

California Energy Crisis and Its Lessons for Power Sector Reform In India

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The imperative necessity of restructuring/reforming the electricity sector in India to overcome the financial ill health and technical shortcomings of the electricity boards is being repeated ad nauseum, particularly by the multilateral donors and their acolytes in government and academia. To justify the recommendations, there are hand waving references to the successes of reform in the industrialised countries. Just when the process appeared to be unstoppable and unquestionable, the 'consensus' has been shattered by the unbelievable news of the California energy crisis. In a state at the forefront of the IT revolution, there have been unscheduled interruptions of power and rolling blackouts covering hundreds of thousands of consumers. Suddenly, the situation there appears no different from backward developing country cities. One is reminded of Hans Christian Andersen's story where it is discovered that "the emperor has no clothes". Clearly, there is a need to understand the California energy crisis and to draw the lessons for India and other developing countries.

Background

California is the third largest state in the US. With a population of about 34 millions in 2000, it has an area of 4,24,002 sq km, which is roughly one-eighth the size of India. If California were a separate country, its economy would be the sixth largest in the world. To serve its approximately 34 million electricity consumers with a peak demand of about 30,000 MW, its power system had a capacity of 52,349 MW in 1998. This consisted of 21,686 MW from non-utility sources including co-generation and of 30,663 MW from utilities – hydroelectric plants (25.8 per cent), petroleum, gas- and dual-fired thermal plants (21.6 per cent), nuclear plants (8.2 per cent) and renewable sources (2.9 per cent). 82 per cent of the electricity was generated within the state and 18 per cent was from out-of-state generation. 53 per cent of the oil was produced within the state, 32 per cent from Alaska and 15 per cent imported from foreign sources. Only 16 per cent of the natural gas was produced within the state, 56 per cent was from other parts of the US and 28 per cent from Canada.

In 1994, when California was just coming out of a strong, persistent recession, the role of its electricity system came under scrutiny. California's electricity prices were relatively high in comparison with other states in the US. The main reason for the high prices was that its consumers were burdened with the cost overruns of nuclear power¹ and the costs of high-priced alternative electricity (green power)² – adding up to stranded investments of about \$ 28 billion. The century-old system of regulators setting rates and guaranteeing an investment return to the stockholders gave utilities little incentive to trim costs since in any case most of these costs would be passed on to customers. Free-market proponents argued that prices would drop if electricity providers had to compete for users.

In December 1995, the state's Public Utilities Commission voted to open the state's electricity industry to competition. Following a debate in the state capital, the then governor Wilson signed the 'deregulation' bill on September 23, 1996. On March 31, 1998, the California Power Exchange, the largest electricity market in the world, came into being to determine wholesale electricity prices.

Objectives

Strictly speaking, the term deregulation should be used only when the generation, transmission and distribution of electricity – involving both wholesale and retail electricity – are determined by market forces without any intervention of the state in decision-making. This complete withdrawal of the state from all aspects of the electricity system is not found anywhere. Different countries and regions reveal various extents of deregulation. The Californian pattern of deregulation is a particular brand to emphasise which it will be referred to throughout this paper in quotes as 'deregulation'.

The Californian 'deregulation' process had many objectives amongst which the following were prominent. (1) The large vertically integrated utilities, Southern California Edison and Pacific Gas and Electric, would be compensated for their 'stranded costs' arising from uneconomic power-generating capacity acquired in pre-'deregulation' days and for excessive payments for alternative energy. (2) These utilities would be relieved of their responsibility for generation so that they could focus primarily on transmission and distribution. (3) The construction of cleaner fossil-fuel plants would be promoted. (4) Greater use of renewable energy sources would be encouraged. (5) Electricity trading would be subject to market forces. (6) Customers would be given a choice of electricity suppliers. (6) Electricity retail prices would be lowered.

California's 'Deregulation'

California's 'deregulation' consisted of several measures. The state's utilities were compensated for their 'stranded costs' with the burden being passed on to new entrants to the generation scheme and to consumers. This compensation to the utilities has been considered by some to be excessive compared to the book value of the assets. The utilities were also compelled to sell their gas- and oil-fired (non-nuclear) power plants in California to other companies. The intention was that a sufficient number of new power plant owners would enter the generation scene so that none could single-handedly influence the price of electricity in California's new marketplace for electricity.

Stripped of most of their generation capacity, utilities had to buy all their electricity requirements in a transparent manner. This had to be done one day in advance from the California Power Exchange, the state-run wholesale electricity market set up for the purpose. Any shortfalls had to be made up on the last day by a second organisation, California's Independent Service Operator (Cal-ISO). Consumer prices were capped or frozen until utilities paid off their debts³ or until 2002. To win widespread popular support, the 'deregulation' was started with a 10 per cent reduction in consumer rates. Participation by utilities in the

'deregulation' was voluntary and it is important to note that many cities with publicly owned utilities including Los Angeles, Burbank, Riverside, Glendale and Anaheim, did not join the experiment.

