Note: Reference is not available

THE ENRON AND OTHER SIMILAR DEALS VS THE NEW ENERGY PARADIGM

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1. Introduction

Though the Enron deal has been attracting a great deal of attention in the media, there have been very few attempts to go to the root of the problem. This paper aims, therefore, at examining the origins of the Enron deal (and others of its type such as the Cogentrix deal in Karnataka). It concludes with the view that such deals are only the unpleasant symptoms of an underlying disease. And the disease is, in general, the basic paradigm for energy guiding Indian decision-makers and in particular, the basic strategy for the power sector in India.

2. The 1990 Crisis of Electrical Capacity Expansion

The relevant history begins with the demand of the power sector for allocations in the Eighth Plan proposal. Starting with a grandiose wish for an expansion of 48,000 MW in 1989, the proposal settled in 1990 to 38,369 MW at a cost of Rs 128,000 crores. But the scarcity of funds resulted in further downward adjustment of funds for installed capacity and the associated targets. The Eighth Plan Working Group, using CEA estimates, proposed a capacity addition of 36,646 MW during 1992-97 (the revised Eighth Plan), but this target was reduced to 30,537 MW. In response, the Planning Commission allocated only Rs 79,589 crores to the power sector (public) of which Rs 49,424 crores was for generation. The expected achievement thus came down to 19,537 MW. However, it soon became clear that even this down-scaled request could not be met out of the public exchequer.

Clearly, the electricity system of India was trapped in a capital crisis if by the word crisis is meant a situation that does not permit continuation of old patterns of behaviour.

And the old pattern of behaviour consisted of the funds for the power sector coming wholly from the government, and the actual allocation being the result of a bargaining process involving the power and finance ministries and the Planning Commission.

In fact, the electricity system was trapped in other crises -- the performance crisis characterized by the deteriorating technical and financial performance of the State Electricity Boards (SEBs); the equity or access crisis because the system was (and is) expanded in the name of the people but a significant fraction of the population (as much as half in the case of Karnataka) does not benefit directly from electricity; and the environmental crisis because almost every conventional electricity generation project is under public attack on environmental grounds. But, these other crises were not priorities for the power ministry. Instead, it came up with what may be called the mendicant's approach that is best clarified with a quantitative analysis of the capital crisis.

3. A Quantitative Statement of the 1990 Crisis

The essence of the capital crisis of the Indian electricity system is that its financial requirements are several times more than what can be provided by its traditional supplier of capital, namely, the Central Government.

In quantitative terms, the annual investment, I, required for expansion of installed capacity can be estimated with the following formula:

$$I = E(0) \times a \times g(GDP) \times UCOP = E(0) \times g(CAP) \times UCOP$$

where E(0) is the installed capacity (in MW) in the base year, g(GDP), the growth rate of the GDP, g(CAP), the growth rate of installed electrical capacity, a, the ratio of the growth rates of installed electrical capacity and GDP, and UCOP, the unit cost of installed capacity in Rs crores/MW.

The Government of India's Eighth Plan proposal for electrical capacity expansion estimating Rs 128,000 crores (1989-90 prices) for an expansion of 38,369 MW from an existing base of 64,000 MW in 1990 corresponds to a growth rate of installed capacity of 9.8494 % and a unit cost of installed capacity of UCOP = Rs 3.336 crores per MW (including transmission and distribution).

4. The Options for Resolving the Crisis

The above expression for the annual investment, I, required for expansion of installed capacity is a useful basis for discussing the capital crisis facing the power sector and the options for dealing with it. In fact, these

options arise from whether the various terms in the above expression are considered to be constants, or whether they are viewed as variables alterable by government policy and intervention.

Option #1 arises from taking E(0) the installed capacity (in MW) in the base year, as well as a and UCOP, as given.
One is left therefore with I, the annual investment required for expansion of installed capacity and with g(GDP), the growth rate of the GDP.

If it is not acceptable to lower the economic growth rate below a certain minimum value of g(GDP), then a certain minimum annual investment I has to be ensured to sustain this growth rate.

In theory, there are five sources for this investment, I:

I = I(GOI) + I(IES) + I(IPS) + I(MB) + I(FPS)

where I(GOI) is funding from the central government, I(IES),
from the Indian electricity sector consisting of the state electricity boards, the electricity generating corporations such as NTPC, NHPC, etc. and the electrical plant manufacturer BHEL, I(IPS), from the Indian private sector, I(MB) from the multilateral banks such as the World Bank and the Asian Development Bank, and I(FPS) from the foreign private sector.

In 1990, the situation was as follows. The central government had reached its limit, I(GOI)(max), as far as funding was concerned. I(IES) was almost zero because the Indian electricity sector had virtually no surpluses to make available for investment. The Indian capital market had not yet been flooded with foreign funds to make a significant contribution I(IPS) from the Indian private sector. The World Bank in 1989 had just highlighted in 1989 an "unbridgeable gap" between capital demand and supply at the level of the whole developing world. The Bank stated that the requests from the electricity systems of developing countries added up to $100 billion per year in response to which only about $20 billion was available from the World Bank and other
multilateral sources leaving a gap of about $80 billion. In other words, there was no hope of getting I(MB) from the multilateral banks such as the World Bank and the Asian Development Bank.

