensing Program (NELP), foreign investors were allowed to bid independently of state oil companies for development blocks. Tax incentives were also offered to encourage foreign and private investment. However, outside interest in the blocks offered under NELP remained limited. ONGC had done the preliminary exploration of the blocks offered under NELP, and thus investors were skeptical any desirable blocks would slip away from ONGC (*Oil and Gas Journal*, June 1, 2001).

NELP had a greater impact on domestic companies. The state-owned oil and gas companies were forced to commercialize—and also allowed to pursue vertical integration—creating some competition between companies such as ONGC and GAIL. Even as the government was opening the production sector to foreign investment, restrictions in the marketing sector continued to stifle foreign interest. Prices for most petroleum products remained fixed, with supplies rationed, under the Administered Pricing Mechanism (APM). Price controls prevented private investors from making suitable returns in the refining sector. However, the government sought to address the lack of refining capacity by requiring companies to invest Rs 20 billion ($US 560 million

in 1997 dollars) in new refining facilities before they could market output domestically (Narang et al. 1997).

A second round of blocks was offered under NELP II in December of 2000. ONGC won the bidding for 16 out of 23 exploration blocks offered with the remainder going to consortiums of foreign, domestic private companies, and state-owned companies such as GAIL and OIL.

Overall, the results of efforts to attract foreign investment to exploration and production have been limited. Total output from all joint ventures and private enterprises was only 12% of all gas production in 1998 (and 13% of oil production) (TERI 2000a). Private sector players remain limited in scope: Reliance and Videocon of India, Marubeni of Japan, and Hardy, Cairn and the BG Group of the United Kingdom (formerly British Gas), and Enron of the U.S.

CURRENT GAS CONSUMPTION & PROJECTED DEMAND GROWTH

To date, gas production in India has been allocated primarily to fertilizer production and electric power. Combined these two sectors consume over 80% of all gas. Almost all of the remainder is used in industrial processes. Less than 1% is distributed to households for heating and cooking or used in transport. This contrasts significantly with the situation in OECD countries, where gas use for residential heating and cooking amounts to nearly a quarter of all gas consumption on average (IEA 2000). The near exclusive allocation of gas to fertilizer and electric power production in India can be attributed to three main factors: (1) the large unmet demand for electric power, particularly peak power generation and (2) the efficiency of gas as a feedstock for nitrogenous fertilizer production relative to alternatives such as oil or coal and (3) the high infrastructure costs associated with expanding the gas network to serve residential and transport consumers.

However, the planned liberalization of gas prices and supplies is likely to alter the composition of gas consumption, as the market begins to determine the best use of gas,

rather than politics and bureaucracy. Current estimates suggest that there is a large unmet demand for natural gas, which will continue to grow rapidly in the next two decades, far outstripping domestic production. The projections shown in figure 6 are taken from the Vision 2025 Report.

These projections assume that least cost planning guides electric power generation investments, fertilizer imports are fixed at 2 million metric tons per year, gas is used to meet all other fertilizer demand growth, and other gas use remains a fixed percentage (20%) of the total.

The particular assumptions used to project gas demand in the Vision 2025 report are not robust. Gas demand for fertilizer production may vary considerably if the government opens its markets and imports more fertilizer to meet food needs, rather than importing gas to produce the fertilizer domestically. Conversely, residential and transport use of gas could rise significantly if local air pollution concerns drive gas grid expansion to urban centers. Power sector demand projections are more reliable. The gas demand estimates for the power sector included in the Vision 2025 Report are supported by modeling results in other studies (Shukla 1999). Given the projected rise in energy demand driven by overall economic growth, these projections reflect a general trend of rapid growth should adequate imported gas become available to Indian consumers.

GAS SECTOR REFORMS AND RELATIONSHIP TO PRINCIPAL CONSUMERS: FERTILIZER AND POWER SECTORS

The most critical and seemingly straightforward step necessary to attract private investment is to free prices so they reflect market realities. However, in any country the process of rising previously controlled prices carries the risk of political backlash. In India the situation is worsened because of the complicated web of subsidies that are used to support domestic industries that buy natural gas, namely fertilizer and electric power. The fertilizer and power sectors are the single largest recipients of government subsidies, receiving $1.8 billion and $7 billion from the central and state governments in 1999-2000, respectively (GOI 2001). The policies in these industries must be reformed and industries restructured before gas prices can rise to import parity levels. Otherwise the

central and state governments will be forced to cover the rising costs of the fertilizer and power companies with further subsidies.

Furthermore, prospective gas importers need credit-worthy buyers with whom to sign contracts for gas delivery. Investors in a major capital investment like an LNG facility demand sales from the project to be guaranteed in a long-term contract before they put their capital at risk. In India the major prospective gas buyers, fertilizer and power companies, are essentially bankrupt and depend on government handouts to operate.

Raising gas prices and reforming the electric power and fertilizer sectors are contentious political issues in India. Such policies are likely to be perceived as anti-poor and antiagrarian, both unpopular positions in a country where the population remains largely rural. However, the economic reality behind the distribution of subsidies in fertilizer and power belies this perception, as I explain in the next two sections.

- Gas pricing reforms are inextricably linked to reforms in Indian the fertilizer industry. Forty-one percent of all natural gas consumed in the country in 1998-1999 was allocated to the production of nitrogenous fertilizers. Conversely, one-half of all nitrogenous fertilizer produced in the country in 1992-1993 used natural gas as a feedstock and energy input. The remainder of the nitrogenous fertilizer is produced using naptha (30%), fuel oil (15%) and coal (5%) (TERI 1996). Similar to the energy industry, fertilizer industry reforms have proceeded slowly over the past decade. Fertilizer producers continue to operate under a system of fixed prices for fertilizer sales, and subsidies are based on cost of production for each individual unit (called the retention price). This system provides fertilizer producers a fixed return on capital employed, regardless of their operating costs. As a result there are no incentives for producers to improve efficiency or pursue cost-minimizing investments. Urea, the most common end use form of nitrogenous fertilizer, is sold for Rs 4,000 per metric ton throughout the country. This is well below the average cost of urea production for all fertilizer plants at Rs 6,720 per metric ton and also ignores differential transport costs. Subsidies on urea and other nitrogenous fertilizers have grown rapidly in the last twenty years, driven by rising consumption. The total subsidy on domestic fertilizer production grew from Rs 1.7 billion in 1980 to Rs. 37.3 billion in 1990, and

reached Rs. 80 billion ($1.8 billion US) in 1999. The vast majority of this subsidy goes to nitrogenous fertilizer producers (GOI 2001).

ELECTRICITY SECTOR

The prospects for gas demand growth in the electric power sector are more stable than in the fertilizer sector. The country is already beset by chronic electricity shortages and the technical and economic characteristics of natural gas-fired power plants are well suited to meet India's power demands. In 1999-2000 there was an overall supply shortage of 6.2% and peak demand shortages averaged 12.4% (TERI 2000a). Overall, power demand will continue to grow rapidly as a result of economic growth and grid expansion to currently unconnected consumers. The use of natural gas for power generation grew at a rate of 25% per year from 1989 through 1997, reaching 6.2% of total electric power generation (TERI 2000a). Most scenarios project natural gas to play an increasing role in base load capacity to meet rising this rising electricity demand (Shukla et al 1999, GOI 2000). This is made feasible by the low capital cost and high efficiency of combined cycle gas turbines. Using this technology imported LNG is competitive with coal, the next cheapest fuel, for generating power in coastal areas. If overland gas pipelines from Bangladesh, Iran, or Turkmenistan are completed, then power generation using combined cycle gas turbines will become economically viable in inland areas as well (Shukla et al. 1999). However, the immediate constraints to expanding gas use in the power sector are similar to those described in the fertilizer sector. India's electric power system is in poor financial condition. The roots of this ill health are inefficient state-owned companies and heavily subsidized prices for electricity. Private investors in gas import projects will be hesitant to sign contracts with power companies until they are financially viable.

Attempts to reform the electric power sector are underway in several Indian states. Only Orissa, however, has managed to privatize its electric distribution function. In all other states power distribution and sales remain the responsibility of State Electricity Boards (SEBs). Under the management of SEBs—which are directly accountable to elected state governments—the provision of electric power is a highly political endeavor. Prices are set artificially low for agricultural and domestic users. In

aggregate, subsidies to agricultural and domestic consumers totaled Rs 338 billion ($US 7.0 billion) in 1999- 2000 (GOI 2001). These subsidies do not include the 22% of total power generation that was never billed (TERI 2000a).

Raising electricity prices to the bulk of the population that are rural consumers is politically difficult. Deteriorating service improves its feasibility. Pricing and regulatory reform are necessary to secure gas imports. However, raising gas prices, without first raising electricity prices, will further weaken the power companies and simply increase subsidy payments.

IMPORT OPTIONS

Despite the uncertainty in the outcomes of regulatory reforms, a myriad of proposals to import natural gas to India have been proposed, via both Pipelines and LNG. LNG imports are the more costly option due to the high capital costs of the liquefaction, transportation, and regasification train. However, political and security concerns with pipeline routes have made LNG the preferred option for India in the near term. Progress on pipeline routes will be largely determined by developments in India's relationships with neighboring countries and the willingness of the international community to become involved in South Asian affairs to advance pipeline agreements.

PIPELINE IMPORT OPTIONS

BANGLADESH

Bangladesh possesses the nearest available gas reserves that could be tapped for the Indian market. The U.S. Company Unocal has long sought to pipe gas from fields it owns in Bangladesh to the Indian market. Most recently Unocal submitted a proposal to the state-owned oil company PetroBangla for a 1,350 km pipeline to connect the Bibiyana gas field in northeast Bangladesh to the Indian capital of New Delhi. The proposed pipeline would be 30 inches in diameter and transport 14 bcm of gas per year, connecting to India's HBJ pipeline in the state of Uttar Pradesh before continuing on to Delhi (*Reuters* November 1, 2001). However, proposals to export natural gas are continuously stalled by Bangladeshi politics. Gas exports are a volatile issue that the country's leaders

have used for political gain. The Bangladesh National Party (BNP) came to power in elections following elections in October 2001. As an opposition party, the BNP protested the export of gas to India. Once in office, however, the party quickly began discussions with Unocal.

Popular opposition to gas exports in Bangladesh are driven by fears that the country will compromise its own future energy needs by selling its gas, but probably more importantly a resistance to do any deal that benefits its more powerful neighbor. Estimates suggest, however, that Bangladesh is sitting on significant gas deposits. The country's proven reserves are estimated at 300 bcm, against current consumption of approximately 10 bcm (BP 2001). A recent survey conducted jointly by the US Geological Survey and PetroBangla estimated that an additional 900 bcm of gas reserves would be discovered by 2030 (USGS 2001).

