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Outages on Nigerian Integrated High Voltage Transmission Grid

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Abstract

Outage is the loss of vitality supply to one or more clients connected with that transmission bit of the framework .This paper discusses the study of power outages on the Nigerian Integrated High Voltage Transmission grid. Statistical study analysis was used to observe the various trends over the years 2006 – 2012. The results showed that the 330KV network division of the Nigerian Integrated High Voltage Transmission grid has more outages than the 132KV network division, lower outages are experienced towards the end of the year and the year 2011 experienced the highest rate of outages on the 330KV network while more outages were experienced in the year 2006 on the 132KV network. Solutions were then proposed to this effect.

Keywords: *Power Outages, Nigerian Integrated High Voltage Transmission Grid, 330KV network, 132KV network*

1. Introduction

Upon the huge investment by the Jonathan administration into the Nigerian power system, it is still plagued by incessant outages. This issue creates a challenge for the Nigerian power system in terms of system effectiveness and reliability. Studies have being carried out by different researchers to propose different methods of improving the Nigerian power system.

Generating stations for the most part produce between 11KV – 16KV and step up this voltage with step up transformers at the generating stations to 330KV for transmission into the power framework or electricity grid. The voltage transmission is stepped up to a high voltage value in view of transmission loses that happen amid transportation.

High voltage transmission is the transportation of high voltages over long separations from the generating stations to the power framework which supplies the high voltage transmission stations. Overhead transmission lines are predominantly utilized as a part of high voltage transmission. High voltage transmission lines are utilized rather than low voltage lines in light of the fact that power transportation is more proficient as the transportation loses are lessened. This makes high voltage transmission practical.

The high voltage transmission in Nigeria is separated into two; the 330KV high voltage transmission and the 132KV high voltage transmission. The 330KV transmission is from the generating stations to the sub-transmission system. The sub-transmission system which works at 132KV is the National Control Centre (NCC) which is at Oshogbo. This 132KV system disseminates voltages at diverse levels relying upon the kind of dissemination example. These voltages are 33KV, 11KV and 415/240V distribution levels [Ibe .A.O. and Okedu .E.K, 2009].

The Nigerian transmission network was at first confronted with various difficulties before the integrated power project was actualized. The difficulties were substantial measure of uncompleted transmission ventures, poor dispatch of created vitality to sufficiently and effectively take care of load demand, awful voltage profile at the northern states, failure of the transmission lines to transport sufficient measure of power. The integrated power project was only actualized in the 330KV transmission network [Omorogiuwa .E. and Ogujor .E.A., 2012].

The electricity grid was regularly defenseless to framework breakdown or system collapse due to the delicate and radial nature of the transmission lines. Most specialists proposed a ring system rather than the radial system to be utilized as a part of the electricity grid as a result of the high loses which were premise in the radial system and infringement of the voltage drop remittance of +5% or -5% [Omorogiuwa .E. ,2011].

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The integrated power project was then executed by the then Power Holding Company of Nigeria (PHCN) for proficient framework or grid strength and successful interconnection of the system. The fundamental goal of the enhanced system was to expand transmission quality by developing more power stations and transmission lines [Omorogiuwa .E, 2011].

The past transmission system embodied nine(9) generating stations, twenty-eight(28) buses and thirty- two(32) transmission lines [Omorogiuwa .E. and Ogujor .E.A., 2012]. The Nigerian integrated high voltage transmission framework which involves twenty- four (24) stations is plunged into four sections; privatized companies –hydro stations, privatized companies – thermal stations, NIPP – thermal stations, IPP – thermal stations. Studies have demonstrated that the privatized companies – thermal stations deliver the most elevated measure of energy [NCC Tentative Generation Schedule Report, 2014].

A typical issue that confronts the integrated power project is outages on the transmission lines. Outages diminish the productivity of the transmission system as it causes power disturbance and interference. The issue of outages can't be totally destroyed however it can be lessened to a sensible level to enhance the transmission system proficiency. Outages happen because of maturing of supplies/defects, lightning, vandalization, poor maintenance [Onoahebi .O.S, 2009].

