

**INDIA'S OIL NEEDS: A GEOPOLITICAL
INTERPRETATION**

*Dissertation submitted to the Jawaharlal Nehru University
in partial fulfilment of the requirements
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Master of Philosophy

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CERTIFICATE

This is to certify that the Dissertation, entitled "India's Oil Needs: A Geopolitical Interpretation" submitted by Shiv Kumar Verma in partial fulfilment of the requirements for the award of the degree of Master of Philosophy, has not been previously submitted for any Degree of this or any other University. This is his own work.

We recommend that this dissertation may be placed before the examiners for evaluation.

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"A teacher affects eternity; he can never tell where his influence stops."

- Henry Adams -

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Shiv Kumar Verma

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Introduction

INTRODUCTION

The world entered an era of high-energy costs with the first oil shock of 1973. The second oil shock of 1979 compounded the problems of the oil importing countries as they had to pay increasing amounts of foreign exchange to the oil exporting countries for purchasing oil and this placed a severe strain on their foreign exchange reserves.¹

The problem regarding oil has mainly arisen because world's oil reserves are largely concentrated in a very small geographical area which is politically unstable. Coupled with this problem is the rising demand for oil and its dwindling reserves. In such a scenario it becomes necessary with great care. The first step in this direction, hence, is to raise the future demand for oil or its products.²

Many developing countries are still using energy planning methods developed to face the challenges of industrial countries. Since the aim and nature of energy planning in developing countries is different from those in developed nation, these method cannot solve the problems in the former countries. These are also certain characteristic features of developing countries, like India, which demand a different approach to energy planning.

¹ Joshi, Vijay and I.M.D. Little, India's Economic Reforms- 1991-2001. Delhi: Oxford University Press. pp.230-236.

² CMIE, Current Energy Sector, Bombay; Centre for Monitoring Indian Economy, 1995. pp.57-59.

In 1973, the events following the upward adjustment of oil prices amply demonstrated that the demand and supply of oil do respond to prices and vice versa. Higher prices of encouraged conservation as manifested by more efficient consumption, reduction of nature gas flaring and development of technologies for finding more conventional source of oil and gas and for exploiting non -conventional source.

The later half of the 1980s witnessed the reverse prices of oil dropped in response to a slower rate of increase in demand and the advent of new sources. As a result, some schemes of the 1970s for developing more costly conventional sources of oil and gas were to large measure cut back.

In the immediate future, world market may knock the world energy trends off their current course. Iraq's invasion of Kuwait in August 1990s, the world faced the third oil shock in just 17 years. This invasion, which immediately raised Iraq's share of oil reserves from 10 percent increase in oil prices in three months and led to near panic in world financial markets.³

The fore runners to this crisis were the failed energy policies that allowed aid-consuming nation, both industrial and developing to increase their dependence on West Asia oil in the late 80s.

³ The history and politics of oil have been extensively and analytically charted by Diniel Tergin in *The Prize; The epic Quest for oil, Money & Power* (New York, Simon & Schuster, 1992), p.76.

In case of low-income countries like India, their fuel imports in 1989 constituted a significant percentage of import bills 17 percent respectively.⁴

Imports of crude oil and its refined products constitute the largest single commodity group in India's import bill. Potential benefits from greater efficiency in the use of oil in India have not been explored so far. This is one of the reason of India's debt problem.

At the end of 1989, according to the World Bank, India had the fourth largest debt among the developing countries between March 1980s and March 1990s, India's outstanding debt more than tripled from \$17 billion on to \$59.1 billion and increased further to \$68.2 billion in March 1991 more specifically the savings in oil consumption that could have been realized in the 1980s through greater efficiency in use of diesel and kerosene. The effect of such savings on India's expenditure on oil import and therefore the extent to which the growth of India's external debt in the 1980s could have been reduced. Further, the savings in oil consumption that can be made in the 1990s if a suitable strategy is initiated will be enormous.

Between 1980-81 and 1990-91 oil imports on the average constituted 21 percent of total imports. These imports also consumed on the average 31 percent of India's annual earnings from merchandise exports .The percentage share of oil imports in all imports did vary from a low of 12 percentage in 1986-87 to a

⁴ World Development Report, 1990, pp. 87-90.

high of 42 percentage in 1980-81. When the offshore Bombay high oil reserves were discovered in the mid-70s, the official strategy could not withstand the second oil price increase in 1980s, which led to an escalation of India's import bill.

The destruction of oil production facilities in Kuwait and Iraq makes the call for steps to promote international cooperation even more urgent. Such cooperation would aim at providing security of supply to consumers and security of demand to producers so that investments can be made on time to meet future higher demand levels. In this process, new approaches should be considered in order to ensure more equitable oil production patterns so that future conflicts among major oil exporters may be avoided. At the same time major consuming countries should aim at consultation and cooperation with producers on their future energy plans.

The alternative to dialogue and international cooperation is to wait for the closing of the gap between demand and capacity which would inevitably lead to considerably higher oil prices and a new cycle of instability in the world's oil industry.⁵

Prices instability leads to a global misallocation of scarce resources, the exploitation of high-cost oil and other energy resources, while at the same time low cost oil reserves are under utilized.⁶

⁵ Geoffrey Kemp, "The Persian Gulf Remains the Strategic Prize", *Survival*, Vol. 40, no. 4, Winter 1998-99, p.82.

⁶ *The Hindu*, March 23, 1999.

World energy situation prior to the Persian Gulf war of 1990-91 shows that periods of oil prices instability have distorted the decision making process. During periods of high prices, investments were made in uneconomic energy sources and in periods of low prices few investments were made at all. To create a rational investment climate, international cooperation between consumer and producers of petroleum is essential. Such cooperation in the form could help to stabilize prices and assure that the economic decisions needed to meet future demand would be made in a secure framework.

Oil is the heart of modern industrial society. Oil could also be an effective tool in the battle against poverty. Although the links among oil prices, oil demand, and economic growth are becoming increasingly complex there is a close correlation between the level of economic development and oil consumption. The standard of living is found to rise with an increase in per capita consumption of oil. There are two major determinants of oil policy for India, first is the life style and a general development model, the country desires to achieve. Second policy determinant closely related to the first, is the options we exercise in production technology in the oil consuming sectors that would materially influence the order of oil demand.⁷

Economic rent on general, and oil rent in particular, is an historically specific, social category, reflective of unique property relations, which goes beyond the conventional notion of

physical scarcity prevailing in economics literature. Neither the Ricardian theory nor the neoclassical General Equilibrium theory suitably explain the nature of the capital-land relation and convey an understanding of the priority of their mutual interaction within the production process. Being an effect of specific property relation, the phenomenon of rent merely assumes the status of a special category applicable to the concrete conditions of some industries. Hence, political economy lacks a general theory of rent.

The concept of oil rent is based on the potentially conflicting interaction of ownership oil reserves, and that of the oil lease, within the global oil industry. The oil rent is the result of the transformation of the existing differential productivity of oil-producing regions within the global oil industry. The formation of global oil prices and differential oil rents on the global competition has become a distinguishing feature of this industry since the early 1970s.⁸

None of these economists paid any attention to the determining influence of the cost trend. The price of crude oils tend to be in line with the development cost of the most expensive deposit when costs are increasing, and with the development cost of the least expensive one when costs are decreasing. Oil in efficiency also contributes to local and global environmental problems. A strategy of vigorously improving

⁷ T. K. Maulik, "The Journal of Energy and Development", Vol. 13, no. 2. pp.238-265.

oil efficiency in thus a key element of a sustainable development path.

The starting point for governing agencies in India is for national leaders and oil sector decision-maker to give careful attention to efficiency improvement as a development investment option and to pursue it. Moreover, India must improve institutional performance by building a management structure that is goal-oriented adaptable and resilient. Efficiency improvements require effective indigenous institutions to implement a reaching plans for improvement. In spite of the inherent difficulties of institutional change a strategy for gap filling and strengthening is urgently needed.

Improving incentive for oil sector efficiency through policy reform in such areas as oil pricing and private sector roles will require facing challenges for policy reform. The geopolitics of oil may be returning once again, to the care of international relations in our region. Oil may have become an important factor shaping the security dynamics in the Indian landmass, and could help redefine the relations among the Great Powers - the United States, Russia, China - and their alliances within our region. It could significantly reorder the balance of power on South Asian countries and the world as a whole. Oil may be at the heart of the ongoing turbulence in the Arabian Peninsula and the "Great Game" to exercise dominance in Central Asia and the Caucasus. The political developments in both the

⁸ Cyrus Bina, "American journal of Economics and Sociology", Vol. 50, no.

regions are likely to have a significant bearing on the foreign relations of most nations of the region, including India.⁹

2, April, 1992, pp.39-72.

⁹ Hasan, Ashraful. " Geopolitics of Petroleum and Gulf Security ", Vol. 4. no.2. Autumn 1983, pp.28-46.

Chapter I
Indian Effort
Toward Self-Sufficiency

CHAPTER I

Indian Effort towards Self-sufficiency

The oil sector has played a crucial role in the economic development of India. The national oil companies have made continuous efforts to discover natural gas being relatively clean and environment in order to meet the ever rising demand in the country. Natural gas, friendly fuel, has become the most favored source of energy. The available options to maximize the share of gas in energy consumption through domestic as well as imported source is being examined.

Oil Security: Our National Concern

Oil security is a concern that requires analysis of many options. A well-balanced portfolio which distributes risks over a number of options is needed. However, each option has a different cost range of supply reliability, risk lead time required and location at which it is available. Therefore, each option needs to be analyzed from these viewpoints and their correlation needs to be understood because disruption in several options may fail simultaneously the supply available to India. This may be small from some other countries and, therefore, the periods for which India can depend on them will also be correspondingly small,

however, this may give a breathing period to explore other options.¹

Trading partners, like Malaysia, Indonesia and Singapore, as possible candidates may mobilize supplies from their stocks for a few weeks. Similarly, the Liquid Natural Gas(LNG) option needs to be explored if long term contracts can negotiate joint ventures with gas rich countries. They are required to reduce oil and gas consumption for non energy purposes at home.

Cost of storage needs to be specified with reference to the capital required for infrastructure and the cost of holding the stocks under various discount rates. This needs to be determined optimally considering the demand and supply points. We need, less or more, to depend on our own situation.²

For a security plan, there is a need to distinguish between the two situations. First, temporary shortage due to mishaps abroad or at home during which we need options to tide over say for a few weeks or up to one or two months. Second, a shortage of a long term nature due to medium or high price rise as experienced in mid-1970s for more than five to eight years. Oil and Natural Gas Commission(ONGC) with its strength and capacity can establish equity oil relationship in abroad if neither foreigner nor national companies can find oil in India.³

¹ Indian Development Report, 1997, ed by Kirit. S. Parikh. Indira Gandhi Institute of Development Research , Oxford University Press. New Delhi. P.87.

² Ibid.

³ Ibid.

Demand side management in the oil sector is not tried enough. There is a room for efficient oil and gas utilization for various products. For this, long term prices signal may have to be given in some cases. IGDR macro economic model with international oil prices shows that export growth and increase in foreign direct investment go a long way in diffusing the impact of oil price rise.

4

<Table 1>

Plan Expenditure and the Share of Oil and Natural Gas

Plan	Period	Expenditure (RS. Crore)	Share Percent Oil/Gas
I	1951-56	1,960	-
II	1956-61	4,670	0.8
III	1961-66	8,580	2.6
IV	1967-74	15,780	1.9
V	1974-79	39,430	3.6
VI	1980-85	109,290	7.8
VII	1985-90	220,220	7.3
VIII	1992-97	434,100	5.5

Source: Ninth Five Year Plan 1997-2002, Draft prepared at the Internal Meetings of the Planing Commission, p.786.

Petroleum and petroleum product imports are expected to claim one third share of maintenance imports. The foreign exchange allocation for oil imports has been raised from Rs.950 cr. to Rs. 1118 cr.. For 1994-95. However, Iran, Iraq and United Arab Emirates have signed handsome credit agreements and the amounts of aid may ultimately double the budget estimates of Rs.740 cr..⁵

⁴ Indian Development Report, 1997, pp.8-9.

⁵ Statesman, New Delhi, August 26th 1974.

Problem Areas

The main policy issues in the oil sector

India's large and growing reliance on imports of oil and oil products makes it susceptible to change in international oil prices. The value of oil imports for consumption amounted to 27 per cent of total imports in 1995-96. This also raises concern regarding ensuring oil security for the nation. The domestic crude oil production has stagnated for some years and even gone down since the finding of Bombay High in the 1980s. We have not found any major fields. The country has also been unable to attract foreign oil companies to come for exploration in India.⁶

The discovery of oil in Bombay High provided a new hope. If 110 million tones of oil had come from this sector by 1980 to buttress the existing indigenous production of crude oil, Indian import bill could come down drastically as the quantum of crude import at that time was not more than five million tones.⁷

Pricing of oil products is highly politicized and full of distortions, it also puts a burden on government finance.

India has about 0.04 percent of the world's proven reserves of Hydrocarbons. The prognosticated geological reserves of Hydrocarbons in the country are estimated at 21.31 billion tones of which 61 percent are offshore and 39 per cent onland. Out of this, the geological reserves established are, however, only of

⁶ The Hindu, March 23, 1980.

⁷ Economic Times. New Delhi, October 10th 1975.

the order of 5.32 billion tones. It is assumed that half of the prognosticated resource represent natural gas of which only 12 per cent has till now been established.⁸

<Table 2>

Onland Blocks		
Assam-Arakan	300	27
Bengan Purnea	7,395	28
	12,	29
	505	
Ganga valley	36,750	31
	14,460	30
	3,965	32
Rajasthan	13,225	36
	23,945	34
	3,545	33
	2,535	35

<Table 3>

Deep Water Blocks	
Basin	Approx. area (Sq. Km)
Cauvery	10,260
	8,360
Palar	8,000
Krishna-Godavari	10,200
	9,620
	7,280
	10,000
	9,620
Mahandi	10,600
	10,840
	10,260
North East Coast (NEC)	11,068

<Table 4>

Offshore Blocks			
Basin	Approx. area (Sq. Km.)	Basin	Approx. area (Sq. Km.)
Bengal	10,425	Kerala-Konkan	15,910
	14,535		14,075
Cauvery	4,940		8,595
	5,215		16,125
	3,530	Mumbai	9,255
	5,920		5,270
Gujarat-Kutch	1,450		5,740
Krishna-Godavari	4,485		18,870
	4,790	Mahanadi	6,730
	2,472		8,480
	4,000		5,420
Kerala-Konkan	20,180	Palar	7,840
	19,450	Saurashtra	5,040

Oil industry needs to serve the national interests in the oil and related sector in accordance and consistent with Government policies. These require to work towards the achievement of self sufficiency in the field of oil refining by setting up adequate capacity and to build up expertise in laying of crude oil.

⁸ Ninth Five Year Plan. 1997-2002, Draft Prepared at the Internal Meeting

Petroleum products pipeline should be to maximize utilization of the existing facilities in order to improve efficiency and increase productivity. This will help in the following ways:

to optimize utilization of its refining capacity and maximize distillate yield from refining of crude oil to minimize foreign exchange outgo.

to minimize fuel consumption in refineries and stock losses in marketing operation which effect energy conservation.

to enhance viable opportunities, both national and global, arising out of the liberalization policies being pursued by the government of India to achieve higher economic growth through harnessing new business opportunities like petrochemicals, power and lube.⁹

The endowments and optimal utilization of natural resources is vital for rapid social and economic development on healthy lines. A rational policy on the supply and cost of oil is of overwhelming importance. A disconcerting feature of economic policy and management in India in recent years has, however, a tendency to meet contingencies as and when they arise regardless of larger and long term implication. This is most marked in the determination of priorities attached to the alternative uses of available energy resources. The result is that while economic

of the Planning Commission, New Delhi, p.725.