If Bangladesh were to take $1 per MMBtu in transit fees, the country could earn $US 400 million per year for the gas exports, and would receive $500 to $700 million in immediate investment for the project (*Reuters* November 1, 2001). If a Bangladesh pipeline were constructed, it would become feasible to connect pipelines to gas fields in the Indian state of Tripura and in also in neighboring Myanmar.

IRAN

Proposals to pipe gas from Iran to India have been discussed for over 12 years. The combination of Iran's immense gas reserves and India's booming energy demand make the project economically attractive. Iran's gas reserves, estimated at 23 Tcm, are second only to Russia. However, gas production in Iran is underdeveloped. In 1998 gross production was only 89 Bcm, and nearly a quarter of this gas was flared or reinjected to increase oil production.

An estimated 8 trillion cubic meters of gas reserves, over 5% of the world's total, are located in Iran's huge South Pars gas field, located just off coast in the Persian Gulf. In the last five years, Iran has attracted nearly $7 billion of foreign investment in the South Pars field from companies including TotalElfFina, Gazprom, Petronas of Malaysia,

and ENI from Italy. These companies will seek to ramp up production rapidly and must find a market for this production. If a pipeline cannot be constructed, they may be forced to invest in liquefaction facilities to sell the gas as LNG, lowering profit margins. Iran has long sought to connect its gas supplies to the rapidly growing Indian energy markets. India and Iran first signed a memorandum of understanding for the transfer of gas in 1993. Several proposals by outside investors languished in the 1990's due to Pakistani inaction, Indian security concerns, and technical limitations. Prior to recent tensions between Pakistan and India, hopes for a pipeline were rising, behind strong support from Pakistani President Pervez Musharraff, and more fruitful talks between Iranian and Indian government officials.

Three routes have been considered for a pipeline to connect the South Pars gas field to
India:

- Deepwater offshore from the Persian Gulf to the Gulf of Oman and India;
- Onshore in Iran, and then offshore within Pakistan's territorial waters, connecting to India; or
- Onshore from the Iranian gas-field terminal at Assaluyeh to the Pakistani border, through Pakistan and on to India.

In June of 2001, India and Iran agreed to commission feasibility studies all three routes, with the deepwater route to be studied by Italian conglomerate Snamprogetti and the onshore routes to be studied by energy major Broken Hill Property of Australia. The deepwater option from Iran is essentially the same as an earlier proposal to connect Oman's Gulf fields to India, which was abandoned due to technical and economic infeasibility in 1996. At depths of 3,500 meters, the Oman to India pipeline would have been the deepest pipeline ever constructed. Cost estimates in 1996 were around $10 billion. In this earlier study, LNG imports via ship were deemed cheaper and technically less risky than such a pipeline (IISS 2001).

However, technical experience with deep water gas pipelines is improving. Gas gathering lines in the deepwater Gulf of Mexico are now being laid at depths of over 2,000 meters. The Malampaya pipeline in the Philippines traverses seismically active ocean floor at depths of nearly 1,000 meters. And perhaps the most similar project to an Iran to India deepwater pipeline is the Blue Stream project, traversing the Black Sea floor to deliver Russian gas to Turkey. Construction on Blue Stream is currently underway at depths over 2,000 meters.

The second option, a pipeline route in shallow waters within Pakistan's territorial waters was proposed under the original memorandum of understanding between India and Iran in 1993. Contracts for feasibility studies of the 2,000 kilometer route were awarded to Pipeline Engineering GmbH of Germany, but the proposal was stalled when Pakistan refused to allow inspections of the route. According to the law of the seas (signed by both Pakistan and India), India has the right to lay the pipeline provided it does not interfere with Pakistan's rights to its territorial waters. This argument is largely moot, however, as security concerns far dominate over cost and technical issues for this route. Pakistan would have little incentive to protect or maintain a pipeline in its offshore that does not provide the country any economic benefits.

The third option, the proposed overland route, would lay a 58-inch pipe 1,100 kilometers through Iran, 700 kilometers in Pakistan, and 850 kilometers in India. This pipeline would deliver about 30 Bcm per year, 70% of this to India and 30% to Pakistan. Construction of the overland route could be completed by Iranian, Pakistani, and Indian firms, keeping costs to $2.5-$3.5 billion largely in local currencies. This option is obviously the cheapest route, but resistance to cooperation by Pakistan and Indian security concerns have long prevented progress. However, Indian security experts are increasingly realizing that tying Pakistani economic benefits to the protection of gas flows to India is the most practical means to guard India's own supply security—and avoiding the increased costs of offshore routes.

Pakistan is also seeking natural gas imports to meet rising demand. Pipeline economics yield economies of scale for capacities up to 20 Bcm per year. However, current Pakistani gas consumption is only 19 Bcm per year. Thus, to build the most efficient pipeline Pakistan would need to double its own gas consumption. Sharing a

pipeline with India could reduce the costs of delivered gas to Pakistan by 30%. In addition to the gas delivered via the pipeline, Pakistan would stand to earn from $200-$700 million in transit fees from a pipeline that crossed its territory in route to India, depending on quantity delivered and fees.

Indian and Iranian officials are also advancing a plan to have the pipeline owned by a consortium of international companies. Under such an arrangement, the consortium would purchase the gas under long-term contract from Iran and sign similar agreements with Pakistan and India for delivery of the gas. The consortium approach would subject Pakistan to major international pressure were it to consider cutting supplies to India, and would also remove the project from the political realms of both countries. Recent events in the region underscore the need for the engagement of the international community, particularly the U.S. in the region and this pipeline in particular. The U.S. Iran-Libya Sanctions Act (ILSA) hampers progress on the Iran route, which threatens penalties on any foreign companies investing more than $20 million in Iran. Removing ILSA would allow the oil majors, with their vast financial resources, to fully engage in the Iran-India pipeline without risk of U.S. intervention.

TURKMENISTAN

Turkmenistan is also a potential supplier of natural gas to India. With 2.8 trillion cubic meters of gas reserves, and current production of only 44 bcm per year, the country has significant capacity for export. Turkmenistan is actively seeking an alternative to exporting gas through Russia. The country produced nearly 50 bcm per year prior to the economic collapse of its former Soviet block trading partners. The country finds itself at the whim of its bigger neighbor to the north in terms of payment and price for its gas. The Centgas consortium, led by U.S. major Unocal, proposed to pipe 20 bcm of gas per year from the Dauletabad fields in the south of Turkmenistan, across Afghanistan and on to Pakistan and potentially India. An initial memorandum of understanding for the project was signed between Turkmenistan and Pakistan in 1995. The pipeline would extend 1300 km from Dauletabad to Multan, Pakistan at an estimated cost of $2 billion, and the 650 km spur to Delhi would add another $600 million.

Instability in Afghanistan delayed the project until 1998, when U.S. missile strikes against the Taliban forced Unocal to abandon the project. Even if the project had proceeded there was hesitancy on the Pakistani side to include the Indian connection (Dadwal 1999). Similar to the Iranian route, economics strongly favor a shared pipeline (Tongia 1998).

In addition to the Centgas route, Turkmen gas could also be exported through Iran, possibly connecting to the Iran-Pakistan-India route discussed above. It may seem wildly optimistic at this time to talk about a major project that would require close cooperation between India and Pakistan. The history of the last decade shows us however that the relationship between the countries can shift fairly quickly. The development needs of the more than 1.3 billion people that live in South Asia require that India and Pakistan improve their relationship sooner than later. The adequate availability of energy at reasonable cost is a major prerequisite for development. We discuss the current energy situation in India and Pakistan and provide the rationale for building a common natural gas pipeline for both the countries.

ENERGY DEMAND-INDIA

The use of commercial energy in India has increased at 4%. Most of the energy was supplied by coal, oil with NG and Hydro playing a substantial role in it. If we just examine the growth in natural gas use, it has increased from 40MMcfdin 1975-76 to current 6.8 bcfd and going up to 11 bcfd by 2011-12.

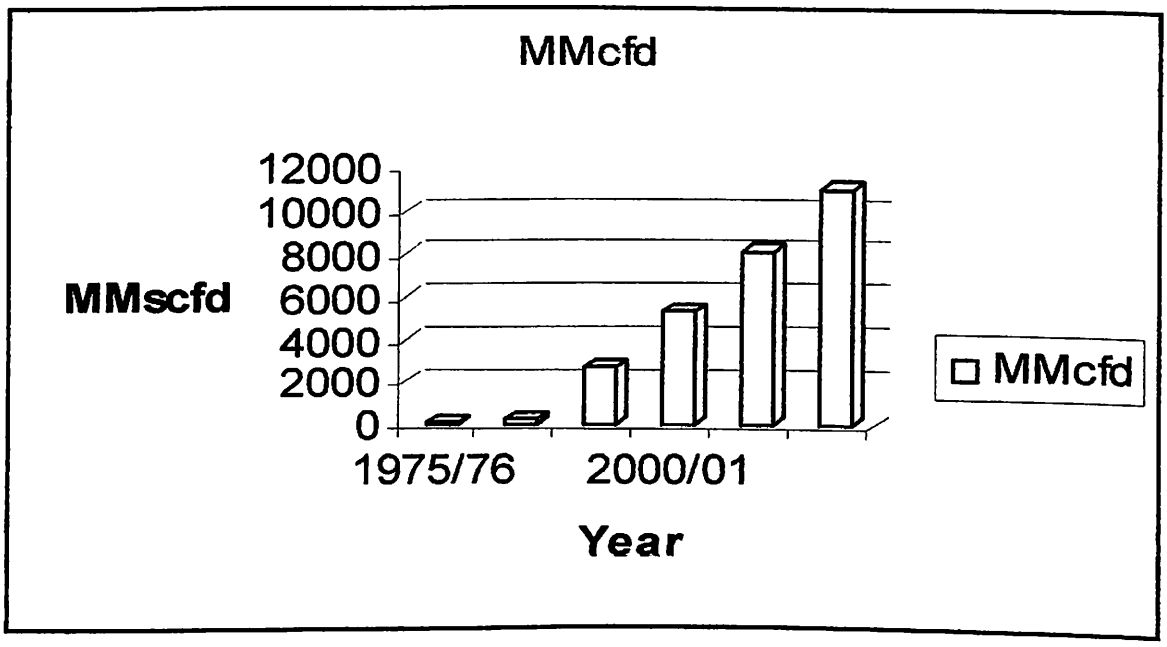

FIG: 3 Daily Consumption of Natural Gas a Prediction

Commercial energy usage increased at a rate of 5%. The largest resources have been oil and NG with Hydropower also making a substantial contribution. The contribution of the different energy sources to the commercial supply of energy in Pakistan.

The graphs below show the Share of commercial energy from different sources in Pakistan and the consumption of Natural gas in sector.

