New Load Allocation Methodology

Networks Unit

Engineering, Standards & Safety Division
NERC

Outline

- Introduction
- Load Allocation as Practiced by SO
- Load Allocation Formula
- New Allocation Methodology
- Conclusion

Introduction

- Nigerian Electricity Regulatory Commission (NERC) is mandated by the Electric Power Sector Reform Act (EPSR Act 2005) in S.32(1a) to create, promote, and preserve efficient industry and market structures, and to ensure the *optimal utilization of resources* for the provision of electricity services;
- The Commission is seeking to develop a methodology for allocation of the available generation capacities from the generation stations down to the consumers.
- The System Operator is mandated to commit and dispatch units of the available generators, based on the technical constraints on ground.

  (See Grid Code Part 4, Section 9)

Load Allocation as Practiced by SO

- Development of Generation Schedule Table
- Development of Load Allocation Table for 12-Hourly Rolling Outage or 8-Hourly Rolling Outage.
- Concept and Procedure of Exempted Loads
- Procedure and Calculation of Load Allocation

Load Allocation as Practiced by SO

S/No.	Location	Load (MW)	Comments
1.	Eastern Axis	756.0	
2.	Benin	282.0	
3.	Osogbo	184.0	
4.	Maiduguri	10.00	
5.	Kano	10.00	International Airport
6.	Lagos (Ikeja)	550.0	Economic Reasons
7.	Lagos (Eko)	450.0	Economic Reasons
8.	Abuja	300.0	Federal Capital Territory
9.	International Lines (Niger & Benin Republic Loads)	223.0	Fixed Bilateral Agreements
10.	Auxiliary Consumptions	40.00	Station Auxiliaries at power stations
11.	Spinning Reserves	210.0	Depends on the availability of machines on free governor control
12.	Station Services	35.00	Consumption at transmission stations
	TOTAL	***3,050***	

Load Allocation as Practiced by SO

EXEMPTED LOADS – WEDNESDAY 11/04/2012

ACTUAL GENERATION (MW)	*3609.6*
AVAILABLE GENERATION CAPACITY (MW)	*8060*

		COMMENTS
INTERNATIONAL SUPPLIES	*223.00*	Fixed Bilateral Agreements
AUXILLIARY CONSUMPTION	*40.00*	Station Auxiliaries at power stations
SPINNING RESERVES	*210*	Depends on the availability of machines on free governor control;
STATION SERVICES & STRATEGIC NODES FOR VOLTAGE CONTROL	*35*	Consumption at transmission stations
EASTERN AXIS	*756*	To reduce load flow on T4A and B1T for system security reason
BENIN	*282*	For Voltage control;
OSOGBO	*184*	For frequency control
MAIDUGURI	*10*	System overvoltage on Damasak/Dissa
KANO	*10*	International Airport
LAGOS (IKEJA)	*550*	Economic Reasons
LAGOS (EKO)	*450*	Economic Reasons
ABUJA	*300*	Federal Capital Territory
TOTAL	*3050.00*	

Capacity for Load Allocation amongst Discos	*559.60*

S/No	DISTRIBUTION COMPANY	LOAD ALLOCATION BASED ON ACTUAL GENERATION (MW)
1	ABUJA	According to Exemption
2	BENIN	According to Exemption
3	EKO	According to Exemption
4	ENUGU	According to Exemption
5	IBADAN	
6	IKEJA	According to Exemption
7	JOS	
8	KADUNA	
9	KANO	
10	PORT HARCOURT	According to Exemption
11	YOLA	

Methodology of Calculation for other discos (or load centers)
1. Subtract total Exempted Load (Le) from Projected Generation (Gp) to get Allocation Load (La)
2. Divide "Allocation Load (La)" by Peak Load of the Zone* (Lz1)
3. Peak Load carried by Disco/Load Center is shared according to its historic load picked as Peak Load carried that Disco/Load Center

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Load Allocation as Practiced by SO