Outage is the loss of energy supply to one or more customers associated with that transmission bit of the framework. It is the after effect of one or more segment defect, contingent upon the framework arrangement. The distinctive sorts of outages are;

i. Forced Outage: it happens when the condition of transmission line or equipment makes it unable to perform its proposed capacity because of unplanned event specifically connected with that component. It could be as an aftereffect of overvoltage issues which could be brought about by lightning or induced voltage impact.
ii. Planned Outage: it is the loss of electric power that comes about when a part is deliberately taken out of service at a chosen time, normally for the reasons of development, preventive upkeep, or repair.
iii. Urgent Outage:
iv. Emergency Outage:

This paper breaks down and gives an analysis of the outage measurable synopsis for the year 2006 through to year 2012 in the Nigerian integrated high voltage transmission network from National Control Centre (NCC), Oshogbo yearly technical report.

2. Materials and Methods

Listed below are the methods and materials used for this study;

- Data collected from the Transmission Company of Nigeria (TCN), National Control Centre (NCC), Oshogbo Generation and Transmission Grid Operations (Annual Technical Report) for the years 2006 to 2012.The data was based on the outages statistical summary for the years 2006 to 2012.
- Review of the Nigerian Integrated High Voltage Transmission Grid
- Analysis of the result to ascertain the network reliability and stability of the Integrated High Voltage Transmission Grid.
- Analysis of the power outages in the transmission network.

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3. Figures

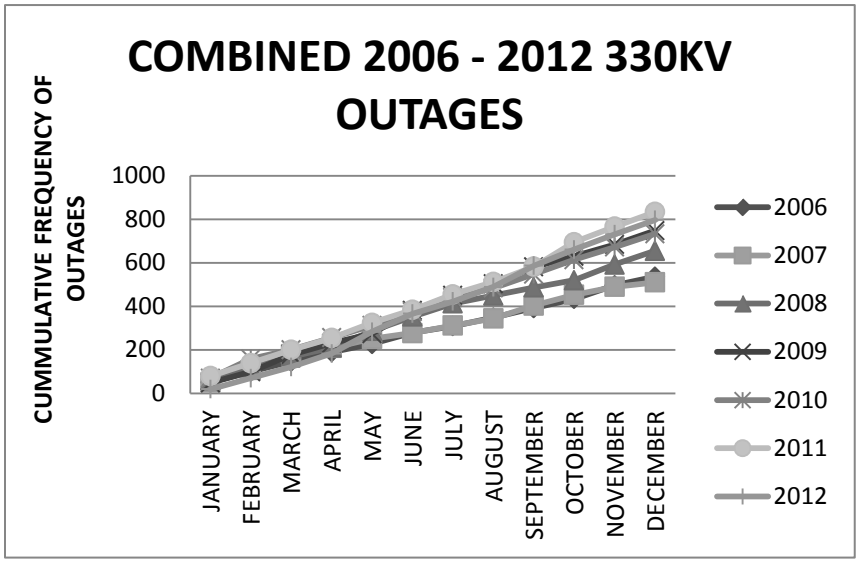

Fig 1: Graphical representation of the total outage cumulative

on the 330kv transmission grid for 2006 – 2012.

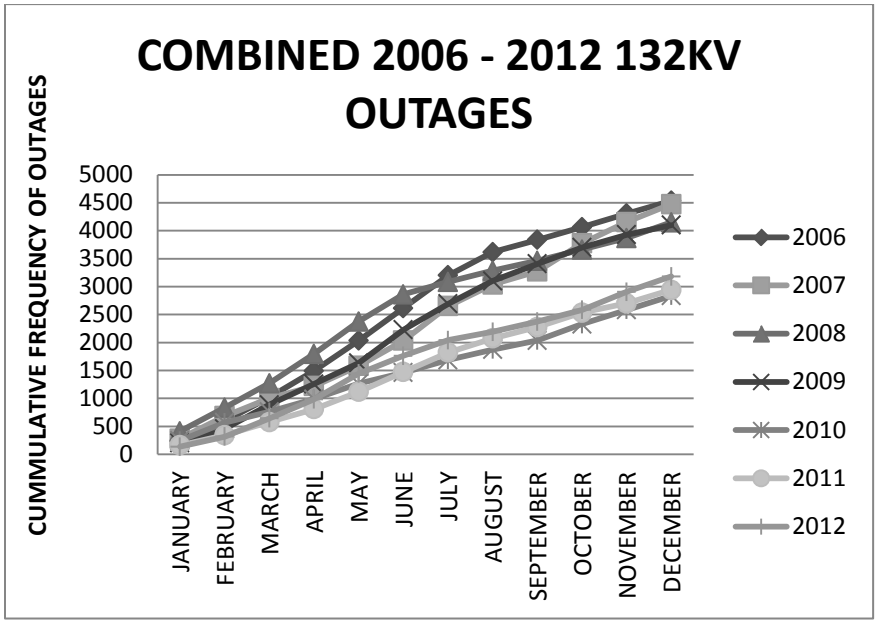

Fig 2: Graphical representation of the total outage cumulative

on the 132kv transmission grid for 2006 – 2012.