⁹ Annual Report, 1996-97, Indian Oil Corporation Limited, p.24.

growth and modernization has been sluggish the energy scenario has become grim.¹⁰

India: The oil scenario

Geological setting

Geologists have identified more than twenty sedimentary basins in India covering an area of 1.78 million sq. km.. Out of this which 0.38 million sq.km. lie offshore within the 200 meter isobath. Only four onland basins have been relatively well explored; the Bombay-Cambay, the Assam, the Krishna-Godavari and the Cauvery.

The Bombay Cambay basin: is one of the major oil producers in South Asia. It is situated in the north western part of the sub continent and extends into the adjacent part of the Arabian Sea. The basin covers the intraplatform Cambay garben and the Bombay near craton offshore trough.

The Bombay arch is the largest positive element of the offshore portion. The basin is composed of cenozoic marine and deltaic deposits Cretaceous/ Paleocene Deccan traps, and Mesozoic, paleozoic subtraps, which together form a thick layer over 7km.

Two petroliferous Miocene and Pleocene and one possible petroliferous (Mesozoic) complexes have been established within the sedimentary cover. The Miocene complex consists of deltaic and

¹⁰ Rahul Roy Choudhury, Paper on, " India's Energy Security Needs", Presented for IDSA Project on " Peace, Security and Economic Cooperation: India and South Asia in the 21st Century", July 1998, p.19.

costal marine sandstone, siltstone and clay with coal interbeds replaced on the shelf by a carbonate-clay formation. Onshore, the reservoirs consist of sandstone and offshore ones are carbonate rocks. Large oil and gas pools of the Bombay Arch and some gas onshore pools are related to the Miocene complex. The Paleogene complex enclosing most hydrocarbon reserves consists of interbedded sandstone and clay and limestone totaling in thickness over 3km. The commercial petroleum potential of the Paleocene is related to the sandstone, siltstone and limestone of Paleocene lower Eocene (North Bassein, South Bassin, Tarapur), etc.

Numerous oil and gas fields mainly small to medium in size have been discovered. The largest Oil fields are Ankleshwar, Bombay High and North Bassin. Almost all the hydrocarbon accumulations are confined to brachyanticline uplifts which are commonly complicated with faults.

Bombay High is the largest gas/oil field in South Asia. The onshelf field of 160 km. is situated toward the west of Bombay city. It is confined to a large arch bounded in the east, north and south by faults varying in amplitude.¹¹

The Assam Basin: Situated in the north eastern part of the subcontinent, it is confined to a marginal trough complicated by a system of regional thrust faults, with displacement amplitude up to 9km. The sedimentary cover consists of Cenozoic marine and alluvial delatic deposits up to 7km. thickness.

The largest fields are Nahorkatiya and Lahwa. Producing horizons have been recognized in all stratigraphic intervals of the section from paleocene through miocene. Reservoirs predominantly consists of Sandstone and Eocene Porous limestone. Eocene marls and upper Oligocene and Miocene clays acts as regional seals. Source rocks might have been paleogene bituminous clay.

The Krishna Godavari Basin: this covers an area of about 20,000sq.km. offshore along the east coast of India. Exposures of Pre-Cambrian rocks limit the basin from the west and north-west; toward the east ,it extends offshore into the Bay of Bengal. It is a pericratonic basin formed along a divergent continental margin. Sedimental and volcanics associated with initial rifting were covered by post-rift clastics and finally by a delta system. Several north-east-south-west trending tectonic elements have been recognized.¹²

The oldest exposed sediments of late Permian conglomeratic sandstone constitute the onshore fields. These are overlaid by an early Cretaceous to recent sequence of volcanics and sediments. In the offshore region, the sedimentary sequence encountered is Cretaceous to recent in age and is comprised of over 3000m of siltstone, sandstone, limestone, shales and clays. Information from wells indicated the presence of regional source rocks within

¹¹ India's The Oil Scenario, Oil Asia, Oct-Dec, 1993, pp. 45-51.

¹² Ibid.

Cretaceous and Paleogene sediments and localized sources within Eocene to early Miocene sediments.¹³

Several gas accumulations (some associated with oil) have been discovered within sandstone, limestone and fractured volcanics of Cretaceous and Paleocene age in the onshore region. Offshore accumulations of oil and gas have been discovered within Miocene and Pliocene sandstone.

The Cauvery Basin: This is one of the largest sedimentary basins on the eastern coast of India. Onshore, it occupies an area of 25,000 sq.km. Offshore, it covers an area of about 35,000sq.km. and extends northwards from the southern tip of India up to Pondicherry.

The western limit of the basin is formed by the exposures of Archaean rocks. The tectonic features are aligned northeast-southeast-southwest, and the basement has a host graben morphology resulting from faults with considerable displacements.

The Cauvery Basin came into existence during the early Archaean gneisses from the basement. Onland, the exposed physical sequence consists of continental sediments of late Jurassic to early Cretaceous age overlain by a marine sequence of Cretaceous sediments. The observed sequence contains several unconformities.

The sedimentary sequence encountered offshore is more continuous. Cretaceous to recent sandstone, claystones and limestones are found to overlie. Volcanics and pre-Cambrian

¹³ Ibid.

basement. The Cretaceous sequence contains mature source rocks. A number of wells have been drilled in the basin and accumulation of oil and gas have encountered within reservoir rocks of Eocene, Paleocene and Cretaceous age as well as with in the fractured basement.¹⁴

Estimation of the demand for petroleum products till 2000A.D.

Data for a period of ten years starting from 1970-71 to 1979-80s estimate was used to the demand for petroleum products for the period 1980-81 to 1984-85s. Taking into consideration the consumption, regression analysis was used to express the future demand assuming a growth rate of 4.5 per cent in Gross National Product and the demand for petroleum products.¹⁵

<Table 5>

Year	Consumption of Petroleum products (Million Tones)
1979-80	32.80
1980-81	34.60
1981-82	36.50
1982-83	38.50
1983-84	40.56
1984-85	42.73

Mulchandani and Gulati, have reviewed the demand forecasting studies that were carried out by the Indian Institute of Petroleum in mid 1976. The demand projections were based on actual figures of 1976-77 and the revised fifth five year plan targets for macro economic indicators and growth of the main petroleum consuming

¹⁴ Ibid.

sectors. Both trend extrapolation and regression analysis used for all major products.¹⁶

<Table 6>

Year	Total products projected (in million tones)	H. S. D projected (in million tones)
1976-77	24.07	7.08
1977-78	25.88	7.65
1978-79	28.34	8.26
1979-80	30.78	8.93
1980-81	32.86	9.64
1982-83	37.97	12.14

The revision of the 1977 figures was done in 1978 and 1977-78 actual consumption figures were used as the base values for demand projection till 1987-88.¹⁷

<Table 7>

Year	Projections (million Tones)
1977-78	Base
1978-79	28.0
1979-80	30.5
1980-81	33.0
1981-82	35.2
1982-83	37.9
1983-84	39.8
1984-85	41.9
1985-86	43.9
1986-87	45.8
1987-88	48.0

The next revision of the demand forecast was done in 1980 taking the base values the results of the forecast are listed in table 5.¹⁸

¹⁵ Saxena V. K, " Oil Economy of India", Agram Prakashan, New Delhi. 1995. P.461.

¹⁶ Mulchandani. H. K and Gulati. I. B, " Demand Forecasting for Petroleum Products in India", in National Energy Data System, New Delhi, 1996, p. 126.

¹⁷ Ibid.

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<Table 8>

Year	Projection (million tones)
1978-79	---
1979-80	Base
1980-81	33.3
1981-82	36.8
1982-83	39.6
1983-84	42.7
1984-85	45.8
1985-86	49.0
1986-87	52.1
1987-88	55.3
1988-89	58.8
1989-90	62.8

In 1982 the oil Coordination Committee working through a number of sub groups and relying mainly on end use method worked out the projections up to 1989-90. It was estimated that by 1989-90 the demand for petroleum products would be in the range of 54.5 million tones. In 1982 I.I.P. carried out yet another forecast study which estimated that by 1989-90 the consumption of petroleum products be around 44.9 million tones.

Ballu estimated the future demand for commercial and non-commercial energy till the end of this 2000 A.D. Using multi level substitution criterion. It was estimated that the demand for oil would be equivalent to Rs. 534.87 million crores by the year 2000-2001 A.D.¹⁹

¹⁸ Ibid.

¹⁹ Ballu. K. Umesh. K. M, Chandrasekharan. P. C and Khan. A. M, " Application of Market Penetration Theroy in energy Demand Forecasting", Energy Management, July-Sep. 1982. Pp. 191-197.

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<Table 9>

Commodity Balance of Petroleum and Petroleum Products

Item	(Million tonnes)										
	1950-51+	1960-61+	1979-71+	1980-81+	1990-91	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
1	2	3	4	5	6	7	8	9	10	11	12
I. Crude Oil											
1. Refinery through put	0.3	6.6	18.4	25.8	51.8	53.5	54.3	56.5	58.7	62.9	65.1
2. Domestic Production	0.3	0.5	6.8	10.5	33.0	29.0	27.0	32.2	35.2	32.9	33.9
(a) on-shore	0.3	0.5	6.8	5.5	11.8	11.2	11.6	12.0	11.9	11.4	11.5
(b) off-shore				5.0	21.2	15.8	15.4	20.2	23.3	21.5	22.4
3. Imports	NA	6.0	11.7	16.2	20.7	29.2	30.8	27.3	27.3	33.9	34.4
4. Exports											
5. Net imports(3-4)	NA	6.0	11.7	16.2	20.7	29.2	30.8	27.3	27.3	33.9	34.4
II. Petroleum Product											
1. Domestic Consumption @	3.3	7.7	17.9	30.9	55.0	58.9	60.8	67.4	74.7	79.2	84.5
2. Domestic Production	0.2	5.7	17.1	24.1	48.6	50.4	51.1	52.9	55.1	59.0	61.3
3. Imports	3.1	2.5	1.1	7.3	8.7	11.3	12.1	14.0	20.3	20.3	19.5
4. Export @@	NA	NA	0.3	Neg	2.7	3.7	4.0	3.3	3.4	3.2	2.9
5. Net Imports(3-4)	NA	NA	0.8	7.3	6.0	7.6	8.1	10.7	-3.4	17.1	16.6

@ Excluding refinery fuel consumption including imports by private parties form 1994-95 onwards.

@@ Including supplies of POL products to Nepal

NA Not available

Neg Negligible

Source : Ministry of Petroleum and Natural Gas in Economic Survey, 1998-99. Government of India,

Ministry of Finance. Economic Division.

The influencing factor in demand estimation

In estimating the consumption of energy there have been numerous studies that have established a positive relationship between consumption of energy as a dependent variable and economic growth as an independent care. Brooks²⁰ and Adam and Miovic²¹ identified energy consumption as a function as a G.N.P. Felix²² using the data of the years 1961 on the existing 153 countries of the world found that national income and total energy consumption were closely related. Chandrasekar²³ studies the outlook of petroleum products in Srilanka and related the increase in their consumption to an accelerated economics of the developing Countries would explain their energy demand that for fossil fuels would continue to expand.

<Table 10>

Consumption of Petroleum Products

St. Item No.	(Thousand tonnes)							
	1960-61	1965-66	1970-71	1975-76	1980-81	1985-86	1990-91	1995-96
1.Light Distillates	983	1370	2697	3596	4388	6776	9801	13540
2.Middle distillates	4297	6197	9040	11653	17056	23948	33106	46130
3.Heavy ends	2705	4351	6175	7198	9452	10148	12128	15050
4.Refinery boiler fuel	300	520	1223	1226	1365	2491	2710	3629
Total(1 to 4)	8285	12438	19135	23673	32261	43363	57745	78349

Source: Planning Commission.

²⁰ Brooks. L.G, " More on the Output Elasticity of Energy Consumption", Journal of Industrial Economics, Vol. 21, no. 1, 1972, p.123.

²¹ Adams F.G. and Miovic.P, "On Relative Fuel Efficiency and the Output Elasticity of Energy in Western Europe", Journal of Industrial Economics, Vol.17, 1968, p.480.

²² Felix. F. "Growth of Energy Consumption and National Income Throughout the World", IEEE, spectrum, 1964, p.62.

²³ Chandrasekera. D. "Outlook for Petroleum Products in Srilanka", Energy(Oxford), Vol.11, no.4-5, 1986, p.192.

Dramstadter²⁴ using per capita income and energy consumption for 49 countries having per capita income of at least \$300 for the year 1965 got a regression relationship of the type:

$$\text{LOG (E/P)} = -0.34 + 1.12 \text{ LOG (Y/P)}$$

Where E is the energy consumption, Y is the income and P is the population of a country. A cross section regression equation for 24 countries with per capita income levels ranging between \$300 and \$899 was also obtained as:

$$\text{LOG (E/P)} = -1.93 + 1.79 \text{ LOG (Y/P)}$$

"The relationship between G.N.P. and energy holds both cross section and historically influences. The higher a nation's income or output on the current international scale the higher, in general, its levels of energy consumption. As its G.N.P. rises over time so does its energy consumption in close, if not proportionate, conformity".

Saxena²⁵ using the data from 1970-71 to 1979-80 derived a direct positive relationship between G.N.P. consumption of petroleum products as:

$$Y = 9.45 + 1.26x$$

Where y is the consumption of oil products and X is gross national product.

²⁴ Darmstadler .J. Teitalbaum. P.D. and Palach J.G, "Energy in the world economy :A statistical review of trend in output, trade and consumption since 1925". Baltimore : Jhon Hapkins Press.

The Economic and Scientific Research Foundation under took²⁶

A forecasting exercise by examining the linear relationship between energy consumption and gross national product this relationship was examined by fitting linear regression models to the data. The gross national product of projections of 5.5 per cent per annum during 1974-79 and 6 per cent per annum during 1979-84 outlined in the fifth five year plan were considered, "optimistic and unlikely to be realized". So a growth rate in gross national product of the 3.5 per cent in the 70's and 80's was considered in their study. The regression relation obtained for the oil products was:

$$Y = - 62.1563 + 0.775X$$

Where X is Gross National Product and Y is the consumption oil products.

The working group on energy policy²⁷

Taking the rate of economic growth as the variable factor, the working group estimated that if the demand for energy is not effected, and the rate of growth of the Indian economy range between 5.5 per cent to 6 per cent annually, there would be a fourfold increase in energy requirements with in the next twenty years.

²⁵ Saxena V.K. "Oil Economy of India", Agam Prakashan, New Delhi, 1985.

²⁶ Chitate.V.P. and Mrs.Roy.M., "Energy Crisis in India". The Economic and Scientific Research Foundation, New Delhi.

²⁷ Report of the working group on energy policy planning commission, Government of India, New Delhi.

A linear regression equation was obtained which considered the demand for petroleum products to depend on the gross national product. The equation was of the following type:-

$$Y = -76.67 + 0.000857X$$

Where Y is the consumption of oil million tones and X is the Gross Domestic product at factor cost in million rupees at 1960-61 prices.