NATIONAL CONTROL CENTRE, OSOGBO (TCN)						
TENTATIVE GENERATION SCHEDULE FOR THURSDAY 08/12/2011.						
STATION	MERIT RATING BASED ON HEAT RATES	GENERATION				REMARKS
		OFF PEAK		PEAK		
		00:00- 18:00 HOURS		18:00 - 24:00 HOURS		
		GEN	S/R	GEN	S/R	
SHIRORO	HYDRO	300	0	300	0	2 units to be on bar.
KAINJI	HYDRO	320	40	320	40	5 units to be on bar.
JEBBA	HYDRO	170	0	340	0	2 units for 15hrs ; 4 units for 3hrs @ morn. Pk & 4 units for 6hrs @ even.Pk..
OKPAI	M1	462	0	462	0	3 units to be on bar.
EGBIN ST(GAS)	M2	730	130	730	130	4 units to be on bar.
SAPELE ST	M3	60	0	60	0	1 unit to be on bar.
SAPELE GT NIPP	M4	0	0	0	0	No unit on bar.
AJAOKUTA	M5	0	0	0	0	No unit on bar.
DELTA II-III	M6	0	0	0	0	No unit on bar.
DELTA IV	M7	120	80	120	80	2 units to be on bar.
AFAM IV - V	M8	65	0	65	0	1 unit to be on bar.
AFAM VI	M9	302	0	302	0	2 units to be on bar.
AES	M10	169.7	0	169.7	0	6 units to be on bar.
GEREGU	M11	297	0	297	0	2 units to be on bar.
OMOTOSHO	M12	76.3	0	76.3	0	2 units to be on bar.
OMOKU	M13	0	0	0	0	No unit on bar.
OLORUNSOGO PHASE I	M14	18.1	0	18.1	0	1 unit to be on bar.
OLORUNSOGO PHASE II	M14	119.3	0	119.3	0	1 unit to be on bar.
IBOM	M15	76.3		76.3	0	1 unit to be on bar.

Load Allocation as Practiced by SO

TRANS AMADI	M16	20	0	20	0	1 unit to be on bar.	
TOTAL AVAILABLE GEN.		3305.7	250	3475.7	250	GENERATION SHORTFALL:	
FORECAST		8240.0		10300.0		OFF-PEAK :	4934.3
GENERATION SHORTFALL		4934.3		6824.3		PEAK :	6824.3
* The above schedule is subject to modification as the system demands from minute to minute							
** Note that Omoku and Trans Amadi generation feed isolated loads; hence, not part of the allocation schedule.							
					Quantity of gas mmscf/day		
OKPAI	1mmscf =	3.5	MWH		132		
EGBIN	1mmscf =	3.5	MWH		246		
AES	1mmscf =	3.5	MWH		48		
DELTA IV	1mmscf =	3.0	MWH		67		
SAPELE	1mmscf =	4.4	MWH		14		
AFAM 1-V	1mmscf =	3.5	MWH		19		
OMOTOSHO	1mmscf =	3.2	MWH		24		
OLORUNSOGO	1mmscf =	3.2	MWH		37		
					TURBINE DISCHARGE (CUMECS)		SPILLAGE (CUMECS)
KAINJI WATER		7.8	MWH/CUMECS		985		0
JEBBA WATER		5.6	MWH/CUMECS		1007		
SHIRORO WATER		22.7	MWH/CUMECS		317		0

Load Allocation as Practiced by SO

NATIONAL CONTROL CENTRE, OSOGBO

LOAD ALLOCATION TABLE FOR 12-HOUR ROLLING OUTAGE

DATE: TUESDAY 10/04/2012 & WED 11/04/2012

FIG 4: FOR 12 HOURS OF CONTINUOUS SUPPLY TO EACH OF THE TWO ZONES IN 24-HOUR PERIOD.

ZONE	S/N	AREA	BASED ON PEAK DEMAND TO DATE (3851.6MW)		ALLOCATION(MW)	TIME
ZONE 1	1	KADUNA (1): KADUNA TOWN/ZARIA	164.29		172.32	00:00HRS - 12:00HRS
	2	GOMBE (INCLUDING MAIDUGURI	133.40		139.96	
	3	YOLA	38.10		39.96	
	6	OTTA	54.65		57.32	
	7	SHIRORO	107.40		112.65	
	8	AYEDE	161.26		169.14	
SUB TOTAL	A1		659.09	B1	691.33	

Load Allocation as Practiced by SO

ZONE	S/N	AREA	BASED ON PEAK DEMAND TO DATE (3851.6MW)		ALLOCATION(MW)	TIME
ZONE 2	7	KADUNA (2):FUNTUA-GUSAU-T'MAFARA	41.28		46.05	12:00HRS - 24:00HRS
	8	BIRNIN-KEBBI (INC SOK & T/MAFARA	73.62		82.12	
	9	ABEOKUTA	44.05		49.13	
	10	PAPALANTO	18.90		21.08	
	11	GANMO	61.50		68.60	
	12	ILORIN	30.55		34.08	
	13	JEBBA	15.74		17.55	
	14	AJAOKUTA	48.20		53.76	
	13	KANO (INC KATSINA)	232.63		259.47	
	14	JOS	53.34		59.49	
SUB TOTAL	A2		619.80	B2	691.33	