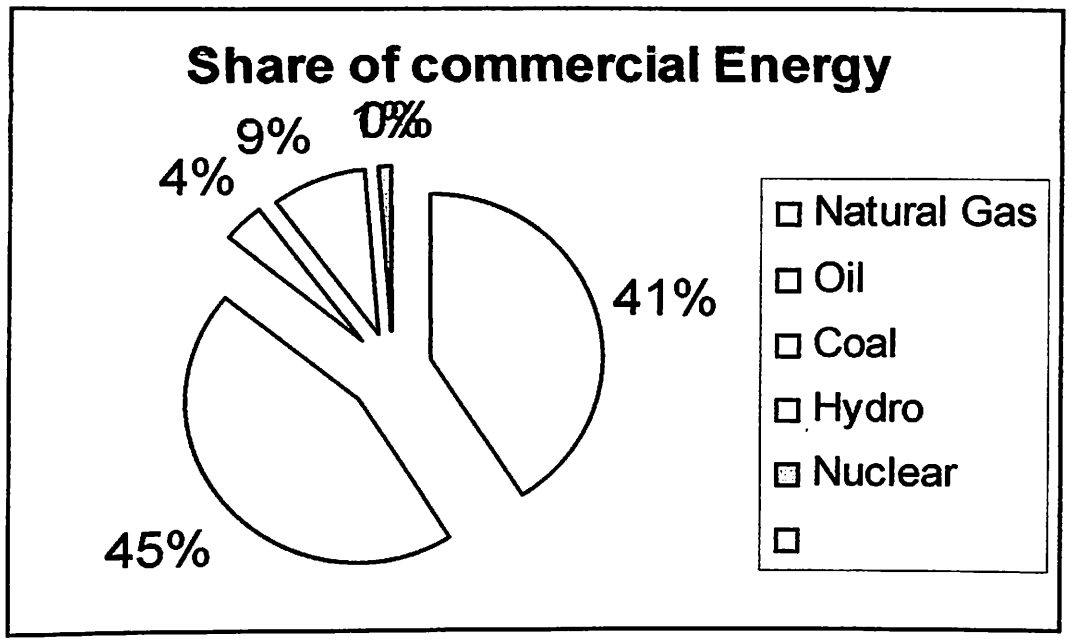

Fig: 4 Share of Commercial Energy

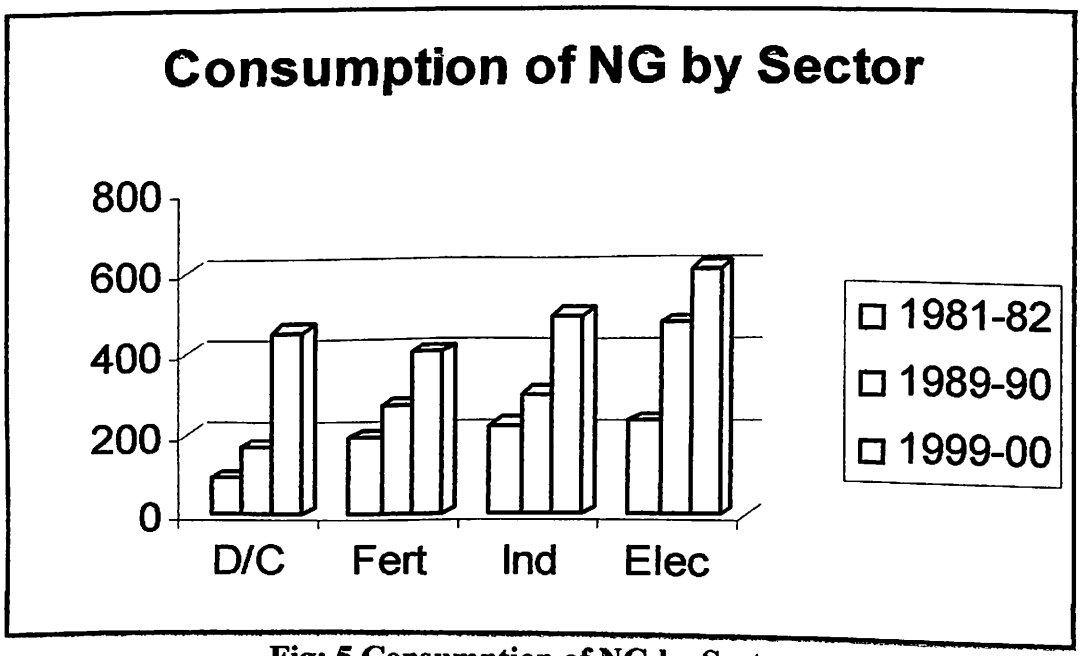

Fig: 5 Consumption of NG by Sector

India has been unable to meet the demand for natural gas for domestic sources. Much of this demand is for generation of electricity but Fertilizers and other sectors are also asking for more NG. The chart below shows the actual and projected demand giving us the gap in supply and demand. By 2010 the gap will be 7400 mcfd. Even if as planned

the coal bed methane is developed its contribution will be less than 500 MMcfd, the remaining demand has to be met by imports or unfulfilled.

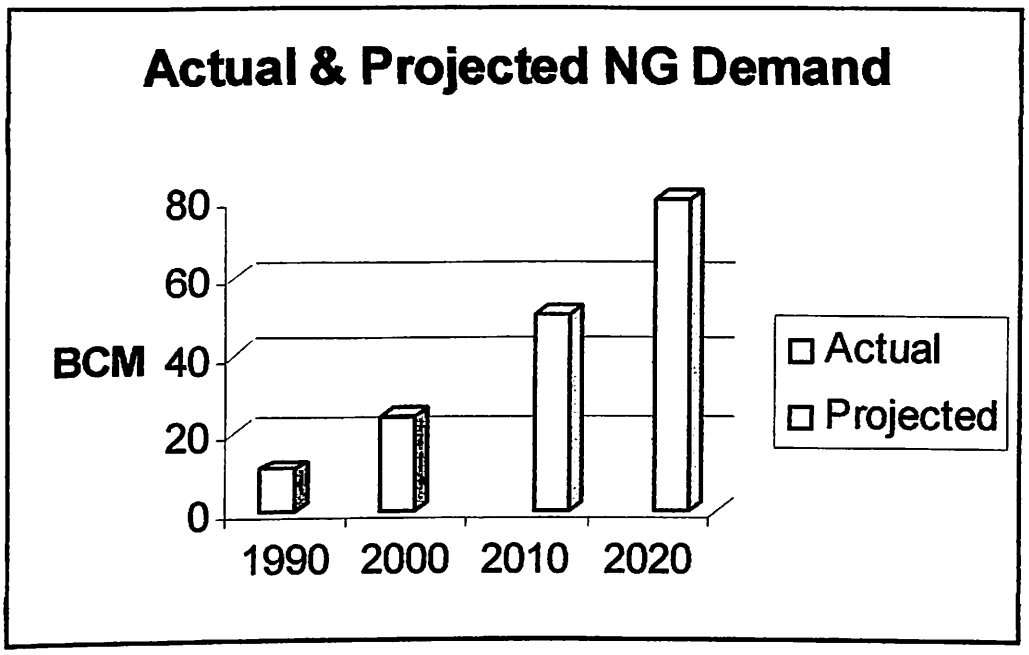

Fig: 6 Actual and Projected Demand

EXISTING INFRASTURUCTURE IN PAKISTAN

Pakistan owes its well-developed infrastructure for transporting of Natural Gas. A 16" diameter pipeline of 558 km with a carrying capacity of 75MMcfd from Sui to Multan was laid to start the new era to develop a new synergy. An 18" diameter pipeline, with a carrying capacity of 267 MMcfd from Sui to Karachi. The Natural Gas field at Pirkoh was also connected to the Sui gas distribution. The transmission network extends to 7900 km and the design flow rate is 850 MMcfd. The system serves for a total of 3.5 million consumers.

EXISTING INFRASTURUCTURE IN INDIA

The main producers of the gas in INDIA are ONGC and OIL, mainly operating in Assam, Bombay High. GAIL was setup as a public sector entity in 1984 to handle the infrastructure and develop a larger market for the gas. A 1700 km long HBJ high-

pressure pipeline starts at Hazira near Surat in Gujarat passing through MP, Rajasthan and UP finally ending in Delhi and Haryana.

In addition to the expansion of HBJ several pipelines systems have been put up in several states including Maharashtra, Andhra Pradesh, Tamil Nadu Assam and Tripura. The pipeline infrastructure now totals to about 3900 km.

OPTIONS FOR IMPORTING NATURAL GAS TO PAKISTAN AND INDIA

From the point of view of geographical closeness and the availability of large natural gas reserves, the most likely sources of gas are Qatar, Oman, Iran and Turkmenistan from the central Asia. The proposed pipelines are mainly land based ones or the ones in the shallow waters.

For the import of natural gas it is generally less expensive from the countries nearby than to liquefy the gas and import it as LNG. LNG terminals have come up in the state of Gujarat with the 3rd one coming up in Kerala at Kochi. Additional Projects were envisaged in the states of Andhra Pradesh and Orissa. Even if all the LNG Projects are successfully completed then the demand in India is so huge that it would save billions of Rupees for India if NG is brought by pipelines. The length of the pipeline from Iran to India would be about 2700 km a 56" diameter pipeline would cost $5billion to build and would deliver about 3.3Bcf per day.

Earlier I mentioned that Pakistan's need for natural gas imports could reach 500 MMcfd by 2010and 1000 MMcfd or more by 2020. Pakistan has already made a large investment in the distribution of natural gas through the country, which serves as an added incentive to import natural gas rather than oil and coal. The anticipated demand of natural gas is likely to exceed 7000 MMcfd by 2010and continue to increase atleast upto 2020. Coal has been the largest source for commercial energy. We are not talking about NG replacing Coal but about meeting the come of the increasing demand for energy. How long this gap in demand and supply continue depends on the steps taken to build up LNG plants and whether pipelines are laid to import natural gas. Political factors were for

example the main reason for Egypt decision to supply gas to Turkey as LNG rather than pipeline as it had to pass through Israel.

THE COST SAVINGS BY A PIPELINE

A pipeline to bring natural gas from Iran the Gulf States or Turkmenistan could result in substantial cost the country. The extent of savings will depend on a variety of factors such as growth in the energy demand, the diameter of the pipeline that is built the prices of natural gas at source such as oil. To get an estimate of the approximate amount of the savings that might be expected we need to make a number of assumptions.

We make the following assumptions

- The natural gas pipeline built would be large enough to supply natural gas having 70 % of the energy value of current used feedstock.
- The furnace oil would cost around $300/tonne keeping the crude price at $50/bbl.
- The natural gas delivered at Delhi would cost $2.99

INVOLVEMENT BY THE INTERNATIONAL COMMUNITY

Each of these pipeline projects would stand to benefit significantly from involvement by the international community. Multinational energy companies are best able to mobilize the resources to complete these large capital projects. More importantly, however, is potential stability offered by international financial institutions such as the World Bank, Asian Development Bank, or the Islamic Development Bank. U.S. involvement could be critical, whether that means removing investment restrictions on Iran, or offering security and loan guarantees as it has recently done in the Baku-Tbilisi-Ceyhan pipeline.

