Thinking Through the Enron Issue

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The Enron issue is once again in the news. The Maharashtra government has once again set up a committee to review the agreement that Maharashtra State Electricity Board (MSEB) has with the Dabhol Power Corporation (DPC) set up by the Enron Corporation of USA. (Dabhol, DPC and Enron are generally used interchangeably by many people, and I will do the same). The issues at the core of this debate are the following:

1. Does India need power? Does Maharashtra need power? Is there a need for a new power plant in Maharashtra?
2. How does the cost of Dabhol power compare with alternatives?
3. Is there a scope to reduce the cost of Dabhol power?

My purpose here is to suggest how these questions should be explored and to provide answers to them. Before that I present a brief history of the project to help us better understand the issues.

1. **A Brief History**

The reforms initiated in June 1991 unwittingly created an infrastructure bottleneck in the country. The primary aim of the reforms was and is to make the Indian economy efficient and fast growing. For efficiency, competition is essential. Domestic deregulation, carried out in the June-July 1991 itself, was to provide domestic competition. Trade liberalization, carried out gradually over the years, was to provide international competition. Along with these, a reduced emphasis on public sector was considered necessary. Because of the political interference to which it is subject to as also the difficulty of imposing effectively a hard budget constraint, the probability of inefficiency in public sector is high. Thus public sector reforms and privatization were parts of the reform strategy. A lowering of public sector investment was also called for, by the need to reduce fiscal deficit. Control of inflation and price stabilization are needed to stimulate investment and protect the real incomes of the poor. Thus, the reforms led to a significant reduction in public investment in infrastructure. As a consequence, in particular, the addition of electricity generating capacity during the Eighth Plan (1992-97) was 16,000 MW compared to the revised and lowered target of 31,000 MW.

The government had recognized the problem that reduced investment in infrastructure can lead to. It had hoped, however, that private investment would come forth to take place of the public investment. Thus, shortly after the initiation of the reforms process in June 1991, the Government of India in October 1991 (Ministry of Power, 1991), opened up the power sector for foreign private plants. 100 per cent ownership was permitted and the requirement to balance dividend by export earnings was waived. Unfortunately, for a whole year nobody came, despite the efforts of Indian commercial attachés. Then in June 1992, the Enron Corporation of USA offered to build a 2015 MW plant at a cost of nearly US$ 2.8 billion in Maharashtra. The plant was to be constructed on a coastal site at Dabhol in Maharashtra, some 250 kms. south of Bombay, in a region famous for the superb Alphonso mangoes. A memorandum of understanding (MOU) was signed on June 20, 1992 between Enron and the Maharashtra State Electricity Board (MSEB). I had raised (Parikh 1993a, 1993b, 1993c) publicly some objections to the proposal. As a response to that and other criticisms, the proposal was modified and envisaged construction of the plant in two stages. After extended negotiations, a power purchase agreement (PPA) for the first phase was signed in December 1993 for the modified proposal. Financial closure was realised in February 1995. Construction was started and the expected commissioning date was end of 1997.

In March 1995, the Congress(I) government of Maharashtra was defeated and in its place a Bharatiya Janata Party/Shiv Sena (BJP/SS) coalition was elected. It set up a committee under the chairmanship of Deputy Chief Minister, Mr. Munde, to inquire into the Enron project. Based on the recommendations of that committee, the new government of Maharashtra cancelled the agreement in July 1995. Arbitration proceedings and legal actions were initiated by both the parties. When the Enron Corporation showed its willingness to renegotiate the contract, the Maharashtra Government constituted in November 1995 a re-negotiation committee (RC-95

8, 1995 and submitted its report on November 19, 1995 in order that the Government could meet its targeted date of December 10, 1995 to take a final decision. After lot of delays and further negotiation, the Government of Maharashtra approved the re-negotiated deal at a slightly lower power price (Rs.1.86 per kWh as compared to Rs.1.89 per kWh re-negoiated by the Committee). Construction resumed in late 1996, and the first phase plant generating 740 MW (exportable2) of power came on stream in May 1999. The first unit of the second phase is expected to start generating in June 2001 and the second unit in October 2001.

Over the months the cost of electricity from Dabhol has fluctuated and has remained at levels that seem very high to people. In July 2000, the cost of electricity reached Rs.7.80/KWhr. This raised an outcry and the Maharashtra government set up on February 9, 2001 Energy Review Committee to review the power situation as well as specific reviews of particular projects. Everyone knows that by particular projects is meant the Dabhol plant.

2. The Original Deal of 1993

From the vantage point of 1992, to the Maharashtra Government there were many attractive features of the Enron offer to build, own and operate a plant at Dabhol.

The plant was to be set up in a fixed time period, at a fixed cost. It guaranteed a 95 percent availability. Enron was ready to agree to penalties for delay in construction as well as shortfall in availability. For any delay in supplying power Enron offered to pay US$14,000 per day for the first 180 days and US$100,000 per day thereafter. Thus, a one year delay would invoke a total penalty of US$ 21 million. For any shortfall in plant's performance capacity it will pay a one-time charge of US$100 per KW. To the then government of Maharashtra, this seemed an attractive offer. Projects in India are seldom completed in time and substantial cost overruns are common. Also the availability of plants leaves much to be desired. After extended negotiations, a power purchase agreement was signed between Dabhol Power Corporation (DPC) a subsidiary set up by the Enron Corporation and its affiliates, Bechtel and General Electric of USA, and Maharashtra State Electricity Board (MSEB), the essence of which was as follows:

a. The DPC will set up the plant in two phases. In the first phase, a 695 MW exportable (i.e. net of plant's own consumption of electricity) plant will be set up by 1997. In the first phase, the plant will run on imported distillate (a somewhat clean oil product). In the second phase, the capacity will be expanded to 2015 MW (exportable), at a total cost of US$2840 million and the fuel will be changed to imported liquefied natural gas (LNG). The option to go ahead with the second phase or not rested with the MSEB and had to be exercised by July 1995.
b. The MSEB agreed to buy power for 20 years after commissioning at US7.5 Cents [? Rs.2.40]3 per unit of electrical ener gy (Kilo Watt hour - KWh) in 1997 of which 3.808 Cents (Rs.1.22) was towards capital charge, 0.000625 Cents (Rs.0.02) for operating and 3.698 Cents (Rs.1.16) for fuel charges. The price agreement was in US$ terms. The capital charge and the operating charge (a total of Rs.1.24) had to be paid for 86 percent of the time in a year whether MSEB purchased any power from DPC or not. For subsequent years, this charge was to be escalated by 4 percent per year. The fuel charge was to be based on actual price paid for fuel and any gain or loss was to be passed through to MSEB.
c. The capital charge of 3.808 Cents (Rs.1.22) per unit was arrived at to provide a rate of return that was considered satisfactory on the investment made by DPC. With the agreed price DPC expected to earn an internal rate of return (IRR) in excess of 25 per cent net of tax and 30 per cent before tax in dollar terms on equity which was to be 30 per cent of the total cost. D. Guidelines subsequently issued on January 18, 1994 by the Central Government suggested a rate of return of 16 percent on equity for a plant availability factor (PLF) of 68.5 percent and a bonus of 0.7 percentage point for every one percentage point increase in availability.