So Option #1 was reduced to the mendicant's approach of begging for I(FPS) from the foreign private sector to fill the gap [I - I(GOI)(max)] between the annual investment required, I, and the maximum funding that could be provided by the central government, I(GOI)(max).

Option #2 arises from taking as given both E(0), the installed capacity (in MW) in the base year, as well as a and UCOP. If, in addition, there is a decision to tighten one's belt and manage within one's means, then I gets fixed at what can be raised internally, i.e., I(GOI)(max), and one has to accept whatever economic growth rate g(GDP), comes out of the equation. The problem is that this growth rate may turn out to be unacceptably low, say 2%, i.e., less than the population growth rate -- in which case this option based on the reducedgrowth-rate approach is unacceptable.

Option #3 is based on the new energy paradigm approach promoted among others by the International Energy Initiative. It takes both E(0) as well as a minimum growth rate g(GDP) as given, and explores the possibility of lowering the annual investment required by decreasing the product (a x UCOP).

Decrease of the product (a x UCOP) can be achieved by decreasing a, the ratio of the growth rates of installed capacity and GDP and/or by decreasing UCOP, the unit cost of installed capacity in Rs crore/MW. The factor a which is conventionally taken between 1.5 to 2.0 can be reduced to much lower values through efficiency improvements, i.e., through getting a greater GDP bang for a lower energy buck. UCOP can also be lowered by reducing the cost of conventional generation through efficiency improvements and the cost of transmission by reducing T & D losses and/or by generating at the consumption sites through non-conventional decentralized technologies (for example by co-generating electricity, for instance, in bagasse boilers in sugar factories, or by decentralized electricity generation in villages from biogasor producer-gas). Thus, apart from the improvement of end-use efficiencies, the efficient production and transmission of conventional energy and the harnessing of non-conventional decentralized sources of energy can also reduce the financial requirements of the power sector.

5. The Mendicant's Approach

In this context, the reduced-growth-rate approach was obviously unacceptable to the electricity establishment in India. And the new energy paradigm approach was too new and too radical to be understood, let alone appreciated, by this establishment which was trapped in the conventional supplybiased approach to energy. The establishment turned naturally to the begging-bowl option.

A new policy of opening electricity generation to private participation was announced in October 1991. Then, in May- June 1992, a high-level team consisting of the Union Cabinet Secretary, Power Secretary and Finance Secretary visited the US, Europe, and Japan, to invite foreign private sector participation in the power sector. Foreign companies returned the visit to India and found the electricity establishment here willing to make all sorts of concessions and provide any number of incentives. In the belief that they were beggars and that "Beggars cannot be choosers!" (to quote a report of a statement by the US Treasury Secretary), the foreign companies were offered concessions and incentives that were unheard of in the power sector business.

Some of those decision-makers now admit that they were learning, but they certainly did not behave at that time as beginners. They did not generate a public debate and benefit from the expertise in the country. Neither did they study sufficiently neighbouring Asian countries such as China. Above all, they kept the arithmetic leading to the decisions hush-hush and ensured a complete lack of transparency!

6. The Price of Begging

Unfortunately, begging abroad for private capital has not brought investment in as alms. The country has to pay an exorbitant price in the form of several harmful features:

- § high plant load factor to the detriment of the system (including power purchase obligations to buttress this high plant load factor)
- § high return on equity investment to the investo(with the return guaranteed by the government)
- high recurring costs,
- high tariffs,
- high capital costs,
- disproportionate share of risks,

- unfavourable financing,
- environmental hazards.

This long list merits some elaboration which is presented below not necessarily in the above order.

High Capital Costs: The capital costs of the Enron project (of the Dabhol Power Company) can be assessed by comparing them with those in the industrialized countries. In the USA, a basic, no-frills 300 MW coal-based steam-electric plant would cost about $1,100/kW in 1990 prices, which works out to about Rs 3.410 crores/MW @ Rs 31/$. The labour component of this capital cost is about 37%.

There are two reasons why the capital costs should be much lower for the Enron project in India: firstly, the Enron power plant with a LNG-driven turbine should be much cheaper (in fact about $600-700/kW or 30% cheaper) than the coal-based steam-electric plant; and secondly, the labour costs should be much lower in India.

It is, therefore, surprising that the capital cost associated with the Phase I Enron project turns out to be Rs 4.358 crore/MW or $1,405/kW (Rs 3,029 crores for 695 MW) for an intrinsically cheaper natural-gas technology. This means that the capital costs of an Enron LNG-based gas-turbine technology are higher than the capital cost (adjusted for inflation) of a costlier coal-based technology in an industrialized country. Such a price increase in moving from an industrialized country to India is contrary to expectations, but it has also been noted by other observers. However, these higher costs have been justified by the President of the Dabhol Power Company which is implementing the Enron project.

