ONGC's Decline and What Should Be Done

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India's demand for petroleum products is rising sharply even as domestic production declines. The Oil and Natural Gas Commission was set up with the national priority of making India increasingly self-sufficient in hydrocarbons. It was run down by subordinating the geo-scientists in the Commission and their procedures to the goal of immediate production at the expense of the long-term. Today nearly every department of the ONGC is mismanaged and corrupt. The company (as it now is) should revert to its original role of the national oil company. Output can be greatly increased in producing fields, and production should be commenced in other areas such as the Assam-Arakan.

INDIA's purchases of petroleum crude and products account for 25 per cent of everything she buys abroad. They constitute the largest item of our imports. Maximising the domestic output of hydrocarbons is critical to this country's survival and growth. But India is not finding any more oil. Exploration has been neglected. Production-sharing agreements have provided contractors such as Enron the right to burn an unlimited amount of gas to maximise their immediate cash flow; and poorly compensated the national oil company for its investment in developing these fields. Its project management is poor, and maintenance of its facilities abysmal. So though Rs 96.253 bn has recently been invested in major capital works – Rs 19.749 bn on L-11 Bombay High North, Rs 41.085 bn on L-III Bombay High South and Rs 35.418 bn on Neelam – ONGC's production in 1989-97 would show an absolute decline, from 31.99 mn tonnes to 31.63 mn tonnes per annum. All producers, public and private, should deliver 36.31 mn tonnes of oil in 1997.

But the demand for petroleum products – on which India is increasingly dependent though it has vast reserves of coal – is set to increase sharply. The Draft Report of the Ninth Plan Group on Demand Projections for the Petroleum Sector has estimated that it could go up from 607.5 mn barrels in 1996-97 to as much as 1.10 bn barrels by 2001 if, among other factors, some of the new fast-track power projects are set up. There should be a 13 per cent annual rate of growth in liquefied petroleum gas, 10.6 per cent in motor spirit, 17.3 per cent in naphtha, 3 per cent in kerosene, and 9 per cent in diesel. Petroleum imports would go up nearly 300 per cent over the next 5 years. Petroleum products this financial year are expected to account for $ 10 bn of India's $ 40.40 bn of import. They could cost $ 20-$ 30 bn by 2001, depending on the availability of sufficient refining capacity. Yet India's exports – which have lagged to produce a trade deficit of $ 4.54 bn in 1995-96 – cannot pay for this. This could precipitate the next balance of payments crisis – or a sharp decline in the rate of growth.

Experts: No Oil in India

Indian basins have been less prospective, and exploration and production consequently more expensive than elsewhere in the world; such as the west Asia, where international petroleum companies have preferred to produce at higher margins rather than India. But it makes sense for an Indian exploration and production company to produce virtually any oil that it can below the international price. The oil majors were invited to India soon after independence. Experts from Royal Dutch Shell, Standard Oil and Burmah Oil consistently maintained that no commercial deposits of petroleum existed in India outside Assam. Stanvac drilled some dry holes, then abandoned Bengal. So the Oil and Natural Gas Commission (ONGC) was set up as in its original form in 1956 to go into areas which neither Oil India nor any oil major thought prospective. Since its front-end activity was exploration, the discipline of geology enjoyed great prestige in the early years and was central to strategic planning in the company. Quality control on drilling and reservoir depletion during production was exercised by the Directorate of Geology. This and the Directorate of Geophysics concerned themselves with where oil lay and at what rate to produce it. Through the Cambay discovery in 1958, and after the Ankleshwar oil discovery in 1960, till Bombay High in the 1970s, ONGC's esprit de corps flourished under the leadership of geologists such as Nikolai Kalinin and Samarendra Nath Talukdar – an eminent geologist who once headed ONGC's exploration and production divisions and was responsible for several world-class discoveries – and a strong sense of national purpose.