A historical example demonstrating the importance of international and particularly U.S. engagement in the region is evident in the success of the Indus Waters Treaty, signed by India and Pakistan in 1960. This treaty, an agreement to share waters flowing from Jammu and Kashmir to Pakistan, has survived two wars and continuous tension over Kashmir since the partition. The World Bank mediated the negotiation of the treaty; however it was the promise of engagement with the West, and in particular the U.S., that kept India at the bargaining table.

LNG IMPORTS

With pipeline import proposals stalled on all fronts, and domestic gas production leveling off, LNG imports have become the only near term option currently available for increasing gas supplies to the Indian market. The first mover in the race to deliver LNG to the Indian market was U.S. energy major Enron, proposing a joint LNG import facility and 2,000 MW electric power plant at Dabhol in Maharashtra in 1992. The LNG facility was to begin receiving gas by year-end 2001, at which point an already completed power project would switch from Naptha to LNG. Following Enron's lead, eight other LNG import facilities were proposed in the late 1990's, all to be constructed before 2010 and totaling over 35 million metric tons (48 bcm) of capacity. The prospects for all of these projects have become uncertain, resulting from a long-standing battle between the investors in the Dabhol project and the Maharashtra State Electricity Board.

TECHNICAL AND ECONOMIC CONSIDERATIONS OF LNG

The low value density of natural gas requires that it be compressed for transportation. Gas is compressed for transportation in pipelines, or it can be condensed further into its liquid state for transport via ship. General cost estimates suggest that onshore and offshore gas pipelines are cost effective compared to LNG for distances less than 4,000 and 2,500 km, respectively (Jensen 2002). These estimates suggest that an overland gas pipeline route would be least cost economically to deliver gas to India. If political and security concerns make an offshore route the only feasible option, then LNG becomes a competitive alternative.

However, the process of liquefaction, shipping, and regasification required in LNG transport is a capital-intensive process. The favorable comparison for LNG costs is reflective of significant cost reductions that have occurred in LNG liquefaction and transport. Improvements in liquefaction technology have cut costs by nearly $0.50 per MMBtu. Transport costs have also been reduced significantly over the past decade.

PROPOSED LNG IMPORT POLICIES

Much of the early optimism surrounding LNG imports to India has been quelled by the lack of regulatory, tariff, and pricing policies to facilitate investment. Currently any LNG imports are subject to a 22% tax, although several exemptions have been issued. Control of lucrative LNG shipping contracts is a key sticking point in the LNG import policies. Vested interests in India's shipping industry, including the Ministry of Surface Transport, are keen to ensure that domestic companies get a share of the potential LNG shipping market. The recently released draft of the Integrated LNG Import Policy requires that all LNG imports be on Indian flagged vessels, allowing exemptions only for previously completed shipping contracts. The implications of the draft policy are problematic for LNG importers since no Indian shipping companies have experience in LNG shipping, or are able to mobilize the capital necessary to purchase the ships. This move adds one more hurdle to the difficult task of completing an LNG project in India. On a more positive note, the draft Integrated LNG Policy is also to reduce the sales tax to 4% on LNG imports and provide a 10year tax holiday for LNG importers.

More critical than the bickering over who controls the shipping contracts is the pricing and viability of sales from the LNG project. The much-publicized struggle between the Enron's Dabhol Power Company and the Maharashtra State Electricity Board (MSEB) is emblematic of the problems faced by all gas importers, if the industries that purchase the natural gas are not reformed. MSEB has refused to make payment for power delivered by Dabhol, arguing that the contracted price of power from the power project at Dabhol is too high. There are substantial arguments on both sides, but the fundamental problem remains that MSEB cannot charge most its customers a price near the cost of supplying power. This problem is not exclusive to the Dabhol case.

OUTLOOK FOR LNG IMPORT PROJECTS

The slow development of LNG import policy, local opposition to LNG facilities, and the lack of credible buyers threaten the progress of all of the originally proposed projects. The Dabhol facility will likely be sold following the demise of its majority owner, Enron. BP, Shell and GAIL have expressed interest. Potential buyers are seeking to extract the LNG project from the power generation facility. It remains unclear when

the project will take its first LNG shipment. After Dabhol, the next facility planned to start importing LNG is Petronet's 5 million metric ton per year facility at Dahej. Petronet signed a long-term take-or-pay contract with Ras Laffan LNG Company (RasGas) of Qatar. However, the group has been unable to find credit-worthy buyers able to sign contracts for sale of its regasified LNG at suitable prices. First delivery is expected in June of 2003, and under the terms of the contract Petronet must pay the agreed price for the full contracted supply. Buyers such as National Thermal Power Corporation (the state-owned power generation company) and various state electricity boards have been unwilling to sign contracts for delivery of the gas, stating that they "will be unable to sell power based on these terms"

The TotalFinaElf supported project at Trombay recently decided to suspend its plans for construction of its 3 million tons (approximately 4 bcm) per year LNG facility. The project had faced local opposition concerned about environmental impacts and had been unable to receive various government regulatory approvals. However, it was the Dabhol situation and the Petronet's marketing difficulties that ultimately led the company to put its plans on hold. Similarly, projects at Ennore and Kochi are contingent on gas sales to power generation companies. Other than Dabhol, which is nearly completed, the success of all other projects depends critically on the moves of the government to raise gas prices and reform gas purchasing industries, particularly electric power.

At the same time one has to look at the other side of the picture too.

DIFFERENT PERSPECTIVE

Liquefied Natural Gas (LNG) facilities are receiving a great deal of public attention due to their increasingly important role in the nation's energy infrastructure and their potential vulnerability to terrorist attack. LNG has long been important to natural gas markets, although energy economics and public perceptions about LNG risks have limited the industry's growth. Concerns about rising natural gas prices and the possibility of domestic gas shortages have recently been driving up demand for LNG imports. But LNG is a hazardous liquid transported and stored in large quantities. In light of the terror attacks of September 11, 2001, the LNG buyers are concerned about the security of

existing LNG infrastructure and the security implications of a major increase in LNG imports to the around the world. The following provides an overview of recent industry and federal activities related to LNG security. It also describes LNG infrastructure, the industry's safety record and security risks, and the industry's security initiatives since September 11, 2001. It summarizes recent changes in federal LNG and maritime security law and related changes in the security roles of federal agencies. The policy concerns related to federal LNG security efforts: 1) public costs of marine security, 2) overlapping federal security jurisdiction, and 3) security implications of building offshore LNG facilities.

LNG RISKS AND VULNERABILITIES

The risks associated with LNG infrastructure have been debated for decades. A prominent accident at one of the nation's first commercial LNG facilities in 1944 initiated public fears and misperceptions about LNG hazards, which persist today. In this accident, the "Cleveland Disaster," an LNG spill from an improperly designed storage tank caused a fire that killed 128 people.34 While this accident continues to serve as a reminder of the hazards of LNG, technology improvements since the 1940's have made LNG facilities much safer. Serious risks remain, however, since LNG is inherently volatile and is usually stored in large quantities. Because LNG infrastructure is highly visible and easily identified, it is vulnerable to terrorist attack.

PHYSICAL HAZARDS OF LNG

Natural gas is combustible, so an uncontrolled release of LNG poses a serious hazard of explosion or fire. LNG also poses hazards because it is so cold. Experts have identified several potentially catastrophic events that could arise from an LNG release. The likelihood and severity of these events have been the subject of considerable research and testing. While open questions remain about the impacts of specific hazards in an actual accident, there appears to be consensus as to what are the greatest LNG hazards.

- **Pool fires.** If LNG spills near an ignition source, the evaporating gas in a combustible gas-air concentration will burn above the LNG pool. The resulting

"pool fire" would spread as the LNG pool expanded away from its source and continued evaporating. Such pool fires are intense, burning far more hotly and rapidly than oil or gasoline fires. They cannot be extinguished–all the LNG must be consumed before they go out. Because LNG pool fires are so hot, their thermal radiation may injure people and damage property a considerable distance from the fire itself. Many experts agree that a pool fire, especially on water due to thermal effects, is the most serious LNG hazard.

- **Flammable vapor clouds**. If LNG spills but does not immediately ignite, the evaporating natural gas will form a vapor cloud that may drift some distance from the spill site. If the cloud subsequently encounters an ignition source, those portions of the cloud with a combustible gas-air concentration will burn. Because only a fraction of such a cloud would have a combustible gas-air concentration, the cloud would not likely explode all at once, but the fire could still cause considerable damage. An LNG vapor cloud fire would gradually burn its way back to the LNG spill where the vapors originated and would continue to burn as a pool fire. If an LNG tank failed due to a collision or terror attack, experts believe the failure event itself would likely ignite the LNG pool before a large vapor cloud could form. Consequently, they conclude that large vapor cloud fires are less likely than instantaneous pool fires.

- **Flameless explosion**. If LNG spills on water, it could theoretically heat up and regasify almost instantly in a "flameless explosion" (also called a "rapid phase transition"). While the effects of tanker-scale spills have not been studied extensively, Shell Corporation experiments with smaller LNG spills in 1980 did not cause flameless explosions. Based on a review of these experiments, a U.S. national laboratory concluded that "transitions caused by mixing of LNG and water are not violent." Even if there were a flameless explosion of LNG, experts believe the hazard zones around such an event "would not be as large as either vapor cloud or pool fire hazard zones." In addition to these catastrophic hazards, an LNG spill poses hazards on a smaller scale. An LNG vapor cloud is not toxic,

but could cause asphyxiation by displacing breathable air. Such clouds rise in air as they warm, however, diminishing the threat to people on the ground. Alternatively, extremely cold LNG could injure people or damage equipment through direct contact. The extent of such contact would likely be limited, however, as a major spill would likely result in a more serious fire. The environmental damage associated with an LNG spill would be confined to fire and freezing impacts near the spill since LNG dissipates completely and leaves no residue.