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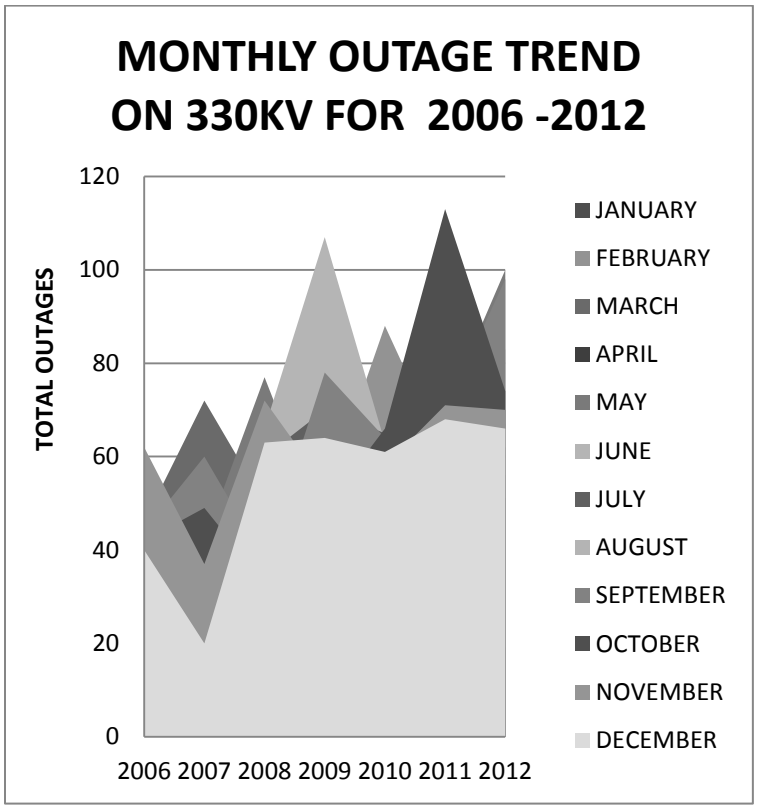

Fig 3: Graphical representation of monthly outage on 330kv for 2006-2012

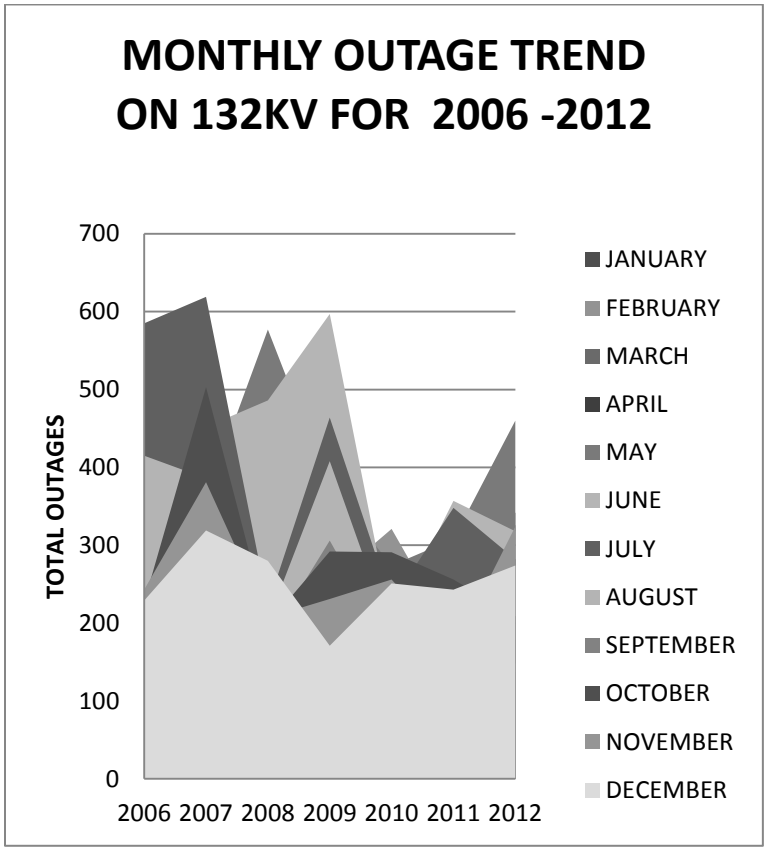

Fig 4: Graphical representation of monthly outage on 132kv for 2006-2012.

