

Electricity blackouts in South Africa: proximate and ultimate causes & recommendations for the future

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Electricity blackouts on 18/01/07 reveal inadequate supply security

- **Rolling load-shedding around country**
- **About 50 GWh of electricity was not supplied**
- **Cost (@R75,000 / MWh) was R3.75 billion**



Proximate causes

- Power shortfall of about 2800MW
- Nearly 4934 MW was out on planned maintenance
- Further unplanned outages of 4904 MW due to problems with 13 units (mainly boiler tube leaks)
- Peak demand about 1000MW higher than forecast

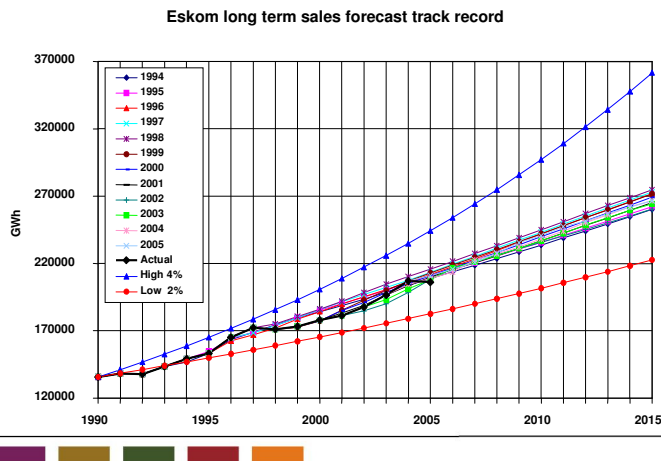


Despite declaring Emergency Level 1, full use of imports and emergency reserves available from gas turbines, pumped storage capacity, hydro-electric plant, dynamic market participation and power interrupt contracts, there was not enough power available



Ultimate causes of supply failures: popular reason (not true!) 1

Some have argued that electricity demand growth is higher than expected – because of high economic growth



BUT - Eskom and regulator forecasting has been remarkably accurate

Ultimate causes of supply failures: popular reason (not true!) 2

Some have argued that the regulator prevented Eskom from investing, by :

- (1) refusing license applications, or*
- (2) disallowing proposed capital expenditure, or*
- (3) restricting revenue through approving too low prices*

Not true

- (1) There is no record (in previous years) of NER refusing or unreasonably delaying new licences
- (2) There is no record of NER completely disallowing new capital investment projects
- (3) While NER awarded lower than asked for price increases, Eskom's financial position continued to improve and it earned record profits

Obstruction by the regulator, or lack of finance, is not the reason for Eskom not investing earlier in more generation capacity



Ultimate causes of supply failures: real reasons (1)

Eskom was prevented by government from building new generation plant between 2001 and 2004

- 1998 White paper envisaged breaking up Eskom and introducing competition and private participation
- Cabinet memo in 2001 said “Eskom is not allowed to invest in new generation capacity in the domestic market”
- **But NO concrete steps put in place to facilitate private investment**

In October 2004, Minister Alec Erwin announces that Cabinet has authorised Eskom to build at least 70% of new generation. Took time to then create capacity and systems in Eskom for new build



Ultimate causes of supply failures: real reasons (2)

DME programme to procure private IPP generators is behind schedule

- Feb 2004 DME tendered for legal and technical advisors
- Originally envisaged that IPP bids would be due by April 2005 and contract would be awarded that year
- So - IPPs could have been in service in 2007!

- While 5 consortia have pre-qualified, the bid process has still not been finalised
- Eskom has contributed to delays though disagreements on PPA and fuel security
- If the final bidder is not selected soon, it is doubtful whether the first IPP will be operational in 2009.



Ultimate causes of supply failures: real reasons (3)

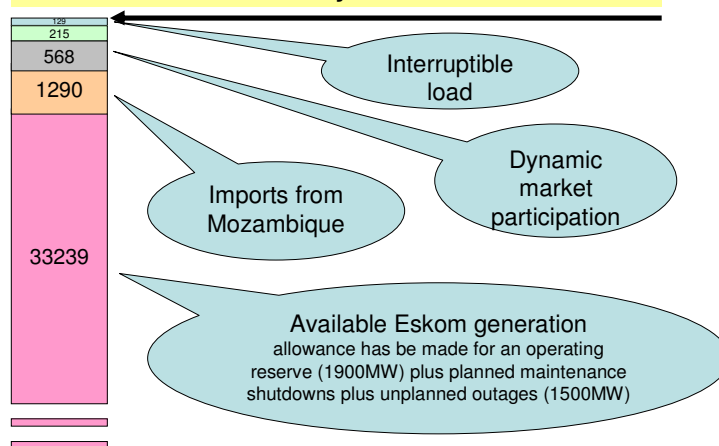
While there was a great deal of planning, some of the earlier assumptions were wrong