ONGC has worked abroad since almost its inception. In the 1950s it participated in offshore Persian Gulf exploration, which led to the discovery of the giant Rustam and Raksh oil fields; and in Tanzania, where the Songo Songo gas field was discovered. When the Persian Gulf discoveries were made, its joint venture partner Phillips Petroleum wanted to terminate the joint exploration contracts, saying the exploratory drilling on the Rustam and Raksh structures had been unproductive. But ONGC's Geology Directorate independently examined the data; and, recalls Talukdar, "Philips' bluff was called". ONGC lifted its share of oil in accordance with the joint venture contract; but none of the refining firms operating in India, such as Burmah Shell or Esso, would handle it, citing their contractual obligations to their principals.

Oil India (OIL) goes back to the Digboi oil field's discovery in 1889. The government of India increased its stake over the years, from 33 per cent in 1959 to 100 per cent by 1981. Although it has large reserves, OIL's timid management has produced the same 2 to 3 mn tonnes annually for decades before and after the government took it over. Increasing production in India did not fit into the plans of its overseas owners. Generations of managers trained by Burmah Oil perpetuated this very strategy of under-production, so it has continued to function as though it were the subsidiary of a multinational. This is not mere abundant caution. For the business of an exploration and production company is neither to milk production dry in the short term, nor to build up a vast bank of reserves, but to maximise the total output over the life of a field. Whether to do that in five years or 50 is an economic decision, not a technical one. The technical decision is the management of the reservoir – in terms of re-pressurisation, water, gas or polymer injection, which wells to shut down or produce from – appropriate to each level of drawdown. With one-fifth the geological reserves of ONGC – 1 billion tonnes against 5.3 bn – OIL produces less than one-fifteenth the oil. This is because it has failed to upgrade its reserves. A billion tonnes of geological reserves should generate at least 300 mn of producible reserves – or 500 mn they were to be developed by an efficient operator. But OIL's producible reserves have remained constant at around 145 mn tonnes. And for

the last few decades, it has added to producible reserves at a very leisurely pace. For instance, from 1990 to 1995, while ONGC's addition to producible reserves grew by 1.235 bn tonnes, a growth rate of 44 per cent – OIL's grew by only 20 per cent adding only 114 mn tonnes. OIL has avoided high risk areas. It has preferred to operate in the very Upper Assam areas which were developed more than 100 years ago. It has been producing oil at a constant rate from 3 fields – Nahorkatiya, Hugrijan and Moran – which it took a quarter-century to develop and which have produced for more than 40 years. Kharsang was "under exploration" for half a century. Moreover, while ONGC operated a great deal in totally unknown sedimentary basins as well as basins with only indications of hydrocarbons, OIL put 90 per cent of its drilling activity in the known petroliferous basins of Upper Assam. In fact ONGC began exploration in Gujarat only after OIL refused to work there in 1956; and produced 200 mn-odd barrels annually for years from here. Its target should now be to upgrade its geological reserves to generate 300-600 mn tonnes of producible reserves; in order to actually produce up to 30 mn tonnes of hydrocarbons every year.

Destruction of Geosciences and Milking of ONGC

The huge reserves discovered by ONGC geologists paradoxically led to the eclipse of the geosciences in the Commission. Production engineers who could deliver immediate increased output – no matter the long-term cost – were now at a premium. The geoscientists' planned approach, which maximises the ultimate recovery over the life of each reservoir, was abandoned. Exploration strategy ceased to exist. The focus switched to immediate production with no thought of the future. Puffed up by the consequently increased output of Bombay High, chairman N B Prasad abolished both the Geology and Geophysics Directorates. Geo-scientific exploration – the key activity in an E and P company – suffered a great loss in importance. Now the practice was that the Geology and Production Sections jointly prepared a monthly production plan for each project. That indicated how much was to be produced from each well; which one was to be shut down for testing, and which wells were to undergo specific repair jobs (because, for instance, water had encroached and pressure had dropped). But the Production section found this discipline irksome.