Thus the 95 percent availability of DPC's plant would qualify for 16 + 0.7 (95-68.5) = 34.5 percent return. The 30 percent IRR implicit in the PPA with DPC was below this norm.

3. The Main Issues in 1993:

I had raised two main objections against this proposal. First, agreeing to a capital charge based on a rate of return without any control over total plant cost provides all incentives to overstate the capital cost of the plant. In fact, the firm would build the plant of gold rather than steel and make lots of additional profits. I also argued that the capital cost of the DPC plant was some 20 percent too high. This was based on the capital costs of a then recently bid coal plant in Maharashtra. This was for the expansion of the Chandrapur power plant.

The bid opened in the middle of 1995 for a 500 MW capacity coal based plant showed a price of Rs.22500 (US$ 700) per exportable KW of power. Adding 20 percent for contingency and 27 percent for interest during construction takes this to US$ 1029/KW (Rs.32700). Since Chandrapur is an expansion, some costs are saved. To bring Chandrapur costs on a comparable basis, we can add 15 percent to its cost. We may also add 10 percent more to account for its lower availability of 68.5 percent. A 10 percent extra capacity of 68% availability plants give the same loss of load probability as a 90 percent plant availability. This will bring Chandrapur cost to Rs.32,700 x 1.15 x 1.1 ? Rs.41,400/KW (exportable) i.e., $ 1290/KW.

While this may look comparable to the initially bid Dabhol project cost of $ 1300/KW, one should realize that gas/oil based plants are usually 20 percent cheaper than coal based plants. It would therefore, seem that the Dabhol plant cost of $ 1300/KW was high and must have provided not only cushion to insure the promoters against all kinds of uncertainties but also for possible escalation, and more.

It is interesting to note that if the high capital cost is not due to actual high cost but because it is inflated by 20 percent, when the debt:equity ratio is 70:30, the actual equity may be only one third the nominal equity. A 30 percent IRR on nominal equity can translate into an IRR of much more than 100 percent on actual equity.

The second objection raised by me was somewhat complex. While there was no compulsion on MSEB to buy power from DPC, the fact that capacity charges had to be paid 86 percent of the time meant that if MSEB did not buy power for that much time the unit cost of power actually purchased would go up. Thus, suppose MSEB bought power only for 60 percent of the time. Then the effective capital and operating charge would be Rs.1.78 (=1.24 * .86/60). To this we have to add Rs.1.16 as fuel charge. Thus the cost of power would be Rs.2.94 per kWh. If on the other hand MSEB actually bought power 86 percent of the time, its cost of power would be Rs. 2.40 per kWh. However, MSEB's demand varies over the day and its load factor is only around 60 percent. [Load factor is the ratio of average demand over the day to peak demand during the day]. Since electricity cannot be stored easily, at the night time off-peak hours when the demand is often less than half the peak demand, some power plants have to be backed down. Providing a high load factor of 86 percent to DPC would imply that during off peak hours (at night) MSEB would be backing down its own power plants, i.e. it would be purchasing power at Rs.2.40 from DPC when it could be generating it from its own coal based plants at a marginal cost of 60 paise per unit. This would mean that MSEB would incur some Rs.180 to 270 crores (US$ 56 TO 84 million) per year of avoidable cost.

MSEB's response to criticism of high load factor given to DPC was as follows:

With the splitting up of the project in two phases and with the changing pattern of demand in Maharashtra, there would be no need to back down MSEB's own plants to absorb the DPC power. While this may be true, the correct question which MSEB should have posed itself is the following. In an operating plan which minimizes the system-wide cost of generation to meet the demand, what should have been the load factor for the DPC plant? In other words, the changing load pattern may provide an opportunity to MSEB to increase the load factor on its own plants. Giving up this opportunity in favour of DPC may not be the best option.

In spite of these criticisms, the Government of India, cleared the project thinking that 20 percent is not too much to permit for the first major foreign direct investment project coming into India. Clearing the project would give a signal to the world that India is open and that it welcomes foreign direct investment. In a sense, this signal was given. A spate of proposals to set up power plants in India followed.

4. **Other Issues:**

A number of other objections were also raised against the deal. [Sant, Dixit and Wagle (1995), Standing Committee on Energy (1995)]. These included, counter guarantee given by the Central Government, fuel management fee, imported fuel, dollar payment, no condition for local content and environmental problems. I deal with these in turn:

a. The counter guarantee given to Enron (Enron and DPC are used interchangeably in this article whenever the context is clear) provided that if the MSEB cannot pay its bill to Enron, for the electricity already supplied to MSEB, the Government of India will do it and recover the money from the Government of Maharashtra. This was reasonable as DPC can sell electricity only to MSEB and MSEB's finances are subject to the political influence of the state government. For example, MSEB is forced to subsidise farmers and domestic consumers.
b. The fuel price was to be approved by the MSEB and as long as MSEB can do this transparently there is no problem. The fuel purchase agreement provided for recovery of excess fuel charges if MSEB can show within 45 days that it could have been obtained at a cheaper, delivered in time, cost. This was fair.
c. The dependence on an imported fuel has also troubled many people, particularly that on imported liquefied natural gas (LNG). What will happen if the fuel supply is cut off? Here, one has to recognise that we depend on imported oil for more than half of our consumption. We will have to import fuels. So if you import some gas, that should be no additional problem. Secondly, the power plant was to be a dual fuel one, so if LNG supply is shut off by one supplier, we can import oil products from others and run it. Thus, as long as our exports grow and we are able to pay for imported fuel, importing fuel is not a problem.
d. Many people are concerned that the agreement fixes the price in dollar and thus MSEB bears the exchange risk. Exchange risk is unavoidable and perhaps least expensive if we bear it. The most likely cause for depreciation of the Rupee is if our domestic inflation is higher than our trading partners' inflation rates. In such a case even domestic fuel will cost more. And if we had built the plant ourselves using funds borrowed from international markets, we would have to pay back in dollars and would have to bear the exchange risk too. If Enron were asked to bear the exchange risk, it would have factored in more than adequate margin in the price, and would have provided more than enough of a margin. The price would have been much higher as it would have been conservative. Yet another point is that over the next 20 years, one should expect the Indian Rupee to appreciate (as has happened in most countries that have grown rapidly, Germany, Japan, Singapore, Taiwan etc.). There is however, an important related point here. The IRR that one should consider reasonable should be different for deals negotiated in different currencies. Thus, while one may agree to an IRR of 25 percent for a deal denominated in rupees, the corresponding IRR for a dollars denominated contract may be much lower. We will return to this later.
e. Finally, some have argued that we should have insisted that DPC buys its equipment from Indian manufacturers, e.g. Bharat Heavy Electricals Limited (BHEL). This is quite unreasonable. We can't expect DPC to adhere to a fixed cost and fixed time-table and tie down its hands. It must have the freedom to discharge its obligations. If we want to ensure self-reliance, we should see that BHEL has the technical and financial resources to compete on equal footing with others. Self-respect comes by self-confidence to face competition. We must see that our firms, both public and private are equal to the best in the world. This would not happen by protecting them but only by exposing them albeit in an open, transparent and a level playing field, to international competition. In the enthusiasm for swadeshi, one should not forget that our national corporations can be equally predatory given half a chance. The answer does not lie in swadeshi but in competition and transparency. If we have these, even MNCs won't be able to take us for a ride. If we don't, our own public and private sectors will fleece us.
f. Finally, concern about the environmental problems of the Dabhol plant related to air pollution and its impact on horticultural output which includes the famous Alphonso mangoes, the impact on fishery due to use of sea-water for cooling and construction of the jetty. Concerning air pollution, we should recognise that a gas based plant is the cleanest plant available, except perhaps a nuclear plant which has other problems. Some of our environmentalists seem to oppose everything. Hydel is bad as it submerges land, coal and oil are dirty, nuclear is dangerous and gas is dirty too. What is an alternative? I think, we need a macro-perspective. We need power. We can minimise the need but even then we will have to build some plants and accept some environmental consequences. We cannot go BANANAS (build absolutely nothing

cannot eliminate it. We will return to these issues later.

Thus, in 1993 it was felt that we need foreign private investment in power as we do not have sufficient financial resources to put up all the plants we need, some of the issues raised above seemed peripheral. It is easy to forget today with more than US$ 40 billion in reserves that in June 1991 we had reserves worth less than two weeks of imports. The main issues remained of guaranteed return without a control on capital cost and of a high load factor guarantee.

5. **The renegotiated Agreement of 1996:**

The renegotiation committee of which I was a member was asked by the Maharashtra Government to consider both phase 1 and 2 together. The committee recommended [Tata Rao, Raghavan, Parikh et.al.,(1995)] the following: i) The total capital cost of the plant would be reduced by $330 million to US$2.51 billion. ii) The plant would provide additional generating capacity at no extra cost. Thus, in phase 1, exportable power would be 740 MW compared to 695 MW as per the PPA of 1993 and at the end of phase 2 it would be 2184 MW compared to 2015 MW proposed earlier. iii) The plant would be made multifuel and in phase 1 would run on naphtha. The cost of US $ 35 million for making the plant a multi-fuel one would be borne by DPC.

The total savings in capital cost is thus US $ 330 million plus US$ 223 million as the value of additional capacity (valued at the rate of phase one cost of 918 million for 695 MW) plus the US $ 35 million, the cost of converting the plant to a multifuel plant. These add upto US$ 588 million.

For a multifuel plant the original proposal would have cost $1.427 (= (2840 + 35)/2015) million per MW. The revised cost is $ 1.149 million/MW. Thus the reduction in capital cost obtained per exportable MW is nearly 20 percent. This is summarized in Table 1.

Table 1: The "Original" 5 and the Revised Deals Original (1993) Revised (1996) Capital Cost (Billion $) (Phase I+II) of 2.84 2.51 Which Regassification Facility (R.F.) 0.495 0.495 Capacity (Exportable MW) Phase I 695 740 Phase II 2015 2184 Fuel Phase I Distillate Naphtha Phase II LNG LNG Unit Capital Cost Per Exportable MW (Million $) With R.F. 1.409 1.149 Without R.F. 1.164 0.923 Source: Tata Rao, Raghavan, Parikh et.al.(1995)

The capital cost of a plant and a notion of a reasonable rate of return help one to arrive at the price of power. However, in the last analysis only the final price is important. Suppose some one is willing to sell you power at Rs.1.50 per kwhr, then whether he makes 100% profit or only 5% profit because his capital cost is very high, does not concern you. So we should look at the price agreement. Table 2 shows the revised tariff.

Table 2: Tariff in the Re-negotiated Agreement (Phase 1 + 2 combined). Cents Escalation Capacity Charges* Fixed O & M 0.625 U.S. & INDIA Capital Recovery 2.438 NONE Energy Charge@ Regassification 0.531 NONE Variable O & M 0.031 U.S. & INDIA Fuel 0.281 ACTUAL Total 5.906 Source: Tata Rao, Raghavan, Parikh et.al.(1995) * Cost per kWh worked out on the assumption of 90 per cent load factor @ Per kWh payable only for exported units.

The renegotiation committee had settled for a price of power of 5.9375 Cents/kWh (Rs.1.90/KWhr) for first phase and 5.906 Cents (Rs.1.89) per kWh for both the phases when phase 2 comes on stream in 2000. Since the fuel price is a pass through we can concentrate on comparing capacity charges. Since phase 1 is only for two and a half to three years, for simplicity, I will compare only the price of the combined phase 1 and 2 plant. Table 3 compares these charges. The levelized capacity charge (See footnote to Table 3) in 1995 $ terms in the original proposal was 3.688 Cents/kWh excluding the charge towards the regassification facility and was payable for 90 percent load factor. This is now reduced to 2.438 Cents/kWh payable for 90 percent load factor. The reduction in capacity charge is 33%. This is much more than the percentage reduction of 20% in capital costs. This implies that the rate of return was also reduced somewhat.