The Enron capital costs are also higher than those in new indigenous projects based on similar fuels. For example, the Enron project costs are higher than those in NTPC's 645 MW gas-based Kawas project (implemented in November 1993 at Rs 2.4 crore per MW), even when the latter are inflated to the 1997 level, according to IDBI's analysis. The National Working Group on Power Sector has in a detailed September/October 1994 study shown that the capital costs of both combined-cycle gas-turbine and coal-based plants are lower with indigenous technology (Annexure 3).

However, for these comparisons to be rigorous, it is important that the technical efficiency of the indigenous version is as high as that of the Enron plant -- otherwise, it would be a comparison of a lower-efficiency technology with a higher-efficiency technology, in which case it is generally true that the advanced technology is costlier. And, the GE Frame 9F gas turbine is one of the most advanced in the world.

In the case of Enron, it appears that the cost increase (relative to the capital costs in the industrialized countries) is mainly because of the inclusion of items that are not merely a part of plant and machinery. These include "preliminary" expenses (Rs 62.72 crores or Rs 0.021 crores/MW), a "development fee" (Rs 86.40 crores or Rs 0.029 crores/MW) to be paid to the three promoters for "initial development work", and a Technical consultancy fee to the "Owner's Engineer" (Rs 35.20 crores or Rs 0.012 crores/MW) and "pre-operative" expenses (Rs 547.26 crores or Rs 0.181 crores/MW) whose constituents in turn, include an "upfront fee" (Rs 75.84 crores or Rs 0.025 crores/MW) (Annexure 1).

There are also payments in the Enron deal for equipment/ consultancy/recurring expenses to affiliates of the firms owning Dabhol Power Company. Naturally, in such transactions, it would not be profitable to wrest competitive deals. For example, the Enron project has an initial Technical Consultancy fee of Rs 35.2 crore to be paid to the Owner's Engineer, an annual Fuel Management fee of Rs 8.0 crore is to be paid to an Enron affiliate, Enron Fuels International Inc., and the Operation & Maintenance contractor is another Enron affiliate, Offshore Power Operations CV. Finally, the generation equipment is being purchased from equity-partners (General Electric and Bechtel Group Inc.).

High Return on Equity: The 16% return on equity (ROE) factored into the tariff when the plant is running at 68.5% capacity is much higher than that expected abroad. In Germany, an ROE of 9-12% for privately financed power projects is considered acceptable, while in the US, the rates on Government Bonds vary from 7.28% to 6.65% for 10-year to 30year Bonds. The ROE is also much higher than that of the Indian SEBs (which is around 3%).

In addition, there is a bonus to be paid for achieving a PLF that is higher than the bench-mark PLF of 68.5% agreed upon PLF. So, the actual return is much

higher.

Guaranteed Return: Even more important than the high ROE is the fact that the return is guaranteed by the Government of India in case the State Electricity Board, the purchaser of electricity, is unable to pay. This guarantee cannot be justified from the standpoint of promoting competition and turning to market forces. It is state-guaranteed protection of a producer at the expense of the purchaser and consumer, a protection that has been constantly criticized as one of the evils of centrally planned economies.

Tariffs: In the year 1997, the tariff per kWh will be about Rs 2.40/kWh (US$ 0.075/kWh). The life-cycle cost of electricity using the TAG method for costing with the Enron data varies between Rs 2.28/kWh and Rs 2.71/kWh (corresponding to annual discount rates of 10% to 15%).

However, the expenses chargeable during the life of the project provide, not only for inflation, but also for escalation of various components - fees (such as Management Fee, Testing Fee, and Commissioning Fee), insurance charges, "tax incremental charges", etc. These contribute to the variable cost component of the tariff (Schedule 10, part IV). Hence, with the tariff payable increasing every year, a comparison of Enron electricity with that from other plants will have to seen from a dynamic perspective. Further, in view of the global trend of declining costs due to the advance of technologies and due to current technologies becoming outdated, it is not clear why Enron should have been protected against technological obsolescence and stranded investments.

It must be noted, however, that in response to many critics who have argued that the Enron deal is a "cost-plus contract", the President of the Dabhol Power Company has asserted that it is a ""negotiated selling price contract", i.e., any cost increases associated with construction, financing, etc., are all borne by the company, not MSEB or the consumer."

High Plant Load Factor at the Cost of the System: The cost per kWh of electricity from the project is computed on the basis of an assured capacity utilization (of 90%) that is higher than that prevailing in the country at present. If such projects are assured a sale of electricity at such consistently high PLFs, obviously other plants would have to be backed down during the daily off-peak hours and the monsoon season. This would result in uneconomic plant dispatch (i.e., lower cost-per-unit power

would be replaced by higher cost power).