Champions of 'Deregulation'

The 'deregulation' scheme attracted a number of champions. The California Public Utilities Commission and the California legislature were the architects of the plan to open electricity prices to market forces. Investor-owned utilities, eager to be unburdened of their stranded assets, spent \$ 5.3 million on lobbying and donations to bring in 'deregulation'. The utilities wholeheartedly supported the idea of market-determined wholesale prices and frozen consumer rates because they anticipated that the trend of falling wholesale prices would continue and they would reap windfall profits from the difference between the frozen retail prices and the falling wholesale prices. Independent power producers supported the move to get a piece of the 'cake'. Manufacturers lobbied for the ability to buy their electricity cheaper from companies other than Pacific Gas & Electric, Southern California Edison and San Diego Gas & Electric. Environmentalists wanted to preserve the half- billion-dollar annual subsidy for renewable energy technologies. Labour hoped to win money to retrain utility workers. Consumers wanted implicit subsidies to continue but interestingly, they were shut out of the negotiations.

Year before Crisis

The new millennium brought with it many indications of the looming electricity crisis. The electricity demand was far greater than expected. In fact, it grew three times more quickly than anticipated. The heat wave in May 2000 aggravated the peak summer demand. From June 2000 onwards, the wholesale price of electricity rose alarmingly – there was a tenfold increase from about \$ 0.050/kWh to about \$ 0.522/kWh. The rise in wholesale electricity prices was much greater than could be accounted for by the rise in natural gas prices. The state's major utilities (Pacific Gas & Electric and Southern California Edison) were paying far more to buy power than they were allowed by 'deregulation' to charge consumers. Thus, contrary to expectations, the wholesale price of electricity was much greater than the retail price and the difference represented a loss to the utilities. In places where there was no cap on consumer prices (for example, San Diego), businesses and homes paid more in the summer of 2000 compared to the previous year (for instance, they paid \$ 10.9 billion more in San Diego). The power system reserve ratio (defined as the ratio of excess capacity to peak demand) started falling to dangerous levels. There was a Bay area blackout in summer and there were shortages on 22 days. The state even declared an emergency when there was a stage 3 Alert because the power system reserve ratio had fallen below 1.5 per cent. Seeing the precarious financial situation of the utilities, suppliers became reluctant to supply them with electricity. Towards the end of 2000, the Clinton administration exercised emergency powers to

compel sales of electricity and natural gas to California and this federal ruling was renewed six times.

Current Energy Crisis

The development of the current California energy crisis and its 'resolution' with short-term measures and a rescue plan can be described with a chronology of the important events for a crucial one-month period.

January 7, 2001: A major storm resulted in near shut down of the Diablo Canyon 2,200 MW nuclear power plant because waves of nearly 20 ft forced kelp into the pipes that suck in sea water for cooling the plant. The loss of power adversely affected the supply-demand gap.

January 8, 2001: California's governor Davis in his State of the State Address said, "California's deregulation scheme is a colossal and dangerous failure" and proposed steps to reassert the state's control over its power market. It was felt that out-of-state companies selling power to California were charging exorbitant prices for electricity on the spot market for immediate delivery. In fact, power producers were accused of price gouging.

January 9, 2001: President Clinton called a meeting of federal and state officials to resolve the California energy crisis. The governors of California, Oregon and Washington argued that the federal government should put a price cap on wholesale power. Clinton's Energy Secretary agreed, but not the Federal Energy Regulatory Commission.

January 11, 2001: Following the biggest storm in three years, governor Davis ordered a wide-ranging energy conservation crash programme involving inter alia the replacement of bulbs in traffic lights with more efficient versions, redirection of power from state-owned aqueducts to the grid, rebates on energy-efficient equipment, etc.

January 15, 2001: Electricity suppliers threatened the payment-defaulting utilities to take them to bankruptcy court.

January 16, 2001: A Stage 3 Alert was declared. The California Independent Service Operator, which manages the grid, declared an emergency. The utilities asked for a one-week deferment of payments. Southern California Edison announced that it would not pay \$ 596 million due to creditors to 'preserve cash'. This undermined the ability of the utilities to buy power on credit. Credit rating companies reduced the rating of utilities to that of junk bonds below investment grade. The utilities moved towards bankruptcy. Out-of-state generators became reluctant to sell power to California for fear that they will not be paid. The state assembly passed a bill for the state to buy power from generators at long-term rates and sell it to utilities thus emphasising a key role for the state in the electricity market.

January 17, 2001: Several factors – shortfalls in generation, transmission bottlenecks and the financial ill health of the utilities – brought California's power system to the brink. But, the system was pushed over the edge by the sudden decline in hydroelectric generation arising from inadequate rainfall in the reservoir catchment areas. Rotating power cuts for up to one-hour duration affecting half a million consumers at a time were implemented. Enron, an out-of-

state supplier, stated that it would limit sales to utilities that are not credit-worthy. Governor Davis declared an Emergency and ordered California's department of water sources to become the principal purchaser of power from generators. It also became the seller of power to financially strapped utilities.