With the collapse of the prestige and authority of the geologists, it became easy for a subsequent chairman, Col S P Wahi, to abandon this production plan entirely. The stage was set for a major disaster. The only priority of the chairman and the production group now became the meeting of oil production targets set for the Bombay High reservoir, which ensured the promotion of production officers, and the extensions given to the chairman by the governments of Indira and Rajiv Gandhi.

These production targets had been set on the assumption that schemes for injecting water through massive marine platforms in order to maintain the appropriate pressures and balances of oil, gas and water would have been installed prior to the increased production. Because of the opportunities to make money in the award of these contracts for water injection platforms (WIN, water injection north and WIS, water injection south) their installation was delayed. Nevertheless, the production was stepped up. With the failure to maintain the pressure regime, the L-III reservoir was damaged. Bombay High production – responsible for 64 per cent of ONGC's total – collapsed. ONGC's overall production declined dramatically, from 31.99 mn tonnes in 1989-90 to 21.22 mn tonnes in 1992-93. An expensive programme to improve output from Bombay High must now be undertaken. Although proposals to produce an additional 38 to 69 mn tonnes of oil – and 14.5 mn cubic metres of gas – from Bombay High have been pending for years, ONGC has shown no sense of urgency in getting down to business.

Once ONGC used to mobilise resources efficiently. Traditionally, its dry-hole ratio was half the world average. Reserves discovered per metre drilled – another important ratio – were high. Today leaking valves and pipeline joints are left unattended. It is customary to surreptitiously change the bean in the production casing – to obtain, in the short run, a higher rate of flow. The refineries have frequently complained that they receive water mixed with oil because fluid separation has been incomplete. The difference between the amount of oil ONGC claims to produce and what the refineries receive is substantial. Water injection schemes have been characterised by execution delays; pumps have failed because of poor maintenance; the treatment of the water injected has often been sub-standard. There has been poor reporting of production matters such as the number of sick wells at any one point of time in a field, and an unwillingness to stop production from wells for testing or repair. All this runs contrary to accepted international practice. Eight years ago I had pointed out that: "Many rigs drilling on contract...in the Western Offshore region have been...idle for inexplicably long periods...The charter rates of $ 21,000 a day must be paid whether or not they are actually drilling...exploratory cycle speed – the daily meterage drilled averaged over the year – has dropped sharply, from 969 in the period June 1985 to May 1986, to 894 in 1986, to 664 in 1987-88. Essar Explorer has been idle since August 23, Kedarnath from August 4 to September 12, Chichen Itza from August 2 to September 11. Although these are operated by private contractors, ONGC specifies the work they must do and provides all supplies. The...Daily Progress Report...for September 20...shows that with 10 per cent of the quarter left, nearly 40 per cent of the work – 6,074 metres of exploratory drilling – remains incomplete." Not much has changed since then.

Recently for instance, at Bombay High South's L-III Field, 7 gas compressors have been installed in order to produce power. But ONGC seems to have overestimated the gas from this field. Only 1 compressor is in use. Six compressors commissioned at vast cost are idle. ONGC is now trying to find any use for these compressors. Quotations in excess of $ 9 mn to shift a compressor have been received from Engineers India and Kawasaki. So over $ 100 mn has been written off in a fit of absence of mind. Such poor planning – possibly associated with corruption – is typical of the manner in which ONGC functions in its procurement of equipment and services. A glance at the board of pending litigation against ONGC shows how poorly this company organises its contracts. ONGC has been in the offshore oil and gas business since 1976. Yet its standard terms and conditions of contract are nowhere near international practices. The bid evaluation criteria, contract clauses and technical specifications are deliberately kept onerous resulting in the issuance of numerous addendums in clarificatory meetings, in the delay in finalisation of contracts, and opportunities to create change orders and cases for arbitration. On ONGC's engineering and construction contracts alone, for example, there are about 12 pending arbitration cases involving every known service company – McDermott, Hyundai, Saipem, Snamprogetti, ETPM, Soconord, Sumitomo, Nippon Steel Corp, Essar, Punj, to name a few. Pending arbitration cases plus awards already made but pending in the high court are in excess of US $ 100 mn.

