

**Generating  
Unit  
Statistical  
Brochure**

**2003-2007**

**October 2008**

**Generating  
Availability  
Data  
System**

# EQUATIONS

## *Un-weighted*

**Average Run Time - ART**  
[SH/Actual Unit Starts]

**Starting Reliability - SR**  
[Actual Unit Starts/Attempted Unit Starts] x 100 (%)

**Net Capacity Factor - NCF**  
[NAG/(PH x NMC)] x 100 (%)

**Net Output Factor - NOF**  
[NAG/(SH x NMC)] x 100 (%)

**Service Factor - SF**  
(SH/PH) x 100 (%)

**Availability Factor - AF**  
(AH/PH) x 100 (%)

**Equivalent Availability Factor - EAF**  
[[AH ÷ (EUDH + EPDH + ESEDH)]/PH] x 100 (%)

**Forced Outage Rate - FOR**  
[FOH/(FOH + SH)] x 100 (%)

**Equivalent Forced Outage Rate - EFOR**  
[(FOH + EFDH)/(FOH + SH + EFDHRS)] x 100 (%)

**Scheduled Outage Factor - SOF**  
(SOH/PH) x 100 (%)

**Forced Outage Factor - FOF**  
(FOH/PH) x 100 (%)

**Equivalent Forced Outage Rate demand – EFORD**  
[(f\*FOH) + (fp\*EFDH)]\*100  
[SH + (f\*FOH)]

where fp= (SH/AH)

$f = \left(\frac{1}{r} + \frac{1}{T}\right) \left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)$  r = Average Forced Outage duration = [FOH / (number of FO occurrences)]  
D = Average demand time = [SH / (number of actual unit starts)]  
T = Average Reserve Shutdown time = [RSH / (number of attempted unit starts)]

**Unplanned Outage Factor - UOF**  
(UOH/PH) x 100 (%)

**Equivalent Unplanned Outage Factor - EUOF**  
[(UOH + EUDH)/PH] x 100 (%)

**Equivalent Unplanned Outage Rate - UFOR**  
[(UOH + EUDH)/(UOH + SH + EUDHRS)] x 100 (%)

## *Capacity Weighted\**

**Weighted Service Factor - WSF**  
[Σ(SH x NMC) / Σ(PH x NMC)] x 100 (%)

**Weighted Availability Factor - WAF**  
[Σ(AH x NMC) / Σ(PH x NMC)] x 100 (%)

**Weighted Equivalent Availability Factor - WEAF**  
[Σ(AH x NMC) - Σ[(EUDH + EPDH + ESEDH) x NMC]] / Σ(PH x NMC) x 100 (%)

**Weighted Forced Outage Rate - WFOR**  
[Σ(FOH x NMC) / Σ[(FOH + SH) x NMC]] x 100 (%)

**Weighted Equivalent Forced Outage Rate - WEFOR**  
[Σ[(FOH + EFDH) x NMC] / Σ[(FOH + SH + EFDHRS) x NMC]] x 100 (%)

**Weighted Scheduled Outage Factor - WSOF**  
[Σ(SOH x NMC) / Σ(PH x NMC)] x 100 (%)

**Weighted Forced Outage Factor - WFOF**  
[Σ(FOH x NMC) / Σ(PH x NMC)] x 100 (%)

\*Applies to groups of units only.

### Notes:

Equivalent hours are computed for each derating and then summed. Size of Reduction is determined by subtracting the Net Available Capacity (NAC) from the Net Dependable Capacity (NDC). In cases of multiple deratings, the Size of Reduction of each derating is the difference in the NAC of the unit prior to the initiation of the derating and the reported NAC as a result of the derating.

# DEFINITIONS

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**Actual Unit Starts**

Number of times the unit was synchronized to the transmission system.

**Attempted Unit Starts**

Number of attempts to bring the unit from shutdown to synchronization.

**Available Hours - AH**

Sum of all SH, RSH, Pumping Hours, and Synchronous Condensing Hours.

**Equivalent Forced Derated Hours - EFDH**

Product of the Forced Derated Hours and the Size of Reduction, divided by the NMC.

**Equivalent Forced Derated Hours During Reserve Shutdowns - EFDHRS**

Product of the Forced Derated Hours (during Reserve Shutdowns (RS) only) and the Size of Reduction, divided by the NMC.

**Equivalent Planned Derated Hours - EPDH**

Product of the Planned Derated Hours and the Size of Reduction, divided by the NMC.

**Equivalent Seasonal Derated Hours - ESEDH**

NMC less the NDC, times the Available Hours (AH), divided by the NMC.

**Equivalent Unplanned Derated Hours - EUDH**

Product of the Unplanned Derated Hours and the Size of Reduction, divided by the NMC.