The energy survey of the Indian committee²⁸

After making an assessment of the past trends assumed that for energy may be assumed to increase in proportion to the national income in the future as in the past. It shows that in estimating the demand for energy economic growth has been a strong influencing factor.

Import policy traditionally aims at an optimum allocation of foreign exchange among competing demands from different sectors of the economy.²⁹

Although, new liberal import policy may prove helpful in importing larger quantities because of the decline in price, it cannot help India to gain a favorable trade balance in view of the huge imports costs of oil which are not covered by the import policy.³⁰

Asian countries became India's largest overseas suppliers since the oil price hike accounting for nearly 43 per cent of

²⁸ Energy survey of Indian committee: Government of India.1965.

²⁹ Statesman, New Delhi, August 26th 1974.

³⁰ Statesman, New Delhi, April 9th 1975.

the country's total imports during 1974. While imports from Iran, Iraq and Saudi Arabia, India 's main suppliers of petroleum products, claimed a substantial share, more than 50 per cent, of the country 's import bills of nearly Rs.1000 crores during the 1974.³¹

The increase in the oil prices by the OPEC countries imposed a further strain an India's balance of payments. Within two years the cost of India 's total imports shot up sharply mainly because of high prices of petroleum and products (POL). On this background, India had to consider that to what extent the increase in oil prices will effect India's balance of payments. It was estimated that India will have to incur an additional expenditure of over 100 crore per year on its oil imports, was exceeding in view of the fact that the then trade deficit already exceeding Rs.1000 crores.³²

Prices in the world markets ruled as much as 43 per cent higher than 1972 level. Petroleum products have to be continuously imported either in crude or finished form as their production in the country was not feasible economically.³³

<Table 11>

Per Capita Availability of Commercial Energy Resource

Resource	Availability		R/P Ratio	Implication
	Total	Per capita		
Oil	0.8 BMT	0.8 Tonne	21	Low R/P, large Imports Necessary
Gas	660 BCM	700 cm ³	30	Low R/P, large Imports Necessary

Source: Ninth five year plan. 1997-2002.

³¹ Amrit Bazer Patrika, Calcutta, April 14th 1975.

³² Financial Express, Bombay, October 15th 1975.

At that time, petroleum and petroleum products were responsible for the major growth in the import bill. They together accounted almost $\frac{3}{4}$ of the total increase in the bill. The relative share of petroleum and petroleum products which was about 10 per cent of total import in 1972-73 increased to almost 26 percent in 1974-75.³⁴

With the exploration of Bombay High, the indigenous output of oil was expected to rise by one million tones in 1976-77 and to curbe the extend imports.³⁵

Given the significant decrease, the import of oil may not go up markedly even as a result of liberalization.³⁶

The foreign exchange content of refineries today is less than 30 percent.³⁷

Foreign exchange reserves are not so high as to enable us to buy technology and equipment for all our needs.³⁸

<Table 12>

Trends in Production of Primary Commercial Energy

Units		Production					
		1950-51	1960-61	1970-71	1980-81	1990-91	1996-97
Crude Oil	MMT	0.26	0.45	6.82	10.51	33.02	33.87
Natural Gas	MCM	-	-	1445	2358	17998	22900

Source : Ninth Five Year Plan, 1997-2002, Draft Prepared at the Internal Meetings of the Planning Commission, Vol. II, Government of India Planning Commission, p.730, New Delhi.

³³ Financial Express, Bombay, October 25th 1975.

³⁴ The Times of India, New Delhi, November 26th, 1975.

³⁵ The Times of India, New Delhi, March 29th, 1976.

³⁶ Hindustan Times, New Delhi, April 16th, 1976.

³⁷ Economic Times, New Delhi, May 4th, 1977.

Exploration History

The beginning of the Indian oil Industry dates back to 1866 when a Mr. Goodenough, employed by a firm in Calcutta gained rights over a small tract on land near Jaipur in Upper Assam.

In November 1880, the Assam Railway and Trading Co.(ARTC) discovered the first commercial oil field at Assam which was to provide virtually all the country's indigenous crude for the next seventy years.

The initial production of the field was a nominal 400BOPD. This rose to 5,000 BOPD by 1931. After independence in 1947, exploration activities were intensified throughout the country. In 1953, Burmah Oil Company discovered Nahorkatiya and Moran fields in the Upper Assam valley. This was followed in 1960 by ONGC's discovery of the Ankleshwar fields in Gujarat. Further successes in Assam and Gujarat were capped by the discovery of the giant offshore Bombay High field in 1974.³⁹

Correspondingly, there was a striking increase in the rate of production. In 1965, total production averaged 60,000BOPD. This rose to 170,000BOPD in 1975 and to some 600,000BOPD in 1985. A peak figure was reached in 1989, with some 670,000BOPD. Recently, there has been a marked decrease in oil production with an average of 560,000 BOPD the shortfall was largely on account of the disruption in normal production and decrease in reservoir pressure.

³⁸ Daccan Chronicle, Hyderabad, May 13th, 1977.

³⁹ International Petroleum Encyclopedia 1980, Tulsa, Prenov Well Publishing Co., pp.131-133.

Oil and Natural Gas

Eighth plan, on the oil front, has been disappointing in respect of crude output and the location of new reserves in the onshore and offshore area. The crude output during 1992-97 estimated at 154 million tones against 159 million tones in the previous five years. While the contribution of the onshore area of Gujarat and Assam has been satisfactory with the total rise to over 12 million tones a year at particular stage against 11.83 million tones in 1990-91. The output of offshore wells in the Bombay High region dipped to 15.37 million tones in 1993-94 from 21.19 million tones in 1990-91. However, with the rejuvenation of the sick wells in Bombay High, there was a recovery in production to 20.22 million tones in 1994-95 and to 22.64 million tones in 1995-96. But there was a set back in 1996-97 to 21.15 million tones.⁴⁰

The prescribed targets could not, thus, be reached in 1996-97 with the total output being only 33.15 million tones. Even in 1990-91 the production was 33.02 million tones. Only a small rise to 33.43 million tones was expected in 1997-98.

The target of 44 million tones for the terminal year of the plan has thus been utopian. While effects are being made to revive the sick wells in the offshore areas and utilize effectively the proved reserves in the Panna and Neelam structure

⁴⁰ Website of Bharat Petroleum, a Major Indian PSE, On the Internet, at <http://www.bharatpetroleum.com>.

significant progress has not been made with exploration in the existing and new structures.⁴¹

No Budgetary Support

Both the oil and Natural Gas Corporation (ONGC) and Oil India (OIL) have been handicapped by a paucity of resources and exploitation activities have to be funded with internally generated and extra budgetary resources. But, no budgetary support has been legitimately complained that the allocation of resource in plan schemes has been woefully inadequate and the two public sector enterprises could not execute. However, the disappointing performance on this front is also due to delays in undertaking exploration in new areas and also in effective exploitation of proved reserves.⁴²

The short comings in this regard have been realized only in recent years and a serious bid is now being made to allot new blocks for exploration by foreign and Indian entrepreneurs and develop also the existing reserves. The entry of foreign interests and entrepreneurs in the private sector should enable a more pronounced rise in crude output in the current plan period. However, there is no firm indication as yet about the scope for a further rise in output, though, it will be considered a great

⁴¹ Ibid.

⁴² "Energy for 90s and Beyond: Prospects, Reality and Challenges", Third Report, Standing Committee on Energy(1993-94), Tenth Lok Sabha, March 1994, p.9.

achievement if the output can be raised to 44 million tones the earlier target, at least in the Ninth plan.⁴³

Rising Import

The shortfall in production has been costly as it has been necessary to import increasing quantities of crude and petroleum products for meeting growing internal consumption. Thus imports of crude oil were quite high at 37.15 million tones and refined product at 22.09 million tones in 1996-97 against 27.34 million tones and 20.33 million tones respectively in 1995-96. During 1992-97 import of crude and finished petroleum products totaled 212.39 million tones against 138.4 million tones in 1986-91.⁴⁴

The oil import bill has, thus, been rising awkwardly in terms of Indian currency as there has also been a depreciation in the external parity of the Indian Rupee.

The outgo in 1997-98 increase due to crude oil imports of around \$11 billion. It was necessary to increase crude import to even 40 million tones as the existing refineries were not capable, after expansion, there was no sizable rise in products.⁴⁵

The up trend in imports will continue in the coming years as there may not be any pronounced rise in indigenous crude output. Greater emphasis will, thus, have to be laid on oil exploration and exploitation even while adopting measures to

⁴³ Ibid.

⁴⁴ The Pioneer, September 12th, 1997.

⁴⁵ Ibid.

achieve economical consumption and discourage the use of liquid fuel for power generation and other purposes.

Encouraging refining sector

While the performance on the production of crude oil has been disappointing the developments in the refining segment have been encouraging. The addition to refining capacity was only ten million tones in the Eighth plan. This could go upto 70 million tones in the current plan period taking the total to 130 million tones by 2001-2002. It is surprising that no serious efforts have been made earlier to expand existing refineries at modest costs.

The importance of adding refining capacity through expansion has been realized quickly. The Koyali, Vizag, Haldia and Barauni refineries will be augmenting their facilities while the proposal of Madras refineries for a third refinery has been accepted Cochin refinery is keen on raising its output similarly and these projects should get completed in two or three years. The Mangalore refinery is trebling its capability.⁴⁶

The total capacity may, thus, rise to around 80 million tones by the end of 1999. Besides these expansion schemes, many new refineries will be constructed by the public sector enterprises and the capacity created will be 36 million tones in respect of six projects. The private sector will be making a sizable contribution as the Manmoth refinery of Reliance, company

⁴⁶ Vijay L. Kelkar, "India's Oil Policy for the Next Century", unpublished paper, The Third Lovraj Kumar Memorial Lecture, New Delhi, August 26, 1996, p.5.

will be capable of a throughout refining of 15 million tones and that of ESSAR six million tones.⁴⁷

Advantageous Locations

Its is noteworthy that new refineries will be located in centres where crude imports can be secured easily. This is because pipelines are not to be constructed from ports to the refineries in Gujarat, Madhya Pradesh, Uttar Pradesh, Punjab, Haryana and Orrisa. All the new refineries except that of RIL will have six million tones capacity. Each Gujarat will, of course, be deriving the maximum benefit as the RIL and ESSAR refineries will be situated in the Jamnager area. Hindustan Petroleum too proposes to erect a six million tones refinery in this state. The Koyali refinery of oil corporation of India in this state is also increasing its to 14 million tones. Gujarat will have a capacity of 41 million tones or 31.5 percent of the estimated total of 130 million tones for all India. It is to be noted that every major state will have an oil refinery by the turn of the century.⁴⁸

There may not be any problem of marketing the huge regional outputs. The requirements from Maharashtra and Rajasthan can be met by other states in the north western region .In the absence of a significant rise in the domestic crude output there will have to be increasing imports of crude as stated earlier.⁴⁹

⁴⁷ Ibid.

⁴⁸ The Economic Survey 1995-96, Government of India, 1996, p.89.

⁴⁹ Ibid.

The only encouraging feature is the scope for eliminating finished product imports and saving foreign exchange with increased processing of crude within the country. The handling of huge crude imports and the marketing of an increasing output of refined products will, however, pose serious challenges.⁵⁰

Plans for large pipeline network

The crude requirements of inland refineries are proposed to be met through pipelines while the extensive marketing network of the established refineries will be utilized by the new entrants in the public and private sector. The objective is to construct pipelines in various regions for adopting an integrated approach and minimizing cross haulage besides reducing strain on the railways.

The work on an extensive network of pipelines will be commissioned first in the areas where expansion schemes will be completed in two years and subsequently in other regions where new refineries will come up later.

Though, no reliable estimates are available about the outlay on different refinery projects and the construction of pipelines on an ambitious scale. However, the total may be easily Rs.1 lakh crores in the current plan period. It may not be difficult to mobilize the required resources in foreign exchange as all the existing and new projects, with the exception of those of RIL and ESSAR will be executed by the PSEs. The mode of

⁵⁰ Ibid.

mobilizing resources will be on different lines from those of RIL and ESSAR which are entirely different entities, though, belonging to large industrial groups.⁵¹

Pricing policy changes

The policies related to the pricing of refined products and natural gas may undergo significant changes as it is being suggested that the system of administered prices should be dispensed within a short period for eliminating subsidies. A different approach may, ofcourse, be adopted in respect of kerosene which is largely utilized in the rural areas for cooking and lighting purposes.

The expectation is that domestic prices for refined products should be in line with those prevailing in the developed countries where product prices are based on crude prices and variations in the demand and availability in world markets.

No major move has been made in this connection so far as there is difficulty in deciding the extent of subsidy elements. Inflationary pressure should not get unduly accentuated but there may be significant developments on the prices front later in the plan period. It is contemplated that the subsidy burden should be reduced gradually without causing serious hardship to consumers.

The situation in respect of availability of natural gas associated products from indigenous sources is ever worse. This is because the consumption of liquefied natural gas has been

⁵¹ Special Correspondent, 'Natural Gas and Petroleum Pipeline Network',

rising fast and there has also been a burst in demand for LPG. The output of natural gas, ofcourse, has risen to 22,308MCM in 1995-96 from 17,998 MCM in 1990-91. It was around 22,840mcm in 1996-97.⁵²

Inadequate gas availability

The fast growth in production by 23.9 per cent even with crude output improving by only 4.7 per cent to 34.57 million tones in 1995-96 from 33.02 million tones in 1990-91 is on account of the better utilization of associated products with reduced harnessing of free gas reserves.

But the growth in production has been grossly inadequate to meet the demand which is around 150 Mcm daily against the output of 63 Mcm. In the Ninth plan period consumption is expected to double to 300 Mcm daily while the output may not increase to more than 77Mcm daily.

The prospects for boosting production cannot be considered bright because of the slow rise in crude output and the difficulties in utilizing sizable free gas reserves in the Tripura region.

It has been necessary to import large quantities from the West Asian region. The consumption of LPG is rising fast and import have to be permitted under the parallel marketing scheme. The requirements are being supplemented to a significant extent with the oil refineries also increasing their contribution with

The Hindu Survey of Indian Industry, 1998, p.161.

better fractionation of light distillates. Even with all these arrangements and a bid to tap the free gas reserves in the Tripura region the expenditure on imports of LNG and LPG will be rising uncomfortably.⁵³

For handling increasing quantities of imported gas, large storage facilities are being created in ports. Also the quantities so acquired will be transported to the interior through pipeline facilities being created at strategic points for supplying LPG in cylinders.⁵⁴

Imports through pipelines

The prospects for importing gas through submarine pipeline from Oman and Iran are not bright as they are unlikely to take shape in the foreseeable future. Construction of submarine pipelines at great depths in the oceans will not be feasible and that the cost of import, too, may be prohibitive because of the heavy expenditure involved on these sub sea pipelines. The Iran project also can not be finalized for the same reason.

The movement of LNG and LPG from foreign countries will be handled by specially constructed vessels. Heavy expenditure will have to be incurred on storage facilities in the respective ports.

In the absence of any new discovery of gas reserves within the country and arrangements for receiving imports in bulk through transcontinental pipelines the growth in consumption will

⁵² Government of India, Economic Survey 1996-97, p.175.