Mukta Panna: Damage Caused by Reckless Production

A unique provision in its agreement with the petroleum ministry permits Enron Oil and Gas to flare freely at the Mukta and Panna oil and gas fields in the prolific Bombay Offshore Basin to the east of the massive Bombay High field. More than $ 600 mn of

hydrocarbons may now be destroyed. These fields were discovered by ONGC and handed over to a joint venture of Enron, Reliance and ONGC to produce around 2.5 mn tonnes of oil annually (145 mn barrels of oil, 12 mn barrels of condensate and 216 bn cubic metres of gas) at an investment cost of $ 1.2 bn. This was in addition to the investment of Rs 7.75 bn by ONGC until 1994. But the designated operator is Enron alone. Gas-oil ratios in Mukta Panna now approach 700, up from 300+ when Enron took it over. This should be compared with GORs between 350 and 380 for the fields managed by the ONGC, which are thought to be high enough to merit concern. By way of comparison, wells which reached GORs of 700 in Bombay indicated that something was seriously wrong; these producing wells had to be closed down. This flaring of gas is possible because of certain terms in the contract which would be inconceivable in any country in the world – including the US, where Enron is based. The "Production sharing Contract among the government of India and Oil and Natural Gas Corporation and Reliance Industries and Enron and Gas India with respect to Contract Area Identified as Panna and Mukta Fields" states at Section 21.4.2: "...If an Existing Discovery is determined to possess Excess ANG, and such Existing Discovery is producing or capable of producing as of the Effective Date of this Contract, Contractor is *granted the right to flare, without penalty or limitation*, such Excess ANG until Gas transportation facilities, if any, can be provided for, and such right shall be extended to such future time or times as such Gas transportation facilities may become unavailable *or their capacity would restrict or limit production of Crude Oil.* Government will use its good offices to *effect early reduction and/or elimination of such flaring* by causing Gas transportation to be made available at reasonable rates *if a proposal to that effect is proposed by Contractor* or a company and approved by the Management Committee (emphasis added)."

This provision permits Enron to flare gas in order to get quickly at the oil that it can transport and trade in order to maximise its immediate returns. This makes it possible to overproduce recklessly. Indeed, under Article 13, these companies can recover their entire expenditure at the very outset, that is, within the first year. For the next 24, it is money for jam. "13.1.1. Development Costs incurred by the Contractor in the Contract Area shall be aggregated, and the Contractor shall be entitled to recover out of Cost Petroleum the aggregate of such Development Costs at the rate of one hundred percent (100 per cent) per annum." Any contractor can offer better terms than this: and defer payment by a few years. "Section 13.1.2. For the purposes of this Article 13.1, Contractor's 'Cost Recovery Limit' means costs incurred after the Effective Data relating to the construction and/or establishment of such facilities as are necessary to produce, process, store and transport Petroleum from within the Existing Discoveries, in order to enable Oil production of thirty-eight thousand three hundred barrels per day (38,300 BOPD) in accordance with the Development Plan for the Panna and Mukta Fields.... The Parties agree that for the purposes of this Article 13.1 the Contractor's Cost Recovery Limit shall be the sum of Five Hundred Seventy-seven Million Five Hundred Thousand US Dollars (US$ 577,500,000)." But not only can Enron burn gas at the outset in order to maximise its immediate returns, it can do so indefinitely. The choice is left to Enron and not the government to conserve and produce this scarce resource. As a consequence, Enron can keep producing the associated gas in Mukta and Panna fields until it is satisfied that it will meet its short-term profits – indefinitely. But this field was given out specifically because the government claimed that it did not have the resources to develop it – and Enron-Reliance said it did. How much gas can be flared in this fashion? Between April 1995 and March 1996 last year, these fields produced 309.153 mn cubic metres of associated gas. Multiplying that by 35.315, as 1 cubic metre of gas is equivalent to so many cubic feet, we get 10.917 bn cubic feet of gas. At $ 3 per mn BTU (discounted since Qatar LNG has been traded at $ 4) x 936 to convert to cubic feet we get a price of $ 2808/mn cubic feet. That would mean that $ 30.657 mn worth of gas was destroyed by Enron last year. And $ 2808 x 216 x 1000 = $ 606.528 mn is the value of the 216 bn cubic feet of gas Enron is *entitled to destroy*. The ministry of petroleum has treated more than half-a-bn dollars of gas as a free good; if Enron produces it, it can sell it and make money; if it destroys it, there is no penalty. Is it lawful for the government of India to permit such wasteful flaring of gas; and such complete discretion to the contractor, in abdication of its own responsibility as the guardian of the country's economic resources? The Supreme Court or an Indian high court could conceivably direct the government to cancel the award of this contract.