In spite of the diurnal variation in the electricity demand, there is no price variation according to the time of the day that electricity from the proposed facility is available.

Environmental hazards In the case of Enron's Dabhol project, a National Environmental Engineering Research Institute (NEERI) report states that human lives could be lost due to leakage of gas from the pipelines or at the storage tanks because the LNG tanks will be positioned too near. Whereas the NEERI suggested a 2.5 km exclusion zone, Enron's consultants have recommended only 750 m. The other environmental concerns centre around the impact of dredging on fisheries and the livelihood of local fishermen, the potential damage to local fishing resulting from the discharge of hot water into the sea, and atmospheric pollution. Enron, with a reputation of being an "environment-friendly" company has responded to and dealt with almost all the objections. The major uncertainty pertains to the sulphur dioxide emissions from the use of low sulphur high speed diesel (LSHS diesel) in the first phase, which will be higher than that released by Indian coal. Even though it is estimated the rise in SO2 will only be a 5% from 21 µg/m3 to 22.1 µg/m3, only the mango crop in the region can decide whether this increase is trivial -- the proof of the environment-friendliness of Enron is in the eating of the mango.

Unfavourable Financing: The rates of interest payable on dollar and rupee debt are fixed as on the date of financial closure. Till this stage (i.e. financial closure, securement of counter-guarantees, etc.) the perceived lender risks and the corresponding rates of interest are relatively high. However, as the project continues, risk falls and the debt can be refinanced (i.e. interest rates can be re-negotiated), but the utility will still be adhering to the fixed rates. On such a large loan, the reduction of each percentage point from the interest would result in a considerable saving.

7. Cogentrix -- another Enron-type Deal

Capital Costs: The capital costs of the Cogentrix-Mangalore Power Co.(MPC) project are Rs 4387.48 crores for 1,000 MW, i.e., Rs 4.387 crores/MW (or $1,415/kW) on January 1, 1997. This is 28.6% higher than the capital costs of barebones coal-fired power plants with flue gas

desulphurization equipment in the US which are estimated to be $ 1,100/kW.

The Cogentrix project costs are also higher than those of indigenous projects based on the same fuels even when the comparison is with new projects, i.e., with the present marginal cost of generating electricity from the same fuel, rather than with historical costs. For instance, the capital cost of NTPC's 2x500 MW coal-based plant - Vindhyachal Stage II was Rs 2,753 crore in the third quarter of 1993-94 ; inflating this to the January 1997 level gives a lower cost than that of MPC.

Further, as per the Techno-economic feasibility report the cost of the "construction & equipment" (Rs 2024.50 crores in January 1997) is only about 46% of the total capital cost. As in the case of the Enron project, there are cost-heads that need to be scrutinized -- pre-operational expenses (Rs 67.22 crores), project management & support (Rs 54.18 crores), as well as finance expenses (Rs 166.35 crores), apart from interest during construction, etc. (Annexure 2)

Recurring costs: The operation and maintenance (O & M) charges, used in the computation of tariffs, like those of the Enron project, are high on several counts.

(1) O & M costs are reckoned at three per cent of the current capital costs (while Indian thermal plants charge 2 to 2.5 per cent). Hence, if the capital costs are inflated, the O & M charges available are padded proportionately.

(2) As the current capital costs will be revised upwards every five years by four per cent supposedly to take care of the appreciation in the value of capital assets, all linked charges will also rise.

(3) Non-fuel operation & maintenance costs decrease when higher quality coal is used. Since the PPAs guarantee a fixed proportion of capital cost for O&M, the saving resultant from the use of higher quality coal accrues to the foreign party alone.

Tariffs: The 1997 selling price of electricity

from the Cogentrix plant will be Rs 2.59 per kWh as against Rs 2.72 from the Raichur Thermal Power Plant - Unit IV, but this apparent cost-effectiveness of Cogentrix electricity must not be taken at face value because, according to the tariff schedules, the electricity price payable rises every year.

Moreover, even these future electricity tariffs have been made subject to further escalation for various reasons apart
from the provision for inflation already included. For instance, the Cogentrix has considered tariff increases on four counts:

(1) the fuel cost will be at the then prevailing international prices computed on the basis of a normative coal consumption rate;
(2) all elements of fixed costs including plant, equipment, construction, insurance, etc. will be based on the actual expenditure (which could include cost-overruns);
(3) although the inflation rates assumed are ten per cent for the rupee component and four per cent for the dollar component, these are subject to upward revision in accordance with the actual rates;
(4) even the exchange fluctuation adjustment, now estimated at four per cent, will be based on the actual fluctuation.

Thus, in the case of Cogentrix, the cost-plus system of payment makes the electricity purchaser bear the brunt of the effects of input-price increases. With such an arrangement, the generator would not have any incentive to curtail inputcosts. (However, as the average CARG between Rs 2.59 in 1997 and Rs 14.73 in 2026 is 5.97%, the Chairman, KEB, has claimed the price increases to be reasonable).