Let me turn to the problem of high load factor assured. The same load factor is now agreed upon as before. It should be noted that in a two part tariff agreement, a fixed capacity charge,

only for the units purchased. Thus, there is no load factor guarantee as such. A load factor is assumed merely to work out the capacity charge per unit. A 90 per cent load factor seemed reasonable for two main reasons. Firstly, in the expectation of the Dabhol plant other plants had slipped and power shortages were visible. Secondly, detailed load flow studies carried out at the Indira Gandhi Institute of Development Research (IGIDR) by my colleagues established that in a least cost operating solution DPC plant would be fully loaded in both the phases. See Table 4.

Table 3: Capital Recovery Charge - Old (1993) and New (1996)* New (1996) Old (1993) New/ Old Cents/kWh 2.438 3.688 0.66 Rs./kWh 0.78 1.18 *The Capacity Charge agreed to earlier in 1993 increases at 4 percent per year. To compare it with the new Capacity Charge which does not escalate, the old charge is converted into an equivalent levelized tariff, equivalent in the sense that it yields the same present discounted value at a discount rate of 17 percent.

Let me describe some of the other provisions in the renegotiated contract and how they dealt with other objections. DPC had agreed to offer 30 percent of the equity at par to MSEB or its nominee. Each 10 percent of equity will entitle one member on the board of directors of DPC. "Furthermore, DPC agreed that all new supply contracts will be competitively bid. Technical specifications and tender evaluations will be done in consultation with MSEB. This should provide a level playing field to Indian manufacturers of equipment such as BHEL. Furthermore, it is required that DPC will pass on any substantial cost reduction realised through such bidding, but if the costs are higher than envisaged, the agreed costs will be binding. Thus, MSEB is entitled to get the benefit of any future fall in equipment prices on the international market" (emphasis added).

The environmental concerns raised against the plants related to its impact on horticulture and fishery. These concerns were taken care of by changing over to Naphtha in the first phase and by requiring additional monitoring stations. The ambient air quality is summarized in Table 5. One may note that the level of SOx will change from its ambient present level of 7.4 parts per million (ppm) to 7.6 and 7.4 in the first and the second phase respectively, and the level of NOx will change from 1.20 ppm to 14.6 and 15.0. The Indian standard for SOx and NOx are 80 ppm each. Dr. Chapekar, former Professor of environmental botany and head of department of botany of the Pune University, who has studied the impact of air pollutants on plants in Maharashtra for 20 years, in his presentation to the renegotiation committee assured us that such changes would cause no impact on horticulture.

Table 4: Optimal System Cost Minimizing Load Factor for the DPC plant. Coal Supply Availability 25% above present Coal Supply assumed to be unlimited Transmission Network capacity constrained as per expansion plans Transmission Network capacity expanded further to remove bottlenecks Transmission Network capacity constrained as per expansion plans Transmission Network capacity expanded further to remove bottlenecks 1998-99 90% 90% 90% 90% 2001-02* 60% 90% 60% 90% * When transmission bottlenecks are removed, the "optimal" system cost is lower and DPC gets 90 percent load factor in the optimal solution. Assumptions: - Transmission network upto 400 KV, 220 KV, 132KV and 100 KV considered. - For non-coal based units, average general cost is considered. - Cost of unmet energy is Rs.5/KWhr. - Hydro capacity expanded so that available water provides a 40 percent load factor. Source: System studies by Kankar Bhattacharya and Kirit Parikh, IGIDR. Table 5: Comparison of Long Term Total GLCs using Distillate, Naphtha & LNG. CAPACITY Base Line (?/cu.m.) Distillate (?/cu.m.) Naphtha with 200 PPM Sulphur (?/cu.m.) LNG (?/cu.m.) SO2 NOx SO2 NOx SO2 NOx SO2 NOx Phase I (695 MW) 7.4 12.0 13.4 15.0 7.6 14.6 - - Phase II (2015 MW) 7.4 12.0 - - 9.8 19.9 7.4 15.0 Source: Presention to the Committee, also AIC Watson (1995).

The impact on fishery due to transient turbidity during construction and discharge of hot water also seemed to be minimal. The temperatures of water discharged into the sea will be 5°C above the sea water temperature and it is estimated that within a sphere of 20 metres radius, the temperature will be normal. This is highly unlikely to affect marine life excepting in a small area.

Nonetheless, as abundant caution we required DPC to have three round-the-clock monitoring stations and regular monthly mobile monitoring by Maharashtra Pollution Control Board, costs of which are to be paid by DPC, and regular monitoring of marine life in the vicinity of the

of 150 hectares of mango, cashew and other horticultural trees by DPC.

The committee had required that the regassification facility be turned into a separate venture. Some have argued that this was an eyewash. This is nonsense. It should be noted that the saving of US$ 588 million in capital costs has nothing to do with this separation w hich however has a possibility of providing an additional saving of upto US$ 200 million. Let me explain. The plant is to run on imported liquefied natural gas (LNG). The imported fuel is stored in liquid form in supercooled storage tanks. The liquefied gas is re-gassified and burnt as a gas as and when needed. This is the re-gassification facility. This facility requires an investment of US$ 495 million. The facility is lumpy and DPC plant will only require 60 percent of its capacity. If customers can be found, and there are likely to be many, for gas, 40 percent of the capital cost can be billed to them. This is an important potential gain which is over and above the US$ 588 million cost reduction. Note also that the capacity charge on regassification is now payable only for actual units generated. Separating this facility also makes the cost of DPC plant easily comparable to other gas based plants in the country.

Finally, one question is left. Did we do the best that was possible? This is impossible to answer. One can give only an analogy. If you try to buy a shirt from a street vendor in Bombay's Fashion street or Delhi's Janpath you haggle. The shopkeeper would ask for Rs.200/-. You would say Rs.40/-. When you finally get it for Rs. 40/- you are still not sure if you got the best price. All you can do is ask your friends if any of them got it cheaper. If not, you feel you have done well. The renegotiated price was lower than that of any other plant that was being considered then in the country.

6. The Actual Experience

The first unit of 740 MW has been operating since May 1999 using imported naphtha which was found to be cheaper than what was offered by Indian Oil Corporation. However, the cost of power seems to be much higher than what was envisaged. Table 6 shows this.

