thought about. The idea was to bring the gas from South Pars to oman and then follow the deep sea route lying completely outside the EEZ of Pakistan. As in the case of the Oman-India pipeline, the feasibility of this route could not be established. India then took the stand that the feasibility of the onshore and the offshore routes be studied together to ascertain which route was cheaper. The matter has been slated to be discussed between the two countries for quite sometime but the discussions have not been held.

The finances for the project can be arranged only if secure arrangements could be made to rule out disruptions in gas supply. This point became specially important in view of the tense relations between India and Pakistan. Promoters of the pipeline usually point out that gas supplies from the Soviet Union to Europe were not disrupted even at the height of the cold war. However, it should be remembered that USA had strong objections to the SU-Europe pipeline on security grounds and agreed to it only on condition that imports from the SU would not exceed 70% of the total requirement and that the Norwegian Troll gas field would be developed as a fallback support. Indian objection to the onland route was precisely on the same ground of security of supplies. The offshore alignment may or may not be cheaper but it would be relatively much more secure.

Other suggestions include an undertaking from Iran that supply to Pakistan could be cut off in case supplies to India is disrupted and the proper structuring of the project with cross holding of equity and by involving the World Bank, ADB, etc. It has been pointed out that the World Bank expedited the Indus water sharing agreement between India and Pakistan, an agreement that has stood the test of time.

The pipeline alignments from Iran are important not only for bringing gas from Iran but also from Central Asia. Turkmenistan has a lot of gas which could be brought to Pakistan and India either through Afghanistan or Iran. UNOCAL of USA has been pursuing the option of a pipeline through Afghanistan but they have recently declared that the project will be pursued only after the situation in Afghanistan normalises. There are no signs as yet of any such improvement and the route through Iran is now more attractive.

However, given the state of the relations between India and Pakistan, espicially after the Kargil War, it would be quite sometime before the two sides could sit down and work out a solution. Meanwhile, India is trying various alternatives for importing LNG.

Another crucial question is that of the US sanctions against Iran. All the projects discussed above, whether gas through pipelines from Iran or Central Asia could materialise only if the sanctions are removed. US energy experts suggest that there has been a substantial improvement in the situation and as a result, the body of opinion in the USA supporting the withdrawal of the sanctions was growing stronger.

LNG Options

In view of the problems faced by the pipeline projects, LNG is seen as a solution to the immediate needs of importing gas. Four public sector companies- ONGC, Gas Authority of India Ltd (GAIL), Indian Oil Corporation (IOC), and Bharat Petroleum Corporation Ltd (BPCL)- have formed a company called Petrouet LNG to import LNG into India. Petronet is planning LNG terminals at Dahej in Gujarat and Cochin in Kerala on the West coast. A number of private projects for importing LNG have also been cleared by the Foreign Investment Promotion Bureau (FIPB), but the lack of a financially sound buyer, and disagreement on contract terms is delaying most of the projects. Table 6 lists some of the prominent LNG initiatives.

