ISAS Insights

No. 177 – 7 August 2012

469A Bukit Timah Road
#07-01, Tower Block, Singapore 259770
Tel: 6516 6179 / 6516 4239
Fax: 6776 7505 / 6314 5447
Email: isassec@nus.edu.sg
Website: www.isas.nus.edu.sg

A Worrisome Blackout in India

S Narayan[1]

On 30 and 31 July 2012, India was hit by a massive power outage that affected three major electricity grids covering the north, east and north-eastern regions. The outage affected over 700 million people. This was arguably the most serious power outage incident in the country in over 50 years. The southern grid, which covers transmission to Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Puducherry (formerly, Pondicherry), escaped the brunt of this blackout, as it is isolated from the north, east, north-eastern and western grids.

India is divided into five electrical regions, namely northern, eastern, western, north-eastern and southern, each with a regional load despatch centre to sustain grid frequency. Over the years, all regions except the southern region have achieved interconnectivity through grid synchronisation, which resulted in the formation of the NEW grid, and a National Load Despatch Centre in Delhi. Southern region is not yet connected to this, and has its own grid network. Thus there are five regional load despatch centres (LDCs), with four of them being interconnected to the National Grid. The regional LDCs function under a subsidiary of Power Grid Corporation of India, a public sector utility vested with the responsibility of managing the national grid. The LDCs are autonomous bodies that have the right to cut off supplies to a state grid after warnings, if the state continues to draw more than its entitlement.

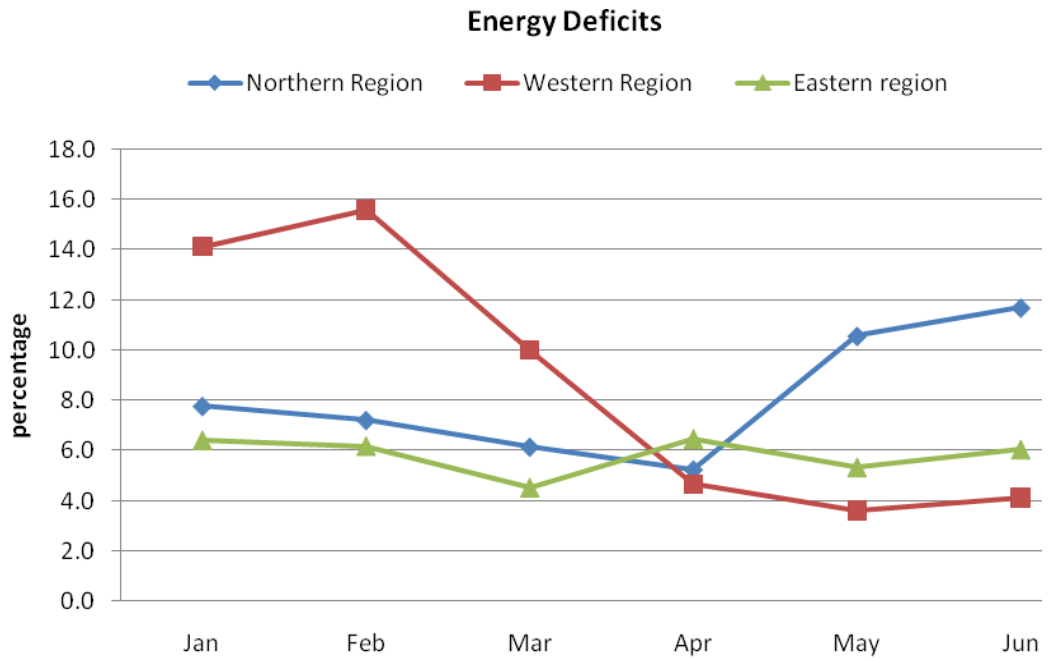
---

[1] Dr S Narayan is Head of Research and Visiting Senior Research Fellow at the Institute of South Asian Studies (ISAS), an autonomous research institute at the National University of Singapore. He was the Economic Adviser to India's former Prime Minister A B Vajpayee. He can be contacted at snarayan43@gmail.com. The views expressed in this paper are those of the author and do not necessarily reflect those of ISAS.