- Too high estimates for plant availability (ISEP9 assumed 89% versus more realistic 86%)
- Too high estimates for non-Eskom plant (ISEP9 assumed 2615MW versus less than 1400MW currently available)
- Interruptible contracts previously part of available capacity planning (now only for emergencies)
- Cost of unserved energy too low (R20,000 per MW versus R75,000 now assumed)
- 10% reserve margin – too low (should have been 15% or more)



Supply security now relies on imports and demand-side management

Maximum demand 25 May '06 35 441 MW



Electricity demand/supply remains extremely tight

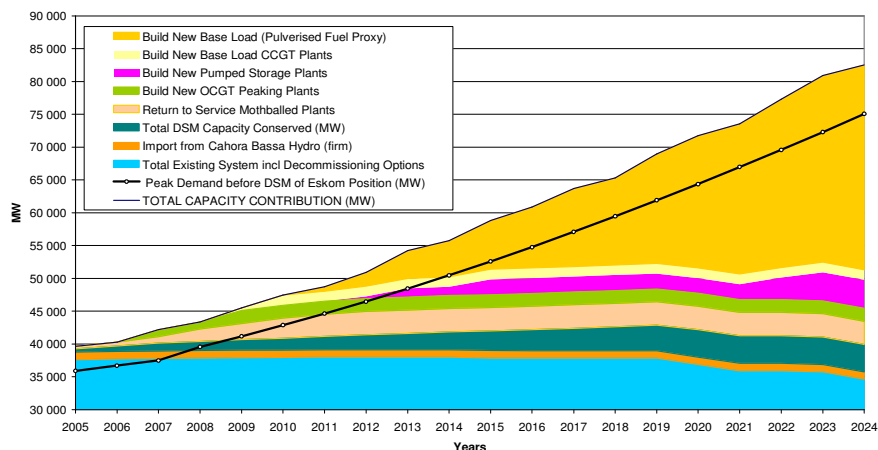
Start of Week	Week No.	Planning Phase				Actual Situation - Worst Day of the Week			Resources Used	Comments
		Forecast	Planned Supply	Reserves	Deficit	Actual Demand	Actual Supply	Deficit (exc. CA)		
15-May	20	34,033	33,728	1,900	-2,227	33,531	31,626	-1,895	Contracted DMP, B.L., I.L. & Emergency DMP	First time used this resource. Otherwise would have had some emergency load shedding. Used 2 times
22-May	21	34,539	34,610	1,900	-1,758	35,544	34,626	-1,012	Contracted DMP, B.L., I.L. & Emergency DMP	
29-May	22	34,443	34,663	1,900	-1,681	34,422	33,109	-1,313	Contracted DMP, B.L., Intermittible Load	Used I.L. 3 times in the week
05-Jun	23	34,961	35,422	1,900	-1,429	33,716	33,044	-672	Contracted DMP, B.L., Intermittible Load	
12-Jun	24	35,400	35,532	1,900	-1,818	33,040	33,326	286	Contracted DMP	
19-Jun	25	35,277	35,532	1,900	-1,645	33,626	33,515	-113	Contracted DMP, B.L.	
26-Jun	26	35,151	36,000	1,900	-661	34,769	33,942	-827	Contracted DMP, B.L., I.L.	Used DMP 4 times in the week and I.L. once
03-Jul	27	35,239	35,724	1,900	-1,444	33,713	34,696	983	Contracted DMP	
10-Jul	28	35,347	35,667	1,900	-1,581	33,843	34,229	386	Contracted DMP	
17-Jul	29	35,473	35,993	1,900	-991	33,311	35,071	1,760		
24-Jul	30	34,361	37,039	1,900	-768	33,757	35,222	1,433		
31-Jul	31	34,122	36,799	1,900	-777	34,708	35,038	300	Contracted DMP, B.L., Intermittible Load	I.L. for a Transmission Constraint in KZN System Peak of 3480MW
07-Aug	32	33,440	36,370	1,900	-1,033	33,916	35,276	2,357		
14-Aug	33	33,636	36,436	1,900	-1,003	34,470	34,477	69	Contracted DMP	Used DMP 3 times in the week
21-Aug	34	33,015	35,999	1,900	-684	33,510	33,753	243	Contracted DMP, B.L.	
28-Aug	35	32,722	35,604	1,900	-982	33,638	32,794	-844	Contracted DMP, B.L., Intermittible Load	Used I.L. once and DMP 3 times in the week
04-Sep	36	33,183	35,446	1,900	-663	32,776	33,549	774		
11-Sep	37	32,330	34,800	1,900	-600	31,794	32,700	906	Contracted DMP	1 to 2 Units put in lock reserve to pressure supply and reduce from available supply at peak. Used DMP 2 times in the week
18-Sep	38	32,229	34,628	1,900	-669	33,236	33,678	442	Contracted DMP, B.L.	Used DMP 4 times in the week
25-Sep	39	32,289	33,530	1,900	-619	31,940	33,137	1,197	Contracted DMP	Used DMP 2 times in the week