The second issue on which there can be a legal challenge is independent of the first. Assuming for the sake of argument that the destruction of gas is lawful, nevertheless there is a separate and distinct consequence which arises out of this production of associated natural gas. It was made evident to the contractor and the consortium that Mukta and the Panna were fields with poor natural recovery; and therefore require specialised re-pressurisation of reservoir in order to maintain the flow which will result in the complete production of the recoverable reserve of oil. The associated natural gas which forms the gas cap for this field is, along with the miscible gas dissolved in oil, and the water in these wells, one of the three natural drives of Mukta-Panna. The destruction of any part of this gas cap will, as was discovered at great cost during the mismanagement of Bombay High during the 1980s, make it expensive and difficult to recover oil from this field. As Wood Mackenzie points out: "Due to the unspectacular nature of the reservoir characteristics, recovery from the Mukta field by natural depletion was predicated to be a very poor 7.8 per cent. The latter necessitates a water injection programme from the outset of development in order to raise recovery to around 25 per cent." In that case, it is a distinct possibility that the reckless production of oil from Mukta-Panna – without the compensatory re-pressurisation of reservoir is doing damage to the fields and bringing down their production life.

Production from the ONGC's giant Neelam oilfield, the largest in the country after Bombay High, has declined from 95,000 barrels of oil per day to 56,000. The oil in place is believed to have been seriously overestimated. Neelam, 45 km south-west of Bombay, was discovered in January 1987. The Neelam Process Complex was commissioned in July 1994. Unlike Bombay High Development, in Neelam water injection facilities to ensure the appropriate secondary recovery are installed at the very outset. The Neelam complex was designed to handle 1,20,000 barrels of oil per day and 2.6 mn cubic metres a day of gas. It is grossly underutilised – by at least 50 per cent. ONGC has initiated steps such as hiring of consultant, independent reservoir study, lift gas scheme, etc, but no notable progress has been achieved on production improvement. Currently, intensive lobbying is going on to enrol multinational oil majors or service companies for profit-sharing based on an incremental increase in production through joint venture. On this basis, ONGC has cancelled their international tender for Neelam lift gas pipeline network project floated in October 1996. Any action being initiated now will not bring results for at least 24 months. The process involves detailed study; the recommendations will need to be evaluated; the implementation is bound to involve additional drilling. ONGC geologists claim that this is because the Neelam's reserves have been seriously overestimated. The

strong increase in ONGC production which was expected in the second half of 1994-95 would have been significant on account of 90,000 barrels a day from this field – instead something like 45,000 bopd is produced. Rs 35.418 bn invested in Neelam is a gross overdesign: resources invested here will not provide any attractive return; Neelam's production could have been met at half or less of that investment.