Table 6: DPC's Monthly Tariff Details (May 99 to Oct 00) (Figures in paise per kWh) Month PLF@(%) Tariff (actuals) Tariff (90% PLF) Exchange Rate Rs./$ Fuel Price Rs./ton May-99 57% 366 309 43.02 7623 Jun-99 43% 514 322 43.54 8410 Jul-99 55% 445 326 43.37 8790 Aug-99 60% 298 359 43.49 10516 Sep-99 63% 448 373 43.61 11570 Oct-99 46% 566 384 43.44 11959 Nov-99 78% 379 388 43.42 12305 Dec-99 79% 430 401 43.51 12790 Jan-00 62% 513 402 43.60 12497 Feb-00 81% 439 412 43.62 13109 Mar-00 66% 514 434 43.63 14408 Apr-00 85% 433 418 43.67 13425 May-00 70% 520 422 44.61 13527 Jul-00 33% 780 431 45.35 13883 Aug-00 43% 682 441 45.87 14359 Sep-00 49% 683 482 46.16 16752 Oct-00 49% 691 498 46.85 17541 Average (May 99 to Oct 00) 60% 494 402 16828 Note: In the month of June 2000, the plant was inoperational. Hence, the month has not been considered. @ Plant load factor.

Why does today, the power from Dabhol look so expensive? Firstly, the exchange rate has increased from Rs. 32 to Rs.46 per US Dollar. Also, the oil price in November 2000 had gone up to $35/barrel in the international market compared to $15/barrel in May 1999. Fortunately today, the price has come down. At the same time, the ability of MSEB to take all the electricity that can be generated by DPC has gone down. MSEB supplies power to farmers and domestic users at subsidised prices. Its T&D losses, which include pilferage of power, continue to remain high. In fact, they have gone up in recent years, partly because, what was shown earlier as agricultural consumption is now correctly shown as "T&D losses". Moreover, many customers do not pay their bills and MSEB is unable for reasons which can only be political, to initiate actions to collect them.

Thus, for every unit MSEB sends out, it receives reasonable payment for only one half to one third of a unit. Thus, every unit it buys from DPC it must sell it at twice the price just to break even. For example, when power is purchased at Rs.4.00 per unit, it must charge Rs.8.00 per unit just to break even. At that price industrial consumers would generate their own power rather than buy it from MSEB. In fact, over the past few years some 870 MW of captive plants have been installed mostly by industries. MSEB has lost this demand from its most profitable customers. Without these plants MSEB would have easily absorbed the DPC power. MSEB's highest tariff is for not-domestic low-tension (LT) consumers and is Rs.6.00/KWhr. In this situation, the more MSEB purchases from DPC the more it loses. MSEB resorts to load

But to the extent that load shedding and staggering impose large economic costs on the consumers, it may not be a socially optimal thing to do.

The Maharashtra electricity regulatory commission (MERC) directed MSEB to purchase or generate power from different units only as per the merit order ranking of power plants. What this means is that MSEB must not buy or generate power from a plant whose variable cost is higher than any alternative source that can supply/generate power.

The first phase Dabhol plant, which uses naphtha has a high variable cost and hence is the last one from which MSEB buys power. This is rational if your objective is to minimise system-wide cost of generation.

Had MSEB been asked to meet all the demand, not to impose any power cuts and follow merit order ranking, what would have been the load factor for Dabhol Plant? My guess is, it will be higher. The cost of electricity from the Dabhol plant would look a bit more reasonable.

MSEB cannot function efficiently unless it is given the freedom to charge and collect appropriate prices from its users and to reign in T&D losses. Once that freedom is available, much of the problem with DPC will disappear.

While MSEB reforms are most critical, a review of Dabhol agreement is welcome to explore all options to reduce cost of power and to ensure that the people in Maharashtra get electricity at lowest cost.

7. **Do We Need Power?**

One question often asked is "do we need the Dabhol plant? Why don't we scrap it?" Assuming there are no legal difficulties, this would be feasible if we don't need additional power. Maharashtra and India need new power plants. This can be seen from the rates at which demand for electricity and generating capacity have increased over the last decade. See Table 7.

It is clear that at all India level generation has grown by 82 per cent over 1990-91 to 1999-2000 whereas generating capacity has grown by only 48 per cent. During the '90s we have managed this shortfall through better utilisation of generating capacity and through imposition of power cuts. The load factor on thermal plants has increased from 54 per cent in 1990-91 to 67 per cent in 1999-2000. For Western states load factor on thermal plants exceeds 70 per cent. 70 per cent is a high load factor for thermal plants and scope for further improvement is limited. The country does need additional generating capacity and from now on it will have to grow at a faster rate than in the 1990s.

Table 7: Electricity Generation and Generating Capacity of Utilities (All India) Year Energy Generated (billion kWh) Generating Capacity (Thousand MW) Load factor Thermal Plants (Percent) 1990-91 264.2 66.1 53.8 1999-2000 480.0 97.8 67.3 Growth Total 82% 48% 25% Annual 6.86% 4.45% 2.5%

The picture in Maharashtra is similar, see Table 8. Electricity pumped into the grid (since some power is imported from outside the state, energy pumped into the grid is a better measure of consumption) has grown at 7.13 per cent per year since 1992-93, i.e., at this rate it doubles over 10 years. Generating capacity, however, has increased only by 3.76 per cent per year i.e., it will increase by 45 per cent over 10 years.

Table 8: Electricity Generation and Generating Capacity of Utilities (Maharashtra) Year Energy Pumped in the Grid (billion kWh) Generating Capacity (Thousand MW) Load factor Thermal Plants (Per cent) 1992-93 44.868 10.683 59.71 1999-2000 72.722 13.832 71.77 Growth Rate Annual 7.14% 3.76% 2.66%

Clearly Maharashtra and India cannot go on like this. We need additional generating capacity. If the economy is to grow at a faster rate electricity supply has also to grow correspondingly.

We can lower the need for generating capacity if we reduce waste, follow energy conservation measures and increase efficiency of energy use. A study by my colleagues at IGIDR (Parikh Jyoti et al, 1994) has estimated a saving potential over a period of 15 years of 2500 MW of peak demand and 10 billion kWh in the 15th year for Maharashtra. An extension of these results to all India level (Reddy, 1995) shows over a period of 15 years a saving potential of 25000 MW and 100 billion kWh in the 15th year. Taken generously, over 10 years we can save 17000 MW from such a programme.

Many of these demand side measures are so attractive that consumers would recover their investment in two to three years. The question this raises, then, is that why don't consumers take up these measures themselves. There must be institutional barriers to adoption. These may not be all too easy to remove. So we should not count on the full savings potential till after we have had some success in pushing demand side management (DSM) to reduce demand.

Another option to expand generating capacity cheaply is through repair and renovation of old derated power plants. A national perspective plan estimates an additional generating capacity of 25000 MW over 15 years at a modest cost of Rs.0.85 crores/MW. A generous estimate would be 17000 MW over 10 years. This is an option that must be pursued.