LNG SECURITY RISKS

LNG tankers and land-based facilities are vulnerable to terrorism. Tankers may be physically attacked in a variety of ways to destroy their cargo–or commandeered for use as weapons against coastal targets. Land-based LNG facilities may also be physically attacked with explosives or through other means. Alternatively, computer control systems may be "cyber-attacked," or both physical and cyber attack may happen at the same time. Some LNG facilities may also be indirectly disrupted by other types of terror strikes, such as attacks on regional electricity grids or communications networks, which could in turn affect dependent LNG control. The study calculated that a fire from one LNG cargo tank with a 1 m^2 hole would cause a pool fire 25 meters across and would burn for 1 hour. Since LNG is fuel for power plants, heating, military bases, and other uses, disruption of LNG shipping or storage poses additional "downstream" risks, especially in more dependent regions like New England. No LNG tanker or land-based LNG facility has been attacked by terrorists. However, similar natural gas and oil facilities have been favored terror targets internationally. For example, over the past two years, gas and oil pipelines have been attacked in at least half a dozen countries. In June 2002, Moroccan authorities foiled an Al-Qaeda plot to attack U.S. and British warships, and possibly commercial vessels, in the Straits of Gibraltar. LNG tankers from Algeria en route to the United States pass through the same waters. In October 2002, the French oil tanker *Limberg* was attacked off the Yemeni coast by a bomb-laden boat. In the United States, federal warnings about Al Qaeda threats since September 11, 2001 have repeatedly mentioned energy infrastructure. In June of 2003, for example, U.S. intelligence agencies

warned about possible Al Qaeda attacks on energy facilities in Texas. The potential hazard from terror attacks on LNG tankers continues to be debated among experts. One recent study of tankers serving the Everett LNG terminal assessed the impact of 1) a hand-held missile attack on the external hull, and 2) a bomb attack from a small boat next to the hull (similar to the *Limberg* attack). The study found that "loss of containment may occur through shock mechanisms caused by small amounts of explosive." The study concluded that "a deliberate attack on an LNG carrier can result in a ... threat to the ship, its crew and members of the public." However, the study also found the risk of a public catastrophe to be small. For example, the study found that the LNG pool hazard would be less than that for a gasoline or liquefied petroleum gas (LPG) pool. The study also concluded that a vaporized LNG explosion would be unlikely because a missile or bomb presents multiple ignition sources. Other experts have calculated that an LNG fire under "worst case" conditions could be much more hazardous to waterfront facilities. Impact estimates for LNG tanker attacks are largely based on engineering models, however, each with its own input assumptions–so it is difficult to assert definitively how dangerous a real attack would be.

PUBLIC COSTS OF LNG MARINE SECURITY

Some policymakers are concerned about the public cost and sustainability of securing LNG shipments. Overall cost data for LNG security are unavailable, but estimates have been made for Everett shipments. The Coast Guard Program Office estimates that it currently costs the Coast Guard approximately $40,000 to $50,000 to "shepherd" an LNG tanker through a delivery to the Everett terminal, depending on the duration of the delivery, the nature of the security escort, and other factors. State and local authorities also incur costs for overtime police, fire and security personnel overseeing LNG tanker deliveries.

The state of Massachusetts and the cities of Boston and Chelsea estimated they spent a combined $37,500 to safeguard the first LNG shipment to Everett after September 11, 2001. Based on these figures, the public cost of security for an LNG tanker shipment to Everett is on the order of $80,000, excluding costs incurred by the terminal owner.

Marine security costs at other LNG terminals could be lower than for Everett because they are farther from dense populations and may face less vulnerability. But these terminals expect more shipments.

Altogether, the six active U.S. LNG terminals, including Everett, expect to have enough capacity for approximately 490 shipments per year by 2006. Currently proposed on-shore LNG terminals operating at capacity would more than double this number of shipments over the next decade to over 1,000 per year. Assuming an average security cost only half that for Everett, or $25,000 per shipment, annual costs to the public for marine LNG security would reach $25 million. LNG security is not a line item in the DHS Appropriations Bill for 2004 (H.R. 2555); it will be funded from the Coast Guard's general maritime security budget. According to Coast Guard officials, the service's LNG security expenditures are not all incremental, since they are part of the Coast Guard's general mission to protect the nation's waters and coasts. Nonetheless, Coast Guard staffs acknowledge that resources dedicated to securing maritime LNG might be otherwise deployed for boating safety, search and rescue, drug interdiction, or other security missions.

State and local agency costs *are* largely incremental, as they are mostly overtime labor charges for law enforcement and emergency personnel. These local resources could also be deployed in other public service or conserved altogether, especially in communities with tight budgets. Few, if any, interested parties have suggested that current levels of maritime LNG security ought to be reduced in the short term. Furthermore, the public costs of LNG security may decline as federally mandated security systems and plans are implemented. For example, new security technology, more specific threat intelligence, and changing threat assessments may all help to lower LNG security costs in the future. Nonetheless, the potential increase in security costs from growing U.S. LNG shipments may warrant a review of these costs and associated recovery mechanisms. Massachusetts state and municipal officials, for example, have argued that their increased LNG security costs should be paid by the Everett terminal owner.

The idea is similar to proposals that would impose additional fees on nuclear plant owners to offset the costs of increased federal government security services. Other

experts have suggested that LNG companies should potentially be required to contract private security to perform duties currently done by government agencies. Some LNG companies have resisted such suggestions, reasoning that the millions of dollars in federal, state, and local taxes they pay should cover public law enforcement and emergency services. Others have expressed a willingness to pay for "excess" security if it exceeds the level of security agency service ordinarily commensurate with corporate tax payments.

IRAN-PAKISAN-INDIA

Since the discovery of natural gas reserves in Iran's South Pars fields in 1988, the Iranian government began increasing efforts to promote higher gas exports abroad. The prospects for profit are especially high in South Asian countries like India and Pakistan, where natural gas reserves are low and energy demand exceeds energy supply. In 1995, Pakistan and Iran signed a preliminary agreement for construction of a natural gas pipeline linking the Iranian South Pars natural gas field in the Persian Gulf with Karachi, Pakistan's main industrial port located at the Arabian Sea. Iran later proposed an extension of the pipeline from Pakistan into India. Not only would Pakistan benefit from Iranian natural gas exports, but Pakistani territory would be used as a transit route to export natural gas to India.

Initially, the Indian government was reluctant to enter into any agreement with Pakistan due to the historically tense relationship between the two neighbors. As an alternative, India suggested the development of a deep-sea pipeline where no threat to security of resources could exist. At present, in 2000, Indian, Iranian, and Pakistani government officials continue to negotiate the possible routes, modes of transport, and geopolitics of the Iran to India natural gas pipeline. These negotiations indicate a significant shift in inter and intra-regional politics between the states. The potential for economic and developmental gain from natural gas will force India, Iran, and Pakistan to reassess their roles and policies in regional conflicts, like Kashmir, Afghanistan, and national security issues. Furthermore, potential economic collaboration and gain will also lead to a possible transformation of social and political discourse between the countries, perhaps even leading to mediation and resolution of regional conflicts.

THE PEACE PIPELINE: IMPLICATIONS FOR CONFLICT RESOLUTION, FOREIGN POLICY, AND REGIONALISM

The exportation of natural gas from Iran to India through Pakistan is a venture, which may change the face of regional politics in South Asia. It is a study in how economic collaboration possesses the power to engender as well as transform social and political discourse between countries. The Indian government speculated whether Pakistan could guarantee security for the flow of natural gas in the pipeline. Furthermore, Pakistan's collaboration with Iran may foster conflict resolution as well. In the past, Iranian and Pakistani foreign policies have disagreed on the issues of Afghanistan and Shi'a-Sunni conflicts in the region. Thus, trade and the larger experience of economic globalization possess the ability to exist as mediators in conflicts in the region and between regions.

Natural gas trade between India, Iran, and Pakistan challenges the geopolitical, historical, and strategic realities of the three countries and the general regions of the Middle-east and Asia. In this way, the relationship between the pipeline venture and globalization is multidisciplinary. It is not characterized solely by economic factors, even though the current economic realities in Iran, India, and Pakistan do foreshadow the future necessity of economic collaboration. The realities of this case study are representative of the notion that multidisciplinary globalization is changing the face of regional politics and altering the social and political landscape of regions.

NEGOTIATING THE PIPELINE

Holding approximately 9 percent of the world's total reserves, Iran is OPEC's second largest producer of oil. Along with oil reserves, Iran contains the world's second largest natural gas reserves "at an estimated 812 trillion cubic feet (Tcf)" (Ibid). While Iranian natural gas consumption is high, the country desperately needs to promote export markets for gas due to its faltering economy and to meet the demands of modernization. To meet these demands, Iran has targeted emerging regional markets like South Asia for natural gas exports.

Iran has proposed the export of natural gas from Iran to India since 1993. Alongside this proposal was the plan to export natural gas to Pakistan as well. The Iranian government proposed the construction of a pipeline from its South Pars fields in the Persian Gulf to Pakistan's major cities of Karachi and Multan and then further onto Delhi, India.

The pipeline 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.

In 1995, Pakistan and Iran "signed a preliminary agreement for construction of a $3 billion, 870 mile onshore gas export pipeline linking South Pars with Karachi, Pakistan" This pipeline did not include the additional city of Multan, Pakistan and excluded the transport of gas on into India. Under a new pipeline project proposing to include India, the Pakistani government would be able to "inject its own exportable gas for sale to the international market that is [Delhi] India" or take out gas for domestic purposes in Multan. The pipeline would be 2,670 km long with a 48 inch diameter, and hold $3.2 billion of gas. Pakistan could earn as much as $500 million in royalties from a transit fee and save $200 million by purchasing cheaper gas from this pipeline project. Four major companies have expressed interest in constructing the Iran to India natural gas pipeline. They are BHP of Australia, NIGC, Petronas of Malaysia, and French Total, which is already partnering with Iran in the development of an international pipeline through Turkey. A consortium consisting of Shell, British Gas, Petronas, and an Iranian business group already existed and "was negotiating how to export gas from South Pars to Pakistan". Also involved is the Iran National Gas Company and the Gas Authority of India Limited (GAIL).

For the pipeline project, the year 1999 was characterized by several meetings between Indian and Iranian government officials which resulted in the formation of delegations and committees to further discuss the feasibility of the pipeline project. In February 1999, Iran signed a preliminary "in-principle" agreement with India, agreeing to the idea of bi-lateral collaboration. However, a tripartite agreement is necessary between India, Iran, and Pakistan for the implementation of the project

In April 1999, the Iranian and Indian governments established a bi-lateral task force of business and government officials to look at the economic and industrial feasibility of developing the pipeline. In September 1999, the National Iranian Gas Company sent a two member delegation to hold talks with the Gas Authority of India Limited (GAIL) and the Petroleum Ministry in India to discuss the production of a feasibility report for the pipeline project (The Hindu 24 September 1999).

At the end of 1999, Chief Executive Pervez Musharraf of Pakistan visited Tehran to discuss bilateral relations as well as the pipeline project. The months following Musharraf's visit to Iran were characterized by more diplomatic visits in the region. In March 2000, the Pakistani Secretary of Petroleum visited Iran to formally agree to the pipeline project between the three countries. Iranian government officials visited Islamabad later in April 2000 for the Pakistani government to sign the contract.