⁵³ Teddy, Tata Energy Data Directory and Yearbook 1990-91, New Delhi, Tata Energy Research Institute, p.26.

have to be moderated and even discouraged in the coming years. While the use of LPG for domestic purposes will have to be permitted. The use of natural gas for power generation cannot be afforded.⁵⁵

It, therefore, remains to be seen that how the various problems will be satisfactorily solved and the dependence on imports of crude and LNG minimized with the adoption of an integrated energy policy and greater emphasis on the use of coal, hydropower and non conventional energy sources.⁵⁶

New policy kindles hopes

Oil had been discovered by the oil and Natural gas Corporation and Oil India. It is worth recalling here that the earliest effort by foreign companies to come to India was taken back in the mid seventies by carlsberg of the United States and Reading and Bates of Canada. The government could not form out any of the areas to other parties.

The results of the earlier initiatives can be seen from the entry of private investments into the Rawwa, Panna and Muktha oil fields in western offshore.

Despite all the efforts of the ONGC and Oil India for over four decades, India remains one of the countries least explored for oil. Only six out of 27 sedimentary basins, identified

⁵⁴ Ibid.

⁵⁵ Narsi Ghorban, Middle East Natural Gas Pipeline Projects : Myth and Reality, The Iranian Journal of International Affairs, Fall 1996, p.649.

⁵⁶ Ibid.

earlier by exploration studies, have been explored leaving a vast virgin area still waiting to be reached.

The pace of foreign investment in oil exploration has been tardy for several reasons. The most important of them being that there is very little support from local banks and financial institutions for oil exploration ventures as they are very risky. The government, therefore, decided on a special dispensation to stimulate foreign investment in this area.⁵⁷

Seismic studies carried out in the Bay of Bengal over 1000 kilometres off the Cauvery offshore basins the Andaman Nicobar islands are now being processed. 33 million tones of oil production was estimated for 1996-97. The level of production for 1995-96 for oil were 2.8 million tones for Oil India and 22.66 million from offshore and 8.97 million tones from onshore for the ONGC. Oil India's gas production during 1995-96 was 1,433 million cubic metres while for the ONGC it was 4,296 million cubic metres from onshore and 16,579 million cubic metres from offshore.

HBJ grid expansion

The GAIL has completed expansion of the HBJ pipeline. Its handling capacity varies from 18 million to 30 million cubic metres a day and the compressors required for this purpose have been installed. The gas now supplied to Mathura refinery is free from sulphur dioxide. The refinery produced gas still has this pollutant which was damaging Tajmahal. GAIL has set blending

⁵⁷ Website of Bharat Petroleum, op. Cit., no.40.

facilities plant at Bijaipur for the transportation of gas which is used as feedstock both by fertilizer and power generation plants.

The infrastructure facilities established by GAIL include a 10 Km. long 8 inch diameter pipeline from Rawa in Krishna Godavari basin to Surascenyanam guidalla in Andhra Pradesh. A 21 Km. pipeline from Mandupetta Cheruvu also from Krishna godavari basin. A 33Km. 12 inch pipeline to Gammewalan dandewalan in Andhra pradesh. A 3.5 Km 4 inch pipeline to Bharat Glass from gandhar field. A 13 km. 4 inch pipeline to Gujarat Borosil Ltd. A 4 Km. pipeline to Ashok chemicals, Standard chemicals and Ramesh industries in Gujarat.⁵⁸

Pipelines

The average annual rate of construction of new pipelines is about 25,000 Km. The global network has exceeded the 2 million Km. mark.

The first crude oil pipeline in India was laid from Digboi oil fields to the Digboi refinery in the north east. However, its real development started only in the sixties.

During 1960-62 Oil India laid the first trunk crude oil pipeline from Naharakatiya and Moran oil fields to the refineries in Guwahati and Barauni covering a distance of 1,156 Km.

The first cross country product pipelines was laid during 1962-64 to transport finished petroleum products from the

Guwahati refinery to siliguri crossing a number of rivers and through diverse terrain in the states of Assam and West Bengal subsequently. A number of other Crude oil pipelines were laid in the seventies and eighties including sub sea crude oil pipelines. Compared to liquid petroleum the use of natural gas is a recent phenomenon in India. Following the discovery of large gas fields in Bombay offshore a 1750 Km. long gas pipeline was laid during 1985-90 from Hazira on the west coast to jagdishpur in Uttar Pradesh. This pipeline is connected to the Bassin offshore fields by a 231 Km. long sub sea pipeline. At present, five major crude oil pipelines and eight product pipelines are in operation with a total capacity to transport about 56 million tones per annum of crude oil and finished petroleum products. Indian Oil Corporation (IOC) is the leader in pipeline transportation in India. It constructed its first product pipeline from Guwahati to Siliguri in 1964. It constructed a large network of crude and product pipelines over the years. At present it owns and operates about 5,399 Km. of crude and product pipelines. Petroleum products are transported from the refineries and port terminals to inland depots and bulks consumers by rails pipelines coastal tankers and road. The share of different modes of transport is dependent on the geography of the country. Most of the major consuming centres being land locked, movement through tankers is limited to coastal location. Even with this, coastal movement and secondary movement has to be effected through other modes as the consumers

⁵⁸ Oil and Gas Development Projects, Monthly Commentary on India

are located away from the coastline. In fact the high share of road transportation, 25-39 per cent, is not by choice but under compulsion due to inadequate rail and pipelines infrastructure. As regards railways, at present it plays a major role in the movement of petroleum products. The provision of such links would the west coast to east Via the north west as well as the pipeline networks would connect major consumption centres of central India. A complex network of pipelines would thus emerge which would ensure uninterrupted supply of petroleum products throughout the country in the foreseeable future.⁵⁹

Pipelines fig

Imports to meet supply gap Natural Gas

The financing of the 1,700 Km. pipelines to Bachau, the land full point in Gujarat, has also run into uncertainties. The proposed pipelines has to the laid at a depth of 3,500 metres and it will be the first time that a pipelines will be sunk at such a depth. The technology required for the maintenance and repair of such a pipeline involves the operation of remotely piloted unmanned vehicles. As for the proposed Indo Iran project for supply through on land pipeline across Pakistan , Islamabad has not yet allowed the initiation of a survey. It will therefore again have to be a submarine pipelines. But since it will be across Pakistan's continental shelf Islamabad 's clearance for

Economic Conditions, 33(5), December 1991, pp.83-90.

the project will be required. If all these hurdles are overcome it will be possible for India to avail itself of 58 million cubic meters a day from Oman and Iran. Under a memorandum of understanding signed between GAIL and Brown and Roots, the Canadian Company is exploring the avenues for obtaining gas suppliers from Bangladesh and Myanmar. The quantities to be obtaining are yet to be finalized. The production of LPG in the Country in 1996-97 was placed at 3.10 million tones of which GAIL's share was 5.5 to 6 lakh tones. It extracts the LPG from the gas being transported by the Hazira Bijaipur Jagdishpur pipelines at Bijaipur and vagodia.⁶⁰

The production from other plants includes solvent propane and pentane. Four more LPG plants with a total capacity of 4.79 lakh tones are being operated in lakwa (Assam) Ussar (Maharashtra) Auraiya and Gandhar in Gujarat. The GAIL has proposed to put up a 1800 km. pipeline for LPG from Kandla in Gujarat to Dadri near Delhi. Once this project is commissioned GAIL's share of LPG production will go up to 45 per cent. The Sunderajan committee was set up to develop a comprehensive long term plan for the hydrocarbon sector in its report submitted in 1995. The compounded growth rate for petroleum products in the Eighth plan 1992-97 was 7.3 per cent which is expected to be well over 6.5 per cent in the Ninth 1997-2002 and tenth 2002-07 plan period.

⁵⁹ Indian Oil Achieves over Hundred Percent Capacity Utilization, Monthly Commentary on Indian Economic Condition, 37(10), May 1996, pp.29-32.

⁶⁰ Mohan, C. Raja, Geo-politics and Energy Security, Strategic Analysis, 19(9), December 1996, pp.1269-1276.

However, this could be as high as 12 per cent in the Ninth plan period if the power sector demand projection are to be fully met.⁶¹

⁶¹ Mitra Neelanjana, Energy Policy Planning in India Case of Petroleum and Natural Gas, Economic and Political Weekly, 27(35), August 29, 1992, pp.109-115.

Chapter II
The Debt Energy Nexus
In India

CHAPTER II

The Debt Energy Nexus In India

In this chapter an attempt has been made a to unravel the energy-debt nexus by linking India's energy imports to the growth of its external debt. The intention is to bring out, firstly, the extent to which India's debt problem could have been avoided with a different strategy of energy use in the 1980s and secondly what changes in energy consumption are needed now to prevent a further build up of debt.

The study considers the effect on India's imports of four important shifts in a strategy that could have reduced oil consumption and could have been implemented between 1977-78 and 1989-90. (I) a shift in long haul freight movement from road to rail. (II) a shift from kerosene to liquefied petroleum gas for cooking. (III) the electrification of unelectrified household. (IV) the replacement of diesel irrigation pumpsets with electric pumpsets.

Debt: Global perspective

The World Bank in its World Development Report, 1991, estimated the outstanding debt of all developing countries at \$1.3 trillion at the end of 1991.¹ Since 1988, international

¹ World Bank's income classification ;GNP per capita of \$580 or less in 1989- Low income countries ; GNP per capita of more than \$580 but less than \$ 6000- Middle income countries; GNP per capita of more than \$ 6000 High income countries.

multilateral financial institutions and Governments of the developed countries have made some efforts to reduce this external debt of developing countries. However, efforts have had little success so far. Firstly, as Table 1 shows, while there has been no new explosion of debt in recent years as was the case in the late 70s and early 80s, there has not been any substantial reduction in the outstanding debt of developing countries. Secondly, the outstanding debt of the World Bank's "severely indebted middle income countries" declined in 1988 and 1989 but increased again in 1990. Thirdly, the external debt of the group of low income countries has been continuously growing while that of all middle income countries declined in 1988 and 1989 but grew the year after 1990.

<Table 1>

Growth of Long-Term Debt of Developing Countries
(Average annual per cent change nominal)

	1973-80	1980-87	1988	1989	1990
1. Low and middle income Countries	22.6	15.0	(-)2.1	(-)0.1	5.0
Low income countries	16.5	18.3	5.5	5.5	8.8
Middle income countries	24.7	14.2	(-)4.6	(-)2.2	3.5
2. Severely indebted middle Income countries	25.2	16.2	(-)4.8	(-)2.4	3.5

Notes 1 World Bank's income classification; GNP per capita of \$580 or less in 1989-Low income countries; GNP per capita of more than \$580 but less than \$6,000-Middle income countries; GNP per capita of more than \$6,000-High income countries.

2 Long term debt covers only loans of more than one year maturity

Source: Extracted from Table A. 11 of World Development Report, 1991 (Washington, world Bank, 1991)

Discussions on how to resolve the debt crisis have usually focused either on the terms of repayment (waiver, rescheduling, altering the interest rate structure, etc) or on the terms of trade that the developing countries have to face. The stepping up of exports has invariably been suggested as the only way to solve the present balance of payments problems of developing countries. The issues of energy imports and what role, they have played in accentuating the debt crisis receives little attention. Thus the debt energy nexus has been ignored.

Among all the 20 countries, that the World Bank has identified as middle income countries, the relative importance of energy imports in total imports does vary. In 1989, fuel imports constituted as little as 1 per cent of the crude petroleum. However, in heavily indebted countries that do not have large oil reserves this per cent was substantial in 1989: e.g, Philippines 13 per cent, Brazil 30 per cent and Hungary 12 per cent.² In the low income countries, the percentage of fuel imports in total imports was just 6 per cent in 1989, but this partly was a reflection of the low level of consumption of commercial energy in these countries. But it also had large country to country variations. In the case of large low income countries, such as India and Pakistan their fuel imports in 1989 constituted a significant percent of their import bills: 17 per cent and 14 per cent respectively.³ Hence, in the case of developing countries,

² Long term debt covers only loans of more than one year maturity.

³ Extracted from Table A.11 of world Development Report, 1991 Washington, World Bank, 1991.

that have built up a large debt, it is important to determine the contribution of energy import in debt. India has to link energy imports in general, and oil imports in particular, to the growth of the country's external debt. The intention is to bring out the extent to which the debt problem could have been at least reduced, if not avoided, with a different strategy of oil use and to highlight what needs to be done now regarding energy use to prevent a further build up of debt.

Debt: Indian Perspective

Imports of crude oil and its refined products constitute the largest single commodity group in India's import bill. Yet, the potential benefits from greater efficiency in the use of oil in India have not been explored so far in investigation of what has caused India's debt problem and how to prevent further large borrowing in the international capital market.

At the end of 1989, according to the World Bank, India had the fourth largest debt among the developing countries.(Table 2) Between March 1980 and march 1990, India's outstanding debt more than tripled from \$17 billion to \$ 59.1 billion and increased further to \$ 68.2 billion in March 1991.(Table 3)

<Table 2>

Outstanding External Debt of the Six Most Indebted
Developing Countries

Country	End of Year		Growth Per Cent
	1984	1989	
1. Brazil	104.3	111.2	7
2. Mexico	94.8	95.6	1
3. Argentina	48.8	64.7	32
4. India	33.9	62.5	84
5. Indonesia	31.9	53.1	66
6. China	12.1	44.9	372

Source : 1. 1984 data from World Debt Tables, 1989-90, First Supplement (Washington, World Bank, 1990)

2. 1989 data from World Development Indication in World Development Report, 1991.

3. For reasons given in Note 6 of Table 3-India's debt above is not the same as that in Table 3.

<Table 3>

Outstanding External Debt of India

(in \$ million)

Financial Year Ending March	External Assistance	External Commercial Borrowings (Long-term)	External Commercial Borrowings (Short-term)	Bank Deposits by Non-Resident Indians	Borrowings from the IMF	Total
1980	14,869(85)	1,529(09)	900(5)	155(1)	-	17,453
1981		9,5841			977	20,561(100)
1985	20,828(61)	5,394(16)	2,856(8)	903(2)	4,111(12)	33,922(100)
1986	22,378(59)	6,250(17)	3,129(8)	1,789(5)	4,320(11)	37,866(100)
1987	25,983(58)	8,077(18)	3,297(7)	2,748(6)	4,341(10)	44,446(100)
1988	28,865(58)	9,931(20)	3,519(7)	3,815(8)	3,650(7)	49,780(100)
1989	33,146(58)	12,453(22)	3,772(7)	5,700(10)	2,552(4)	57,623(100)
1990	33,460(57)	13,253(22)	4,659(8)	6,802(12)	1,545(2)	59,749(100)
1991	38,100(56)	14,884(22)	4,912(7)	7,471(11)	2,860(4)	68,227(100)

Notes: 1 Figures in brackets are percentage shares in each year's total. Because of rounding off in some years they do not add up to 100.

2 Sources: No official document of the government of India provides the borrowings under each category and for all years from 1980-81. It has been the practice to list under external debt only external assistance, long term external commercial borrowings and borrowing from the IMF. Bank deposits by non-resident Indians are usually given separately but not short term commercial borrowings.

It was only from 1985 that figures on external commercial borrowings were published. For earlier years there are figures on "authorisations" which are not the same thing as either gross or net borrowings. Hence, year-wise estimates of aggregate external debt are not officially available.