January 18, 2001: This was the second day of rotating blackouts affecting several million customers. Industry responded with temporary lay-offs of workers. Some production units were moved to other states. The state's energy crisis threatened everything from milk supplies to gasoline deliveries. Traffic lights went out in the Bay area, computer screens went dark, heaters and bank machines were silent, and lights went out in classrooms. California with 50,000 MW capacity should have had no trouble meeting a 31,000 MW peak but 11,500 MW became unavailable due to unscheduled plant shutdowns. California lawmakers passed a \$ 400 million rescue plan to buy electricity on the expensive spot market. Southern California Edison was suspended from the California Power Exchange.

January 23, 2001: The new president, George Bush, extended by two weeks federal orders that require power producers to sell surplus electricity and natural gas to California, but said that after February 7, California would have to resolve its crisis on its own.

January 31, 2001: The California Senate approved a \$10 billion plan to make the state a major power buyer to rescue utilities from bankruptcy. State purchases were expected to account for one-third of the total requirement compared to the two-thirds from (a) generation in the plants that the utilities were allowed to keep after 'deregulation' and (b) cogenerators and decentralised generators (wind and solar power). The state was expected to sign long-term contracts to buy power and sell it to the customers of the financially strapped utilities. For this purpose, the state would spend \$ 500 million more (over and above the previous \$ 400 million) buying electricity on the expensive spot market while making cheaper long-term deals with wholesalers. In order to encourage conservation, there would be a rate increase for residential customers using 30 per cent more than a baseline that varied with climate and end-uses. Governor Davis announced emergency conservation measures (for example, curtailing outdoor lighting) intended to reduce demand by up to 20 per cent.

February 1, 2001: After an initial hiccup, the Legislature also approved the Senate plan. With a new approach in place to purchase electricity, the California Power Exchange that was set up for these purchases was shut down.

February 2, 2001: Since the impacts of the California energy crisis were felt all over the western part of the country, the governors of nine western states organised an Energy Policy Roundtable at Portland (Oregon). The purpose of the meeting was to plan their energy future based on short-term solutions to their energy shortages as well as a long-term plan for coping with increasing energy demand. To coincide with the start of the Roundtable on February 2, governor Locke of Washington state published a New York Times op-ed article in which he said: "This is not a 'normal' market where the integrity of price signals needs to be protected. This is a highly distorted market where intervention is needed. And because interstate commerce is involved, only the federal government can

supply this intervention.” The energy secretary Abraham from the new Bush administration attended the Roundtable and praised California’s energy bill. However, he rejected requests from eight of the governors for price caps arguing that they are disincentives against reducing demand.

Causal Factors

Supply shortage with respect to demand: There was a gross underestimation of California’s electricity demand, which grew 25 per cent in 1990s. This was partly because computer-based businesses in particular, and the IT sector in general, increased demand (for stable and reliable power) and consumed electricity at rates unheard of in the old economy. But there was also a serious slackening of conservation efforts even when wholesale prices skyrocketed. This slackening was not helped by the rate freeze for consumers, which insulated them from wholesale prices. There were also problems on the supply side because polluting plants were idled and old power plants (55 per cent of California’s plants were more than 30 years old) operated less efficiently. In the tight supply situation, some generators were shut down because of untimely unscheduled power-plant maintenance – for instance, on March 19, 12,367 MW went out of action when the 7 PM demand reached 29,270 MW. Though California imports 18 per cent of its electricity, no new major power plants had been built in California in the 1990s. This lack of new capacity has been blamed on the citizens’ ‘Not in my backyard!’ (NIMBY) attitude to new plants. Finally, just when California depended most on importing power from out-of-state, there was increased demand in states exporting power to California.

Transmission bottlenecks: Trading in power has resulted in greater distances between generators and consumers as a result of which the transmission grid is overtaxed. In particular, there is a transmission bottleneck at Path 15 when electricity flows from California’s south to its north. Unfortunately, ‘deregulation’ and unbundling has resulted in a situation where there is little incentive to invest on a transmission grid that is accessible to all generators.

Natural factors: The weather did not help the situation. Storms led to the shut down of the 2,200 MW Diablo Canyon nuclear plant. And, late runoff on the rivers of the Pacific north-west reduced hydroelectric generation.

Defects in ‘deregulation’: A sweeping divestiture (involving old generators being forced to sell off most of their plants) was implemented without ensuring that new owners would sell electricity at a reasonable price for a long number of years. There was widespread failure on the part of utilities to anticipate that energy supply companies could easily exploit the mechanism and earn very much more than the going rate by holding back electricity and selling it when the system was desperate for electricity. There was inadequate regulation of wholesalers. ‘Deregulation’ did not prompt more competition right away. ‘Deregulation’ has also resulted in disincentives not only for new capacity but also for improvement/expansion of transmission and for R and D relevant to transmission.