Review of actual versus forecast for May to Sept 2006 reveals there were sufficient reserves in only 4 of those weeks

Forward planning reveals tight supply/demand situation for next 5 years

Eskom's position plan

Capacity Outlook of Eskom Position (MW)



Eskom's capacity expansion plan (reserve margin still too low!)

YR	Mothballed			Coal-Fired				Base Load Proxy	Gas				Pumped Storage				DSM (Load Management)			Reserve margin on scenario assumptions	Unreserved Energy (GWh)	LOLR (Hours)	Total SO capacity (MW)
	Cam (PF)	Gr/bed (PF)	Kom (PF)	PF (1) (3X705 MW)	PF (2) (3X705 MW)	PF (3) (3X705 MW)	PF (4) (3X705 MW)		OCGT Aduants (Peaking)	OCGT Mossel Bay (Peaking)	OCGT WPP (Peaking)	OCGT "Congo" (6X384 MW (Mid-merit))	PS (A)	PS (B)	PS (C)	PS (D)	PS (E)	CLM, ILM, RLM					
2005	230																102	10%	534	551	39127		
2006	190																102	9%	1017	771	39422		
2007	300																102	10%	283	366	40963		
2008	570	376															102	10%	167	266	43040		
2009		376	202														102	11%	154	163	44657		
2010		376	202														102	11%	88	145	46599		
2011			333	705													102	11%	53	104	48545		
2012				705	705	638											102	12%	10	34	51136		
2013				705	1410	638											102	15%			54842		
2014						1272											102	13%		22	56114		
2015						1272											102	13%			58288		
2016							1272	1302									102	14%		10	60882		
2017								1302									102	14%		34	63546		
2018								1302									102	14%		25	66200		
2019								1302									102	14%			68864		
2020								1302									102	13%			70778		
2021								1302									1002	13%			73584		
2022								1302									1002	12%			76388		
2023								1302									1002	13%			79944		
2024								1302									1002	13%			82567		
TOTAL	1520	1128	808	2115	2115	3544	3816	1302	1386	754	804	2304	1332	1002	1002	1002	1002	1632					

Eskom stretch programme to restore reserve margin

- Improve plant availability
- Contract co-generation
- Expand DSM programmes
- Fully utilise non-Eskom generation
- Accelerate commissioning of capacity
- Additional OCGTs?



Progress needs to be tracked!

Conclusions

- South Africa's security of supply is inadequate
- We understand the proximate or *immediate* causes
- We now need to address ultimate or *root* causes
- While some of Eskom's planning assumptions (in early 2000s) may have been wrong – the root cause of today's power shortages was policy uncertainty (and the lack of follow-through) in the period 1998 to 2004
- Supply security in the short term is being addressed by Eskom (they are probably doing all that is possible)
- Medium to long term supply needs to be secured through a range of policy and institutional reforms



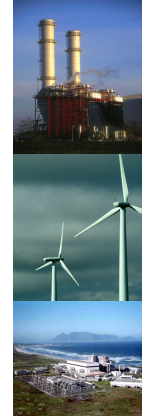
Recommendations (1)

- A clear electricity security standard needs to be established
 - By DME in consultation with NERSA, DPE and Eskom
 - NERSA should monitor security of supply
 - Eskom's system operator should report and publish actual performance against security standard
- Electricity planning should be co-ordinated and integrated and made more transparent
 - Combine Eskom's ISEP and NERSA's NIRP
 - Institutionalise in new central electricity planning office attached to system operator under stakeholder governance
 - Plans should be published



Recommendations (2)

- Investment approval & licensing processes should be streamlined
 - Eskom Board, DPE PFMA, NERSA licence and DME approvals
- Private participation in generation capacity (30%) should be facilitated
 - Transparent allocation of new build opportunities
 - Fair off-take agreements
 - Institutionalise procurement through single-buyer office attached to system operator (along-side central planning office)
 - Convert SO to ISO in medium term



Electricity supply security is threatened not only by inadequate generation capacity but also by distribution failures caused by inadequate investment in human and physical capital caused by policy uncertainty and lack of progress in establishing REDs

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