Load Allocation as Practiced by SO

Exempted load		CALABAR		44.58		44.58	24 HRS
		PORT HARCOURT		207.15		207.15	
		ALAOJI		132.42		132.42	
		ONITSHA		148.54		148.54	
		NEW HAVEN		143.75		143.75	
		AKWA IBOM/UYO		78.95		78.95	
		OSHOGBO		183.24		183.24	
		BENIN		281.76		281.76	
		MAIDUGURI		10.00		10.00	
		KANO		10.00		10.00	
		SAKETE		150.00		150.0	
		NIGER	NIAMEY (45MW) (B/KEBBI)	72.9		73.00	
			GAYA (3 MW) (B/KEBBI)				
			DAMASAK/BISSA (5 MW) (MAIDUGURI)				
			GAZAOUA (20MW) (KATSINA)				
			KATAMPE (ABUJA COMPLEX)	278.7		200.00	
			1. LAGOS (AJA, AKANGBA)	463.1		142.16	
			2. LAGOS (IKEJA WEST/EGBIN)	393.3			
			AUXILIARY CONSUMPTION(5%)	40.0			
			SPINNING RESERVE	210.0		220.00	
			STATION SERVICES & STRATEGIC NODES FOR VOLTAGE CONTROL.	35.00		160.00	
SUB TOTAL	A3			2883.33	B3	2918.27	
TOTAL	(A1+A2+A3)			4162.2	(B1+B3) or (B2+B3)	3609.6	

Load Allocation as Practiced by SO

- The allocation/rotation is either 2-Zone 12-hourly or 3-zone 16-hourly. Usually, for generation of up to 3,700MW and above, 3-zone 16-hourly is employed while it is 2-zone, 8-Hourly for generation below 3,700MW.
- Subsisting Peak Generation to Date serves as a baseline for load allocation.
- Allocation to a load centre is a function of the Projected Generation.
- Load demand profile of each load centre is obtained from system transformer maximum loading on the date the subsisting Peak Generation was attained.
- The total exempted load ***(Le)*** is subtracted from the projected generation ***(Gp)*** to obtain the power available for allocation to areas not covered under exempted load. Let this be ***(La)***. In a 2-zone 12-hourly load allocation/rotation, for example, this figure is available for only one of the zones for 12hours, after which the zone goes off and the power is rotated to the other lone.
- Let the Zone1 and Zone2 loads on the date of the subsisting
- Peak Generation to Date be Lz_1 and Lz_2 respectively.

SO LOAD ALLOCATION PROCEDURE

The multiplying factor for load of each load centre in Zone1 on the date of the subsisting Peak Generation to Date to obtain their corresponding allocation

= La/Lz1.

Similarly, for zone2, the multiplying factor is ***La/Lz2.***

(1) The Projected Generation = ***Gp***

(2) The Total Exempted Load = ***Le***

(3) The Power Available for Allocation = ***La***

(4) Zone110ad on the date the subsisting Peak Generation to Date was attained = ***Lz1***

(5) Zone2 load on the date the subsisting Peak Generation to Date was attained =***Lz2.***

(6) Multiplying factor to obtain allocation to load centers in zone1 ***= La/Lz1.***

(7) Multiplying factor to obtain allocation to load centers in zone2 = ***La/Lz2 .***

Load Allocation Formula

$$Disco_j = \alpha_j G_b + \sum_{i=1}^{5}(G_c y \beta_i)$$

$$Disco_j = \alpha_j G_b + G_c(s\beta_1 + t\beta_2 + u\beta_3 + v\beta_4 + w\beta_5)$$

Where:

α_j	=	*MYTO Percentage Factor for* $Disco_j$	
β_i	=	*KPI Factor for* $Disco_j$	*(Percentage Loss Reduction, Increase in Metering, Network Expansion, Customer Satisfaction Index, Distribution Capacity)*
s,u,t,v,w,y	=	*Weight values for each performance factor*	
G_t	=	*Total Available Generation / Power Sent Out*	
L_e	=	*Exempted Load*	
G_b	=	$G_t - L_e$	*(Available Generation less Exempted Loads)*
G_c	=	$G_b - \sum_{j=1}^{11}(\alpha_j G_b)$	*(Remaining power to be shared based on performance)*