The bilateral India-Iran task force met again in July and August to discuss the feasibility, security, and economics of the pipeline project. The purpose of the task force was for the Indian government to achieve some clarity and confidence on these issues. The Pakistani government and Iran already decided on some of the practical logistics of the project, like security for the pipeline in Pakistan, duration of its construction, and pipeline length. The Pakistani energy minister guaranteed in July 2000 to Iran and India that security of the pipeline remains of topmost concern and will be ensured. It was later decided that if the Pakistani government agreed to build the pipeline in the shortest possible time, that being three years, then the Iranian government would increase the transit fee

TRADE AS CATALYST FOR REGIONAL COOPERATION

As meetings amongst the three governments, oil companies, and committees persisted; the pipeline project came to involve a whole host of new issues, ranging from security concerns to meeting the high demands for energy in South Asia. Above all, the issue of regional cooperation emerged as that which has the propensity to initiate the greatest reform. Regional cooperation in the form of India-Pakistan collaboration, alongside India-Iran and Iran-Pakistan collaboration, can potentially influence bilateral

relationships between the countries on the key issues and conflicts of Afghanistan, Kashmir, and overall national security.

After meeting with Iranian President Muhammad Khatami in New York in September 2000, Musharraf expressed Pakistan's willingness to participate in the pipeline venture and promoted the idea as an example of regional cooperation. Musharraf stated that the development of the pipeline and natural gas resources in Pakistan are "the country's economic salvation" and will "break an age old dependence on cotton and textiles as Pakistan's main export earners". Also discussed was the need for evolving a joint strategy towards the resolution of the Afghanistan conflict. Khatami stressed on the need for two things. First, "for removing any existing misunderstandings between Tehran and Islamabad" on the Afghanistan conflict. Second, to evolve a joint strategy towards resolution of the Afghanistan conflict

IRAN AND AFGHANISTAN:

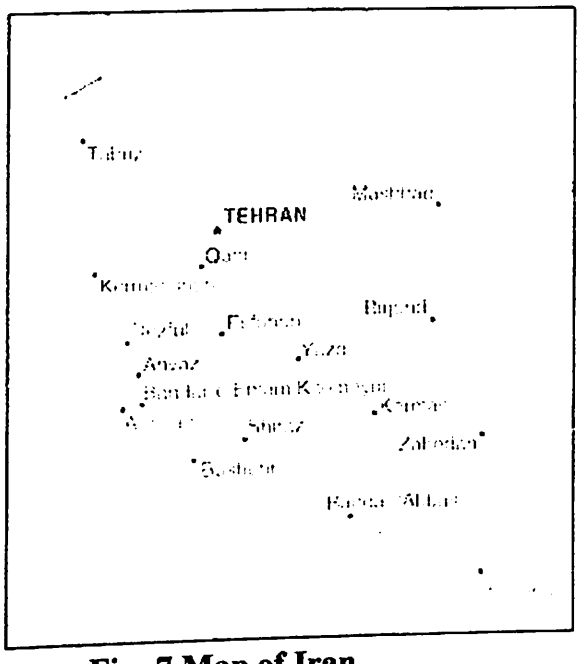

Fig: 7 Map of Iran

Resolution of the Afghanistan conflict within Afghanistan itself as well as between Iran and Pakistan would lead to overall economic benefit in the region. Given the large amounts of natural gas resources in Central Asia and the need to use Afghanistan as a route to transport these resources to other markets like South Asia, oil companies are extremely eager to invest in economic development and collaboration with Afghanistan, Iran, and Pakistan. In the past, however, the issue of Afghanistan has prevented such development. Ahmed Rashid writes in Taliban: Militant Islam, Oil, and Fundamentalism in Central Asia,

> "The U.S. bombing of Bin Laden's camps in August 1998 forced Unocal to pull out its staff from Pakistan and Kandahar and finally, in December 1998, it formally withdrew from the CentGas consortium, which it had struggled so hard to set up. The plunge in world oil prices which had hit the world's oil industry also hit Unocal hard. Unocal withdrew from a pipeline project in Turkey, closed its offices in Pakistan, Turkmenistan," and withdrew financing due to civil war among the Afghans" (Rashid 211).

The example of the Afghanistan conflict introduces the issue of national security and its importance in the context of regional cooperation. Initially, both Pakistan and India were skeptical and rejected the pipeline proposal because of security concerns. Both the Benazir Bhutto and Nawaz Sharif governments halted the projects because of reservations in the army on the type of impact this project would have on the regional issues of Kashmir and the government's position on bilateral trade with India. (Zehra 2000). For the Indian government, concerns pertained to "Pakistani fundamentalists disrupting supplies" (Bagchi 2000). India also believes the pipeline places Islamabad at a strategic advantage where it can "shut of the tap" in times of crisis or conflict (Reuters 2000).

TRADE AS MEDIATION

The pipeline posits trade as a mediator in the development of India, Iran, and Pakistan's bilateral policies and conflict resolution. For Pakistan, the pipeline project assists in Pakistan's to re-establish ties with Iran. In recent decades, Pakistan and Iran have remained isolated from one another due to major differences over the Afghanistan civil war. Pakistan supports the Taliban while Iran supports the opposition forces, the Northern Alliance, who are fighting against the Taliban. For India, the pipeline project serves as a route to better improve both trade relations and communication with Iran.
On November 7, 2000, and Indian business delegation visited Iran to discuss what India's private sector is willing to offer the Iran-India pipeline project. A. C. Patankar, the principal advisor of the Confederation of Indian Industry which has 4,000 member companies, stated the roles and functions the private sector would like to perform. First, he stated how the objective of the delegation's visit was to explore business opportunities and also to strengthen India-Iran relations. Second, he mentioned how dialogue between the two countries experienced a "communication gap." This gap was the "main reason for the low level of trade relations between Iran and India". The Indian point of view defines the pipeline project as a bilateral agreement excluding the third country. Improved trade relations are viewed as methods to ameliorate communication gaps or differences in regional conflicts.

Pakistan and Iran could also begin to resolve their regional conflicts in light of their proposed collaboration on the pipeline project. Disputes between Pakistan and Iran have traditionally focused on Afghanistan as well as tensions between Sunni and Shi'a muslims. As Afghanistan's eastern and western neighbors, Pakistan and Iran have proven detrimental to the Afghan peace process:

> "There is no common ground between the two states on a solution to the Afghan civil war and even more ominously both states are funding proxy wars between Shi'a and Sunnis in each other's countries as well as in Afghanistan, increasing the likelihood of a major explosion in the region" (Rashid 211).

These conflicts are nothing new to the region. They do, however, present a powerful challenge to the reality of economic collaboration, interdependence and globalization in the region. The need for resolution of these conflicts is fueled by the emergence of oil and natural gas reserves and various other pipeline ventures in the region. Knowing this, we must ask if the development of pipelines in war torn and conflict laden regions bring resolution and if economic collaboration and globalization can foster peace? Because of the potential economic prosperity for all countries involved, a shift in regional political discourse is necessary.

So far, the project has been viewed as a catalyst for the promotion of regional cooperation and mediation by only on bilateral levels. For Pakistan, pipeline is not viewed as a partnership with India, but rather as "a bilateral Iran-Pakistan project which, through the Iranian partnership, does involve India" (Zehra 2000). Thus, the Pakistani government views the pipeline project as regional collaboration with Iran and not India. Pakistani promotion of economic collaboration with Iran as an example of regional cooperation indicates a geopolitical shift in both Pakistan and Iran's regional identity, since Pakistan historically has identified with South Asia and Iran with the Mideast and Central Asia regions. This shift shows Pakistan's economic and political alignment with Central Asia and the Mideast more so than with South Asia. Perhaps this is an effort by Pakistan to further distance itself from the role it has acquired in the South Asian regional context. It is a role characterized predominantly by its hostile relationship with a much larger India. Additionally, India's hegemonic presence in areas of trade and economic

policies in the region has led most of the other South Asian countries to look outside the region for greater economic collaboration.

In this case, economic collaboration indirectly sows the seeds for a shift in regional politics and perspective. With more economic collaboration between Iran and Pakistan, the states' previously conflicting positions on Afghanistan transform into common policy objectives which are handled differently. Rather than taking sides in the Afghanistan conflict, both Iran and Pakistan have decided to let "the ground realities determine the flow of the Afghan situation" (Zehra 2000). The pipeline project exemplifies the ushering in of an economic globalization which changes the face of regional politics and, literally, a region. Sharing a 909 km border, Iran and Pakistan realized the necessity of a cooperative relationship and foreign policy which would benefit both countries economically through increased trade.

In addition to promoting its regional identity with Iran, Pakistan could further its sense of regionalism with Iran by enforcing the notion of the ummah, a transnational identity which does not recognize national borders, to further promote economic collaboration . If this becomes the case, Pakistan will be able to transform a political discourse of regionalism into a communal and religious movement, stating that Iranians and Pakistanis should work together economically because they are already spiritually unified as Muslims. This too will serve to further Pakistan's regional identity away from India, which is both secular and predominantly Hindu. In all practicality, economic collaboration between Iran and Pakistan will not completely erase Pakistan's presence and role in South Asia. It does, however, represent a greater effort made at repairing and reinforcing inter-regional ties. This effort is needed in relations between Iran and Pakistan but is even more so urgently needed in the relationship between India and Pakistan.

The relationship between Pakistan and India has dominated the face of South Asian politics. It is a relationship marked by political distrust, communal overtones, and land disputes. The countries have fought three wars in the past 52 years. Most economic collaboration with India is avoided by Pakistan and other South Asian countries due to India's role as the geographic and economic hegemony in the region. Cooperation is seen by Pakistan and other countries as only strengthening India's economic dominance by

securing a regional market for India (Dash 1996). Additionally, the cultural and social ties between India and Pakistan are exceedingly tense with numerous acts of communal violence committed between Muslims and Hindus. One example is the destruction of the Babri Mosque at Ayodhya in 1992 by Hindu fundamentalists. The mosque was built under the authority of the first Mughal emperor of India, Babar, in 1528. Leaders of Hindu fundamentalist political parties and their followers believed that the Hindu god Rama was born at the location of the Babri Mosque. Furthermore, they believed that "Rama's birthplace was destroyed to build the mosque" (Ludden 1). To avenge this destruction, the fundamentalists plan to reconstruct a temple in honor of Rama over the rubble of the Babri Mosque. It is the emergence and recurrence of events of this nature which have plagued the political, economic, and social relationship between India and Pakistan.

Given the tense multidimensional relationship, an agreement on the pipeline project between India and Pakistan would be seen as an historic event. The only other successful bilateral agreement between the two countries pertaining to distribution of resources is the Indus Water Treaty of 1960. After India and Pakistan received independence from the United Kingdom in 1947, the Indus River Basin was divided in half. Initially, "the two nations failed to settle the dispute over distribution of water resources in the basin" and only signed an agreement with the facilitation of the World Bank thirteen years later in 1960 (Nakayama 1996). According to the treaty, Pakistan has access to the flows of the Indus, Kabul, Jhelum, and Chenab rivers while India has rights to the Ravi, Beas, and Sutlej rivers.