**Equivalent Unplanned Derated Hours During Reserve Shutdowns - EUDHRS**

Product of the Unplanned Derated Hours (during Reserve Shutdowns (RS) only) and the Size of Reduction, divided by the NMC.

**Forced Derated Hours - FDH**

Sum of all hours experienced during Forced Deratings.

**Forced Outage Hours - FOH**

Sum of all hours experienced during Forced Outages.

**Net Available Capacity - NAC**

The NDC, modified for equipment limitations.

**Net Actual Generation - NAG**

Net electrical megawatthours (MWh) produced by the unit during the period being considered.

**Net Dependable Capacity - NDC**

NMC modified for ambient limitations.

**Net Maximum Capacity - NMC**

Capacity a unit can sustain over a specified period when not restricted by ambient conditions or equipment deratings, minus the losses associated with station service or auxiliary loads.

**Period Hours - PH**

Number of hours a unit was in the active state. A unit generally enters the active state on its commercial date.

**Reserve Shutdown Hours - RSH**

Total number of hours the unit was available for service but not electrically connected to the transmission system for economic reasons.

**Service Hours - SH**

Total number of hours a unit was electrically connected to the transmission system.

**Scheduled Outage Hours - SOH**

Sum of all hours experienced during Planned Outages and Maintenance Outages plus any Scheduled Outage Extensions associated with those outages.

**Unplanned Derated Hours - UDH**

Sum of all hours experienced during Forced Deratings and Maintenance Deratings plus any Scheduled Derating Extensions of any Maintenance Deratings.

**Unplanned Outage Hours - UOH**

Sum of all hours experienced during Forced Outages and Maintenance Outages plus any Scheduled Outage Extensions of any Maintenance Outages.

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# INTRODUCTION

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This brochure highlights some of the information from NERC's *Generating Availability Report* (GAR). Statistics are shown for the cumulative five years, 2003–2007, and are calculated using both the capacity-weighted technique and the traditional, un-weighted method.

## **Generating Availability Report**

Continuing the effort to bring timely, useful information to the industry in an efficient manner, NERC again will “publish” the *2003–2007 Generating Availability Report* in electronic format. The report is available for downloading from the Internet. A printed, bound version of the GAR is not available.

The electronic GAR consists of a series of formatted files ready for printing on any laser printer set to a condensed font. Included are all the tables and graphs found in previous printed editions of the report, and more. The traditional unit groupings – by generation technology, size and, in some cases, fuel type – have been retained.

The new GAR is available to everyone at no cost. To download the GAR from the NERC home page (<http://www.nerc.com>) go to “Assessments and Trends,” then “Generating Availability Data System (GADS),” then (on the left side in white lettering) “Reports,” then “Generating Unit Statistical Brochure” and download the self-extracting zip file GAR2007.EXE. That’s all there is to it!

## **GADS Data Applications**

The statistics in this brochure and the GAR are calculated from data that electric utilities report voluntarily to NERC's Generating Availability Data System (GADS). Operating histories for more than 6,500 electric generating units reside in GADS. Data are reported by more than 230 utilities in the United States and Canada representing investor-owned, municipal, state, cooperative, provincial, and

federal segments of the industry. NERC aggregates these data and presents the results annually in its GAR.

The GAR provides an overview of the availability performance of classes of generating units. More specific data are available from NERC's GADS database to use in detailed unit- or equipment-level reliability, availability, and maintainability (RAM) analyses. GADS data are used in a wide variety of deterministic and probabilistic applications to:

- benchmark unit performance against statistically validated peers,
- conduct loss-of-load and similar system-wide analyses,
- optimize maintenance schedules and prepare cost-benefit analyses,
- compare the reliability of original equipment manufacturers' (OEM) components, and
- prepare reports for state and federal regulators.

You can conduct your own GADS special analyses with a software product called pc-G.A.R., available from NERC on CD-ROM. GADS data for special applications are also available by calling NERC. Call or e-mail ([gads@nerc.com](mailto:gads@nerc.com)) NERC for further information.

## **Historical Availability Statistics**

Back again this year is the *1982-2007 Historical Availability Statistics* (HAS) report. Based on previous GAR publications, this report provides statistics for individual, five, ten, and twenty-three-year periods.

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**2003-2007 Generating Unit Statistical Brochure -- All Units Reporting**  
 Revised April 13, 2009

NOTE: This brochure contains data on all units, whether they reported event records or not. For a review of statistics containing only those units that reported events, see the brochure "2003-2007 Generating Unit Statistical Brochure -- Units Reporting Events".  
 (The differences between statistics with or without events will appear in equations needing derating information such as EAF, EFOR, and other equations. The equations are more accurate if events are reported.)