What ONGC Should Do

ONGC's job therefore should be to maximise the domestic production of hydrocarbons. This can be done almost entirely from internal cash flow if a remunerative price for its oil is allowed. But a great deal of reorganisation including restoring the central role of geology will be necessary. ONGC's production – of 30 mn tonnes of oil and 18 mn of gas equivalent to oil appears to be too low. The company has *geological reserves* of the order of 5.3 bn tonnes. Of that 1.25 bn tonnes has been upgraded to recoverable reserves – of which around 300 mn tonnes has been produced already, leaving around 950 mn tonnes as *balance recoverable reserves*. So the job before ONGC is to upgrade its geological reserves to producible reserves to the order of 3 bn tonnes over the next 15 years – a recovery factor approaching 60 per cent. This would make possible a step up in production to over 100 mn tonnes every year within the 10 years 1995-2005 – and thereafter up to 170 mn tonnes or so annually. This raising of production would require (a) increasing recovery factors from existing reserves and (b) lowering the reserves to production ratio to 15:1. Gross mismanagement the last 20 years; the diversion of funds from exploration to production; and lucrative inflated contracts to service companies have ensured that ONGC's reserve replacement ratio has steadily declined. So the key job today is to upgrade its geological reserves – located in basins with proven hydrocarbon reserves, but where there has been little commercial production – of 5.3 bn tonnes. ONGC should lower its R/P ratio from 20:1 to 15:1 and embark on a strategic plan to upgrade its geological reserves to recoverable reserves. Instead of a 20 per cent recovery ratio, if the policy requirement be high long-term production, ONGC should aim at a recovery ratio of 60 per cent with primary, secondary and tertiary recovery – the norm in high quality American oil companies.

Higher recovery should be possible in, for instance, fields such as Cambay, argues Talukdar, where another 25 per cent should still be produced. And in Ankleshwar, where carbon dioxide (CO_2) injections could still produce another 10 per cent. So too North Kadi in Gujarat, where substantial additional production should be possible. And Bombay High should, most geologists are agreed, produce substantially more. In fact, Occidental, Amoco, Chevron and Arco made detailed investment estimates ranging from $1.46 bn to $1.93 bn to produce an additional 38 to 69 mn tonnes of oil – and 14.5 bn cubic metres of gas from Bombay High. Each sublayer of Bombay High has a different permeability from the next; the giant field L3 has 4 or 5 sublayers. Bombay High will have to change over to patterned flooding rather than to line flooding so that oil is driven only into some layers from which it can be recovered and, says Talukdar, the major recompletion of many wells will have to be done. Additional wells will have to be drilled, new platforms, pipelines and process platforms installed, and sick wells repaired. The present pattern of repressurising the reservoir and maintaining the flow of oil would be modified by injecting water, gas, or polymers. In two areas of the country, the north-east and Kashmir Valley, the Indian government's inability to arrive at an equitable political arrangement ensures that atractive reserves of hydrocarbons are not produced. In Kashmir a considerable quantity of biogenic methane gas occurs at shallow depth.

In important instances, ONGC does not develop attractive prospects because there are no transportation facilities for the hydrocarbons produced, and no proximate consumers. When ONGC discovered there were substantial reserves of hydrocarbons within four years of beginning exploration in the areas adjacent to Nahorkatiya in the Brahmaputra Valley of Upper Assam it could not develop them because of the lack of additional pipeline capacity for a long time. This delayed ONGC's cash flow and increased unit costs. And in the Assam-Arakan fold belt, gas discoveries take too long to provide revenues because of the delay in laying pipelines to West Bengal and the Gangetic Valley where potential consumption centres are located. It may make sense to locally process this gas to high-value end-products which can be conveyed by existing surface transport to wherever there are markets – less what can be sold locally. Products such as carbon black high density petrochemicals can also be sold in neighbouring Myanmar and Bangladesh. Similar investments could be undertaken producing gas in the Andaman and Nicobar Islands. Several decades have elapsed since gas discoveries in Tripura and Surma Valley were made, but no revenue has accrued from them to ONGC (or to GAIL) because pipelines have not been laid and downstream consumers have not been firmed up. Perhaps GAIL could compress the waiting time between the discovery of gas and its exploitation. Even the earliest hydrocarbon discovery, that of Jawalamukhi-1 in Kangra district of HP has not been utilised from the time it was unearthed by drilling in 1957.