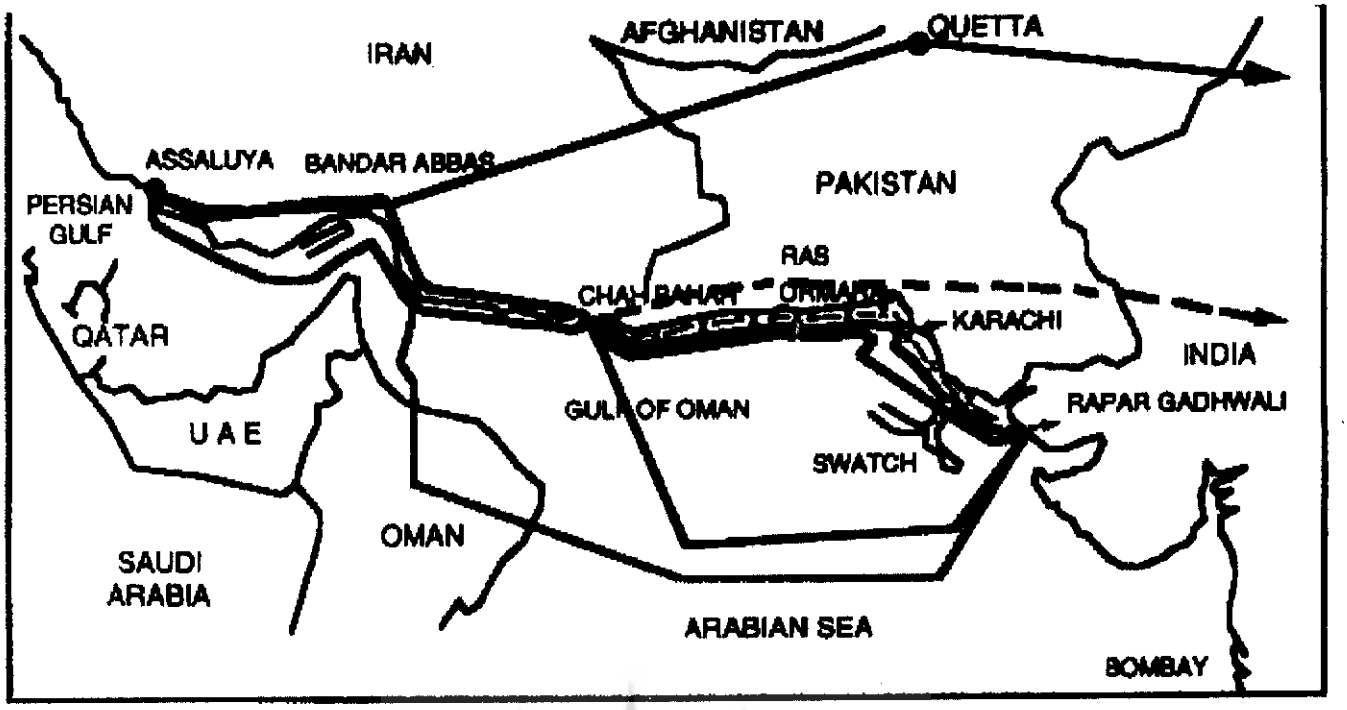
Table 6: LNG Terminals

Name of Company	Location of the terminal	Capacity (MMTPA)
Enron International Inc.	Dobhol, Maharashtra	5
British Gas	Pipavav, Gujarat	2.5
Ispat Group of Industries	Kakinada, Andhra Pradesh	2.5
Reliance Industries Ltd.	Jamnagar and Hazira, Gujarat	5, 5
Shell	Hazira, Gujarat	2.7
Petronet	Dahej, Gujarat & Cochin, Kerala	5, 2.5
TIDCO	Ennore, Tamil Nadu	2.5

Conclusion

This note clearly points out disparity between indigenous gas resources and the demand for natural gas in India. There is an immediate need to chalk out a strategy for gas imports into India. With pipeline import options in a deadlock at some stage or the other, the immediate reprieve is going to be in the form of LNG imports. However, imports via pipeline are desirable with a possibility of utilising the synergy between the new system and the existing HBJ pipeline system. The HBJ system runs through the North Western part of the country and can use the "rich" gas imported via a pipeline. Regassified LNG being a "lean" gas would require a separate transmission system and hence increase the cost of the delivered gas. There are already plans to expand the capacity of the HBJ network and once through, the system can offer immediate offtake of supplies from the Persian Gulf. ■

IRAN-INDIA GAS PIPELINE PROJECT



FEATURES
OFFSHORE - 1050 KMS, 42" NB
ONSHORE - 950 KMS, 46" NB
CAPACITY 2-3 BCFD

Myanmar to India via Bangladesh

The bulk of the discovered gas off the Myanmar coast has been committed for supply to Thailand. However, exploration for more gas continues and in case more gas becomes available, it may be feasible to transport it to India through an offshore pipeline in combination with gas from Bangladesh. A pre-feasibility study of these options is under way.