The grid frequency is supposed to be 50 hertz at all times but typically ranges between 49 and 50. When demand overshoots supply, the frequency can drop, causing stress on the grid. Demand beyond a limit will result in the interconnections collapsing and the generating stations shutting off automatically as a result. There are relays and circuit breakers that are supposed to cut off demand when the grid is overloaded, but they obviously did not work on those two days — whether accidentally or deliberately will have to be established only after an inquiry.

There is power scarcity in the country, and the demand-supply gap worsens during the summer. Northern region is a deficit region, and draws heavily from western and eastern regions.

Deficits (MU)	28-Jul-12	29-Jul-12	30-Jul-12	31-Jul-12	01-Aug-12	02-Aug-12	03-Aug-12
Punjab	38.15	15.05	0.00	55.52	39.72	38.14	38.40
Haryana	11.50	3.98	1.54	12.93	24.62	36.18	24.29
Rajasthan	1.72	0.00	2.07	1.54	3.69	0.01	0.00
Uttar Pradesh	40.55	39.59	35.56	28.60	66.27	54.21	49.33

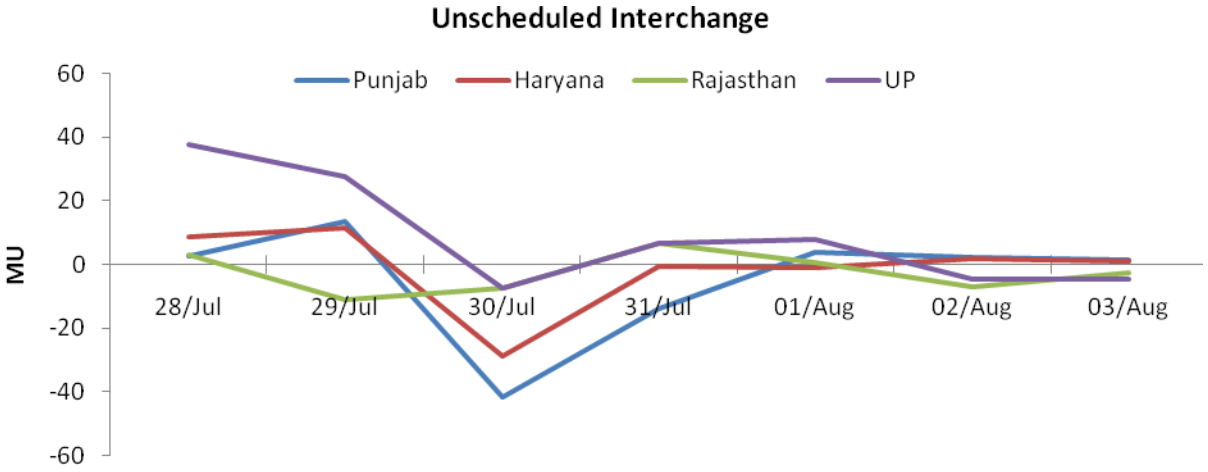


Source: Central Electricity Authority Monthly Reports

It is reported that the heavy overdrawing of power from the transmission line between the western and northern regions resulted in the generating stations in this region breaking down, which increased the load on the other generating stations, which then began to break down one after the other.

The obvious cause was overdrawing by one or more states that are part of the grid, perhaps among Uttar Pradesh, Rajasthan, Haryana and Punjab. It may be seen that prior to 30 July 2012, there was a heavy overdrawing, resulting in the outage. This was followed by better grid discipline.

The total addition to generation capacity has been only around 50 per cent of the targets in the 8th, 9th and 10th five-year Plan periods. The performance during the Eleventh Plan (2007-2012) has only been marginally better. The reasons include non-availability of coal, the poor financial conditions of the state electricity utilities, project delays due to delays in environmental clearances and lack of gas for approved power stations.[2]



Source: Northern Region Load Dispatch Centre

Northern Region- Energy Scenario (MU)			
	Requirement	Availability	Deficit %
Jan-12	22,799	21,155	7.8
Feb-12	22,090	20,604	7.2
Mar-12	22,759	21,441	6.1
Apr-12	21,149	20,096	5.2
May-12	26,138	23,639	10.6
Jun-12	29,003	25,965	11.7