ONGC has to date operated in relatively less extreme conditions. Much exploration and production has centred round the relatively better known shallow waters of the western offshore region, and onshore Gujarat. ONGC has functioned at a depth of no more than 150 metres. Newer areas such as Kerala-Konkan will require depths of 1,000 metres and more and costs per barrel found and produced are bound to rise significantly. The Deccan Trap basins are difficult to explore by geophysical means. This is why there have been no takers when they have been offered for exploration to both OIL and the MNCs. Yet should improved techniques show significant oil and gas in these sedimentary basins in central India, drilling in the Krishna Godavari and Bengal basins might have to be abandoned in order to work here instead.

The Assam-Arakan geological province has difficult logistics. Oil occurs at great depth, making production expensive. Drilling is difficult and slow; individual pay zones where oil is concentrated are less productive; and any hydrocarbons produced have a high transportation cost. But this region represents the largest sedimentary tract in India and holds promise of enormous oil and gas deposits. Sarat Roy Choudhary, former director of the ONGC's Institute of Petroleum Exploration says: "...The Eocene-Oligocene reservoir-source equivalents of the Assam area may be within drillable depths further east. There are numerous oil seeps and shallow (biodegraded) oilfields in the area have been sourced from Assam-equivalent sourced rocks. This may indicate there is deep oil play in the region with very significant potential." Indeed the north-east is contiguous with producing or prospective areas in Bangladesh and Myanmar where ONGC could perhaps operate as a foreign oil company albeit with the advantage of a neighbour. In Myanmar for instance, "seven proved and two indicated generic hydrocarbon plays in the basins of Hukawng, Chindwin, Eastern platform, Central Burma and Ayeyarwady Delta/ Offshore Basins comprising the Central Burma Tertiary Trough yield a mean expectation of about 1,930 mn barrels of oilequivalent and oil...a range of reasonable certainty of 425 mn barrels..." ('Production Sharing Contracts', Ministry of Energy, Myanmar, 1995).

Nature of the Task

The government of India, ONGC's largest shareholder, should hold it accountable to quantitative and qualitative performance relevant to upgrading reserves and increasing production. This should be the nature of it accountability; not only profits obtained by playing the money markets or buying derivatives. For exploration will not rise in a straight line correlation the moment ONGC gets a market price. Production has meant jam today. Even after substantial production fields such as Mukta and Panna were taken away, there were fewer immediate production jobs in the early to mid-1990s. These funds were not directed to exploration. Instead the reserve replacement ratio declined. This is because the focus was immediate profits; not ONGC's long-term role as the national oil company. Today the job of monitoring the performance of the national oil company lies with the directorate general of Hydrocarbons; lamentably this is an ineffectual body.