But even when we neglect all the institutional barriers and assume that DSM and renovation potentials will be fully realised, we will need additional generating capacity from new plants. See Table 9. Over the next 10 years India would need to augment generating capacity at least by 43300 MW from new plants. This is a conservative estimate and if the economy is to grow faster which is likely, we should need more.

Table 9: Meeting Generating Capacity Need over the Next 10 Years 1. Installed capacity (1999-2000) 97800 MW 2. Required in 2009-2010 @ growth rate of 6% per year 175100 MW 3. Additional capacity required (2-1) 77300 MW 4. Less 4a. Full DSM potential 17000 MW 4b. Repair, Renovation and Maintenance 17000 MW 5. Additional New Generating Capacity Needed (3-4a-4b) 43300 MW

tional generating capacity is obvious for India and even more so for Maharashtra. For Maharashtra, the need, if anything, would be higher as the slack of poor load factor from existing plants is smaller and some DSM measures such as time of day tariff and co-generation in sugar mills have already been adopted.

8. Options for Power

Which kind of power plant is the best one among the many types of power plants available? I consider only the conventional plants as the costs and reliability of non-conventional plants are not yet attractive. Even if they were, they are unlikely to be available in large capacity or in large number of small plants.

Among the conventional plants also hydel and nuclear are not included. A hydel plant's economics is very site specific. Nuclear plants as of now take too long to build and are also expensive. I compare plants based on domestic coal at some distance from coal mines, natural gas and imported liquefied natural gas (LNG) such as the one at Dabhol.

These plants differ in capital costs and in their variable cost, which is mainly fuel. The relative costs of power would depend on the load factor on the plant. If one needs a plant for base load one would use a plant with a relatively lower variable cost. For a plant built mainly for peaking purposes one would like a plant with relatively smaller capital cost even though the fuel charge is high..

The capital cost of plants with state electricity boards (SEBs) cannot be easily compared with the capital cost of a plant built by an independent power producer (IPP) such as DPC. The SEBs do not include many real economic costs in their accounting. For example, interest during construction is not included in capital cost. (No wonder there are 6 months to 3 years delays in plant construction). Thus we need to take capital cost data from IPPs which have been wetted by Indian financial institutions.

Data for a number of such coal-based plants indicate a capital cost ranging from Rs.4.43 crores/MW generated to Rs.5.00 crores/MW generated. Since the plants own consumption of electricity is not available to others and since this varies depending on the type of plant (from 9.5% for coal to 3% for gas), we should compare cost per exported MW. For the coal based plant these correspond to Rs.4.80 crores to Rs.5.50 crores/MW exported. Thus, for a 500 MW coal based plant coming on stream around this time, we can take the capital cost to be Rs.5.2 crores per MW exportable (i.e., Rs.52000 per kW) including interest during construction. With a debt/equity ratio of 0.7/0.3, interest on loan of 16% and a return on equity of 16%, the fixed charge per day per kW of exportable capacity would be Rs.24.9.

The price of coal of calorific value 3500 Kcal/kg including transport cost and transit losses is Rs.1450/tonne for a plant located at 1000 kms from coal mines. The fuel cost per kWh sent out would be Rs.1.16 at current conversion efficiency of 35% and auxiliary consumption of 9.5%. With some operational charges, cost of starting fuel etc. this comes to Rs.1.20 per exportable kWh. The cost of starting fuel would vary depending on how many times the plant is started and how many hours it is operated each time it is started. For simplicity, I have taken a conservative low estimate.

If such a plant were to be operated under two part tariff, where a fixed capacity charge per day would be given, than the average cost of electricity would vary depending on the number of units generated. It should be noted that if MSEB owns the plant, it is equivalent to operating under two-part tariff. It bears the capital cost whether it was the plant or not. This is shown in Figure 1.

A plant running on natural gas has usually a capital cost which is 80 per cent of that of a coal based plant but it has auxiliary consumption of only 3% compared with 9.5% of coal based plant. The daily capacity charge would be thus 0.8 x 24.9 x (1.03/1.095) = Rs.18.7 per KW of exportable capacity.

The price of natural gas in India is Rs.2.7 per cubic metre with a calorific value of 9000 Kcal/cubic metre. With an efficiency of 42%, the fuel cost per kWh comes to only Rs.0.62, which is even lower than a coal based plant at pithead. Thus, a natural gas based plant has a lower capacity charge and lower variable cost. It should thus be always cheaper than a coal based plant at the prices prevalent in India. This is also shown in Figure 1. Unfortunately, we do not have adequate natural gas to generate all the power we need. We have to use other alternatives. Imported LNG was seen to be one such option and the Dabhol plant is based on that option.

I have also plotted the 1996 renegotiated Dabhol I + II costs at the then prevailing exchange rate of Rs.32/US$. It is seen that Dabhol does better than coal but not natural gas. Of course, the comparison of Dabhol should be made with coal plant costs prevailing then. A 15% reduction in both capital cost of a coal based plant and in the price of coal would still show Dabhol to be cheaper.

Since the Dabhol plant uses imported fuels and since the tariff is denominated in dollars, the cost would depend on the exchange rate. Some scenarios have been worked out. These are shown in Table 10 and compared with coal plant in Figure 2.

Table 10: Dabhol I + II Capital Recovery Charges (CRC) and Variable Cost under Alternative Assumption As renegotiated - 1996 As renegotiated - 1996 30% lower CRC Plus 60% Reduction in Regassification Charge Rs. per US$ 32 46 46 46 Capital Recovery Charge (CRC) Rs. per KW/day 21.22 29.00 20.3 20.3 Variable Cost Rs./kWh. 0.90 1.298 1.298 115.4 Notes: 1) Col.1 as per 1996 agreement at Rs.32/US$; 2) Col.2 as per 1996 agreement at Rs.46/US$

Thus Dabhol's viability depends critically on the price of imported fuel and its capital charge which depends also on the interest rate on debt and the rate of return on equity that is desired. On both these counts there is a scope to rework Dabhol tariff as was provided in the report of the renegotiation committee.

It should be noted that such a plant by plant comparison of the cost of power is somewhat

and distribution of the entire network.