Unit Type	MW Trb/Gen Nameplate	# of Units	Unit-Years
<b>FOSSIL</b> <i>All Fuel Types</i>	All Sizes	1,467	6668.83
	1-99	373	1538.33
	100-199	388	1752.67
	200-299	170	809.67
	300-399	131	622.00
	400-599	233	1108.58
	600-799	123	592.58
800-999	36	180.00	
1000 Plus	13	65.00	
<b>Coal</b> <i>Primary</i>	All Sizes	894	4199.75
	1-99	174	738.50
	100-199	238	1133.67
	200-299	118	570.58
	300-399	78	373.42
	400-599	154	740.08
	600-799	95	458.50
800-999	25	125.00	
1000 Plus	12	60.00	
<b>Oil</b> <i>Primary</i>	All Sizes	146	532.42
	1-99	47	168.75
	100-199	36	134.33
	200-299	10	37.83
	300-399	16	73.25
	400-599	19	53.50
	600-799	10	42.42
800-999	7	17.33	
<b>Gas</b> <i>Primary</i>	All Sizes	434	1725.33
	1-99	135	524.75
	100-199	129	484.58
	200-299	43	182.58
	300-399	42	175.33
	400-599	63	263.00
	600-799	13	57.58
800-999	9	37.50	
<b>Lignite Primary</b>	All Sizes	19	92.00

ART	SR	NCF	NOF	SF	AF	EAF	FOR	EFOR	EFORd	SOF	FOF	UOF	EUOF	EUOR	POF	MOF
299.38	97.97	57.99	79.99	66.22	87.46	85.10	5.61	7.66	6.66	8.60	3.93	5.93	7.65	10.60	6.61	2.00
195.41	99.02	36.65	69.42	49.67	89.33	87.24	7.19	9.64	7.34	6.82	3.85	5.83	7.24	13.03	4.84	1.99
284.04	98.26	48.86	72.80	66.21	87.70	84.95	5.34	7.56	6.52	8.57	3.74	6.02	8.01	11.09	6.28	2.28
355.70	97.92	57.49	77.13	74.63	86.73	84.12	6.09	7.65	7.05	8.43	4.84	6.66	8.38	10.31	6.61	1.82
311.16	97.60	50.68	73.43	69.54	86.88	84.84	4.56	6.50	5.78	9.80	3.32	5.52	7.13	9.50	7.60	2.20
332.64	97.23	59.44	80.45	73.40	86.29	84.03	5.20	7.29	6.66	9.68	4.02	5.92	7.72	9.73	7.78	1.90
498.74	95.59	65.55	85.76	76.79	85.99	83.57	5.22	7.26	6.82	9.76	4.23	5.78	7.75	9.39	8.21	1.55
566.59	97.21	62.76	83.97	74.21	88.32	87.43	2.90	3.60	3.36	9.46	2.22	3.66	4.37	5.61	8.01	1.44
727.99	92.65	72.14	88.65	80.65	82.22	79.48	7.44	8.96	8.83	11.30	6.48	8.39	10.49	11.78	9.39	1.90
525.93	96.94	73.52	85.78	83.53	87.74	84.81	4.76	6.79	6.56	8.08	4.18	5.91	8.08	9.04	6.35	1.73
288.13	98.51	55.42	73.90	73.73	88.40	85.48	5.48	7.99	7.16	7.32	4.28	6.44	8.56	10.67	5.16	2.17
560.75	97.04	66.42	78.70	83.89	88.56	85.06	4.59	6.79	6.54	7.41	4.04	5.96	8.53	9.49	5.49	1.92
638.38	97.47	72.47	83.41	86.82	88.24	85.09	4.46	6.01	5.93	7.70	4.06	5.68	7.70	8.32	6.08	1.63
659.89	95.48	72.78	83.11	87.41	87.96	85.24	4.19	6.25	6.21	8.22	3.82	5.47	7.63	8.21	6.56	1.65
584.38	95.83	74.54	86.76	85.81	86.28	83.66	5.10	7.23	7.19	9.11	4.61	6.21	8.31	9.03	7.51	1.60
727.12	94.37	76.41	88.61	86.28	86.63	84.10	4.67	6.47	6.44	9.12	4.23	5.43	7.42	8.09	7.92	1.20
971.62	96.26	80.88	91.33	88.46	88.55	87.63	2.87	3.55	3.54	8.83	2.62	3.73	4.54	4.92	7.72	1.11
735.68	92.13	75.40	90.97	82.51	82.80	80.12	7.25	8.65	8.63	10.75	6.45	7.80	9.82	10.88	9.41	1.35
88.56	99.28	22.02	54.70	36.51	83.43	81.38	12.08	15.59	10.35	11.56	5.02	7.76	9.31	20.99	8.82	2.74
59.88	99.57	24.78	61.75	33.91	85.11	82.64	14.39	19.86	10.85	9.19	5.70	8.20	10.43	24.73	6.69	2.50
90.29	99.05	18.69	55.96	30.13	82.76	80.69	13.04	16.58	11.14	12.73	4.52	7.10	8.40	22.47	10.14	2.59
72.94	99.08	15.22	58.08	28.70	74.42	72.74	36.31	37.80	27.06	9.22	16.36	18.11	18.80	40.15	7.47	1.74
161.09	99.72	31.22	59.63	53.26	83.80	81.96	3.02	5.38	4.21	14.54	1.66	4.86	6.27	10.78	11.35	3.20
139.10	99.04	26.14	53.03	47.70	86.02	84.52	5.44	6.42	5.14	11.24	2.74	6.49	7.28	13.44	7.49	3.75
65.50	98.52	15.85	50.84	30.87	82.59	80.41	11.48	17.36	10.62	13.41	4.00	6.99	9.05	23.90	10.42	2.99
357.53	96.25	15.84	52.38	30.35	86.85	86.51	2.35	2.71	2.21	12.42	0.73	1.71	1.87	5.82	11.44	0.98
97.22	98.71	14.83	39.92	31.58	88.12	87.16	8.29	9.98	6.40	9.03	2.86	5.34	6.01	16.24	6.54	2.48
95.34	99.34	8.05	42.09	16.48	92.45	91.88	13.42	14.39	7.49	4.99	2.56	4.22	4.42	21.31	3.32	1.67
85.49	99.09	15.23	43.42	34.42	87.05	85.87	7.54	9.55	6.01	10.14	2.81	5.87	6.68	16.53	7.08	3.07
112.25	98.21	18.85	40.53	46.27	85.99	84.75	6.95	8.67	6.33	10.55	3.46	5.96	7.03	13.44	8.05	2.50
102.20	98.40	13.17	34.98	38.13	85.85	85.19	7.19	8.33	5.84	11.19	2.95	5.90	6.44	14.61	8.24	2.95
93.86	98.39	15.14	39.15	39.97	85.70	84.53	6.69	8.74	6.12	11.43	2.87	5.31	6.35	14.01	8.98	2.44
150.50	95.25	11.45	37.16	31.04	81.70	80.23	13.01	15.95	11.40	13.66	4.64	8.27	9.62	24.37	10.03	3.62
165.73	98.43	21.62	45.45	47.29	88.18	87.14	3.25	4.20	3.30	10.23	1.59	4.37	4.98	9.64	7.45	2.78
703.44	97.47	83.42	93.03	89.57	89.58	86.61	3.29	5.60	5.60	7.38	3.05	4.34	6.61	7.04	6.09	1.29