All figures other than for end-1980, 1981 and of short term external commercial borrowings are from Economic Survey 1990-91 and 1989-90 (New Delhi: Ministry of Finance).

March 1980 figures are estimates made by the Reserve Bank of India-India's International Investment Position (RBI Monthly Bulletin, April 1985, Bombay). Estimates for 1981 are from the

World Bank's World Debt Tables and refer to the 1980 calendar year-end data.

Official debt statistics usually exclude short term commercial borrowings. Other than for 1991, all figures on this kind of debt are from world Debt Table 1989-90. First Supplement, (Washington: World Bank). The 1991 estimate is from a statement made in parliament on July 16 by the minister of state for finance (Deccan Herald, July 17, 1991).

- 3 NRI bank deposits are of two kinds (1) fully repatriable in foreign currency and (2) payable in rupees only. Only category (1) is included here.
- 4 Long term commercial borrowings are of more than one year maturity and short term borrowings of less than one year maturity.
- 5 NRI bank deposits figures for 1980 are end calendar year 1979 figures. Short term external commercial borrowings for all years other than 1991 are also end calendar year figures.
- 6 Other than data taken from World Bank estimates, all figures are rupee estimates converted into US \$ at average exchange rate for the financial year in question. Rs/\$ values are taken from the Economic Survey, various issues.
- 7 The above estimates of total external debt differ from that of the World Bank by (-) 0.4 per cent (1985), + 7.98 per cent (1986), + 8.79 per cent (1987), + 11.14 per cent (1988), (-) 0.02 per cent (1989) and + 8.4 per cent (1990). The coverage of external debt by the World Bank and in the above estimates is the same. The differences could be due to the following reasons: (1) World Bank estimates are calendar year end estimates, those above are financial year end (March) estimates and (2) the above estimates are rupee values converted to \$ values using the year's average exchange rate. The rupee values themselves are likely to have been obtained by converting loans in each currency to the rupee values by using the appropriate exchange rate. The World Bank may have for other than \$ denominated loans, converted foreign currency loans to \$ values using the ruling international exchange rates and not the cross exchange rates implicit in obtaining the above estimates.
- 8 The above estimates are all stock estimates, i.e., year-end estimates of outstanding debt after accounting for receipts and repayments during the year.
- 9 External assistance is bilateral aid and aid from the multilateral institutions (World Bank, IDA, Asia Development Bank, etc).

India suffered a trade deficit throughout the 1980s (table 4). In the first half of the 1980s, this was substantially neutralised by a surplus in invisible trade almost entirely from remittances by expatriate Indians but as invisible as a proportion of the gross domestic product (GDP) fell by more than

50 per cent in the second half of the 1980s. The current account deficit as a proportion of the GDP was on the average 70 per cent higher in this period (Table 4). Further in the second half of the 80s, there was a shift in the mode of financing of the current account deficit. During the course of India's sixth Five Year-plan (1980-81 to 1984-85, hereafter abbreviated to 1981-85), concessional aid from the multilateral institutional and bilateral country donors contributed as much as 55 per cent of the inflows on the capital account. But in the seventh plan 1985-86 to 1989-90 (hereafter abbreviated to 1986-90), the pattern of financing of the current account deficit changed drastically. As table 5 shows, concessional external assistance between 1985-86 and 1989-90 met only 29 per cent of India's financing needs in its balance of payments. Loans from international banks met 24 percent of the financing requirement and deposits in banks by non residents and additional 22.8 per cent. Thus, net borrowing abroad, on commercial terms, covered over 46 per cent of the current deficit. It was the twin effect of the widening current deficit (an average of \$5.5 billion a year in the Seventh Plan as against an annual average of \$ 2.3 billion in the Sixth Plan)⁴ and greater dependence on expensive sources of international borrowing that saw India's external debt more than triple in the 1980s. Focusing on oil consumption in India, this study examines potential impact of greater efficiency in the use of oil on India's imports and external debt. More specifically, it

⁴ India's Current Account Balance in the 1980s (As a percent of GDP).

investigates: (i) the saving in oil consumption that could have been realized in the 1980s, through greater efficiency in use of diesel and kerosene, the effect of such savings on the India's expenditure on oil imports and therefore, the extent to which the growth of India's external debt in the 1980s could have been reduced. (ii) the Savings in the oil consumption that can be made in the 90s, if a suitable strategy is initiated and evaluation of the foreign exchange benefits of these savings.

<Table 4>
India's Current Account Balance in the 1980s
(As a per cent of Gross Domestic Product)

Financial Year (1)	Exports (2)	Imports (3)	Trade Balance (4)=(2)-(3)	Net Invisible (5)	Current Account Balance (6)=(4)+(5)
1980-81	4.8	9.2	(-)4.4	3.2	(-)1.2
1981-82	4.9	8.7	(-)3.8	2.4	(-)1.5
1982-83	5.1	8.4	(-)3.2	2.0	(-)1.3
1983-84	4.9	7.7	(-)2.8	1.7	(-)1.1
1984-85	5.2	8.1	(-)2.9	1.7	(-)1.2
Average 1980-85 (Sixth Plan)	5.0	8.4	(-)3.4	2.2	(-)1.3
1985-86	4.4	8.1	(-)3.7	1.4	(-)2.3
1986-87	4.5	7.7	(-)3.2	1.2	(-)2.0
1987-88	4.9	7.7	(-)2.8	0.9	(-)1.9
1988-89	5.3	8.9	(-)3.5	0.8	(-)2.7
1989-90	6.4	9.3	(-)2.9	0.6	(-)2.3
Average 1985-90 (seventh Plan)	5.1	8.3	(-)3.2	1.0	(-)2.2

Source: Table 9.1 in Economic Survey 1990-91 (New Delhi: Ministry of Finance, 1991).

<Table 5>

India's Financing Need in Its External Account and Sources of Financing
(1985-86 to 1989-90)

Financing Need (in \$ million)	Source of Financing (in \$ million)
1 Current account deficit (including errors and omissions). 27,740.0	1 External assistance 9,093.9 (29.0)
2 Repayment to IMF 3,610.3	2 Commercial borrowings 7,524.7 (24.0)
3 Financing Need (1+2) 31,350.3	3 Bank deposits by non-resident Indians 7,163.1 (22.8)
	4 Other capital transactions 3,942.2 (12.6)
	5 Use of Reserves 3,627.2 (11.6)
	6 Total 31,350.3 (100.0)

Note: Figures in Brackets are percentage shares of total.

Source: Reserve Bank of India, Annual Report, 1990-91 (Bombay: Reserve Bank of India, 1991).

Crude Oil and Petroleum Products in 1980s Production, Consumption and Imports

Throughout the 80s, imports of crude oil and petroleum products constituted the largest single commodity group in India's import bill. Table 6 gives share of oil imports in this period to export earnings. Oil imports on the average constituted 21 per cent of total imports in this period. These imports also consumed on the average 31 per cent of India's annual earnings from merchandise exports. The percentage share of oil import in all import did vary from a low of 12 per cent in 1986-87 to a high of 42 per cent in 1980-81. Though Table 6 shows no secular trend, there is a clear pattern in which oil imports were linked to the growth in consumption of petroleum products and the trends in the domestic production of crude oil (Table 7).

When the offshore Bombay High oil reserves were discovered in the mid-70s, the official strategy was to restrict exploitation of these reserves. But, this strategy could not withstand the second oil price increase in 1980 which led to an escalation of India's import bill. As Table 7 and 8 show, the magnitude of India's oil imports, in both quantity and value, were high in 1980-81. In order to reduce India's oil imports, the new approach was to step up exploitation of the offshore Bombay High reserves. Thus production of crude almost tripled from 10.5 million in 1980-81 to 28.9 million tones in 1984-85 (table 7). But

the fall in imports of crude was not much from 16.2 million tones to 13.6 million tones in the same period as consumption of petroleum products rose from 30.9 million tones in 1980-81 to 38.8 million tones in 1984-85. The rate of growth of consumption accelerated in the second half of the 80s. Consumption grew at an annual average rate of 5.5 per cent during the Sixth Plan 1980-85 but this increased to 6.8 per cent a year during the Seventh Plan.⁵ In 1990-91, a steep price increase effected by the government, and to a lesser extent, constraints on availability brought the growth of consumption of petroleum products in that year down to 0.9 per cent.⁶ As Bombay High came to be exploited to the full in the mid-80s and no new discoveries on the same scale as in the mid-70s were made, an increase in imports to meet the growth in consumption was inevitable. Crude oil imports therefore began rising again from 1985-86 and imports of petroleum products from 1987-88(table 7).⁷ In values terms, however, imports of oil almost halved in 1986-87 because of the sharp fall in international oil prices that year. But, from 1987-88 onwards, a relative hardening of oil prices and India's requirement of crude and petroleum products resulted in the oil bill steadily rising(Table 8). India's imports of petroleum products comprise mainly middle distillates. Of the 6.6 million tones of imports of refined products in 1989-90, imports of diesel and kerosene were 5.64 million tones. These imports of

⁵ Ibid, p.70.

⁶ Ibid, p.71.

⁷ Ibid, p.70.

middle distillates have become necessary as the rate of growth of consumption of high speed diesel in particular has been more than that of the average growth of consumption of all petroleum products. Consumption of HSD grew by 7 percent a year in the sixth plan(1980-85) as against the 5.5 per cent growth in consumption of all petroleum products. In the Seventh Plan(1985-90), the difference in growth rates had widened: 8.6 per cent a year of HSD versus 6.8 per cent a year of all petroleum products.

The net annual increase in the oil imports bill between 1980-81 and 1990-91 accounted for as much as 18 per cent of the incremental increase in India's imports bill in the same period(Table 9).

The 1980s began with a large oil imports bill and so have the 90s but, this is not a return to 'Square one' because there is no Bombay High to save the country this time.

<Table 6>

Imports of Crude Petroleum and Petroleum Products
as a Percentage of all Imports and of Export Earnings
(1980-81 to 1990-91)

Year	Oil Imports (Net) as a Percentage of All Imports	Oil Imports (Net) as a Percentage of Exports
1980-81	42	78
1981-82	37	64
1982-83	30	48
1983-84	20	33
1984-85	21	31
1985-86	22	40
1986-87	12	19
1987-88	15	22
1988-89	14	19
1989-90	16	20
1990-91	23	30
Average	21	31

Notes: 1 Value of net oil imports is given in Table 8.

2 the averaging is done by dividing the sum of oil imports

by the sum of all imports.

Sources: Computed from (1) value of net oil imports as in the Reserved Bank of India Report on Currency and Finance, Vol. II, various issues and (2) value of total imports and exports as in Economic Survey, various issues.

<Table 7>

Oil Production, Imports and Consumption (1980-81 to 1991-92)

Year	Crude Oil Production (in Million tonnes)	Crude Oil Imports (Gross) (in Mt)	Crude imports (gross) as a Per Cent of Refinery Throughout	Petroleum Products Production (Gross) (in Mt)	Petroleum Products Imports (Gross) (in Mt)	Domestic Consumption of Petroleum Products (in Mt)	Petroleum Product Imports (gross) as a Per Cent of Domestic Consumption
1980-81	10.51	16.22	63	24.12	7.29	30.90	24
1981-82	16.19	15.30	51	28.18	4.88	32.52	15
1982-83	21.06	16.95	51	31.07	5.03	34.66	15
1983-84	26.02	15.97	45	32.96	4.33	35.84	12
1984-85	28.99	13.64	38	33.24	6.09	38.80	16
1985-86	30.17	15.14	35	39.88	3.87	40.87	9
1986-87	30.48	15.48	34	42.76	3.05	43.66	7
1987-88	30.40	17.70	38	44.70	4.70	46.40	10
1988-89	32.00	17.80	36	45.70	6.5	50.10	13
1989-90	34.10	19.50	38	48.70	6.6	54.10	12
1990-91	33.03	20.80	40	48.56	8.6	54.61	16

Source: 1 Data up to 1986-87 from Table 4.1 of Current Energy Science in India, 1990 (Bombay: Centre for Monitoring Indian Economy, 1990).

2 Data for 1987-88 to 1990-91 Economic Survey (1990-91). Statement 1.30 and Table 4.6.

<Table 8>

Value of Imports of Crude Oil and Petroleum Products (1980-81 to 1990-91)

Year	Crude Oil (in Rs Million)			Petroleum Products (in Rs Millions)			Total Net Imports (in Rs Million)	Exchange Rate (Rs/\$)	Total Net Imports (in \$ Million)
	Imports	Exports	Net Imports	Imports	Exports	Net Imports			
1980-81	33,490	-	33,490	19,140	250	18,890	52,380	7.908	6,623.7
1981-82	37,360	2,050	35,310	14,530	180	14,350	49,660	8.968	5,537.5
1982-83	40,440	10,850	29,590	15,270	2,470	12,800	42,390	93.666	4,385.5
1983-84	35,410	12,310	23,100	12,910	3,570	9,340	32,440	10.3340	3,137.3
1984-85	34,390	15,630	18,670	19,790	2,550	17,240	35,910	11.889	3,020.4
1985-86	36,870	1,350	35,520	13,020	5,100	7,920	43,440	12.235	3,550.5
1986-87	21,200	-	21,200	6,910	4,110	2,800	24,000	12.778	1,878.2
1987-88	30,360	-	30,360	10,070	6,490	3,580	33,940	12.956	2,617.6
1988-89	28,630	-	28,630	15,160	5,050	10,110	38,740	14.482	2,675.0
1989-90	40,100	-	40,100	22,630	6,970	15,660	55,760	16.649	3,349.2
1990-91	NA	-	NA	NA	9,380	NA	98,820	17.943	5,507.4

Notes: 1 Sources for imports: (a) Reserve Bank of India report on Currency and Finance, Vol. II, Various Issues, (b) Annual Report of the Ministry of Commerce, various issues (New Delhi: Ministry of Commerce).

2 Sources for Exchange Rates: (a) Economic Survey, 1990-91.

<Table 9>

Share of Incremental Crude Petroleum and Petroleum Product Imports
in Incremental total Imports (1980-81 to 1991-92)

Year	Gross Oil Imports (Rs/Crore)	Increment (+/-) (Rs/Crore)	All Imports (Rs/Crore)	Increment (+/-) (Rs/Crore)	Incremental Oil Imports in Incremental Imports (per Cent)
1980-81	5,238	-	12,549		
1981-82	4,966	(-)272	13,608	1,069	(-)26
1982-83	4,239	(-)727	14,293	685	(-)106
1983-84	3,244	(-)995	15,831	1,538	(-)65
1984-85	3,591	347	17,134	1,303	27
1985-86	4,344	753	19,658	2,524	30
1986-87	2,400	(-)1,944	20,096	438	(-)444
1987-88	4,015	1,615	22,244	2,148	75
1988-89	4,397	364	28,235	5,991	6
1989-90	6,400	2,021	35,416	7,181	28
1990-91	10,820	4,420	43,171	7,755	57
Total		5,582		30,622	18

Source: Same as Table 8.

Contribution of Crude Oil and Petroleum Products to External Debt

The above picture of the production consumption and imports of crude oil and petroleum products in the 80s can now be related to external debt and external receipts. One simple way to measure the contribution of oil imports in the 1980s to the growth of external debt in the same period is to relate the aggregate value of oil imports (of crude and refined products) to the growth of external debt in the same period.⁸ Another measure is to relate oil imports in the 80s to the total net external receipts of India in the same period. Net external receipts would include not only net borrowing but also exports earnings and net invisible earnings on the current account and other inflows on the capital accounts. This measure will indicate how much of every dollar

⁸ Here, flows-oil imports- are not being measured against the stock of outstanding external debt. A difference between outstanding debt at the

that India receives from all sources goes to pay for oil imports. Table 10 gives the year wise percentage of oil imports in net external receipts between 1980-81 and 1989-90.