Imperfect market: On November 1, 2000, the Federal Energy Regulatory Commission commissioners called the California market ‘seriously flawed’ and

said that they found clear evidence of market power based on rising natural gas prices, higher loads and supply disruptions. Cal-ISO also became an easy way of bypassing the market – all that suppliers had to do was to withhold electricity until the last day and, in order ‘to keep the lights on’, Cal-ISO would have to buy at whatever exorbitant prices were quoted.

Financial concerns: As the debts of utilities accumulated to staggering proportions (\$ 13 billion in debts), credit rating agencies started rating California utilities as junk bonds less than investment grade. As investor-owned utilities approached bankruptcy, they could not purchase electricity for distribution.

Myths Regarding Roots of California Energy Crisis

Before proceeding, it is important to dispel some myths regarding the roots of the California energy crisis.

Myth #1 is that the crisis arose because retail rates were frozen whereas wholesale electricity prices were allowed to be determined by the market. The implication is that the ‘deregulation’ did not go far enough and was restricted only to wholesale but not retail prices. The deregulation loyalists argue that all is well with deregulation (the real thing); it is the Californian pattern (the unreal thing) that is at fault. Thus, The Economist subtitled its January 20, 2000, article: “Don’t blame deregulation for the chaos in California’s electricity supply industry. Blame ‘deregulation’.” The problem with this logic is that if wholesale electricity prices had become increasingly lower than frozen consumer rates – this was the ‘deregulation’ scenario expected by the utilities – the utilities would have made windfall profits and there would have been no crisis. In reality, volatile wholesale electricity prices became increasingly greater than capped retail prices resulting in the accumulation of huge utility debts.

Myth #2 is that the crisis arose from the fact that the consumer rates were frozen and if they were allowed to rise, the utilities would not have suffered losses. The fact is that where retail prices were not frozen, the resulting rise in prices led to a revolt of consumers and to a political crisis. Hence, uncapping retail prices is a non-solution when wholesale prices are as volatile as they were in California.

Myth #3 is that the crisis stems from the ‘stranded costs’ of the utilities arising from uneconomic power-generating capacity acquired in pre-‘deregulation’ days and over payments for alternative energy. If, however, according to the expectation of utilities from ‘deregulation’, the proceeds from the sales of generation plants plus the gains from the difference between frozen consumer rates and lower wholesale electricity prices had been used as compensation, the stranded assets problem would have disappeared.

Assessments of California’s ‘Deregulation’

There have been several negative assessments regarding California’s ‘deregulation’. For instance, it has been said, “California was hailed as a model for the rest of the nation. And it has been a model – of how not to do it”. It has also been asserted that deregulation has been “...one of the most expensive public policy miscalculations in California history.”

The fundamental objective of 'deregulation' – that consumers should exercise choice of suppliers – was not realised. In fact, consumers by and large persisted with their old suppliers – less than 2 per cent of homes switched to a new supplier compared to 25 per cent in UK. In the California pattern of 'deregulation', a new marketplace in which prices fluctuated violently replaced a monopoly in which government set stable rates. 'Deregulation' resulted in enormous spikes in wholesale prices. Increased revenues from price hikes flowed to out-of-state energy firms (for example, the Houston-based Reliant Energy). Power producers are now being investigated for jacking up wholesale prices because of power shortages and financial troubles of utilities. California regulators estimated that generators charged \$ 6.2 billions above competitive levels over 10 months. Investor-owned utilities were pushed to bankruptcy (having run up about \$ 13 billion in debts) because wholesale prices (reaching \$ 1.40/kWh) went far above retail prices (capped at \$ 0.066/kWh). At the same time, utilities transferred billions to their parent companies – Edison transferred \$ 4.8 billion and Pacific Gas and Electric \$ 4.7 billion between 1996 and November 2000 – in transactions that are now the subject of audit and investigation. Generators became reluctant to sell power to utilities because their credit ratings plummeted. Cogenerators (accounting for 20 per cent of supplies) had not been paid as much as \$ 500 million. To survive, utilities say they need a release from 'deregulation'. 'Deregulation' has capped earnings from transmission. 'Deregulation' has made the electrical system less technically reliable. Cities like Los Angeles with publicly owned utilities that opted not to be deregulated have been unaffected. It was said: "You look at where the lights are on in California, and you look at the municipal utilities!" California's 'deregulation' is now deemed a failure needing large-scale intervention in market. The California energy crisis has scared the other states in the US that were rushing along into deregulation – they are now applying the brakes on deregulation. It appears that deregulation is dead!