The Iran-India gas pipeline

The idea of an Iran-India pipeline has been discussed since the early 80's but serious efforts started after a MOU signed between the two countries in July 1993 at the ministerial level. Another MOU was signed in November 1993 during the visit of the Iranian minister for petroleum to India. In terms of the first MOU, experts from the two countries made a desk top study of the feasibility of the project. The South Pars field was taken to be the gas source. The pipeline routes considered for the study were:

1. Onshore from South Pars to Assalouyeh along the Iranian land to Chah Bahar on the Gulf of Oman and then offshore keeping the depth as low as possible but avoiding Pakistani territorial waters.

2. The same as above with the depth of the offshore line kept within 200 meters even if it involved going into Pakistani territorial waters.

3. Offshore from South Pars via Assalouyeh along the coast of the Persian Gulf to the straits of Hormuz and then along the continental shelf avoiding Pakistani territorial waters.

4. Same as (3) with offshore depth restricted to 200 meters.

Later, some other alignments were also considered, as shown in the map. Estimates made of the cost of the project and the cost of the delivered gas have varied. Some analysts have projected the production and transportation cost between USD 8-9 billion resulting in a delivered cost of around USD 2.5/ MMBTU for the gas at the Indian border. This was based on a volume of 50 MMSCMD, which was modest, compared to available estimates of the requirement.

Based on the above findings of the experts, the two countries decided to commission a feasibility study for the pipeline. This was jointly awarded to PLE of Germany in March 1995 and they were asked to complete the study by December 1995. The scope of the study included surveys off the coast of Pakistan for the purpose of identifying a suitable pipeline corridor as well as evaluate its technical feasibility.However, no progress could be made as the government of Pakistan did not accord permission for the pipeline route study through the EEZ of Pakistan. Instead, the Government of Pakistan suggested a route lying onland through Pakistan. In view of this difficulty, the suitability of the deep sea route earlier considered for the Oman-India pipeline was also

Table 2: Sectoral gas projections (MMSCMD)

Sector	1977	2000	2005	2010
Power	22	31	72	156
Fertiliser	24	26	30	30
Sponge Iron	6	7	12	15
Others	5	10	74	83
Total	56	74	188	284

Natural Gas Production

India's balance recoverable gas reserves stand at 640 BCM. The three main producing basins in the country, the Western offshore region, the Cambay basin in Gujarat, and Upper Assam region, are in the mature phase of exploration and with the exception of Assam, future findings in these areas are not likely to be large in size. Trends in production of natural gas are summarised in Table 3.

Table 3: Trends in production of natural gas (MMSSCMD)

Sector	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Production	49.5	50.2	53.1	61.9	63.9	72.4
Flared	5.1	5.3	5.5	4.7	5.3	5.1
Utilisation	44.4	45.0	47.6	57.2	55.9	67.2
Internal use	6.6	6.6	7.4	8.5	8.6	9.5
Total Supply	37.8	38.4	40.1	48.4	50.0	57.8

The Oil and Natural Gas Corporation (ONGC) acoounts for the bulk of the natural gas produced in India. ONGC draws long term profiles for gas production on regular intervals. Current projections show that gas production will rise from the current level of 73 MMSCMD to about 80 MMSCMD by 2001 and steadily decline thereafter. The outlook on gas production is summarised in Table 4.

Demand/ Supply Balance

Based on the above-mentioned projections the resultant demand-supply balance for natural gas is summarised in Table 5.

The declining production profile, coupled with the projection of rising demand shows a widening demand-supply gap. The implications of this gap are that exploration efforts need to be stepped up and the feasibility of importing gas from the neighbouring countries be examined seriously. A number of options for importing gas through pipelines and as LNG have been examined or are being examined, as is the prospect of utilising domestic coal-bed methane (CBM) reserves.