<Table 10>
Oil Import as a Percentage of Net external Receipts (1980-81 to 1989-90)

Year	Oil imports (Crude and Refined Products) (in \$ million)	Net Receipts on Current Account (in \$ million)	Net Receipts on Capital Account (in \$ million)	Total Receipts (in \$ million)	Oil Imports as a per Cent of Receipts
	(1)	(2)	(3)	(4)	(5)
1980-81	6,623.7	13,767.4	1,442.4	15,209.8	43
1981-82	5,537.5	12,341.9	1,337.6	13,679.5	40
1982-83	4,385.5	13,052.7	3,021.8	16,074.5	27
1983-84	3,137.3	13,323.9	2,935.5	16,259.4	19
1984-85	3,020.4	13,312.7	3,177.3	16,490.0	18
1985-86	3,550.5	12,453.1	4,844.6	17,297.7	20
1986-87	1,878.2	13,177.8	3,542.5	16,720.3	11
1987-88	2,617.6	14,962.4	4,115.7	19,078.1	14
1988-89	2,675.0	16,429.2	6,187.6	22,616.8	12
1989-90	3,349.2	17,979.5	5,555.0	23,534.5	14
Total	36,774.6	140,800.6	36,160.0	176,960.6	21

Notes: 1 Current account receipts are net of all items other than merchandise exports.

2 Capital account receipts include 'errors and omissions' but are net of change in reserves.

Source: Balance of Payment data from Economic Survey, various issues (New Delhi: Ministry of Finance).

The following are summary values for the above two measure:

1980-81 to 1989-90

1. Oil imports (crude + petroleum products) = \$36.774 billion.
2. Growth of external debt = \$ 42.296 billion.
3. Oil imports / net borrowings = 87 per cent
4. Net external receipts = \$ 176.961 billion
5. Oil imports / net external receipts = 21 per cent

The relative softening of international oil prices after the West Asian war offers little hope for India as long as the

beginning and at the end of the period is the next external borrowing by

consumption trends of the 80s continue. Domestic production is unlikely to increase in the near future. In fact in 1990-91 production of crude declined, albeit marginally, for the first time in a decade.⁹

A conceptual framework for the Energy Debt Nexus

India's oil imports have been and will continue to be the same, if the consumption trends of the 1980s do not change to a large magnitude. Hence, it is obvious that savings in consumption will have a direct effect on India's imports bill and therefore on its need to borrow abroad to cover its current accounts deficit. Instead of concentrating on such energy savings, the view underpinning much of the government of India's current economic program is that India's balance of payments problem have not got so much to do with large imports as with a low of exports. But exports growth in the Seventh Plan (1984-85 to 1989-90) did increase to an average of 11.6 per cent a year in terms of dollar as against average of 4.5 per cent a year in the Sixth Plan (1980-81 to 1984-85). But imports growth too accelerated from 6.2 per cent a year in the earlier period to 8.2 per cent a year in the later period, the net effect of which was that there was only a marginal contraction of the trade deficit. Still, compared to other developing countries, India's imports as a proportion of GDP remain small. According to the World Bank in the year ending

India, i. e., net inflow of borrowed funds.

1989, India's imports: GDP ratio was only 8 per cent while that of all low income countries was 14 per cent and that of the middle income countries as much as 25 per cent.¹⁰ It is probably the low value of India's import: GDP ratio that has resulted in the view that restraining import growth through efficiency in use of imported commodities has little role to play in an economy fully integrated with the World the direction in which India is presently moving. Perhaps, for the same reasons there is little emphasis on promoting a greater efficiency in use of petroleum products.

It is clear that a strategy that stresses efficiency in the use of oil and natural gas in so far as it reduces imports of crude and petroleum products, directly improve the balance of payments and therefore reserves. In an ex-post analysis of the effect of efficiency in oil consumption on the balance of payments, likely past savings in oil consumption get reflected in a national increase in the foreign exchange reserves in each of the year. The reduction in the growth of external debt would have naturally also had a beneficial impact on India's debt servicing burden.

Importance of Middle Distillates in Consumption and Imports of Petroleum Products

⁹ Newspaper reports of planned production in 1991-92 indicate a crude output of only 30 million tonnes in 1991-92 against earlier projections of 34 million tonnes, The Economic Times, Bangalore, September 1, 1991.

¹⁰ World Development Report, op. cit, World Development Indicators, Table 9, pp.220-221.

The sectoral consumption pattern of petroleum products in India in 1986-87 was as follows: transport 36 percent, Industry 31 per cent, Domestic 17 per cent, Agriculture 11 per cent, Power 5 per cent. The pattern of consumption of petroleum products according to the various distillates in 1989-90 was: light distillates 17 per cent and middle distillates 61 per cent and heavy distillates 22 per cent.¹¹

Within middle distillates which form the overwhelming bulk of oil consumption the distribution was high speed diesel oil 64 per cent, kerosene 26 per cent and aviation turbine fuel 5 per cent and light diesel oil 5 per cent. India's oil problem, therefore is primarily a problem of the two middle distillates, diesel and kerosene, in that order. Together, they account for as much as about half of India's oil consumption and for the bulk of the country's imports of petroleum products (as distinct from crude oil). The consumption of high-speed diesel and kerosene has, therefore been adjudged to be the crux of India's oil problem.¹² Gasoline represents less than one tenth (actually 6.6 per cent) of the oil consumption in 1990 (compared to 6.3 per cent a decade ago). So, the popular belief that gasoline used in vehicles of the affluent like cars, scooters etc are major causes of the oil

¹¹ All data contained in this section, unless otherwise mentioned, are from Amulya K N Reddy, "Sustainable Development in India through Reduction of Oil Dependence", in *The Role of Petroleum in International Development-Proceeding of Seminar, International Programme of Petroleum Management, Norway, 1991.*

¹² (i) Amulya K N Reddy, *ibid.*, (ii) Amulya K N Reddy, "A Strategy for Resolving India's Debt Crisis", *Current Science*, Vol. 50, no.2, 1981, pp,50-53, (iii) Jose Goldmberg, Thomas B Johanson, Amulya K N Reddy and

crisis does not hold true, though, measures to reduce gasoline consumption may be good populist politics. Gasoline which in 1980 accounted for only 12 per cent of the oil used in the transport sector had increased to 18 per cent in 1990. Thus, gasoline may be a small problem. Diesel consumption is accounted for by trucks 42 per cent, irrigation pumpsets 30 per cent, buses 17 per cent, railway 8 per cent, with ships and three-wheeler automobiles consuming the remaining 3 per cent. The large proportion of total diesel consumption due to trucks reflects the growth of freight movements by roads. Indeed, in the past four decades, there has been a major shift away from rail towards roads in freight movement. In 1950-51, the railway accounted for 89 per cent of total freight movement. This fell to 71 per cent in 1960-61, to 66 per cent in 1970-71, to 62 per cent in 1980-81 and further to 46 per cent 1988-89, road movement accounted for 54 per cent of the total freight movement of 505 billion tonnes kilometers.¹³ But while 88 per cent of the total diesel utilized in India in 1986-87 for freight haulage was accounted for by trucks in carrying 59 per cent of the total diesel-hauled freight the railway in the same year accounted for only 12 per cent of the total diesel consumption to move 41 per cent of the total diesel hauled freight. This clearly reflects the relative energy inefficiency of road movement of freight. In spite of this, road movement has overtaken rail in freight haulage. It is because

Robert Williams, *Energy for a Sustainable World*, Wiley Eastern, New Delhi, 1998, pp.256-270.

diesel prices in India are kept lower than they should be, considering the resource costs as distinct from financial costs of freight movement. Trucks move goods more cheaply on short distances up to a break-even distance beyond which rail freight is more economical. On the basis of diesel prices 50 per cent higher than the 1979-80 prices, the break-even distances are between 200 and 400 kms. But the actual lead distances in freight movement by road are much larger for example 276 kms. for cement than these break-even distances.¹⁴ While the costs of distillation of crude oil to yield various fractions should be more or less the same, the price of gasoline in India in the 1980s was on the average 2.28 times that of diesel (in comparison with average 1.22 times in industrialized countries), while the ratio of diesel kerosene prices averaged only 1.62. Unfortunately, diesel prices cannot be raised towards the gasoline price because when there is a large disparity between diesel and kerosene prices, truck operators tend to mix diesel with kerosene and cause a kerosene shortage. Thus, diesel price have to be kept not too much higher than those of kerosene. With regard to kerosene in 1986-87, over two thirds of the 142 million households in the country did not have electricity for lighting and depended entirely on kerosene for illumination. A third of the 6.6 million tones of kerosene consumed in India that year was used for lighting homes, while the rest was used for domestic cooking. It

¹³ Basic Statistics-All India, Centre for Monitoring the Indian Economy, Bombay, 1990.

is the low income urban and most rural households that depend on kerosene for lighting and it is the middle income households that depends upon on kerosene for cooking. Hence, raising the price of kerosene so that diesel prices too can be raised in order that the financial costs of freight hauled by road reflect true resource costs would affect these vulnerable sections adversely. Thus, increasing the price of kerosene is not an acceptable option from a political point of view unless kerosene can be made redundant as an illuminant and as a cooking fuel. An emphasis on electrification of all Indian homes (which would improve the quality of life of Indian's poor) and a shift away from kerosene to other cooking fuels, will make kerosene redundant, yielding a situation in which the prices of kerosene and diesel can be raised and facilitate a shift away from the energy-inefficient road haulage of freight.

Projection and Alternative Scenarios for 1999-2000

If recent trends in oil consumption continue, the pressure on India's balance of payments will remain severe and even worsen. As the consumption of diesel has been growing at a rate that is above, that of all refined products and the gap between the two widened in the second half of the 80s. Further, no discoveries of new exploitable large reserves have been made and production from currently used wells may decline. These triple pressures will continue to keep imports of crude and refined petroleum products

¹⁴ Report of the National Transport Policy Committee of 1978, Chapter 3,

the largest single item in India's import bill. A comparison of three estimates of oil consumption in the year 2000 will indicate how much saving in consumption is possible in the years between now and 1999-2000. And from these potential saving, the likely beneficial impact on the balance of payments can be estimated. Projection assumes that the current growth rates of load number of users in each oil consuming sector between 1980-81 and 1986-87 will continue until the year 1999-2000. The year 1986-87 has been adopted as the benchmark as it is the base year of the Planning Commission's draft in 1990 in "Sectoral Energy Demand Analysis".¹⁵ Based on fuel consumption norms of petroleum products, which are assumed to remain unchanged oil consumption in each end-using sector between 1990-91 and 1999-2000 has been estimated in scenario(i) The only exception is diesel consumption by irrigation pumpsets where, because of a fixed groundwater potential, the total number of irrigation pumpsets cannot grow beyond a ceiling of 20 million and the number of irrigation pumpsets run on diesel is not expected to cross 5 million.¹⁶ A small shifts from road to rail in freight movement of homes, greater use of LPG in homes and substitution of diesel pumpsets. However the magnitude of each of the shifts corresponds to a timid move in on the projection consumption in the year between 1999-2000 the compound annual growth rates of consumption in

Government of India, New Delhi, 1980.

¹⁵ Sectoral Energy Demand Analysis (draft), Mimeographed, Planning Commission, New Delhi, 1990, p.10.

¹⁶ See A K N Reddy(1991), op. cit., A K N Reddy(1981), op. cit., and Goldenberg, Johansson, Reddy and William, op. cit.

each sector have been derived and from them the sector wise consumption in the years between 1990-91 and 1999-2000. In this connection it should be noted that the Planning Commission's projection of gasoline consumption are based on an acceleration in the growth rate of the automobile population.

Non Oil Energy Imports

Oil imports constitute the largest single group in India's import expenditure but they are not only kind of energy imports. It would not be proper to stretch the definition of "other energy imports" to include energy end use equipment such as boilers, furnaces, heating and cooling equipment, pumps, etc, because, in the ultimate analysis all equipment uses energy. Further, just as there are possibilities for the reduction of oil imports between 1980-81 and 1985-86 shows that they are of same order as oil imports (Table 11). Thus, total energy imports oil plus non oil taken together are roughly half the import bill and reducing oil import of energy source and equipment for the generation of electricity.

<Table 11>

Oil and Non-Oil Energy Imports			
Year	Percentage share of Oil Imports in Total Imports	Percentage Share of Other Energy Imports in Total Imports	Percentage Share of Total Energy Imports in Total Imports
1980-81	42	16	58
1981-82	37	15	52
1982-83	30	24	54
1983-84	20	25	45
1984-85	21	28	49
1985-86	22	23	45

Source: 1 Col(2) from table 5.

2 Col(3): (a) Non-oil energy sources such as coal and

(b) equipment for the supply of energy carriers, I e, equipment for generation, transmission and distribution of electricity, Monthly Statistics of the foreign Trade of India (New Delhi: Ministry of Commerce) various issues.

Chapter III
India's Energy Security
Options

CHAPTER III

India's Energy Security Options

Oil has been the primary source of energy almost all over the world for the last several decades now, so much so, that it represent 39 per cent of the total energy consumed worldwide.¹ But with crude prices down to pre-1973 levels in real terms mainly because of a glut in stocks, many analysts began questioning the relevance of "energy security" in the current context. However it is perhaps more relevant today than it was a decade ago. Through consumers everywhere are rejoicing at the prospect of cheap, plentiful oil for the foreseeable future, if oil prices continue to remain as low as they are now, oil producers (both state companies as well as multinational corporations) will have to slash their exploration budgets resulting in fewer investments and consequently, less production, from areas that are not cost effective. Also for countries that are dependent on oil for much of their revenues, low prices will mean increasing budget deficits, more borrowing and cost cutting. This, in turn may lead to political instability in many of these countries. All the Gulf governments are suffering from the decline in oil prices. Most are repressive and unpopular. None has a sure hold on power. The

¹ Hasan Johar and Gawdat Bahgat, *The American Dilemma in the Gulf Region*, *Journal of South Asian and Middle East Studies*, Vol. xix, no.1, Fall 1995.

Persian Gulf region is privy to two third of the world's cheapest reserves of high quality oil, while Russia has the largest reserves of natural gas. Thanks to the high prices dictated by the Organization of Petroleum Exporting Countries during the 1970s and 1980s, more expensive fields in the North Sea and elsewhere could be developed and crude sold at a profit. Gulf producers are being accused of deliberately flooding the markets with oil in order to push smaller and more expensive producers out of the market, there is fear that it may not be long before cash strapped Gulf states decide to produce more to increase revenues.² This would, in turn increase the danger of once again creating dependency on a few West Asian countries for oil. Once low prices move more production back to the Persian Gulf region, any instability caused by the overthrow of a regime could have repercussions on oil flows from the region as a whole.

Though any such shock would be different today, as the world is less dependent on oil than it was previously, and the development of markets to trade oil and oil futures means that price signals are relayed faster and more efficiently, nonetheless, any interruption to oil supplies would be very damaging to the world economy, especially to the less developed or developing countries, which are, by and large, oil-dependent economies.