Fuel: According to the Techno-Economic Feasibility Report, Cogentrix will charge the State Electricity Board fuel costs for a Tariff Heat Rate (WHR) of 10,813 BTU/kWh (11,408 kJ/kWh). This appears to be much more inefficient than the average international norms, and even higher than that of Indian plants (˜ 9,525 BTU/kWh) in spite of the 40 per cent ash content of Indian coal and the fact that these plants have to back down during the monsoons. What is more, energy experts are of the opinion that the plant may be operated far more efficiently while the owners obtain payment at the current fuel prices for much more than they

actually use, i.e. in agreeing to a normative flat rate WHR, the utility will not benefit from efficient fuel usage.

Return on Equity Investment: When the plant runs at the bench-mark capacity of 68.5% (68.493%), a 16% return on equity investment is guaranteed.

Further, as in the Enron deal, Cogentrix earns bonuses on ROE for additional plant utilization. This bonus is computed at 0.7 per cent ROE for every percentage point of generation above 68.5 per cent PLF, up to 85 per cent, and 0.65 per cent ROE for every percentage point PLF above that.

Although the Cogentrix ROE does not have to be actually paid out till the plant is in operation, it accumulates during the construction period (from the date of execution of the PPA till the commissioning of the project) and becomes a component of recoverable fixed charges. As such, it should be included when computing the cost per unit of electricity from the power plant.

Power Supply & Unfavourable Purchase Obligations: As per the PPA with Cogentrix, the generating company is obliged to "operate each unit of the Facility at all times at a level of output at least equal to 68.493% of the Unit Capacity of each Unit, except during periods of Forced Outages and Scheduled Outages and as otherwise permitted" and the purchaser has to "accept and purchase from the Company, all of the Facility's electric energy . . pursuant to the terms and conditions of the Agreement". Therefore, if unavoidable circumstances (for example, safety risks or problems with a part of the system) prevent the plant from being operated, the SEB would be forced to pay the monthly fixed charges in spite of there being no electricity delivery. Thus, such risks are transferred from the generator to the SEB.

Plant load factor: The cost per kWh of electricity from these projects is computed on the basis of an assured capacity utilization of 85% that is higher than that prevailing in the country at present. Like Enron, Cogentrix will operate as a base-load station, hence, other power stations would have to back down in the event of a drop in demand. (This would push up the costs of these other plants).

Risk-sharing: At present, a greater share of the risks seem to be borne by the purchaser (State Electricity

Board) rather than the generator.

(1) Completion and construction risks -- There does not appear to be any risk to the generator of a penalty for non-completion of construction of the plant according to the schedule (40 months). Further, as the entire impacts of an increase of capital costs (of equipment, consultation, insurance, etc.) are being borne by the purchaser, the risk of cost-overruns with any delay will not affect the generator.

(2) Fuel supply/price risks -- A number of "Qualified Fuel Suppliers" will be identified, from whom fuel (according to the required specifications) could be purchased. Criteria for the selection of the most favourable bid have also been listed. While the generating company has to ensure the availability of suitable fuel, it is compensated for this by a fuel management fee. Payment for the entire fuel-cost is by the electricity-purchaser who bears the risk of rises in fuel-prices.

(3) Risk of under-utilization of capacity -- The Tariff Heat Rate agreed upon in the PPA with Cogentrix is considerably higher than international rates; this would compensate for the increase in heat rates that would result from the plant being run at reduced capacity. Hence, the generator does not suffer from this risk.

(5) Risk due to "Government Force Majeure" -- "Force Majeure" events have been listed in the PPA. These pertain to uncontrollable circumstances such as natural disasters. Insurance coverage will be obtained for such calamities and the premia will be paid for by the purchasing utility. However, the purchasing utility is not under any circumstances relieved of its obligation to pay money due.

Financing: Cogentrix has been allowed to complete construction entirely on debt; equity will be brought in only during the first year of commercial operation. This is advantageous to them because interest on debt is payable even during construction while return on equity will commence only from the date of commissioning.

Since the interest rates (on debt) are a component of the Monthly Fixed Charged Rates which are reimbursed by the utility purchasing the electricity, there seems to be no

incentive for the company generating electricity to obtain the lowest possible rates. (If the interest burden were to be borne by the generators or even shared, the attitude may have been different).

Environmental hazards: Cogentrix has not yet prepared the environmental impact assessment (EIA) report as yet.
This is particularly essential as the plant will depend solely on imported coal which has a higher sulphur content than Indian coal.

8. Enron-type Deals will only aggravate the Electricity Crisis

In analysing the impact of Enron-type deals on the capital crisis of the electricity system (described in Section 2) that motivated the search for foreign private investment, attention can be focused on the basic equation (Section 3) for the annual investment required for electrical capacity expansion:

$$I = E(0) \times a \times g(GDP) \times UCOP = E(0) \times g(CAP) \times UCOP$$

By pushing up UCOP, the capital costs, and therefore, the unit cost of power, for a given investment, I, the growth rate in capacity, g(CAP), is much less than it would have been if indigenous capital costs had prevailed. The country has got less electrical capacity than what the decision-makers hoped for.