Efficiencies in production engineering coupled with major investment can result in significantly greater production in A+B+C1 category reserves, which comprise the known producible reserves. And a great deal has to be done in upgrading C_2 category reserves to producible reserves in the next 3 years or so at the least cost per field. Mr. It should be possible to upgrade at least 30 per cent of D and E categories of Indian sedimentary basins – the so-called 'prognosticated' reserves over 10 years and continuously add to India's total production from them. Now the important condition precedent for this level of production is intensive and expensive secondary and tertiary recovery. Such a focused programme will have high investment costs. The lower price available for indigenous crude has made it necessary for ONGC to go in for a version of development with widely-spaced production wells in the first phase. This minimises investment costs so investment is recovered faster during this period of 'self-flows' (when oil rises without any other inducement). Today only after this investment has been recovered in these production wells is secondary recovery by the injection of water or gas or polymers begun. And only after these secondary costs are recovered from revenues from production can tertiary recovery – by drilling more infill wells, injecting fluids under pressure to increase sweep efficiency from production – be installed. Each stage finances the next: a slower and less efficient process than setting up all necessary facilities at one go. The more appropriate choice which would mean an higher and speedier recovery is to drill closely spaced production wells at the outset. This will have more than twice the drainage radius. Producing at the maximum economic rate from the outset, this will deplete the reservoir at a faster rate, and pattern flooding to flush out more into producing wells will be necessary. The opportunity costs will be too high for an investment in drilling and production unless the return to ONGC is sufficiently attractive for such intensive production. Investment costs in tertiary recovery are especially high. Higher returns would enable closer spaced wells and patterned flooding. This has so far been too expensive. Presently primary, secondary and tertiary are segregated into distinct stages of investment in order that there is full cost recovery at each stage to pay for the next. A programme of high investment by ONGC will require either that government subsidise its investment or that it cut its own 'take' by way of royalty/cess/production sharing. The higher the level of self-sufficiency expected, the lower should be the profit to shareholders and the return to the government by way of taxation. This would release investible resources to ONGC for increased exploration and production. Most of the global increase in production today does not come from large additions to geological reserves by new discovery but from increased recovery from existing reserves.

The focus should be to do most of the work with re-invested profits. Such a coherent focus in accretion to reserves – and production from discovered fields at the greatest efficiency and lowest cost are specific targets which are attainable. This is a much more specific goal for ONGC than vague management buzz-words such as 'globalisation'. ONGC's priority should not simply be the short-term maximisation of its share price but rather the long-term maximisation of indigenous production. The conceptual brain of an E and P company is its geology. An E and P company does exploratory surveys and drilling – not to fulfil coverage and meterage targets but to obtain the best possible data in order to develop its geological model of sedimentary basins, to narrow the search area for traps (which should have formed prior to the geological time when the migration of hydrocarbons is most likely to have occurred). Only highly trained geoscientists can conceptualise this. Similarly the withdrawal of hydrocarbons from a reservoir on commercial exploitation of a discovery depends on an understanding of the fluid regimes of layers above and below the pay, and the supervision of the drilling and production teams by geologists. The poor state of drilling and its complete disorganisation during the Prasad-Wahi years has resulted in the fact that drilling activity in ONGC has often little to do with exploration. Drilling is meant to be a source of information for exploration by reason of the geological information that feeds back to the geologists. But because in the 1980s ONGC developed a whole culture of 'bogus drilling' to merely satisfy drilling meterage targets unrelated to actual exploration requirements. So this ceased, by and large, to be a source of information for the process of discovery of the geological reserves and accretion thereupon, to the producible reserves. So core samples have not been available from a good deal of drilling. The quality of information to ONGC geologists from this expensive activity has been poor. So has well completion. Depths to be drilled have often have not been specified. Since the costs per metre drilled are very high if wells are in any unknown area or great depths, there has generally been tremendous expenditure without result. The different stages before drilling have to be systematised so that drilling output is coherently related to these. For over a decade, ONGC drilling meterage has been an end in itself. The same prospects are drilled again and again. And necessary exploration and production work is ignored. Because the only indicator of drilling performance is the number of metres drilled – the most expensive single activity in oil production. It affords the most lucrative opportunites for corruption. In the US, fiscal incentives such as the depletion allowance, foreign tax credit and the expensing of intangible drilling costs have ensured that the corporate federal tax bill for the 19 largest domestic oil companies averaged less than 8 per cent of their income before tax. Had the US followed comparative advantage, it would not have created such a regime of fiscal benefits which has made it one of the most intensively explored areas in the world. Likewise ONGC's and OIL's market price for their crude should not simply reward investors but be directed towards a specific programme of investment in increased production.