² Geoffrey Kemp, The Persian Gulf Remains the Strategic Prize, Survival, Vol. 40, no.4, Winter 1998-99.

Therefore, even with prices at an all time low, consuming countries should be alert to the dangers of oil dependence.

Over the last decade, it is the Asian economies like China, India, South Korea, Indonesia and Thailand which are consuming more energy than ever before. According to a World Bank estimate, the increase in energy demand in these countries will account for more than 40 per cent of the increase in global energy demands between 1990-2005. To meet this increasing demand for energy, these newly emerging economies will have to increase as well as diversify their domestic supplies and sources of energy- both conventional as well as non-conventional.

More and more countries these days are turning to natural gas as an alternative sources of energy. As gas reserves continue to rise sharply while discoveries of new petroleum fields lag, most Asian countries realize that their future economic growth lies in the development of gas. For those countries which are heavily dependent on oil imports, natural gas not only signifies a diversification of energy sources but a more secure supply. And for developing countries like India, Pakistan and Thailand, which have limited liquid reserves, it is a necessary supplement to oil. Even net oil exporter, like Indonesia, Brunei and Malaysia, view natural gas as a replacement for oil for domestic use, thereby freeing oil for export; abundant reserves of gas also create more opportunities for Liquefied Natural Gas(LNG) exports and

ultimately pipeline exports.³ The reasons for this are: gas is cheaper, cleaner and plentiful, and in an increasingly environmentally conscious world, developed countries see this as an attractive alternative to oil and mineral fuels. Hence, oil-producing states in the Persian Gulf, like Qatar, Oman, Abu Dhabi and Iran(which has the second largest reserves of natural gas at 24,000 billion cubic metres or 19 per cent of world conventional reserves) are striving to develop their gas reserves to supplement their dwindling oil reserves.⁴

The India Scenario

India's Gross Domestic Product(GDP) growth rate averaged 6.5 per cent during 1992-97 and despite decreasing slightly to 5 per cent in 1997-98, it is expected to pick up again to around 6 per cent in 1998-99 and around 7 per cent thereafter for the rest of the Ninth Plan period. The demand for total primary commercial energy in India increased from 25.5 million tonnes of oil equivalent(MTOE) in 1953-54 to 212.9 MTOE in 1994-95, representing an increase of more than 8 times over a 40-year period, and is projected to increase to 770 MTOE by 2011-12. In per capita terms, the demand for primary commercial energy was 67 kilogram per oil equivalent(KGOE) in 1953-54. It increased to 234 KGOE in 1994-95

³ Petroleum Economist, September 1995.

⁴ Narsi Ghornam, The Evaluation of Recent Gas Export Pipeline Proposals in the Middle East, The Iranian Journal of International Affairs, Vol. vii, no.2, Summer 1995.

and is expected to increase to 648 KGOE by 2011-12. However, this is low compared to the international average of per capita energy consumption levels of 1,433 KGOE in 1994-95, and over 5,000 KGOE in the developed countries.⁵

Currently, India's oil consumption is around 80 million tonnes(m.t.) per year. If the GDP rate grows at a rate of 6 per cent, by 2020, India will be needing around 275 m.t. of oil(crude plus petroleum products); if the GDP growth rate is 7 per cent, the requirement will be 350-400 m.t. The demand for gas also is expected to increase. Though India does not import any natural gas at present, imports are scheduled to start from 2001-02 when India is expected to import about 2.2 billion cubic metres(bcm). This is projected to increase to 12.8 bcm by 2005 and 25.5 bcm by 2010. Therefore, in this scenario, the security of oil supplies becomes important.

Since adequate energy resources are critical to maintain current and future economic development, the government has to make the necessary arrangements to make these energy resources available in sufficient quantities. Also with population growth pegged at 2.1 per cent per year,(by 2015, India's population, according to a 1995 World Resources Institute study, will stand at 1,394 million), and per capita income expected to rise considerably, the need for massive infusions of energy resources

⁵ Government of India, Ninth Five Year Plan Document on Energy 1997-2002, Vol. 11.

will be acute. However, not only is India's indigenous production of hydrocarbons inadequate to meet its growing requirements, the gap between demand and supply is expected to increase at an alarming rate.

The pattern of India's energy consumption has changed over the years. From the dominance of traditional of non-commercial fuels like fuelwood, dung and crop residues, the demand has shifted to commercial sources of energy, out of which coal, oil and natural gas are the main sources of primary energy, with coal dominating the total indigenous energy supply. India also has a large potential for hydroelectric power, estimated at 600 Bkwh(billion kilowatt hour), out of which only a fifth has either been developed or is under development. Another 94,000 MW(megawatt) of probable potential also exists if 63 sites which have been identified can be exploited, while 6,789 MW of potential for exploitation through mini/micro hydel schemes also exists.⁶

India also has uranium resources, which are sufficient to meet the life-time requirement of the first stage of the country's nuclear development programme of 10,000 MW. Over and above this, about 363,000 tonnes of thorium oxide deposits are known to exist, which when used through breeder reactors, may produce 900,000 Bkwh of electricity. Currently, only 2.6 per cent of India's power consumption is met by nuclear energy. Although it is relatively

⁶ Ibid.

expensive in terms of the capital costs, it is free from many of the problems discussed above, and should be given greater consideration as a viable alternative source of energy.

The industrial sector is the largest consumer of energy followed by the transport sector. While 99 per cent of coal and natural gas is used by the industrial sector, which is also the largest consumer of electricity with a share of 38 per cent in the total consumption, the transport sector is the largest consumer of petroleum products and accounts for nearly 50 per cent of the total energy consumption.⁷ Though the government has laid emphasis on developing unconventional or renewable energy resources, for the foreseeable future, India will continue to depend on primary sources of energy, especially oil and natural gas, as the economy is becoming progressively oil-intensive. This is due to the increasing use of oil products in sectors like household and transport with the share of oil and, more recently, natural gas, gaining ground over coal for environmental reasons.

However, the country is not self-sufficient in primary resources with its import dependence particularly for oil increasing over the years. Since 1984-85, when oil production was at its peak, India was importing only 30 per cent of its crude supplies. Since then, though production has been increasing, it could not keep pace with rising demand. Therefore, while

⁷ Ibid.

production of crude was 33.02 million metric tonnes (MMT) in 1990-91, it has been more or less stagnant since then, with production at 33.87 MMT in 1996-97. As a result, India's self-sufficiency in petroleum products has declined from 60 per cent in 1985-86 to about 34 per cent at present.⁸

Natural gas accounts for about 8 per cent of energy consumption in the country. The current demand for natural gas is about 96 million cubic metres per day (mcmd) as against availability of 67 mcmd. The aggregate natural gas production during 1997-98 was 23 bcm and is likely to peak in the next two-three years. By 2007, the demand is expected to be around 200 mcmd. Nevertheless, a large gap is expected to develop between domestic supply and potential demand unless major new discoveries are made in the future. However, with long gestation periods needed for both oil and gas projects before they can become commercially viable, it is clear that large amounts of both oil and natural gas will have to be imported if the current rate of economic growth has to be maintained.

Some of the important questions that the planners will have to address are: (a) How long will resources, such as hydrocarbons, last? (b) What sort of strategy will have to be adopted in the short, medium and long term so that growing energy imports are met without compromising India's security or adversely affecting the

⁸ The Hindu, March 23, 1999.

balance of payments position? (c) What are the environmental consequences associated with intensive use of mineral and hydrocarbon resources such as coal, oil, etc?

Reserves vs. Demand

The country's proven recoverable crude oil reserves are likely to be of the order of 513 m.t by 2001-02, if no further accretion to reserves takes place. While the current production of crude is around 33 m. t., demand is around 84 m. t. By the end of the Ninth Plan, production of crude oil is expected to be 37 m. t.. Natural gas reserves are placed at 660 bcm, with production around 78 mcmd. Demand, however, is around 96 mcmd. Though the position regarding other energy resources like coal is comparatively better, mining is beset with environment problems as it often leads to deforestation, diversion of land from agriculture to other purposes, etc. Also, greater use of energy would result in increased carbon emission and other pollutants, which in turn is likely to worsen the environmental problems.

With the demand for electricity expected to increase to 1,473 bkwh by 2010-11, as against 394.5 Bkwh in 1996-97 representing an average increase of 9.1 per cent per year and with a major portion of the generation likely to be gas based, as coal based thermal power plants are environmentally unfriendly, it would result in greater dependence on hydrocarbon and the consequent reduction in

self-reliance. This , in turn, would have repercussions on the country 's balance of payments position.

One way of meeting India's oil and gas requirements, is domestic production via more intensive exploration, both onshore and offshore. According to a Geological Survey of India report, India has 26 sedimentary basins out of which only six have been commercially explored.⁹ Realising that it lacked the capacity to take on the challenge by itself, the government decided to open exploration and production to private sector participation. Since the 1980s, several bids have been held where acreage was offered to private companies on a production sharing basis and in March 1997, the government launched the New Exploration Policy to attract more private sector participation, both domestic and foreign. However the response has been lukewarm, mainly because most of the acreages on offer are deep sea blocks, and require huge resources, and with the current drop in oil prices, the companies are wary of committing large funds in risky ventures. Also, the government was accused for offering fields which have low prospectivity especially when compared to the regions in China, the Caspian Basin and Vietnam and the national companies had kept the best fields for themselves. Also, there were complaints that the data offered was inadequate.

⁹ Vijay Kelkar, Paper Presented at the third Lavraj Kumar Memorial Lecture, August 1996.

Imports

Even if domestic production picks up, India will continue to remain and become increasingly dependent for imports of both oil and gas for the foreseeable future. Therefore, the government has decided to acquire acreage in other countries to augment domestic supplies. ONGC Videsh Ltd., a subsidiary of the Oil and National Gas Commission has entered into a production sharing agreement with British petroleum in Vietnam to explore for natural gas, which should start production in 2002. The company has also signed two contracts for oil exploration and production sharing in Iraq. Other projects which are under negotiations are for exploration in Russia and Iran. Though some projects are also being negotiated with the Central Asian states of Turkmenistan and Uzbekistan for natural gas, and Kazakhsan and Azerbaijan for oil, the fact that these states are landlocked makes transportation costs prohibitive in the absence of agreed upon transit routes and the unstable situation in the region. Also explorations there are expensive there because of the harsh climate and difficult terrain, and given the current low price of oil, the seismic data received does not make any of the projects attractive. Most of the big projects there have already been taken up by the big oil consortia, and the small to medium projects would not be cost effective from India's point of view. However, the Ministry of Petroleum and natural gas is contemplating importing oil and natural gas from Turkmenistan and Kazakhstan, as part of the policy to diversify our energy

sources. Pipeline projects with both countries are economically viable as they could be laid directly from the source of gas supply. However, transit problems remain and any south-eastward bound pipeline from the Caspian region would have to pass through Afghanistan. Unfortunately the disturbed and the political situation in that country has so far prevented any project from being completed. Though Unocal and Delta has signed an agreement with Afghanistan and Pakistan to set up a 2000-km Turkmen Afghan Pakistan natural gas pipeline to transport 55 mcmd of NG through a 1,400 km pipeline to Multan in Pakistan, with the possibility of extending the line a further 600 km to New Delhi, the ongoing insurgency in Afghanistan has prevented the projected from going through, and late last year, Unocal announced that it was putting the project on hold indefinitely.¹⁰

Currently, however, most of India's energy needs are met by imports from the Persian Gulf states. While oil is shipped across the Arabian Sea, in the case of natural gas the government is negotiating with a number of countries for supply of LNG to be transported by sea and later as piped gas. India has already signed agreements with Qatar and Oman to transport natural gas over a 20 year period beginning 2001-02.

India is also in an advanced stage of negotiations with Iran for the import of natural gas via offshore or onshore pipelines.

¹⁰ Public Opinion Trends and Analyses, Pakistan Series, Vol. xxv, no.270, November 22, 1997.

However, once again the pipelines would have to transit Pakistan territorial waters or lands, and Islamabad has so far prevented India from conducting feasibility studies for laying sub sea pipelines. In fact, for a while it seemed that the deal would fall through given the state of political relations between India and Pakistan. But of late, Pakistan has been assuring India that it would not disrupt supplies in case the Iran India pipeline is laid on a land route through its territory. An earlier deal to transport natural gas via deep sea pipelines from Oman to India through as it was economically not feasible, given the prohibitive cost of laying deep lines, and Pakistan was against the pipeline passing through its continental shelf.

India is also looking eastwards for supply of natural gas. Both Bangladesh and Myanmar have huge reserves of natural gas and have been identified as potential suppliers. In fact, India and Myanmar have agreed to exchange geo-technology data of basins lying across the India Myanmar border so that both sides could optimize their exploration programmes in these basins. ONGC has also evinced interest in studying for exploration opportunities in Myanmar. But, despite its geographical proximity, political issues have so far prevented Dhaka from taking any concrete decisions to transport natural gas to India. Many international oil companies that have acquired blocks in Bangladesh are keen to supply gas to the large Indian market and the US in particular has been urging

the Bangladeshi government to allow the construction of a pipeline to India, but with little success, so far.

Security

The increase in current as well as future import dependence has repercussions on the country's security. Since most of our oil imports are shipped across the Indian Ocean via tankers and LNG imports scheduled for 2001-02 are also to be sea based, the question of the safety of shipping and the Sea Lanes of Communication, has been the focus of a considerable amount of attention. This includes production from our offshore fields. Though an all out war is a remote possibility, it cannot be ruled out completely as most of our present and future imports are sourced from West Asia and possibly Central Asia, which are politically volatile regions. Less than 15 years ago, a major battle was fought in the Gulf, which took a heavy toll on tanker traffic. Also, the Straits of Hormuz, through which a third of the world's energy supplies are routed, was blocked, causing a disruption of supplies, and this was followed a few years later by the second Gulf War after Iraq invaded Kuwait. Most of the Gulf states have territorial disputes with one another, and with an ongoing arms race, the potential for conflict is a constant possibility.

With consumption of hydrocarbons by Asian countries poised to increase dramatically over the next few decades, and low cost

sources likely to be concentrated in a few regions, the competition for oil and gas will grow. Both India and China are projected to be the largest consumers of energy in the future with Japan and South Korea not far beyond. Since 1993, China has become a net importer of crude oil. In 1996, it faced a deficiency of around 22 m.t., and by the turn of the century, its oil shortage is projected to reach 54.6 m.t. if its GDP grows at the expected 7-8 per cent per annum. Like Japan and India, China too is dependent on much of its oil imports from the Persian Gulf region via the Indian Ocean and the South China Sea, while their future natural gas imports are also likely to come from common sources. Therefore, the guarantee of the security of SLOCs will remain a matter of prime concern for Beijing.¹¹

Though a major naval battle which may disrupt our oil supplies is unlikely, one cannot rule out the possibility of terrorist actions such as the blowing up of oil and gas pipelines, and piracy. India is already facing a problem in this respect in the north-east, and pipelines would, therefore, have to be made secure against terrorist attacks, sabotage, internal unrest, etc.

