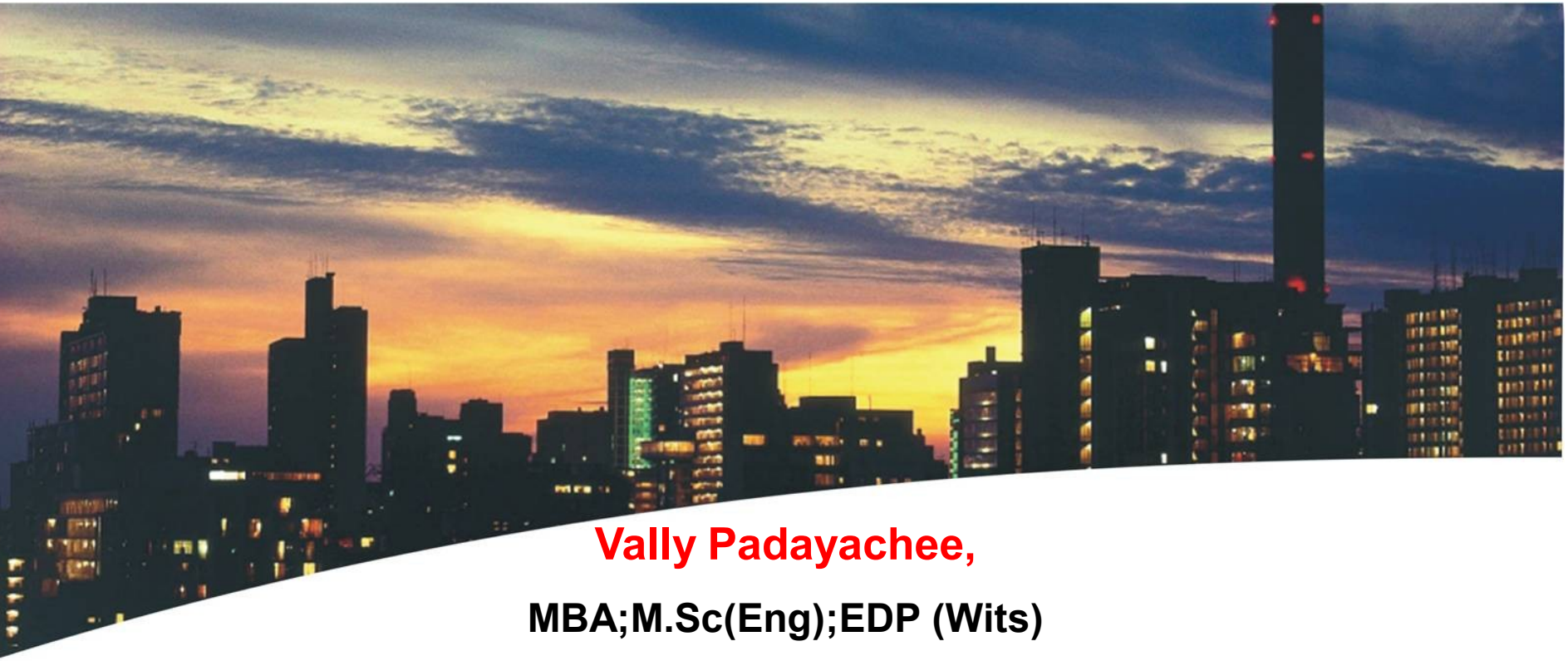
The challenges in implementing power rationing in a sensible manner – an international perspective



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Introduction

- Dealing with energy shortages has become a reality in developed and developing countries.
- The balance between supply and demand can be threatened by a variety of reasons, from droughts that lower the water levels in reservoirs that hydro generators depend upon to financial disasters that curtail utilities from purchasing sufficient power to provide to their customers.
- The impact of curtailed services goes beyond the immediate inconvenience of a lack of electricity. Power crises affect the economic and social fabric of a community, region ,or nation
- Access to reliable power is an essential ingredient to foster economic growth and reduce poverty. However, mere access does not guarantee sustainable development.
- Problems with inadequate and insecure supply of electric power have increasingly affected both developed and developing countries.
- Unreliable power disrupts production, damages equipment, causes personal discomfort, increases the cost of doing business, deteriorates the investment climate, and, in the medium term, hurts job creation and economic development.