WSF	WAF	WEAF	WFOR	WEFOR
72.51	86.67	84.41	5.20	7.10
52.80	89.59	87.31	6.68	9.40
67.12	87.62	84.89	5.18	7.38
74.54	86.65	84.02	6.17	7.74
69.01	86.96	84.94	4.54	6.47
73.88	86.36	84.14	5.18	7.22
76.44	85.91	83.47	5.30	7.38
74.74	88.43	87.53	2.85	3.54
81.37	82.68	80.05	7.17	8.60
85.70	87.10	84.48	4.70	6.53
74.99	88.57	85.55	5.33	7.96
84.40	88.49	85.07	4.53	6.67
86.88	88.27	85.08	4.43	5.98
87.57	88.11	85.40	4.13	6.17
85.91	86.36	83.81	5.05	7.11
86.22	86.59	84.03	4.71	6.53
88.55	88.65	87.74	2.82	3.48
82.88	83.16	80.58	7.02	8.35
40.26	83.20	81.32	9.19	12.08
40.13	86.37	83.18	11.09	17.29
33.40	81.69	79.57	11.49	14.97
26.20	73.60	71.92	39.63	41.18
52.36	83.94	82.12	3.13	5.49
49.30	85.94	84.42	5.25	6.20
31.18	82.36	80.15	11.69	17.53
30.24	86.95	86.60	2.37	2.76
37.15	86.23	85.13	7.53	9.36
19.12	92.44	91.77	11.67	12.80
35.07	87.14	85.84	7.18	9.33
46.51	85.94	84.69	6.94	8.66
37.65	85.92	85.24	7.30	8.47
38.68	85.67	84.53	7.07	9.11
30.81	81.46	79.99	13.48	16.40
47.57	88.29	87.20	3.13	4.14
89.67	89.68	86.75	3.54	5.92