For India, apart from military and defence-based actions, what is more essential is to develop its energy future. While this would involve a substantial restructuring of the economy toward more efficient use of energy, any imports via pipelines would

¹¹ BBC Monitoring: Summary of World Broadcasts, Far East, Vol. 2956, June 1997.

necessitate cordial relations with not only source countries but also transit countries, including Pakistan. At the same time, the potential for disputes over ownership of offshore gas fields in the Arabian Sea is a distinct possibility with Islamabad. A breakdown in diplomatic relations with supplier countries would also disrupt supplies, therefore, the role of diplomacy should never be under-estimated. Good relations with potential supplier countries should also be pursued, as with the Central Asian countries, while tensions with neighbors like Bangladesh and China should be sought to be defused as imports from these countries can go a long way in bringing down transport costs.

Though pipelines could be a future source of tension, they could also be used to build more cordial relations with neighboring(transit) countries as it would be to the mutual benefit of both, as a large market would bring down costs. For instance, any pipeline targetting the South Asian market would not be cost-effective unless it included the huge Indian market. At the same time, a transcontinental pipeline network can be built, such as a pan-Asian pipeline, connecting several countries in a region as well as between regions, while foreign participation in terms of investment and financial stakes could ensure a degree of safety of a project and ensure the security for uninterrupted long-term supply of energy. This, in turn, could promote better relations among the transit countries.

Reforms

That the government realizes the importance of energy for India's development can be seen from the fact that the Ninth Plan outlay for the key infra-structural sectors of energy, transport and communications has been increased by 35 per cent from Rs. 45,252 crore in 1997-98 to Rs. 61,146 crore in 1998-99.

In September 1996, a Cabinet note based on the recommendations of the R-Group (a group of experts on restructuring of oil industries) called for a phased dismantling of the administered price mechanism over a period of six years by which time it was envisaged that the petroleum sector would be totally deregulated and prices would be market-oriented.¹²

As per recommendations of the group, primary energy resources like coal, lignite, petroleum (other than crude) and its distillation products were delicensed and de-reserved from exclusive public sector production. The government also announced disinvestment of specified portions of equity from Gas Authority of India Ltd. (GAIL) and Indian Oil Corporation (IOC), as well as other reforms like buy-back of shares while inter-corporate investments without prior approval are to be allowed. Financial institutional investment norms have also been liberalized. The Electricity Acts were amended to allow private investment in power transmission, and other laws were simplified. At the same time,

¹² Times of India, March 8, 1997.

foreign equity participation up to 100 per cent has been allowed for power generation, transmission and distribution(except those of atomic reactor plants). The tax holiday for the power sector has been extended to 2003.

In an effort to bridge the gap between supply and demand of natural gas, several measures have been taken- (a) joint venture between GAIL and British Gas for supplying gas to households in Mumbai, (b) implementation of the Gas Flaring Reduction project by ONGC in the western offshore area, (c) expanding capacity of the HBJ pipeline by GAIL and (d) proposed commissioning of two new LPG plants in Assam and Maharashtra have been taken up in the current year. The JVC Pertonet Ltd has been set up with GAIL, ONGC, IOC, and BPCL(Bharat Petroleum Corporation Ltd.) having 50 per cent equity and the balance by financial institutions for setting up LNG terminals at various points. To facilitate an optimal evolution of the sector, a proposal for setting up of a Gas Regulatory Authority is being considered.

In March 1997, the government launched NELP, offering incentives for increased exploration rights to both public and private sector companies, such as allotting an open acreage system to all as well as attractive investment incentives in the hope of attracting investment, both domestic and international, in exploration activities. However, with current oil prices being abysmally low, and allegation of low quality acreages being

offered to private parties for exploration, the response has been below expectations.

Several projects for expansion of refinery capacity are also under consideration, such as setting up of refineries in Paradip and Bhatinda. Proposals to setup refinery residue-based power plants at Cochin, Panipat, Koyali and Kosikalan by IOC and at Chennai have been formulated.

The first phase of dismantling the administered price mechanism (APM) in the petroleum sector commenced in April 1998. The cost plus formula for indigenous crude oil producers and for shipping of crude oil have been withdrawn with a minimum floor price fixed as a temporary measure. Retention pricing for refineries has been abolished and refinery gate prices of certain controlled products like high speed diesel (HSD), liquid petroleum gas (LPG) are being fixed on "adjusted import parity pricing" basis for existing refineries, though their consumer prices are still administered. Prices of naphtha, fuel oil (FO), bitumen and paraffin wax have been decontrolled from April 1998 and free market operation has been allowed to oil companies.

Other measures include reduction in customs duty on crude oil from 27 per cent to 22 per cent from June 1998. In order to boost refining capacity for meeting future needs, the tax holiday has been extended up to 2003 for new refineries set up after October 1, 1998. Also petroleum (other than crude) and its distillation

products have been removed from the list of industries reserved for the public sector and have been delicensed.

To promote greater investment in coal mining, the government has delicensed coal and lignite and they have also been removed from the list of industries reserved for the public sector.

The government has recently announced a policy on hydropower development with a view to exploiting the vast hydroelectric potential available in the country at a faster pace. It has been decided to encourage greater private investment through independent power producers(IPPs) and joint ventures(JVs), and several investments are to be offered to this effect.

Conclusion

CONCLUSION

India's oil requirement depend on country's economic, foreign and defence policies. It is imperative that the momentum of reform in the hydrocarbons sector continues. Recent policy initiatives such as the NELP, and the dismantling of APM by 2003, clearly provide considerable financial and equally important, psychological benefits, there is much more that needs to be done to fully decontrol this sector. This sector need financial investment requirement for exploration and production to be achieved.

As it is quite clear that this cannot be met from internal resource and therefore the bulk of the investment is expected to come from abroad. The resulting pressure to open up India's economy even further, in hitherto closed areas, cannot be ignored, and will most likely create its own tension. These would need to be overcome in the best possible manner, with minimum cost to the country. In addition, to encourage, to utilize a substantial increase in investment, India would need to strengthen its infrastructure and core capabilities; new initiatives also need to be developed and undertaken in a systematic manner.

It is important for oil and natural gas and public sector enterprises become internationally competitive, to undertaken exploration and production efforts worldwide, in order to maximize

India's share in global equity oil and provide a secure supply to the refining sector, there by enhancing the country's energy security. In this endeavor, Oil and Natural Gas Commission a global exploration wing, ONGC- Videsh, has entered into production sharing contracts in Tunisia, Egypt and Yemen. It is presently focussing on the exploration of the 15,000 sq. Km; field at the Pavladar basin in Kazakhstan, possibly to carry out jointly with the China National Petroleum Corporation. In addition, ONGC needs to strengthen its R&D activities and concentrate increasingly on unexplored areas, such as deep water, satellite and marginal fields, as well as gas hydrates. In the view of India's increasing dependence on West Asia for oil and natural gas (via liquid natural gas tankers and/or pipelines) in the future its foreign policy needs to take a much closer look at the complex interplay of geo-politics and geo-economics in the area. The importance of the " freedom of navigation " needs to be stressed, along with the Sovereign rights of some of the littoral states of the region. An effective diplomatic response to any military manoeuvres. In the area needs to be developed, rather than an ad hoc approach at the last minute. The stakes for India's oil security are too high for ad hocism in policy initiatives.

Pakistan's strategic location astride the SLOCs to West Asia will necessitate sufficient naval and air capabilities to ensure the security of crude oil and natural gas to India. This will clearly not be effective in the absence of a limited "sea control"

" capability, simply because it is not possible to defend shipping against threats from the air by submarines and the limited anti-air capabilities aboard surface ships. Indian submarines alone may only be able to deny parts of the sea to the Pakistani navy, they will not be able to control movements (shipping) on the surface of the sea.

The provision of carrier air capability therefore, is a necessity in order to seriously ensure the security of SLOCs in the Persian Gulf and the Arabian Sea. In addition, it is imperative that a realistic position be adopted vis a vis the strong American naval presence in the Persian Gulf and the western part of the Indian Ocean. It is clearly in the interest of both the United States and India to keep the SLOCs in the Indian Ocean secure and safe. Globalization taking place, supply disruption (whether availability or transport) from one region would affect all other regions, at least in the short term or till the market has time to adjust. For instance, a sudden increase or decrease in the price of oil can have serious consequences for both consumers and producers. In the case of supply disruption, finding a substitute for petroleum products would be difficult in the short term as demand would be relatively inelastic.

For producing countries, while high prices would increase their revenues, in the long term a significant rise in oil prices will invariably lead to lower demand and an inevitable fall in revenues, which in turn would have political implication.

On the other hand, if prices continue to rule low it would encourage consumption and lead to dependence on imported oil, though in the long term this may lead to reduced efforts in conservation and development of alternatives to petroleum. Also, low prices would mean less funds invested by producers on new oil infrastructure. This in turn, is leading to pressure being applied on producing states like the Gulf countries to modify their restrictive oil policies and allow foreign investment into their oil sectors, both upstream as well as downstream.

The implications of dependence on foreign source can be seen from the major oil shocks which have taken place so far. During the 1973-74 crisis, India's import bill rose by over 50 per cent, while the direct over all adverse impact of the 1990-91 was estimated at Rs. 5,180 crore with inflation going into double digit figures for the first time and remaining at around 13 per cent for the next two year. India's economic growth also slowed down considerably. In the north-east an increase in output from offshore area in Bombay High the Government was euphoric and a number of fertilizer plants came up in Maharashtra, Gujarat, Madhya Pradesh, Rajasthan and Uttar Pradesh. Natural gas was also used for power generation by the National Thermal Power Corporation.

By the first half of the century, India will be one of the top five consumers of petroleum products, even ahead of industrialized countries like France, the UK and just behind

Russia and China. Therefore, it is imperative that policies for dealing with a possible oil shortage and consequent prices hike are formulated and put into place in advance. Also, with oil reserves of the world being concentrated primarily in two of the most politically unstable region, the dangers to the security of supplies became all the more relevant. India's economic problem are complex in nature and can be solved only if a multi-pronged and integrated policy is formulated and implemented to deal with outstanding issues. The current trend in the international energy market shows a movement towards the formation of mergers of large oil companies, which may lead to the re-emergence of the dominance of giant oil companies which control and dictate policy vis-a-vis production and prices in this sector. Energy dependent countries like India will have to devise strategies to protect not only the security of their supplies but also keep their access to low cost energy open.

One way of doing this is to intensify exploration of indigenous oil reserves. India needs large investments, which, under the present price regime, are not available. Also, the national oil companies face a resource crunch as they do not have access to the huge funds needed to expedite exploration projects, especially offshore ones possessing comparatively small equity bases. These companies face a disadvantage, especially in the international markets when bidding for foreign acreage. Neither is their in maintenance of discovered fields very good and most

Indian fields are facing decline or stagnation in production, it has been emphasized that the methods adopted for recovering reserves in an optimum manner have not been effective and unscientific methods of exploration have led to sickness in oil wells as happened in Bombay High.

At the same time, it is necessary to reduce the country's dependence on hydrocarbon. Therefore, it is imperative that power generation through hydel and coal based projects as well as the use of other non conventional source of energy should be encouraged, as to leave the use of petroleum products to the transport, fertilizer and petrochemicals sectors. Therefore, exports will have to increase substantially. Efforts will simultaneously have to be made to reduce the oil intensity of the economy.

Fuel switching is yet another way to reduce dependence on oil. With oil producing countries cutting production in an attempt to raise prices, very soon, the oil market may become a sellers' market. The case with gas is different. The gas market in Europe is already saturated and the market for the future in Asia. Even though the infrastructure to import gas has a long gestation period, thanks to the huge proven reserves spread over a larger area Russia, the Caspian and Persian Gulf states as well as India's eastern neighbors till 2020, gas is expected to remain a buyers' market. While arrangements with neighboring countries for promoting joint ventures and getting oil and gas supplies on a

reasonable basis are necessary, implementation of projects for utilizing surplus natural gas from west and Central Asian region with the establishment of fertilizer and petrochemical projects and the construction of sub sea pipelines will also be helpful in reducing costs of imports and minimizing outgo in foreign exchange.

Even if pipelines are used to import much of the imported oil and natural gas in the future, a major portion of there will still be dependent on tankers. However, India's port structure is inadequate to handle the expected hike in hydrocarbons imports. At present, India has 11 ports and modernization at the same time, the Indian shipping industry is also undersized with only 476 ships for both coastal and overseas trade, with a total of 6.88 Million Gross Registered Tonnes less than 1.5 per cent of total world tonnage. Therefore, it is necessary that this problem is dealt with on a priority basis. Some of the strategies that can be adapted by the Asian countries as well as India to meet future challenges till their energy security are building stock piles (including joint stock piles), diversification of energy supply source, increased capacity of fuel switching, demand restraint and development of renewable energy source. However, though all these option are feasible, their implementation will take time. Also for countries like India, reliance on stock building would tend to be slow because of resource constraints. Nor is the market sophisticated enough to predict the supply situation in time to take necessary action , insufficient storage capacity is another

cause for worry and needs to be augmented if India has to increase its energy stock build.

Despite the economic slowdown over the past year and the sanctions that were imposed on India after the Pokhran tests, India continues to be regarded as an attractive market by overseas investors, mainly because of its sheer size and long term potential, as well as the move towards liberalization and market reform. However, there is need for further changes as well as quick implementation of the reforms announced. The government has rightly devoted attention to the development of renewable forms of energy like biogas plants and wind energy capacity and the solar photovoltaic programme has also made some progress. However, the hydrocarbon sector continues to be source of worry and sectors like hydro electric power and nuclear energy are not given adequate attention or resources. Since the government and the Public sector undertakings (PSUs) do not have the wherewithal to take on the challenge by themselves the government should expedite the entry of private investments and participation in different segments of the energy industry.

With demand for power generation projected to be 1,473 Bkwh by 2010-11, the major problem of the power sector is the optimum generation mix. In the short run, dependence on gas and oil based plants seems inevitable on account of the relatively shorter gestation periods of these projects. But in the long run, the optimum mix has to be planned in such a manner that the bulk of

the base load requirements is met from coal based thermal electricity and supplemented by nuclear electricity to the extent possible, while the peak requirement has to be met from hydroelectric stations and oil and gas based power. The case of oil for meeting oil base load requirements will have to be discouraged. If domestic production remains constant at 37 million tonnes from 2001-02 and the anticipated recoverable reserves of 513 million tonnes, the crude oil reserves are likely to last only till 2015-16. These reserves could be completely exhausted in 2011-12, if it assumed that 30 per cent of the demand of petroleum products will be met from domestic crude oil production. The situation for natural gas is marginally better. However, India also possesses potential of around 850 billion cubic metres of coal bed methen, 600 million tonnes of oil shale and 6,156 trillion cubic metres of gas hydrates. If these estimates are confirmed by detailed exploration, there will be a big improvement with regard to our country. But until and unless these new hydrocarbon source are proved and developed, the demand for petroleum products in the years to come will have to be increasingly met from imports. This will put pressure on the balance of payments.

One of the main problems in taking a rational decision on natural resource use is the lack of an appropriate information system and a methodology for natural resource accounting. As a result, the depletion of the national asset base is simply not

taken into account while evaluating alternative strategies. With the recent OPEC decision to cut oil production by 2 Mbd, thereby negating much of the advantage India was enjoying because of the low price, the need for a pragmatic policy will be all the more necessary. While our own natural resource will have to be evaluated and utilized more efficiently, taking care they are not over exploited, technologies which conserve the use of these resources also need to be developed and promoted vigorously. The challenge to ensure that our energy security is taken care of for at least the next 50 years should be tackled in such a way that our social, security, economic and environmental demands are ensured.

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