9. Restructuring Dabhol Tariff

The scope for reworking Dabhol tariff comes from a fall in global interest rate and capital costs of combined cycle gas turbines. When the cost of borrowing goes down, the rate of return on equity should also go down. We examine these issues in turn.

a. *Impact of Lower Interest on Debt*

DPC had announced that the financial closure for the second phase was obtained at lower interest rates than the first phase. For every one percentage point reduction in the interest in debt, the capacity charge should go down by 2.25 per cent. I have worked out the capacity charge for a plant with debt/equity ratio of 0.7/0.3, a tax holiday for five years (which with depreciation carry over become a tax holiday for 10 years) and corporate tax rate of 35 per cent, to provide an internal rate of return on equity of 16 per cent. Table 11 shows these calculations for an interest rate on debt of 10 per cent. By varying the interest rate one works out the capacity charge that gives the same IRR of 16 per cent.

Thus for one percentage point reduction in interest rate the capacity charge should come down by 2.25 per cent.

b. *A Fair Rate of Return*

The capital recovery charge depends on the total investment and the expected rate of return. In a competitive market the rate of return would depend on the market rate of return plus a premium for any undiversifiable risk that the particular investment entails. Using this and the capital asset pricing model (CAPM) one can estimate what rate of return investment in power plant in India should get.

Table 11: Capacity Charge Internal Rate of Return & Interest Rate on Debt year Capital cost Outstand-ing debt d:e =7/3 Debt Repay-ment Interest on Debt at 10% Depreciation claimed 10% Revenue Gross PLF = 90% at Rs. 1.2/unit Taxable Income 10yr holiday Tax Paid Net profit After Tax Rs./kw Rs. Rs Rs Rs Rs Rs Rs Rs 1 52000 36400 0.1 1.2 -15600 2 36400 3640 3640 5200 9460.8 620.8 0 620.8 3 32760 3640 3276 5200 9460.8 984.8 0 984.8 4 29120 3640 2912 5200 9460.8 1348.8 0 1348.8 5 25480 3640 2548 5200 9460.8 1712.8 0 1712.8 6 21840 3640 2184 5200 9460.8 2076.8 0 2076.8 7 18200 3640 1820 5200 9460.8 2440.8 0 2440.8 8 14560 3640 1456 5200 9460.8 2804.8 0 2804.8 9 10920 3640 1092 5200 9460.8 3168.8 0 3168.8 10 7280 3640 728 5200 9460.8 3532.8 0 3532.8 11 3640 3640 364 5200 9460.8 3896.8 0 3896.8 12 0 0 0 0 9460.8 9460.8 3311.28 6149.52 13 9460.8 9460.8 3311.28 6149.52 14 9460.8 9460.8 3311.28 6149.52 15 9460.8 9460.8 3311.28 6149.52 16 9460.8 9460.8 3311.28 6149.52 17 9460.8 9460.8 3311.28 6149.52 18 9460.8 9460.8 3311.28 6149.52 19 9460.8 9460.8 3311.28 6149.52 20 9460.8 9460.8 3311.28 6149.52 21 9460.8 9460.8 3311.28 6149.52 Interest on debt@10% Cap. Charge= Rs1.2/kwhr IRR = 15.98

The Capital Asset Pricing Model (CAPM) approach is a generally accepted methodology for determining the Cost of Equity. CAPM is based on the portfolio theory of finance in which risks are classified into systematic risks and specific risks.

The return that one expects should depend on the risks involved. Higher the risk higher the return. Empirical evidence suggests the risk return relationship to be linear over the long run. This provides a way to estimate the risk parameter - volatility of a particular stock relative to that of the market the so-called beta, from the following relationship.

re = rf + equity Beta * [E(rm)-rf] where: re = is the expected rate of return on equity (cost of equity) rf = is the risk free rate of return (e.g. government bonds) E(rm) is the

the volatility (risk) of the stock relative to the market, which measures the systematic risk of the stock.

Using this framework and market data for various comparable firms a Crisil Advisory Service (CAS) paper estimates equity beta for power plants for India. Since the return on equity would depend on debt/equity ratio and interest rate on debt, an asset beta is defined for a firm with no debt. A fair rate of return i.e., one which is comparable to other investment opportunities and which accounts for differential risk, is then worked out from the CAPM equation written for a firm with no debt.

rasset = rf + Asset Beta * [E(rm)-rf] Asset beta for power generation is estimated to be 0.39. The risk free rate of return, rf, is the one on government bonds. We can take this at 11 per cent. The difference between rf and the expected rate of return on a market portfolio E(rm) is estimated to be 8.5 per cent. This gives an asset rate of return for power plants to be ra = 11 + 0.34 (8.5) = 14.3 per cent The asset rate of return, ra, is related to equity return, re, by the following accounting identity. ra = e * re + d * rd (1-T) where e is proportion of equity in total asset (capital stock) d is proportion of debt rd interest rate on debt T corporate tax rate With 5 years' tax exemption and depreciation carry over a firm does not pay any tax for 10 years, the period over which debt has to be repaid. So, we take T to be zero. This gives re = (ra - d * rd) / e The rates of return that equity will get under alternative assumption of interest rate on debt are given in Table 12 for a debt/equity ratio of 0.7/0.3 for an ra of 14.3 per cent. Table 12: Implied Return on Equity and Debt Interest Rate Return on Total Asset ra Debt/Equity d/e Interest Rate on Debt rd Implied Return on Equity re %age point gain in re over rd = 10 14.3 0.7/0.3 10 24.33 14.3 0.7/0.3 9 26.67 2.23 14.3 0.7/0.3 8 29.00 4.67 14.3 0.7/0.3 6 33.67 9.33 14.3 0.7/0.3 5 36.00 11.67

A 1 percentage point reduction in interest on debt leads to a 2.33 percentage point increase in the return one gets on equity. This is excess return. Thus when debt rate goes down it provides an opportunity to reduce the capacity charge. Corresponding to the reduction in DPC's cost of debt it should be possible to reduce its capacity charge.

What should be the reduction in the capacity charge for Dabhol? Calculations similar to what is shown in Table 11 summarized in table 13 shows that for each percentage point reduction in the IRR, the capacity charge falls by more than 2.5%. For an 11 percentage point reduction in the internal rate of return, the capacity charge should be reduced by 30 percent.

Table 13: Internal Rate of Return (IRR) Vs. Capacity Charge Percentage point Reduction in IRR Per cent Reduction in Capacity Charge 4.00 10 7.75 20 11.25 30

The Enron project involves investment by foreigners and an agreement in dollar terms. The returns should then be similar to what a US investor would expect for investment in power generation in the US. Using the CAPM approach the rate of return permitted the US would come to around 8%. However, Enron is investment by US investors in India. What is the undiversifiable risk for a US investor in India? For an equity investor it is smaller than what an Indian investor faces. An US investor is able to invest in equities around the world and diversify her risk This would suggest that a rate of return a bit above US risk free return should be acceptable. The US government bond interest rate is 5%. How large should the "bit" be? That should correspond to undiversifiable country risk (which Enron by now may consider not small). Should it be 1% or 2% or more? One can't have a good theoretical answer to that.