California Governor's Rescue Plan and Its Sequel

To tackle the energy crisis, California's Governor's announced on February 15, 2000, a strategy for tackling the state's energy crisis. This strategy aims at stopping the financial haemorrhage of the utilities and rescuing them from bankruptcy. It involves the following components: (1) re-regulation of the electricity sector involving massive intervention of the state, (2) rescuing the utilities with financial inputs, (3) improving the electricity supply position so that the system has enough reserve capacity to cope with nature's vagaries, unscheduled maintenance of plants, etc, (4) stabilising wholesale electricity prices, and (5) protecting consumers from excessive rate increases, It is proposed that the state intervenes in the electricity sector by (1) buying the transmission system of the utilities with cash from a bonds issue, (2) promoting the establishment of new capacity, (3) stabilising wholesale electricity prices at affordable values, and (4) permitting some increase in customer rates. With regard to wholesale electricity prices, apart from spot purchases on behalf of utilities to circumvent their loss of credit rating, the state would also enter into long-term purchase contracts with suppliers and with the utilities for the

generation still under their control, and reduce the rate at which alternative energy is purchased.

Five sources of fresh cash infusion for utilities are envisaged: (1) the sale to the state of their transmission (not distribution!) systems with about 32,000 miles of wires for about \$ 7 billions, (2) sale of fresh bonds to the public, (3) dedicated rate increases for customers in lieu of transmission charges, (4) fees for operating the transmission systems and (5) transfer of funds to utilities from their parent companies. With these cash receipts, the utilities can unburden themselves of the massive debts arising from wholesale electricity prices being increasingly larger than the frozen consumer rates.

The measures planned by California suggest that there are several short-term steps that can be taken to tackle a California-type energy crisis. (1) The state (with its good credit rating) can purchase power and sell it to the utilities. (2) The utilities can be kept solvent while arranging long-term supplies of power to address the shortages. (3) The state can buy power on long-term contracts and insulate the distribution utilities from spot market pressures. (4) A price cap can be imposed on wholesale power. (5) Power plants can be bought and built so that the state becomes more self-reliant with respect to external suppliers. (6) Crash conservation measures can be implemented on a war footing.

After securing approvals from the state congress and senate and 'successful' negotiations with the main utilities, governor Davis addressed the state on April 5 regarding his energy plan. The very next day, PG & E made a move that took even the governor by surprise – PG & E filed for bankruptcy. This meant that while it could continue to conduct its business, all decisions regarding its assets, debt payments, etc, would have to be decided by a bankruptcy court. Thus, another crucial actor – the bankruptcy judge – has entered the California energy scene perhaps setting back the governor's plans to procure PG & E's transmission system. The governor soon announced that SCE, in contrast to PG & E, had agreed to sell its transmission system to the state. At the moment of writing (April 15, 2001) it is not clear how the state and the bankruptcy court will proceed with governor's plan.

Issues Thrown Up by California Energy Crisis

The California Energy crisis has thrown up several crucial issues that need to be addressed.

Was California's 'deregulation' just badly implemented and can its electricity market be made to work for example by long-term contracts for wholesale electricity and/or uncapping consumer prices? If the retail prices were unfrozen, would the inevitable rise in consumer prices be politically viable? Or was California's 'deregulation' 'botched' so thoroughly by the two-step purchase of wholesale electricity that it could not possibly work especially amid shortages? When 'deregulation' in California is compared with deregulation in Europe, can the difference in outcomes be explained by the capacity excess, system reliability and rate unfreeze in Europe compared to the capacity shortage, system unreliability and retail rate freeze in California?

Is the California crisis simply the result of utilities competing for increasingly scarce wholesale power in contrast to the expectation that, after 'deregulation', wholesalers would be competing to supply utilities?

Should there be a cap on wholesale electricity prices based on cost-plus pricing or should there be a vibrant and robust market for wholesale power?

Should stranded costs be passed on to consumers or should they be borne by shareholders because they are the result of bad decisions by utilities, for example, with regard to choice of generation technology?

Should utilities be allowed to go bankrupt or should they be saved by re-regulating the system with a major state presence in electrical power?

Should the state concern itself with self-reliance in energy (and in the words of governor Davis 'take control over our energy destiny') or should it allow intra-country globalisation to take its course even at the risk of out-of-state profiteers.

Fundamental Considerations

There are also fundamental considerations. For instance, can the power sector (or for that matter, education, health, water, roads, communication, transport, and all other infrastructural services) be left completely to the market along with a total withdrawal of the state? Markets (with vibrant competition) foster efficiency but they also have limits. In general, with their preoccupation with the bottom line (of balance sheets), they have grave shortcomings. They do not safeguard equity and distributional justice. They are not bothered about the environment (unless environmental externalities are internalised). They are unconcerned about the strengthening of self-reliance and the empowerment of people and their communities. And they pay no heed to the long-term, particularly research and development. In short, markets do not protect *public benefits*.

In the case of the power sector, however much market-driven efficiency may lead to profit maximisation at the level of utilities, the balanced development of the whole sector is likely to be neglected. A profit-oriented electricity body would focus on servicing profit-yielding customers. It would have no incentive to connect and serve un-connected consumers unless the resulting revenues justified the additional investment. The protection of the environment through an emphasis on end-use efficient devices and renewable sources would also be sidelined. The empowerment of consumers would receive little emphasis. And long-term R and D would get scant attention.