New Allocation Methodology

ACTUAL GENERATION (MW)	*4500*
AVAILABLE GENERATION CAPACITY (MW)	*5125*

G_t

Exemption 1

		COMMENT
INTERNATIONAL SUPPLIES	*160.00*	Fixed Bilateral Agreements
AUXILLIARY CONSUMPTION	*225.00*	Station Auxiliaries at power stations
SPINNING RESERVES	*180.00*	Depends on the availability of machines on free governor control; dependent on dynamics of the system and availability of generators
STATION SERVICES & STRATEGIC NODES FOR VOLTAGE CONTROL	*160.00*	Consumption at transmission stations
TOTAL	*725.00*	

L_e

Capacity for Load Allocation amongst Discos	*3775*

j

G_b

$s\beta_i$

S/No	DISTRIBUTION COMPANY	PERCENT LOAD ALLOCATION BASED ON MYTO (%)	LOAD ALLOCATION BASED ON PERCENT (MW)	LOAD ALLOCATION BASED ON PERFORMANCE INDICATORS										FINAL LOAD ALLOCATION (MW)
				Loss Reduction (% Points) Weight: 25%	*Load Allocation (MW)*	Metering (%); Weight: 25%	*Load Allocation (MW)*	Network Expansion (%); Weight: 20%	*Load Allocation (MW)*	Customer Satisfaction Index; Weight: 20%	*Load Allocation (MW)*	Distribution Capacity (MVA); Weight: 10%	*Load Allocation (MW)*	
				143.75	*143.75*	*143.75*	*143.75*	*115.00*	*115.00*	*115.00*	*115.00*	*57.50*	*57.50*	
1	ABUJA	*11.5%*	368.00	5.6	17.09	52.3	17.32	61.3	10.87	25.41	12.30	61.30	5.60	*431*
2	BENIN	*9.0%*	288.00	4.9	14.95	48.2	15.96	64.2	11.38	24.72	11.97	64.20	5.87	*348*
3	EKO	*11.0%*	352.00	5.2	15.87	46.7	15.46	78.7	13.96	27.31	13.22	78.70	7.19	*418*
4	ENUGU	*9.0%*	288.00	5.1	15.57	39.9	13.21	57.4	10.18	21.83	10.57	57.40	5.24	*343*
5	IBADAN	*13.0%*	416.00	3.9	11.90	30.2	10.00	47.1	8.35	17.23	8.34	46.30	4.23	*459*
6	IKEJA	*15.0%*	480.00	4.5	13.73	46.7	15.46	74.2	13.16	26.08	12.63	76.20	6.96	*542*
7	JOS	*5.5%*	176.00	3.4	10.38	30.1	9.97	76.3	13.53	22.44	10.87	49.20	4.50	*225*
8	KADUNA	*8.0%*	256.00	2.9	8.85	32.5	10.76	42.3	7.50	16.27	7.88	52.30	4.78	*296*
9	KANO	*8.0%*	256.00	3.5	10.68	30.2	10.00	44.6	7.91	16.55	8.01	45.60	4.17	*297*
10	PORT HARCOURT	*6.5%*	208.00	4.6	14.04	43.9	14.54	65.8	11.67	23.97	11.61	57.40	5.24	*265*
11	YOLA	*3.5%*	112.00	3.5	10.68	33.4	11.06	36.6	6.49	15.70	7.60	40.70	3.72	*152*
	Total	*100%*	*3200.00*											*3775*

$\Sigma(\alpha_j G_b)$

ALLOCATION BALANCED

EASTERN AXIS	*607.87*	31T can take up to 500MW; Balance would be evacuated through Benin
BENIN	*282*	For voltage control
OSOGBO	*183*	For frequency control

Diff of Peak (less Exemptions) and % Allocation	*575.00*
Exemptions	*725.00*

G_c

New Allocation Methodology

ACTUAL GENERATION (MW)	*4500*
AVAILABLE GENERATION CAPACITY (MW)	*5125*

Exemption 1

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				143.75	*143.75*	*143.75*	*143.75*	*115.00*	*115.00*	*115.00*	*115.00*	*57.50*	*57.50*	
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	Total	*100%*	*3200.00*											*3775*

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Conclusion

- It is important that as regulator, there is enforcement of the Act , Codes, regulation and orders on fair resource sharing.
- The MYTO II is developed on basis of predictable energy receipts and onward sales. In the current situation of low generation, power can be dispatched in an open and transparent manner.
- Disco's maximum loading (distribution) capacity is a militating factor, even when there is adequate supply, some Disco's may not be able to distribute beyond certain threshold. This also necessitated abandoning uniform percentage value for initial allocation.

THANK YOU