Western Region- Energy Scenario (MU)			
	Requirement	Availability	Deficit %
Jan-12	26,454	23,180	14.1
Feb-12	24,286	21,010	15.6
Mar-12	24,921	22,656	10.0
Apr-12	24,075	23,006	4.6
May-12	25,069	24,198	3.6
Jun-12	23,098	22,181	4.1

Eastern Region- Energy Scenario (MU)			
	Requirement	Availability	Deficit %
Jan-12	8,183	7,690	6.4
Feb-12	8,142	7,668	6.2
Mar-12	9,206	8,806	4.5
Apr-12	9,019	8,471	6.5
May-12	9,540	9,056	5.3
Jun-12	9,595	9,048	6.0

[2] The reasons will require a separate and detailed analysis.

However, chronic shortages have been managed hitherto by resorting to graduated power cuts that would help manage the demand-supply imbalance. However, the latest blackout has no precedent. The Central Electricity Regulatory Commission has commenced an investigation into the reasons for the collapse, which would look at the grid frequencies prevailing prior to the collapse, the voltages at inter-state points, and examine the recorders at the LDCs. The report is expected in about a week.

Meanwhile, several hypotheses are being advanced. First, there was heavy overdrawing from Uttar Pradesh. This has been happening for some time now, but went out of hand during this period. The failure of the monsoons has caused the farmers to try desperately to save the crops by pumping out water from wells and reservoirs, and some reports suggest that the agricultural load rose by 20 per cent in the week prior to the latest blackout. This overdrawing was concentrated in sugarcane- and wheat-growing areas. And, since farmers, by and large, act in concert, the sudden surge in demand from this sector resulted in a heavy overdrawing. A second argument is that while states have the option to purchase power from private producers, they are reluctant to do so since upfront payments for such power-purchase is required. State utilities are notoriously in the red, and are unable to make this payment. Overdrawing from the national grid provides some cushion in this regard, because the national grid prices are usually lower than those for privately produced power. In the race to be the first to draw the most, the four northern states caused the collapse. Third, it is pointed out that non-adherence to grid discipline of reducing the demand as frequency falls below 49.5 hertz, was not followed by these states.

It is argued that the new Government in Uttar Pradesh did not want to annoy its rural electorate and the farmers by resorting to large-scale blackouts, or regulated power cuts. It is interesting to note that, faced with an identical situation, the newly elected Tamil Nadu Government last year decided to bite the bullet and imposed severe power cuts across regions and industries while simultaneously attempting to address issues of fresh capacity. It has been a very unpopular move, and is certainly likely to affect the future of the ruling party, but it was a very sound and strong decision, transparently implemented. Evidently the UP Government did not have the stomach for such a move. There is also the allegation that these northern states do not adhere to the grid discipline. These arguments are perhaps only part of the truth. R Ramachandran[3] argues that data obtained from NTPC station on 30 July 2012 shows that the grid conditions and frequency conditions were stable till the grids collapsed. He also points out that it was a rainy night, and that it would be extremely unlikely that farmers would draw power on a rainy night (of course, the rains may have been localised). Ramachandran puts the blame squarely on the poor management of the LDCs: at the time of the outage, there is evidence of a power overflow in some circuits rather than overdrawing. In the case of overflow, the LDCs are expected to make

[3] The Hindu, August 3, 2012

parallel lines available to handle the increased flow. As per this argument, LDC mismanagement was the cause of the outage, not the overdrawing. It is also argued that in the case of any overdrawing, the sophisticated systems available would have automatically shut down the excess load lines, unless this was not done deliberately.

Finally, suspicion that this was a deliberate act cannot be totally ruled out without a proper inquiry. The LDCs have been identified as a vulnerable and weak link in the system, and now steps would have to be taken to make them fail-safe and disaster-proof.

Most interestingly, the damage did not affect the southern grid. It is common knowledge that grid discipline is much better in the southern states, and the generators and transmitters here are in regular touch with each other. The southern states have also the capacity to 'island' or isolate parts of the grid in the event of generation failures, so that the damage does not spread. It is clear that, even though the southern states may have identical problems of demand-supply gaps and financial stress, the governance and administration of these institutions is still quite sound.

. . . . .