It is because of these limitations of the market and the virtual certainty of public benefits being neglected that regulation of the market becomes imperative. Thus, marketisation and regulation are two sides of the coin of restructuring. If there is marketisation without regulation, public benefits would be under-emphasised and perhaps even jettisoned. Already evidence is pouring in from 'successfully' reformed utilities in developing and industrialised countries that equity programmes, end-use efficiency measures, renewable sources and energy research and development are shrinking.⁴

Quite apart from these general considerations, it must be noted that electricity has several unique characteristics that distinguish it from other commodities such as oil or natural gas and make marketisation of electricity a different proposition.

(1) For all practical purposes, electricity 'cannot' be stored economically except to a limited extent through pumped storage and compressed air storage. (2) Hence, continuous supply-demand matching is required. If supply falls short of demand, the frequency falls below the value for which generating and utilisation equipment is designed. And, if supply exceeds demand, frequency rises above the frequency that is healthy for generating and utilisation equipment. (3) Demand varies hourly, daily and seasonally with the peaks in demand being well above the 'average' demand. (4) Electricity has become so essential that demand is relatively price-inelastic. (5) Electricity is very easy to control in the sense that a supplier can easily turn the supply on or off.

An integrated system of generation-transmission-distribution can handle the above unique characteristics of electricity for example by load dispatch centres that keep the supply and demand in balance. Unbundling of the system into separate generation, transmission and distribution entities raises the problem of the integrated operation of the whole system. If all the units resulting from unbundling are driven by profit maximisation (all players pursuing their self-interest), there must be an authority that will coordinate their operation for supply-demand matching. The absence of such an authority aggravates the problem of grid discipline and management. In principle, however, it is possible for an unbundled system to establish the agencies and the regulatory practices to tackle the problem of the integrated operation of the whole system. But, the challenge requires special attention.

In the past, electricity generation also displayed strong economies of scale of generation (~ 1,000 MW plants) and of regional/national transmission grids (stretching hundreds and thousands of kilometres). An alternative approach is to emphasise decentralised and distributed generation and localised distribution. Indeed this was the norm in the early days of electrical systems but gradually the grid started hooking together the local systems because large-scale generation coupled to extensive grids became more cost-effective. However, new technologies of distributed generation (for example, through micro-turbines of ~ 1 MW) are becoming increasingly viable. Today it can be argued that electricity is no more a natural monopoly, as it was in the past.

Assuming that the classical vertically integrated electricity monopolies are inefficient and pass on the associated costs (of inefficiency) to their customers, and also assuming that competition is the key to efficiency, there should be an emphasis on introducing competition into the system. This thrust has inspired reform of the electricity sector. But, it has invariably, but not always, been coupled to privatisation with the faith that efficiency requires privatisation. The experience, however, is not uniform. Norway which is reputed to have one of the most efficient electricity systems, has introduced competition in generation whilst overwhelmingly retaining public ownership, i e, it has competition without privatisation. The question therefore is: what should be the objective function – privatisation or competition? and if competition is the objective, it must be accepted that privatisation is not essential. Privatisation is a separate agenda. But, is economic efficiency the sole criterion in power sector reform? or must one go beyond that to achieve public benefits such as equity/access, self-reliance,

environmental soundness and the long-term through R and D. If so, sustainability should be the real objective in power sector reform.

Lessons of Californian Energy Crisis for India

Before identifying what lessons the Californian energy crisis has for India, it is important to start with a brief analysis of the power sector in India. In particular, following the American adage: "If it ain't broke, don't fix it!", it is vital to decide whether the power sector in India is broke and whether it can be fixed. There are three responses to this question: (1) "it ain't broke and it does not need to be fixed", (2) "it is broke but it is fixable and therefore it should be fixed" and (3) "it is broke but it is unfixable and therefore it should be scrapped and replaced". The diehard command-and-control votary articulates the first response insisting that all is well with the vertically integrated electricity boards and nothing needs to be done. However, the consumers, the state and the balance sheets, have a different story.

From a detailed diagnostic case study of Karnataka's power sector⁵, the International Energy Initiative came to the conclusion that its power sector is 'broke but fixable' and that it should be fixed. IEI's bottom-up cure for the sickness of Karnataka's Electricity Board includes, apart from internal generation of revenues by eliminating theft of power, institutional changes consisting of liberation from direct government management control through corporatisation, and the establishment of an Electricity Regulatory Commission. Further, as long as there is no net subsidy to the power sector, subsidies to particular consumer categories and cross-subsidies depend upon whether they are politically necessary and acceptable.

There is only partial overlap between IEI's bottom-up cure for the sickness of SEBs and the World Bank's top-down reform process. The World Bank's cure goes beyond corporatisation and the establishment of an Electricity Regulatory Commission. In addition, the WB also insists on unbundling of the vertically integrated system into separate generation, transmission and distribution entities, and removal of all subsidies and cross-subsidies. Further, the WB is insistent on privatisation of generation, transmission and distribution. Thus, the WB approach is based on the view that the power sector "is broke and unfixable and therefore it should be scrapped and replaced". The WB acolyte wants a complete dismantling of the old system and its replacement with a totally unbundled privatised the generation-transmission- distribution system.