Also, the country has not got the type of electrical capacity it needed. In almost all the states, the shortage of peaking capacity is approximately double the shortage of baseload capacity. On the supply side, therefore, the first requirement is for peaking capacity through peaking plants. But, many of the plants based on foreign private investment, for example, the Cogentrix plant, are for coal-based base-load plants which will not eliminate the peak load shortage.

The Enron plant for Maharashtra may be of the right type because gas- or oil-based generating plants are quicker to
start and bring on load than steam-based plants, and their operation and maintenance costs are relatively higher. Therefore, it should be used for peak-loads rather than baseloads. But, by assuring the plant the purchase of its

electricity at very high PLFs, it is being forced to run in a "base-load mode" and the higher costs are underwritten by giving it a bonus for running at high PLFs. In an efficient electrical system, the peaking plants with high running costs lose the competition with cheaper base-load plants and shut down. But in the case of Enron, the dis-economies of running peaking plants in the base-load mode are being compensated through the PPA with bonus that reward these plants for running in an unorthodox manner.

This would result in uneconomic plant dispatch because the existing (and possibly more economical plants would have to be backed down during the daily off-peak hours and the
monsoon season, and even periodically shut down, to fulfil the contractual obligations of the PPAs to Enron. Thus, the PPA has a damaging effect on the performance of the rest of the state's electricity system.

It is clear that in the desperate bid to bring in foreign investments to address the capital crisis of the power sector, the decision-makers have forgotten that the electricity system also has a technical performance crisis. In fact, they are tackling the capital crisis in a manner that will make the technical performance of the SEBs even worse by forcing the
SEB plants to either back down or shut down thereby reducing even further their average plant utilization factor.

It is not only the technical performance that will deteriorate; the financial position of SEBs will also worsen drastically. With the high and increasing price of electricity from projects such as Enron, the SEBs will find that the only consumers that can pay for this expensive electricity are the industrial consumers. So, the SEBs will more and more be left to sell their electricity to the lower tariff-paying consumers and if present trends continue they will be left with the consumers that contribute most to their losses, pumpset-owners and the politically influential domestic consumers. Whereas at present, the SEBs use the revenues from the higher tariff-paying consumers to crosssubsidize the lower tariff-paying consumers, in future, those revenues will have to used to subsidize the Enron-type project. Thus, the financial performance of the SEBS will deteriorate further.

In short, Enron-type deals will aggravate both the

technical and financial components of the performance crisis of SEBs.

In this context of declining performance of SEBs, the impact of the inevitable rise of prices must be taken into account. Customers will not take kindly to these price increases; they are bound to protest and even revolt particularly when it becomes clear that there were cheaper alternatives.

If the mendicant's approach had not been adopted by the electricity establishment, there was a chance, albeit remote, that the capital crisis may have induced it to look at the new paradigm approach in which the annual investment required would have been reduced by decreasing the product (a x UCOP) through efficiency improvements and decentralized generation of electricity. The temporary glut of post-Enron-type power projects will create a euphoria in which the product (a x UCOP) will continue to be taken as unchangeable and attempts to promote efficiency improvement and decentralized generation will be considered less and less.

9. Enron-type Deals jeopardize the Country's Future

The Indian electrical-equipment industry (BHEL) has been built over the years to strengthen national self-reliance in electricity generation. BHEL has developed a high level of technical expertise particularly in relation to coping with
the country's poor coals with high ash content. BHEL has also built a large reservoir of highly trained professionals who can undertake all aspects of electricity generation projects. All this is a extremely valuable national asset.

In promoting Enron-type deals, the decision-makers have spurned and by-passed the precious asset of a mature national electrical-equipment industry apparently unaware of its immense value to the electricity system. They and their foreign advisors have treated India on par with countries which do not have this asset. Their policy of neglecting this industry in favour of straight imports of foreign equipment will severely damage morale in indigenous electrical-equipment industry and may even lead to its being dismantled and its human resources being frittered away.

In the estimates of the World Bank - India Country Department, the choice of fuel at Enron has been

inappropriate. "Even when taking into account the fact that India will face increasing difficulties in meeting the growing demand for its local coal and gas, and allowing for the differential costs of emission controls, imported coal -- not LNG -- would appear to be the next best option for base-load generation".

When the foreign exchange outflows on account of Enrontype deals are estimated in a social benefit-cost analysis, it turns out that these will be a significant drain on the economy, and that this drain will grow rather than diminish. Thus, the Working Group has shown with respect to the seven foreign investor power plants studied, that "the annual outflow from the SEBs to the FIPPs for these projects will be of the order of Rs 5,600 crore" and "if tariffs are not raised, the additional losses will be of the order of Rs 3,700 crore".