An agreement between India and Pakistan on the pipeline project will be considered historical because it also directly impacts the Kashmir conflict, which has been the major source of friction between the two countries since they both received independence from the British in 1947. While Kashmir is comprised mostly of Muslims, it also includes Hindu and Buddhist populations. For Pakistan, "Kashmir is essential to maintaining national identity. Ceding control of the third of the country it occupies to the Indians would be regarded as a betrayal of Pakistan's historic portrayal of itself as a pan-Islamic homeland" (Rose 95). For India, maintaining control in Kashmir is essential because it is "the key to holding the subcontinent together, especially in this era of

increasing ethno-religious nationalism" (Rose 94). There are large numbers of Muslims, Sikhs, and Christians in five Indian states and Sikh separatists in the Indian state of Punjab (Rose 94). The Indian government must consider these realities when debating whether it should agree to a plebiscite amongst the Kashmiri people allowing them to determine their own nationality or to direct bilateral negotiations with Pakistan over the accession and/or succession of parts of Kashmir.

Pakistan and India:

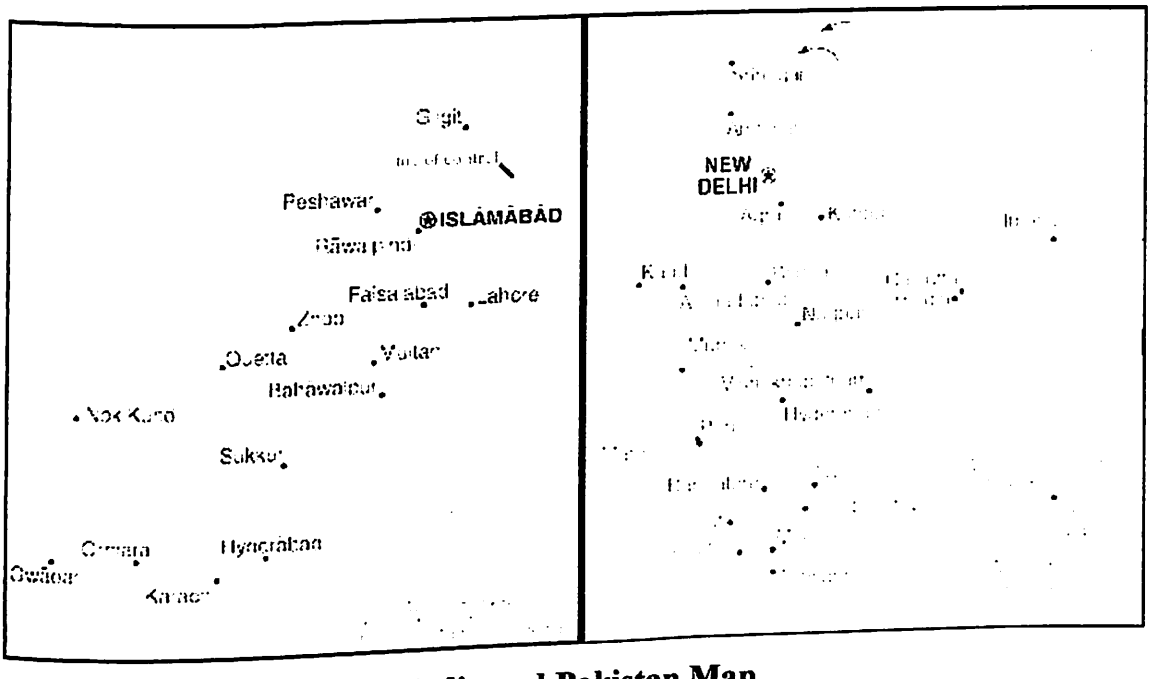

Fig: 8 India and Pakistan Map

The Pakistan controlled part of Kashmir is known as Azad ("free") Kashmir. The part which is under Indian control is called Occupied Kashmir by Pakistan and known as Jammu and Kashmir in India. They are divided by the "Line of Control" (see Map A). Note the use of language by the Pakistani state to form national discourse and opinion on the Kashmir conflict. The portion under Pakistani control is considered free while the portion under Indian control is termed "occupied." India is viewed as an occupier, the outsider who has come in and usurped land which belongs to another nation. However, which nation does this refer to? Does it refer to the Pakistani nation-state or to the Kashmiri nation as a people not defined by the boundaries between India and Pakistan? In these questions it is evident that the political discourse of Indian occupation of Kashmir has lead to further questions of nationhood and nationality. These questions

have affected social discourse between the Indian, Pakistani, and Kashmiri people. A new generation of Pakistani and Indian youth who did not experience the horror of partition of the birth of the Kashmir conflict are well versed in the rhetoric of the respective Indian and Pakistani enemy. Furthermore, Kashmiris living in both Indian and Pakistani Kashmir have found themselves increasingly discontent with both countries policies towards Kashmir and have started calling for more political autonomy from India and Pakistan.

In a case similar to this one, a proposed pipeline project in the European natural gas market has also being labeled "the peace pipeline." The project involved a scheme to ship Egyptian natural gas in liquid form (LNG) to Turkey. Previous to this agreement, there was a plan to supply natural gas to Turkey through Israeli territory. Instead of agreeing to the land route, Egypt opted for the LNG route, providing Turkey with up to 350 billion cubic feet of gas starting in 2000 (Energy Information Administration 2000). "The switch to the LNG scheme demonstrates that LNG is still commercially viable in areas where political issues constrain pipeline development" (Energy Information Administration 2000). This example shows how LNG development may serve as an alternative to collaboration between countries and regions where cooperation proves difficult on account of political conflicts. For India, this is definitely the case. Instead of addressing regional disputes and points of tension with Pakistan, India has considered the alternative option -- to withdraw from collaboration with Pakistan and propose a pipeline which would go through water instead of Pakistani territory.

India and Pakistan have never been successful in negotiating Kashmir. In recent years, the pattern has been that one side says it will negotiate through bilateral talks with the other. The other side rejects the proposal for bilateral talks, stating the Kashmiri people must be included in the peace process. Additionally, the political parties of Kashmir also seek a role in the peace process and state their own positions often independently of both India and Pakistan. The hostile political and social discourse and lack of conflict resolution between India and Pakistan over Kashmir is challenged by the emergence of the pipeline project. The project forces the two countries to reconsider their political discourse and interdependence, especially in light of their energy crises and desperate need for natural gas resources.

ENERGY CONSUMPTION IN INDIA AND PAKISTAN

Both India and Pakistan consume more energy than they produce. The production of natural gas in both countries cannot meet the countries' demands for energy and natural gas consumption. Approximately 8 percent of energy consumption in India is accounted for by natural gas and 27 percent in Pakistan. Table shows the natural gas reserves, production, and consumption of India, Iran, and Pakistan. Iran's 812 trillion cubic feet of natural gas reserves and low levels of natural gas consumption make it a natural potential distributor of natural gas resources to India and Pakistan.

Country	Natural Gas Reserves	Natural Gas Production	Natural Gas Consumption
India	22.9 trillion cubic feet (Tcf)	761 Bcf	761 Bcf
Iran	812 trillion cubic feet (Tcf)	1.9 Bcf	1.8 Bcf
Pakistan	21.6 trillion cubic feet	0.7 Tcf	0.7 Tcf

TABLE 2: Natural Gas Statistics - Country Specific (CIA 2000)

The current demand in India for natural gas is nearly 96 million cubic meters per day (mcmd) and only 67 mcmd is available. Pakistan's demand also exceeds its current supply. "Pakistan's demand for natural gas is expected to rise substantially in the next few years, with an increase of roughly 50% by 2006". Furthermore, the output of 0.7 trillion cubic feet (Tcf) meets only 39% of Pakistan's energy needs. Pakistan has only 21.6 Tcf of natural gas reserves, resulting in the production of 0.7 Tcf of natural gas, which is exactly the same as the level of natural gas consumption in the country. India also has this problem with both production and consumption of natural gas at 761 billion cubic feet (Bcf).

Nearly 70 percent of India's natural gas reserves are in the state of Gujarat and the Bombay High Basin. The Indian government has encouraged further exploration of gas

rich areas but it will be unable to meet the increasing demand for natural gas and energy in India's near future due to cost and industrialization factors.

Pakistan, as well, attempted to cultivate its natural gas resources in the southern province of Sindh in a natural wildlife preserve, where the "dry and hilly terrain supports many endangered species and a quarter million pastoral people who refuse to give up their way of life". When the Sharif government in 1997 invited British Premier Oil to cultivate the land into natural gas fields in hopes of discovering the predicted three million cubic feet of gas, the quarter million pastoral people living there protested, refusing to give up their way of life. Presently, the Pakistani government still hopes the development of new natural gas fields would serve to prevent the future energy crisis predicted in the next four years. However, this hope falls short of the reality, considering the environmental concerns expressed by pastoral peoples as well as lack of industrial facilities to implement cultivation efforts.

GLOBALIZATION AND REGIONAL COOPERATION IN THE DEVELOPING WORLD.

Because of the demand for energy in South Asia, both Pakistan and India must reevaluate their positions on the Iran-India pipeline project. They must view the project as the emergence of an economic globalization by which regional cooperation could save them from a common future crisis. Historically,

> "As the globalization process began to gather speed, states quickly realized that their neighbors, who often had similar economies to their own, faced many became one way of attempting to come to grips with these common problems"

In the context of South Asia, this economic globalization thus plays an influential role in forming and transforming regional politics and relations. The Pakistani and Indian governments must realize that their situations fall on common ground. Only once this happens can regional politics and relations significantly transform.

Punjab Finance Minister Shahid Kardar Pakistan spoke in November 2000 on regional cooperation and globalization after announcing that Pakistan attracted $704 million in the past year for investment in the gas and oil sector. He commented that

economic and social reforms were desperately needed. He also commented on the current era of economic globalization, which many developing countries now face. He said,

"We do not have the luxury of time. It has run out on us. We need to seize the moment, or we will be marginalized in the global system with increasingly difficult political, economic, and social challenges confronting us".

While Kardar does not specifically mention regional cooperation, his mention of the marginality of developing countries highlights one of the primary reasons for participating in regional projects like the Iran to India natural gas pipeline. Surely this is something India, Iran, and Pakistan can all understand.

POLITICS

The US has issued a veiled threat to both India and Pakistan expressing its concern against the proposed gas pipeline from Iran apparently on grounds of Iran's allegedly nuclear intransigence. The true reasons behind are

1. More of the west Asia oil has started moving eastward. India's imports have increased fourfold.
2. Spot markets have sprung up increasingly with the unaccounted production, thus quotas have limited relevance.