Whereas the IEI approach is much more cautious and incremental, the WB cure involves major surgery with little record of proven success to justify the recommendation. Despite this, the WB approach is being forced on the various states of India. The objections and opposition are being steam-rolled and brushed aside with the leverage of conditionalities imposed by lending agencies. In this context, it should be noted that the California 'deregulation' bears strong similarity to the WB approach particularly with regard to unbundling the electricity sector and privatising its components. Hence, it is important to draw crucial lessons from the California energy crisis to safeguard the Indian power sector.

Lesson # 1: It is not enough to point to specific shortcomings of the regulated electricity system, and therefore assume that a market-driven system will be ipso facto more successful and advantageous to society. The establishment of a market-driven system is associated with transaction costs and gestation times. Hence, a careful comparison of the costs and benefits of the old regulated system and the new deregulated system is essential before dismantling the old and ushering in the new.

Lesson # 2: If it is decided to replace a cost-plus price regime with market-driven prices, then it must be realised that a market alone is not sufficient. It must be demonstrated (not merely argued!) that the market does not permit the exercise of market power, price gouging and gaming. In addition, the extent of competition must be monitored and it must be shown that there is indeed effective competition..

Lesson # 3: The case for unbundling the power sector must not be made merely on economic grounds (such as separate profit centres, etc); the restructuring must also be justified convincing on technical grounds. Thus, apart from economists and bureaucrats, power system engineers must also be involved. In particular, a technically stable and institutionally sustainable integrated operation of supply-demand matching must be ensured before unbundling is implemented and the vertically integrated system is dismantled into separate generation, transmission and distribution entities. There must be a clear understanding of which agency will command the supply-demand fine-tuning and whether its writ runs over the generators, transmission grid and the consumers. And the sensitivity of the process to electricity shortages and surpluses must be clarified. The quantitative indicators of the success of supply-demand matching are (1) the frequency of the system, (2) the voltage supplied to consumers and (3) the continuity of the supply, and all these must be within specifications.

Lesson # 4: Whereas a vertically integrated system has to cope with sudden peaks in demand with reserve (capacity) margins of 15-20 per cent, an unbundled system involving a large number of wholesale generators may have no incentive to maintain such reserves. In fact, when reserves fall below to precarious levels, profitable price increases may be facilitated. So, the policy, technical and institutional measures to ensure safe reserve margins are extremely important.

Lesson # 5: The affordability of retail electricity prices to consumers is a necessary condition for the success of restructuring, but it is not a sufficient condition. Whether the consumer prices are frozen or not, if wholesale electricity prices rise above the retail prices, and the difference is borne by the utilities, then the utilities go increasingly into debt – a process that is not financially sustainable. Hence, the impact of restructuring on prices must be anticipated before rushing into restructuring particularly unbundling and privatisation. In fact, the success of restructuring must be judged by the behaviour of wholesale and retail electricity prices. If there are any doubts about the reliability of the forecasting of prices, it is advisable to test the assumptions underlying restructuring in experimental areas.

Lesson # 6: Notwithstanding any general considerations and expressions of faith regarding the wisdom of leaving the development of the infrastructure to the market, the unique character of electricity is such that a strong role for the state and for regulation is essential. The market alone cannot take care of the integrated functioning of the electricity system, and therefore the requisite regulatory arrangements must be in place. For example, it is important to have mechanisms in place to ensure that there are adequate reserve margins to cope with sudden peaks of demand and shortfalls of supply. These mechanisms may well involve supplementary markets for capacity for instance. In case the process derails – as happened in California – there must be emergency procedures for the state to come to the rescue.

Lesson # 7: The behaviour of the actors involved in the electricity system is radically different under conditions of supply shortages compared to that under conditions of surpluses. Further, it appears that the experience of restructuring has come by and large from countries and systems with surplus capacity. Thus, deregulation under conditions of shortage is not the proven success that is being touted; it is very much an unproven experiment with California yielding the first disastrous results.

Lesson # 8: Compared to increasing capacity by building new power plants, energy conservation measures provide the quickest way out of the crisis.

Lesson # 9: It is unwise to go ahead with restructuring/reform without specifying the criteria by which the success/failure of the restructuring/reform process will be judged.

Lesson # 10: Notwithstanding all the hype about the economic efficiency of globalisation, there are major advantages of state electricity systems being self-reliant in the sense of not allowing control to be assumed by forces external to the state. This means that dependence on external power must be a strategy of the last resort.

Quite apart from these basic lessons that the California energy crisis has thrown up for power sector reform in India and other developing countries, there are interesting comparisons between the short-term measures being pursued in California and the difficult predicament faced by Maharashtra state and the central government over the horrendous bills from the Enron power project in Dabhol. But, these comparisons are reserved for a separate treatment.