10. What is to be done in the short term?

Much of the controversy in the media about the Enron deal and others of its ilk centres on the costs and benefits of
going ahead with these deals. On the one hand, it is pointed out that the country's image has already suffered from the questioning of these deals, and the image will suffer even more drastically if these deals are terminated or renegotiated.

An example of advice on these lines is provided by the interview with the Chancellor of the Exchequer of UK who said: "... The Enron controversy is a setback. It changes the whole contractual status of the parties concerned. From the international point of view, such a thing is never done by Governments. It has a tremendous negative effect of sending a message to the international investor community that there are uncertainties in the whole system. Investors abroad will start doubting the continuity of economic reforms. This will vitiate the climate for long term investments....".

On the other hand, some analysts have argued that over the long run the costs of going ahead with these deals are too high. No view is taken on this question here except to say that this is a standard problem in management practice -whether to keep a defective system going or to replace it with a better system. The problem has to be resolved by looking at the costs and benefits over the entire life of the system.

If the life-cycle benefits are greater than the lifecycle costs for the Enron deal (and others of its type), then it is essential to make the best of the bad bargain and go ahead with the first phases of these projects. Perhaps even at this stage, attempts could be made to secure modifications so that the project does not have negative impacts on the rest of the system, for example, forcing the base-load plants of the system back down to assure the Enron-type project bonuses for high plant utilization.

Living with Enron-type plants may involve raising prices even to the marginal costs of generation. There are two aspects to be considered. Firstly, the marginal costs must be genuine; they must not computed by including avoidable capital and running costs, wasteful expenditures and technical inefficiencies. Secondly, the negative reaction of consumers to price increases must be taken into account. Fortunately, the real concern of consumers is expenditures -- and not tariffs per se. Hence, consumers are unlikely to object to these price increases if they are offset with efficiency improvements resulting in lowered consumption because their expenditures will remain the same or even decrease. The guideline therefore is to implement efficiency improvements as a means of getting the prices right which is exactly opposite to the conventional wisdom of getting the prices right to promote energy conservation.

If the life-cycle benefits of Enron-type deals are less than the life-cycle costs, it is advisable to cut one's losses by terminating the system and replacing it with something better; otherwise, it is like throwing good money after bad. There is bound to be a damage to the country's image in the eyes of foreign investors but this has to be weighed against the long-term benefits of making it known that the country has a vigilant and knowledgeable public and therefore deals have to withstand open scrutiny in an age when the photocopying machine has revolutionized access to so-called "secret" documents. Also, the country's position is not as abject as is made out -- the market for expanding electrical capacity has collapsed in the industrialized countries and their giant equipment manufacturers have to find markets in the developing countries, particularly in China and India.

In searching for alternative solutions, it is important to realize that genuine solutions are those that simultaneously resolve all the crises of the electricity system -- the crisis of capital, performance, equity/access

and environment. Solutions that focus on only one of these aspects, for example the capital crisis in the case of Enrontype deals, are sub-optimal and defective solutions that aggravate other crises. In particular, special attention must be paid to the performance crisis of SEBS -- any solution such as Enron-type deals that do not result in improving the technical and financial performance of the associated SEB is a wrong solution and should be rejected. The constant concern should be with what the deal will do to the associated SEB.

An equally important concern is the impact on the electrical equipment industry in general and BHEL in particular. For instance, if the concern is to upgrade the technology, there could be joint ventures between the international electrical-equipment giants and BHEL so that BHEL grows with the import of advanced technology. In a study on India's Power Sector, it was found that although substantial cost increases had to be incurred by BHEL, to meet international specifications, their boilers and turbines were "cheaper by almost a factor of 2 in most of these cases". Thus, any solution that undermines, rather than strengthens, the capacity and human resources of the indigenous electrical equipment industry is an unacceptable solution.

What has come out very clearly from Enron-type deals is that major decisions such as the expansion of services provided by electricity should not be left solely to the concerned ministries. In the case of Enron and other similar deals, they have shown a naivete that is astounding and a lack of appreciation of the multi-faceted character of the problems of the electrical system. Because finances and foreign exchange are involved, the finance ministry should also be brought in. It is in fact necessary to go much further. The decisions are too important to be left to government ministries. There should be public participation in decision making so that the enormous amount of talent and expertise that this country is endowed with can be utilized for improving the decisions. Note must be taken of the fact that the personal computer has democratized expertise so that even students can become experts. A tremendous benefit from the Enron controversy is the debate that it has generated and the awareness and expertise that has developed in the country.

But for the resources of the public to be brought

to bear on the problem, information on the projects must be freely available and there should be complete transparency of the process and product. In USA, the homeland of Enron, there is a practice of public hearings on such projects particularly with regard to the rates and environmental impacts. Of course discussions of such projects are meaningless unless choices are considered and alternatives are discussed.