Types of shortages and responses

- An energy shortage is one in which the power system can supply the instantaneous demand at any given moment, but cannot supply energy on a continuous, long-term basis, as was the case in Brazil in 2001–2002, when lack of water in reservoirs led to a shortage in hydroelectric power;

- A capacity shortage is one in which the system is physically unable to supply part of the peak demand, but can still supply energy needs during off-peak hours, such as happened in California in 2000–2001;

- A combination energy-and-capacity shortage, as the name implies, involves both problems, as occurred in Chile during its worst period in 1998–1999 and now in South Africa (2008 -)

Some select international case studies

Country or region	Period	Geog scope	Major causes	How govt dealt with crisis
(1) Brazil	2001-2002	Nationwide except in southern region	Drought & delays in the expansion of thermal generation	Quotas with price signals – no brown-outs or black-outs
(2)China	2003 until today	Two thirds of country	High demand growth, but capacity not growing at the same pace	Forced curtailment, black-outs & some DSM
(3) California	2002-2002	State and West Region	Shortage of capacity, drought in NE USA and defective mkt rules	Interruptible contracts, some rolling black-outs, & demand responses in the end
(4) Dominican Republic	2002 until today	Country wide	Financially unstainable sector and no resources to buy fuel – "financial black-outs" despite abundant capacity	Haphazard black-outs for several hrs, more intense in poor neighborhoods
(5) Japan	2003	Tokyo concession area	Forced stoppage of several nukes for security reasons	Strong campaign & massive DSM efforts – no black-outs
(6) Chile	1998-1998	National interconnected system	Drought & over depletion of hydro reservoirs	Brown-outs & black-outs

[1] The Brazilian crisis

- The Brazilian power system experienced its major supply crisis in 2001 and 2002.
- As a result, the country was forced to implement an aggressive energy rationing plan from June 2001 through February 2002.
- Rationing encompassed the most important areas in the country, corresponding to about 80 percent of its population, GDP, and electricity consumption.
- Twenty two out of the 27 states of the Federation were subject to some degree of rationing.
- Aggregate consumption was reduced by almost 20 percent from the previous year's levels, and, more importantly, the system was able to overcome this long period without blackouts and brownouts
- Brazil was also experiencing relatively very high inflation rates at the time of the power crisis in 2001.
- The latter inter alia resulted in consumers purchasing and stocking huge quantities of perishable goods e.g meat, vegetables . This in turn resulted in such consumers buying more than one refrigerator (sometimes three per household).

[2] The Chinese crisis

- In recent years, China's energy usage, both industrial and residential, has increased greatly. The government has had to deal with shortages in most parts of the country
- China faced a serious power crisis in 2003, which became more acute and widespread in 2004. The capacity shortage in 2004 was estimated to be from 20 000 to 30 000MW. The real extent of the shortage varies depending upon seasonal and climatic conditions, such as temperature and rainfall.
- As in most power crises, the electric sector in China has faced both supply and demand shocks. On the supply side, several factors have contributed to a large reduction in the available energy capacity.
- Perhaps most important is the fact that energy planners underestimated electricity consumption in China, partly influenced by the slow electricity growth after the 1998–2000 Asian financial crisis.
- Planning authorities and utilities had deliberately revised their forecasts and reduced their expansion plans under the assumption that slower economic growth was a long-term trend across the entire region.
- It was even thought that supply would outstrip demand. This misperception led to the postponement and delay of some important power projects.

[3] The Californian crisis

- The California electricity crisis is a story about what happens when price controls are imposed on scarce goods
- The "California crisis" had in fact two main components. The first was the power shortage per se, which led to rolling blackouts in some parts of the state. The second was the financial crisis that profoundly affected the incumbent distribution companies, some of which ended up filing for bankruptcy as a result.
- The energy crisis in California lasted for about seven months, from November 2000 until May 2001. It has been widely publicized and documented.
- No other crisis in the power sector worldwide has received so much press coverage and political attention, even when compared to the Chernobyl and the Three Mile Island nuclear accidents combined.
- Interestingly enough, the California crisis resulted in 6 days of power curtailment for firm customers, amounting to less than 4 percent of the state's peak demand, for a few hours during those critical periods.
- If curtailment of interruptible customers is included, the number of days of load-curtailed increases to 38.

[4] The Dominican Republic crisis

- Historically, power cuts have been a constant problem in the Dominican Republic, in recent years due to financial, rather than energy or capacity, constraints.
- Power cuts persisted for many years during the 1980s, due to insufficient generation capacity. The power system was chronically constrained and widespread blackouts, lasting up to 20 hours per day, were considered "business as usual." With the power sector reform in the 1990s, significant additional generation capacity was built by the private sector in a matter of a few years.
- However, the country has been experiencing supply restrictions due to generators' financial difficulties to produce energy.
- Generators have not collected sufficient revenues for the energy sold to distribution companies. Sometimes distribution companies do not pay a sufficient amount to cover variable costs of production.
- Under those circumstances, some power plants have been forced to stop producing, potentially leading to involuntary power rationing.
- All those things combined contributed to create, over the last few years, another kind of power shortage, the so-called "financial blackout."