Postscript

The February 20, 2001 (first) draft of this paper received a number of useful comments that were taken into account in finalising the paper on March 28, 2001. Just after that, the author received an emailed version of the March 2001 paper 'The California Experience with Power Sector Reforms' by John E Besant-Jones and Bernard Tenenbaum from the Energy and Water Department, Private Sector Development and Infrastructure of the World Bank. Since the Besant-Jones-Tenenbaum (BJT) paper deals with the same topic and also draws lessons for power sector reform for developing countries, it is useful to make some comparisons with the present paper.

Whereas the present paper is based virtually entirely on internet sources in general, and reports of the Los Angeles Times and the New York Times newspapers in particular, the BJT paper has more diverse and academic sources. Despite this difference in sources, there is considerable similarity in the papers – the facts characterising the California energy crisis are identical and almost the same list of causal factors are cited. Perhaps, one difference is that the BJT paper attributes a greater role to the rise in natural gas prices, whereas the present paper tends to view gas prices as not having a dominant explanatory role in the rise of wholesale electricity prices.

What is surprising is the similarity in some of the lessons for developing countries that have been drawn by the two papers. Whereas the BJT paper has given a far more elaborate treatment of what can go wrong with regard to wholesale competition and retail competition, the general validity of Murphy's Law – if something can go wrong, it will go wrong! – is implicitly upheld in both the papers. Unfortunately, the BJT checklist of what to ensure before embarking on reform has come with 20-20 hindsight after the California crisis, and not before the reform was undertaken. Foremost among the dangers are the possibility of market power undermining the effectiveness of the market. Also, competition requires adequate installed capacity and the short-term market does not encourage investment in new capacity and the maintenance of adequate reserve margins. The BJT paper lists the large number of conditions that must be satisfied for success and underlines the importance of insurance against market flaws. Its crucial recommendation is a guarded experimental approach involving testing proposed structures. The problem with the big-bang approach to reform tried in California – to quote the BJT paper – is that it “is open to the risks of unexpected market conditions, as well as the unexpected ability of players to ‘game’ the market. A structured transition strategy is needed that is planning for steps that might be taken if crucial assumption, such as continuation of surplus power capacity and low natural gas prices, proved to be wrong.” All this is in tune with this paper's approach to restructuring/reform that it is better to make small reversible mistakes than large irreversible mistakes based on theory and ideology.

It is unfortunate that the BJT paper has not provided checklists to insure against failures with regard to the basic reforms of unbundling and privatisation being advocated for India. It has, however, stressed the importance of the system operator and the vital function of supply-demand balancing.

There is however a fundamental difference in the attitude to reform/restructuring supported by this paper and that revealed in the BJT paper. This paper would like a detailed diagnosis of the problems of the power sector to pinpoint the essential elements of reform/restructuring leaving measures such as unbundling and privatisation – that have more ideological than empirical justification – to be approached cautiously and incrementally, if at all. The BJT paper maintains its faith in reform/restructuring which it believes is as a must that will succeed if there is sufficient caution, testing and insurance against design errors.

Notes

[The learning that went into the preparation of this paper was based on a daily perusal of the reports on the California Energy Crisis in the Los Angeles Times and the New York Times via their web sites. The author is moved to acknowledge the contributions of all those who have made the Internet possible because without the Internet, this study by a non-Californian residing in India would not have been possible. In addition, thanks are due to the staff reporters, correspondents and columnists who wrote the various reports of these papers. Special thanks are also due to Anton Eberhard, Jose Goldemberg, J Mohan Rao, Otavio Mielnik, C Rammanohar Reddy and Robert Williams for their prompt and insightful comments on the February 20, 2001, first draft of this paper.]

1 PG & E's Diablo Canyon Plant ended up costing \$ 5.8 billion compared to the 1965 estimate of \$ 400 million and the Onofre plant, \$ 4.3 billion compared to the budget of \$ 1.3 billion.

2 The high prices for alternative power originated from overestimates of the future prices of oil and natural gas.

3 The underlying expectation was that the pre-'deregulation' trend of falling wholesale prices would continue and therefore the utilities would realise greater and greater profits from retail prices being increasingly higher than wholesale prices and recoup their stranded investments by 2002.

4 In California, 'deregulation' has not resulted in disincentives for R and D relevant to the electricity system. Although such R and D activity has indeed declined sharply at the big utilities, public interest energy R and D is being carried out with funding from the System Benefits Fund (SBF) created under 'deregulation' with revenues from a non-bypassable wires charge on all generators. A SBF appropriately crafted and managed, can be used to support a wide range of public benefit activities – and in fact the California SBF does support many such activities. California is one of the few places around the world where public benefits protection was provided for as a key provision of electric sector restructuring legislation.

5 Reddy, A K N and D Gladys Sumithra, 1997, 'Karnataka's Power Sector – Some Revelations', Economic and Political Weekly, Vol XXXII No 12, pages 585-600, March 22-28.

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