Import Options

In order to bridge the growing gap between the demand and availability of gas the government has come out with a policy for encouraging exploration by the private sector. The New Exploration Licensing Policy (NELP) provides a level playing field between the national oil companies (NOCs) and private operators. Exploration blocks for CBM are due to be offered soon. The government has also been examining alternatives for importing natural gas LNG. The options examined so far are described below.

Table 4: Projected gas production (MMSCMD)

Year	Production
1997	72.3
2000	74.8
2005	60.7
2010	47.6

Table 5: Projected gas demand supply balance (MMSCMD)

Year	Supply	Demand	Deficit
2000	60	74	14
2005	49	188	139
2010	38	284	246

Supply estimates exclude flaring and internal consumption

Oman to India via a deep sea pipeline

It was envisaged that 2 BCFD of gas would be brought by two deep-sea pipelines from Oman to Gujarat The Oman Oil Company (OOC), which was to lay the offshore pipeline, had indicated that an investment of US$5 billion would be required. The OOC is no longer interested in the project as the feasibility of the deep-sea pipeline could not be proved The project is dead.

Turkmenistan to India via Afghanistan and Pakistan

This project was at one time being pushed by UNOCAL who were pursuing and alignment through Afghanistan and Pakistan. There are obvious political and security problems associated with the project and an early breakthrough is not expected.

Persian Gulf Gas Exports, Prospects & Limitations:

Indian Perspective

R.K. Pachauri, Director, TERI, New Delhi, India & Rahul Deep Singh, Research Associate, TERI, New Delhi, India

Introduction

Oil and Gas were discovered in India in the onshore Cambay Basin in the state of Gujarat Exploration of the western offshore basin area off Bombay began in 1964 and in 1974 the Bombay High field was discovered. The giant South Bassein free gas field was discovered in 1987.

In the early 1980's the western offshore gas began to be exploited as a resource rather than treated as a by-product, as was the case earlier. The Government appointed a number of committees and expert groups to examine the ways in which the gas could be best utilised. The views that emerged was that the optimum use of gas would be in producting fertilisers. Initially there was quite some opposition to the use of gas for power generation but later the idea was accepted. In 1986 work began on the 1700 km Hazira- Bijaipur-Jagdishpur (HBJ) gas transmission line linking the western offshore gas fields with fertiliser and power consumers. This allowed the utilisation of the western offshore gas production, which resulted in significant growth in gas production through the late 1980's.

Till the late 1980s the demand lagged behind the supply mainly because of a lack of infrastructure. In the 1990s the demand exceeded the supply. Under the circumstances, the government has been allocating gas through the Gas Linkage Committee which is an the Secretary, Petroleum and Natural Gas with members from the Ministry of Finance, the Planning Commission like Power, Fertilisers and Steel. Gas allocations were made after careful assessment of the projects for which gas was sought. In general, around 80% of these allocations have been made to the power and fertiliser sectors.

Natural Gas Demand

During the 8th plan period (1992/93-1996/97) natural gas sales increased at an annual rate of 6.4% Sectoral gas sales are summarised in Table 1.

The demand for gas in the country is likely to rise substantially due to a high preference for use of natural gas. The high preference is rendered on account of the fact that natural gas is environmentally benign and an efficient fuel as compared to other fossil fuels. The Ministry of Petroleum and Natural Gas had, hence, constituted an Expert Group to project the demand for natural gas in the country. The Expert Group had adopted and end-use approach to come up with estimates of natural gas requirements. The group was of the views that it would be economical to import fertilisers in comparison to domestic production with gas as a feedstock. The projections by the Expert Group, hence, primarily relate to gas requirements for power generation and its use as an industrial fuel. These have been summarised in Table 2.

Table 1: Sectoral gas sales in India

Sector	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Power	13.14	12.99	14.28	18.54	18.99	22.1
Fertiliser	18.58	17.81	18.35	20.79	20.88	23.98
Sponge Iron	0.98	1.6	1.99	4.56	4.89	5.62
Others	5.06	4.97	4.48	3.12	3.77	4.71
Total	37.76	37.37	39.1	47.01	48.53	65.41