[5] The Japanese crisis

- The crisis in Japan was caused by a very unique supply shock resulting from a sudden loss of generation capacity, provoked by operational security issues
- The Tokyo Electric Power Company (TEPCO) is the largest utility in Japan and provides one-third of the electricity in the entire country. It serves 27 million customers with annual sales of about 280 TWh. Its peak load may reach 64 GW in summer months.
- In April 2003 TEPCO stopped operation of all of its 17 nuclear power plants for safety analysis. Nuclear plants represented more than 17 GW, or 29 percent of TEPCO's generating capacity
- The Japanese experience is an interesting case study regarding the effect of ongoing emphasis on efficiency and demand side responses for the continued reliability and affordability of the power system
- The 2003 energy crisis in Japan was resolved without blackouts or other rationing measures. High consumer awareness about the need to conserve energy, combined with already existing high energy-efficiency standards for appliances, helped avert a more serious crisis
- The required response was achieved, and the country was able to overcome a sudden and massive reduction in generation capacity without the need to resort to blackouts

[6] The Chilean crisis

- Chile was one of the first countries in the world to privatize and deregulate its power sector.
- Chile has been extremely dependent on hydro power over the last decades. Only recently, it has had access to Argentine gas, after the private sector built a pipeline crossing the Andes.
- Chile has experienced several power crises in recent years. The most important one took place from November 1998 until June 1999. In that eight-month period there was a restriction of about 450 GWh, for a total annual consumption of 25 000 GWh.
- Besides the mandatory and government-supported reduction in voltage, there was almost no attempt to utilise demand response to manage the crisis. Rolling blackouts had to be implemented according to pre-specified rules, but the use of price signals to trigger demand reduction was virtually absent.
- City Power, Eskom & EPRI are currently participating in a voltage reduction pilot project with a view to reducing energy consumption

OVERALL LESSONS LEARNED (1)

- **Load shedding and power rationing does have a negative affect on the economy – Brazil is only now (2008) beginning to recover economically from its 2001 power crisis.**

- **Blackouts are the worst way to deal with electricity shortages and should be considered the last resort, when everything else has been [honestly] tried and failed;**

- **Price signals can entertain demand response and help bridge the supply gap. Even if price elasticity is modest, high price increases entertain sufficient demand response;**

OVERALL LESSONS LEARNED (2)

- **A good rationing program should be tailored to the specifics of each power system. The case of Brazil, mentioned in this report as an international best practice, may be greatly simplified and adjusted to the specifics of smaller power systems. Sensible schemes may be simple, yet effective;**

- **Capacity and energy shortages affect power system reliability in different ways, but similar concepts may be applied, particularly if technology is available. Price signals should be given that consider the reality of each system, the available technology and the existence of reasonable commercial practices. The nature and intensity may vary, but there will always be some way to entertain demand response via price and quantity rationing**

RECOMMENDATIONS (1)

1. Plan in advance, long before rationing is necessary and also as a way to avoid it. Planning for a crisis is not politically incorrect. It merely acknowledges that systems fail, particularly if heavily dependent on hydro resources;

2. Have good early warning signals before the situation gets out of control. Starting and ending rationing is the most difficult decision to be made in the power sector; the political process and most governance mechanisms are ineffective to make the right decision at the right time. Some objective criteria should be put in place to help society before the situation gets out of control;

3. Foster the rational use of energy on a permanent basis to avoid crises. Expose customers to price signals, both in times of abundance and scarcity. Provide tariff hedges, but do not completely isolate the retail market from the reality of the wholesale market

RECOMMENDATIONS (2)

4. When an energy crisis does occur, put someone in control with across-the-board authority. Crises are multi-faceted and require fast decisions. They need expedited processes and someone to make the entire bureaucratic machine work;

5. Protect the poor from the consequences of rationing. Price increases may hurt the poor unless there are safety nets. Those nets should be designed in such a way to engage the poor in the overall conservation effort. The poor who save should be financially rewarded;

6. Do not socialize losses and gains. A market-based rationing scheme heavily relies on incentives and penalties. By definition, those who save should win and those who waste should lose. The political temptation to socialize gains and losses by virtue of a crisis defeats the purpose of price signals;

7. Finally, honor contracts—always. Crises should not be an excuse for not honoring contracts or for evoking *force majeure*. It is essential to preserve the contractual arrangements that encourage people to save and penalize those who do not.

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Thank You