If we take it a generous 3%, a rate of return in dollar terms of 8% should be about right. This means a reduction of 10 to 12 percentage points in Enron's internal rate of return can be justified on that ground also. Thus, from this point of view too, a 30% reduction in capacity charge may be considered as reasonable.

The renegotiation committee report of 1995 (RC-95) also provided that DPC will have open tender for the 2nd phase plant and equipment, and any substantial savings

international market and an examination of possible savings on this account may be in order. I assume alternatively reduction in capital cost to be US$ 250 million and US$ 500 million.

Also, the corporate tax rate has come down from 46.5 per cent to 35 per cent. Savings on this account should also be passed on.

Pulling all these reductions together, all of which are consistent with the RC-95 report and follow from its recommendation, the capital charge should be substantially reduced. These calculation are summarized in Table 14. Apart from these reductions, there may beer possibilities of further reductions by restructuring its capital base.

It is seen from Table 14, that with a 2 to 4 percentage point reduction in interest rate on debt, and a $500 million reduction in capital cost the capacity charge comes down to 1.28 to 1.55 cents/kWhr (calculated on 90 per cent load factor basis). This would be lower than any other alternative plant that one can build.

Finally, the capacity charge may be back-loaded to further reduce it for the near term. It may be noted, however, that a rupee denominated back-loaded tariff is equivalent to a dollar denominated constant tariff if the rate of back loading equals the expected rate of devaluation.

The total capacity charge also involves fixed O&M charges. Now that the plant is functioning it should be possible to audit and verify these. If found to be lower than what was anticipated further reduction should be possible.

c. *Fuel Costs*

Separating the regasification facility should help reduce the fuel charge, as the costs would be shared with other purchasers of gas. A careful reexamination of the regasification charge and comparison with other countries such as Korea or Japan should be made.

The regasification charges as per the RC-95 are US$ 0.814 per mmbtu or US cents 0.52 per kWh exported. The regasification charge is mainly capital recovery charge on regasification facility. The reduction due to lower debt interest rate should also apply here. Thus a reduction of 30 per cent as per notes 1 and 2 of Table 14 [(1- .91)(1- .23) = 0.7] is due here. Moreover, the Dabhol power plant will use only 60 per cent of the regasification capacity. Thus a further reduction of 40 per cent is justified as was indicated in the RC-95 report. Thus the regassification charge would become no more than (0.52)(0.91)(0.77)(0.6) = 0.21 cents per KWhr. With bulk discount as noted in the RC-95 report, the charge for DPC could be even lower. The cost of regasification of LNG could be brought down at least by 60 per cent to US$ 0.34/million btu. The total energy charge would thus be reduced from 2.82 cents to 2.52 cents.

At this price DPC power would be quite attractive and whatever temporary surplus that MSEB has could easily be sold to other states.

d. *Volatility in Fuel Prices*

While the fuel cost is pass through, high volatility of oil and gas prices on the international market causes a problem of fluctuating prices for power. A hedging mechanism or an averaging mechanism should be worked out.

Hedging by a public sector manager is difficult. If the fuel price goes up on the international market, he won't get any pat on the back. However, if the price falls, CBI will investigate and CAG will castigate him. DPC should be asked to hedge against fuel price variation. This, however, would cost some money and we should be prepared to pay for it.

Alternatively a scheme can be worked out in which a fixed price is agreed for a year and actual deviations are passed on in the next year's price.

10. **Concluding Comments**

The 1995 report of the renegotiation committee provides ample scope to restructure the power purchase agreement with the DPC. The tariffs suggested are only indicative of the directions in which one can renegotiate. Details would have to be worked out and gone into carefully. With a new PPA, Dabhol can be an asset to Maharashtra for its economic development particularly when the Chief Minister has set up an ambitious target of raising the per capita income to Rs one lakh for every one in Maharashtra (Sab Banega Lakhpati).

References:

- AIC Watson (1995), Environmental Impact Assement: Comprehensive Report - Proposed 2000 MW Power plant at Dabhol AIC Watson Consultants, Bombay.
- Ministry of Power (1991), "Resolution No.7/8/88 Thermal", The Gazette of India No.237, October 22, New Delhi.
- Parikh Jyoti, Reddy Sudhakara B., and Banerjee Rangan (1994), Planning for Demand Side Management (DSM) Options in the Electricity Sector, Tata McGraw -Hill, New Delhi. Parikh Kirit (1993a) "Why Protect Foreign Power Plants?", The Times of India, May 7, 1993, Bombay.
- Parikh Kirit (1993b) "Playing Ostrich to Good Sense" The Economic Times, November 1993, Bombay.
- Parikh Kirit (1993c) "Modified Enron Deal: Digging Deeper", The Economic Times, December 27 1993, Bombay.
- Reddy Sudhakara B., (1995), Energy efficient options: Techno-economic potentials for mitigating greenhouse gas emissions: Report prepared for Energy Management Centre, Ministry of Power, Govt of India.
- Sant Girish, Dixit Shantanu and Wagle Subodh (1995), The Enron Controversy; Techno-Economic Analysis and Policy Implications, Prayas, Pune.
- Tata Rao N., Raghavan S.V.S., Parikh Kirit, Ayyar T.N.V., Pinto M.P. and Basak Asoke (1995), Summary Report of The Negotating Group on Dabhol Power Company, Government of Maharashtra, Mumbai.

1 Sections 1-5 are based largely on Parikh Kirit S. (1997), "The Enron Story and Its Lessons", The Journal of International Trade and Economic Development, 6:2, 209-230.

2 Exportable power excludes the power consumed by the plant itself. In India, generally generating capacity is stated including the plant's own consumption.

3 Throughout this section, an exchange rate of Rs.32 = 1US$ is used. Since the agreement was in US$, the exchange rate merely serves the purpose of giving comparable figures in Rupees.

4 Montek Singh Ahluwalia, the then Finance Secretary, in a private conversation.

5 It should be pointed out here that the phase 2 power purchase agreement had not been finalized and what is called "original" here was the Enron proposal and subject to further negotiations.

6 Market portfolio refers to a well-diversified portfolio that is assumed to reflect the behaviour of the market as a whole.