The European Union s already nervous of excessive dependence on Russian gas, more than 36% in Western Europe and 50 % central Europe. Russia is envisaging for itself a central for gas, analogous to Saudi Arabia for OPEC. If the Russian and the Turkmenistan deal is furnished it will place Russia in full control of the European Market.

As much as 70% of the Kazakh current oil Production is piped to Russia, over that if Iran India pipeline o\s made to fructify then it will effectively rule out the last chance for a hold for US in the Central Asia.

In this context that the US threat has to viewed. The following points are relevant:

a. Pakistan is in desperate need of at least 10 million cubic metre of gas a day by 2010 to meet the need of existing industries due to the depletion of its **SUI** fields.

b. India needs the gas for its future development. The quantity will however have to carefully decide in conjunction with the reliability and the deliverability of gas from the Godavari basin and the utilization of the residual fuel oil from North Gujarat oil and even more from the Barmer oil fields. A pipeline can neither be undersigned nor allowed to run half empty.

c. It would be much fruitful for Pakistan if it goes for larger diameter pipeline which eventually cut down the costs of transportation.

d. Clauses would be certainly built into an international contract against possible risks

e. Instead of dissipating energies from the far flung areas like Venezuela Angola and Sakhalin, India's diplomatic activism should be focused around Saudi Arabia Iran and Central Asia.

ANNEXURES

HYDROCARBON VISION 2025

The government of India has recently published a document entitled "**HYDROCARBON VISION 2025**" which examines the demand for gas up to 2025 the indegineous supply situation and the deficit. The requirement of gas over this time horizon is affected by a number of factors. The growth of rnergy consumption in the country depends upon factors such as population growth, GDP, structural changes being intriducced in the Indian economy and their impact on the growth of the industrial and the agricultural secxtor, energy pricing and tariffs and the success of energy conservation measures based on the need to contain damage to the environment.

		1998/99	2001/02	2006/07	2011/12	2024/25
Power	Scenario1	22	40	67	90	153
	Scenario2	22	67	119	168	208
	Fertilizer	24	54	66	83	105
Others	Scenario1	9	23	33	43	64
	Scenario2	9	30	46	63	78
Total	Scenario1	55	117	166	216	322
	Scenario2	55	151	231	313	391

Table:3 Total gas demand in Million Cubic Metre per day

LNG – THE BASICS.....

LNG is natural gas that has been condensed to a liquid through a cooling process. The composition of natural gas, and hence the LNG that is formed from it, varies slightly according to its source and processing history, but it consists almost entirely of methane (CH4), the simplest hydrocarbon compound. Typically, the composition of LNG is 85 to 95+ percent methane, along with a few percent ethane, even less propane and butane, and possibly trace amounts of nitrogen. Water is necessarily removed from the natural gas stream prior to its liquefaction. Like its primary constituent, LNG is odorless, colorless, non-corrosive, and non-toxic. LNG is not formed by compressing natural gas nor is it maintained as a liquid through the use of high pressure. At atmospheric pressure [14.7 psi], methane will condense to a liquid when it is cooled to –259 °F (-161 °C). Cooling the gas to this temperature and keeping the resulting liquid cold allows the LNG to be transported and stored under normal [atmospheric] pressure as a cryogenic[very low temperature] liquid. The density of LNG is less than half that of water, so if LNG were to be accidentally spilled onto water it would float and then vaporize rapidly. An open container of LNG at room temperature and pressure would look and behave much like a container of boiling water. The liquefaction process reduces the original volume of the natural gas being converted into LNG by a factor of more than 600, which allows for its efficient transport and storage. This shrinkage is roughly analogous to shrinking the gas volume in a large beach ball into a liquid volume the size of a ping-pong ball. Because of this dramatic reduction in volume, just one shipload (138,000 m3)of LNG can deliver nearly 5 percent (~3 billion cubic feet) of the United States' average daily demand for natural gas.

THE PIPELINE OF PEACE

It is significant that the chief guest at this year's Republic Day parade would be the President of Iran, Mohammed Khatami. Prior to the visit of the Iranian President, a team of officials from that country led by the Deputy Foreign Minister Dr Mohammad Hossein Adeli have done valuable preparatory work. Indo-Iran relations have grown significantly across various sectors, but India's greatest interest lies in secure and economically attractive import of hydrocarbons from Iran. The current situation in Iraq and the implications this holds for the price and stability of supply of oil from West Asia only add greater relevance to cementing contractual and infrastructural arrangements for supply of natural gas from Iran to India. It was in 1989 that Dr Ali Shams Ardekani, later Deputy Foreign Minister of Iran, and I jointly developed a proposal for import of natural gas from Iran to India through a pipeline stretching overland across Pakistan.

For Iran, which has huge reserves of natural gas in the southern part of that country, South Asia is clearly the most attractive market. For India, dependent as it is on an increasing volume of imports of oil, natural gas through a dedicated pipeline not only provides security of supply of a large quantity of clean fuel, but also addresses a strategic challenge which has several positive dimensions.

The initial reaction of Indian policy makers to whom this concept was first put forward in 1989-90, was generally sceptical. The question was asked: "How can we think of a supply arrangement where we would be at Pakistan's mercy to give us uninterrupted transit?"

This question has still not been answered, but sufficient progress has been made now to think of the pipeline option as a real possibility. What makes this arrangement even more attractive is the prospect of supply at a very reasonable price reported to have been discussed at $1.80 per million metric British thermal units (mmBtu) delivered to the Indian border. This is almost half the price of imported liquefied natural gas, for which specific projects in India are currently in hand with some shaky prospects of successful completion.

The strategic importance of the Iran-India pipeline can also be seen in the context of recent reports that indicate Iran's plans to open up the southwest Iranian port of Chahbahar with large discounts on various port charges. A three-way arrangement between Afghanistan, Iran and India could open up the hydrocarbon reserves in Central Asia as well which would by-pass the Afghan-Pakistan route. The Iranian leadership is of course very conscious of Pakistan's sensitivities on some of these issues, and it is for this reason that the Iranian President visited Pakistan a few weeks ago to balance his presence in India on Republic Day.

With membership of several Islamic forums, Iran and Pakistan have had a formal relationship for several years now, which however, has not been without tensions and with a history of largely sterile economic cooperation.

As a result, bilateral trade between the two neighbors is abysmally low, and people-to-people exchange hardly at a noticeable level. This contrasts with a record of increasing Indo-Iranian trade in recent years. If the proposed pipeline were to become a reality, there would be strategic benefits for both India and Iran, but Pakistan would also benefit substantially in an economic sense. Firstly, Pakistan itself would have a growing demand for natural gas, and with the planned pipeline configuration, the offtake of gas from Pakistan would be 50-60% of the total quantity for India. Economies of scale with the larger India-oriented pipeline would benefit Pakistan also in terms of lower unit costs.

Additionally, the transit fee that India would pay for the piped gas passing through Pakistan would be somewhere of the order of $ 600 million annually. Some in the Indian establishment recoil at the thought of providing Pakistan this large source of regular income, but Indian policy in this regard cannot rest on cutting your nose to spite your face. The economic benefits to India would be huge, and provided the contractual and infrastructural arrangements ensure secure supply, benefits from natural gas from Iran would far exceed the benefits that Pakistan may derive directly or indirectly. India certainly has security concerns, and given the danger of terrorism in Pakistan, these cannot be laid to rest easily. But the manner in which discussions are evolving between Iran and India can lead to firm arrangements that would ensure uninterrupted supply of

gas. Firstly, an international consortium could finance and own the bulk of this pipeline, which would make them stakeholders in the project. Secondly, the contractual arrangements could carry heavy penalty terms that would compel Pakistan to ensure proper protection of the pipeline, particularly since it would be earning huge revenues. There could also be other interlocking measures such as India receiving part of the gas, generating power from it and supplying it to Pakistan as part of a comprehensive contract. Much else can be done to make the cost of mischief in Pakistan prohibitively high. But to create a sense of reassurance, Pakistan needs to urgently change its rhetoric.

General Musharraf in a speech delivered on June 23, 2000 aired an inflated view of Pakistan's strategic advantage due to its geographical position. He said, "Iran wants to send gas to India, it has to go through Pakistan... God has given us this strategic location, the importance of which is emerging fully now". In the same speech, he referred to an earlier interview where he had stated:

> "We are a responsible country and when we reach an economic arrangement, we will abide by it".

In the same breath, when pressed on India's fear that Pakistan would tamper with supply he said contemptuously ... "Well, then you can ask Indians to take out the gas by air. That is the only way left".

Over two years ago, The Energy Research Institute launched a joint project with a Pakistani institute for drawing up the contractual and financing arrangements for an overland pipeline, which would provide adequate security to India.

When I mentioned this fact to Gen Musharraf during his visit to India in September 2000, he said he supported such a study and the establishment of the Iran-Pakistan-India pipeline. However, none of his statements subsequently has deviated from the conceited view of his June 2000 speech quoted above.

If Pakistan is serious about the pipeline option and wants the economic benefits flowing from it, then the Pakistan leadership must signal a change in posture. Perhaps, Iran can influence such a change with a sense of urgency.

Iran, clearly, is the biggest stakeholder in this deal, not only because it would get substantial revenues from the sale of natural gas, but also because a large part of the investment to be made would lie on Iranian territory, extending over 1,000 km as compared with 800 km over Pakistan and perhaps 700 km in India. Republic Day 2003 would be a unique opportunity for the leadership of India and Iran to discuss threadbare the historic opportunity for a new era in this region through the gas pipeline from Iran to India. The deep sea pipeline option bypassing Pakistan is favored by Indian decision-makers for obvious reasons, but this would saddle us with a far more expensive solution, even though the security concerns of the overland route are more challenging and problematic.

But, it is through the genius of statesmanship that such challenges have been met throughout history, and perhaps Republic Day provides the leadership of India and Iran a unique moment to create a mutual structure of economic relations providing major benefits to both countries and to Pakistan. It could also usher in a new era in Indo-Pak relations.

CONCLUSION

For bulk, energy efficiency pipeline is the safer and better mode of transportation. The estimated energy consumption per km is less when compared for pipelines. They are environmental mode of transportation. It is possible to further boost its economic advantage by augmenting its capacity using cost effective options like the drag reducers boosters pumps and loops lines.

Taking the above facts and INDIA at a critical stage of enormous need of energy at the same time going greener and cleaner. The new finds in the east coast the KG basin and opened a new avenue for source of energy. With greed in gaining hegemony in the central Asia USA started imposing sanctions on Iran regarding the nuclear intransigence and Russia having its own plans of taking the role of Saudi Arabia in the case of Natural Gas. This seems to be right time for India to play a vital part in the Iran - India pipeline as Pakistan envisaging the growth in its demand for NG and becoming energy secure.

The participation in the pipeline would not only give Iran diplomatic support that it is looking from the Indian side but also suffice India's quench of energy.

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