11. The New Energy Paradigm -- the Solution for the long term From a long term point of view, the genuine solution to the crises of the electricity system is a shift to the new energy paradigm. In this paradigm, firstly, the emphasis must shift from energy consumption to energy services as an index of development. What human beings want is not energy per se in the sense of kilowatt hours, joules or kilocalories, but the services that energy provides in the sense of heat for cooking, illumination, warmth, mobility, etc. The shift in emphasis from energy to energy services is not a semantic trick because energy services can be increased by increasing energy supplies and energy consumption or/and by improving efficiency. Which is a better option depends upon the relative costs, convenience etc. but the important point is that efficiency improvements must be brought into the scope of increasing energy services. The discussion must not be restricted only to expansion of energy supplies.

All this goes back to the expression for the annual investment required to expand electrical capacity:

$$I = \{E(0) \times g(GDP)\} \times a \times UCOP$$

from which it is clear that three interventions must be pursued: (1) increasing I to expand electrical capacity, (2) decreasing a through efficiency improvements and (3) decreasing UCOP through cheaper conventional centralized technologies and cost-effective non-conventional decentralized technologies.

Whereas there are "fundamentalists" who argue solely in favour of one of these categories of interventions -conventional centralized technologies or non-conventional renewable decentralized technologies or efficiency improvements, the rational approach is to identify a least cost mix of these three potential contributions to the expansion of energy services. The

methodology of identifying this mix is based on Integrated Resource Planning which regulatory commissions have made mandatory for 40 out of 50 states in the USA.

It is this emphasis on energy services (rather than energy consumption) and the pursuit of Integrated Resource Planning that is the essence of the new paradigm necessary to provide the long-term solution to the capital, performance, equity and environmental crises threatening the electricity system. Unfortunately, the critiques of the Enron and similar deals have not been set in the context of the paradigm shift that is taking place. The Enron deal is representative of the dying conventional paradigm preoccupied with a growth-oriented supply-sided consumption-focused (GROSSCON) approach. In that sense, such deals are more symptoms than the disease itself, and the disease is the GROSSCON paradigm. The priority task is to get the paradigm right by shifting to the new DEFENDUS paradigm based on a development-focused end-use oriented service directed approach.

Annexure 1

CAPITAL COSTS OF THE ENRON (DABHOL POWER COMPANY) 695 MW PLANT (in Rs crore)

Land	78.40
Turnkey construction cost	1703.77
Miscellaneous fixed assets	51.20
Pre-operative expenses:	
Insurance (Foreign companies)	73.60
"Upfront fee"	75.84
Legal expenses	12.80
Financial advisor's fee	17.41
Interest during construction	354.78
Operation support	6.40
Others	6.43
	547.26
Import duty (@ 20%)[1] (a)	168.23
Additional taxes	48.00
Contingency charge	160.00
"Development fee" to promoters (@2.9% of project cost) (b)	86.40
Technical consultancy fee to "Owner's Engineer" (c)	35.20
Preliminary expenses	62.72
Working capital	87.82
TOTAL	3029.00

Source: Annexure XII, Detailed Appraisal Note, IDBI, quoted by N.Ram et al.

[1] (a) Implied value of imported equipment = Rs 841.15 crore
(b) Implied project cost = Rs 2979.31 crore
(c) Offshore Power Operations CV and Enron Mauritius Services Co.

Annexure 2

CAPITAL COSTS OF THE COGENTRIX (MANGALORE POWER COMPANY) 1,000 MW COAL-BASED THERMAL PLANT (1997 in-service costs) in Rs crore

Construction & equipment	2024.50
Infrastructure	272.28
Insurance & freight	139.23
Turnkey fees & expenses	214.03
Duties & taxes	185.11
Pre-operational expenses	67.22
Engineering	117.78
Bank engineer	5.98
Finance expenses	166.35
Legal & accounting	42.21
Sponsor develop. expenses	51.34
Project management & support	54.18
Contingency	157.16
Interest during construction	890.10
TOTAL	4387.48

Source: Techno-economic feasibility report dt.January'95, quoted by S. Mahalingam and P. Menon

COST AND FINANCING NORMS FOR PROJECTS (PER MW)

	Foreign Investor		Indian Alternative	
	CCGT	Coal-Based	CCGT	Coal-Based
1. Plant and equipment cost (Rs Cr)	3.90	4.35	2.70	2.70
2. Financed by				
(a) Equity 30%	1.17	1.31	0.81	0.81
(b) Loans	2.73	3.05	1.89	1.89
3. Loans				
(a) Rupee (at 17% interest)	1.56	1.74	1.08	1.08
(b) Forex (at 8.25% interest)	1.17	1.31	0.81	0.81
4. Forex inflows (2a + 3b)	2.34	2.61	0.81	0.81
5. Interest During Construction	0.60	0.65	0.35	0.42
6. Total Project Cost (1 + 5)	4.50	5.00	3.05	3.13

Source: Table 5.3 of "Current Power Policies - A Critique" p.14, National Working Group on Power Sector.

References