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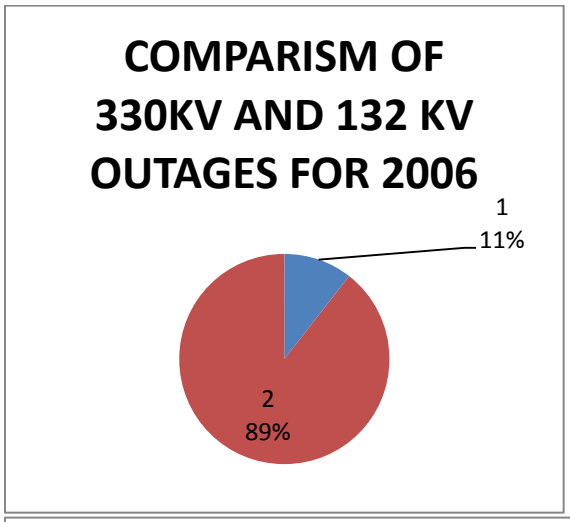

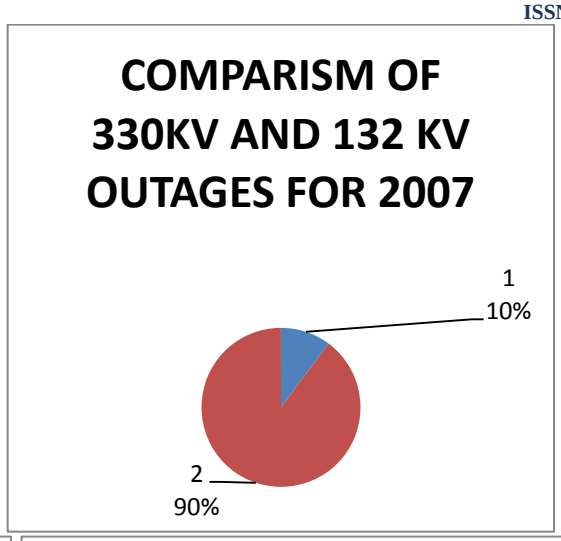

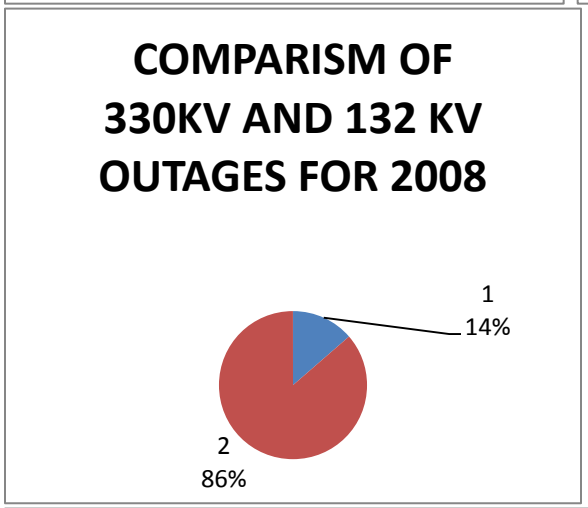

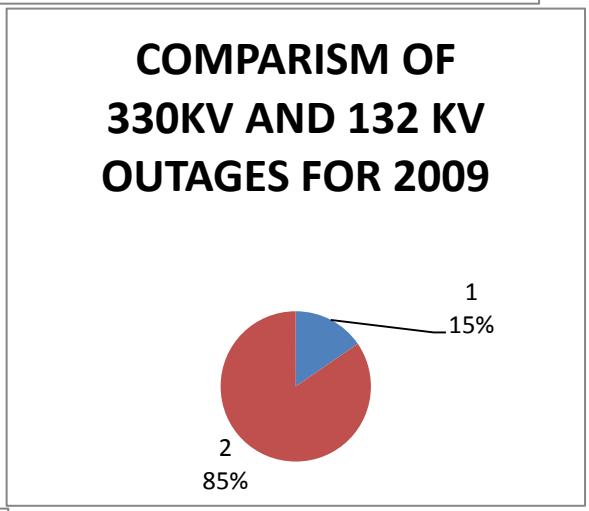

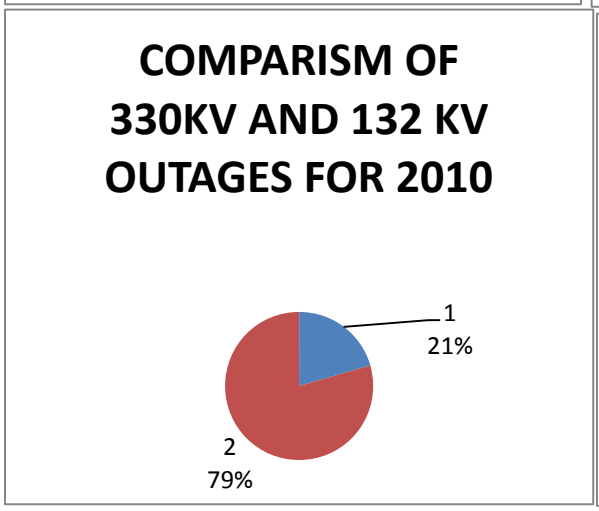

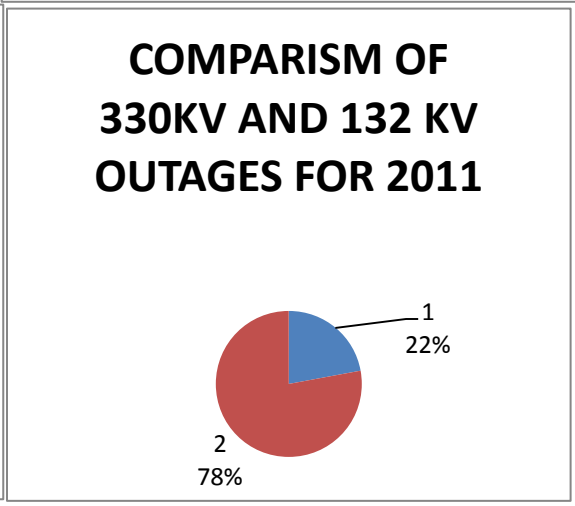

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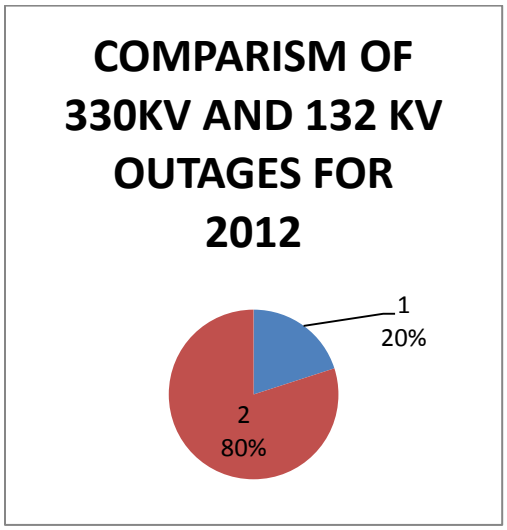

Fig 5: Comparison Of Outages On 330kv And 132 Kv For 2006-2012.

4. Discussion, Conclusion and Recommendation

4.1 Discussion

Fig 1 shows that year 2011 has the highest number or amount of outages (forced, planned, urgent and emergency) on the 330KV transmission network.

Fig 2 shows that year 2006 had the highest amount of outages (forced, planned, urgent and emergency) on the 132KV transmission network.

Fig 3 and Fig 4 show that over the years (2006 – 2012) there is low outage rate on both the 330KV and 132KV transmission networks at the end part of the year.

The comparison between the outages on the 330KV and 132 KV shows that the rate of outages on the 132KV network is higher than the rate of outages on the 330KV network (Fig 5).

4.2 Conclusion

The high amount of outages in the year 2011 on the 330KV network and the year 2006 on the 132KV network can be attributed to the high rate of machine failure; vandalization and weather conditions (lightning) (fig 1 and fig 2)

The results also showed that the rate of outage is generally low at the end of the year for all the years studied. This is because of the favorable weather condition at that time of the year (dry season) in Nigeria. (fig 3 and fig 4)

The results show that there is an improvement in the system reliability of the 132KV transmission network while the system reliability of the 330KV network is poor and more efforts have to be put in for its effectiveness (fig 5).

4.3 Recommendation

More power stations should be introduced into the transmission grid to reduce overloading of the network

More stable transmission lines should also be introduced for efficiency of the system.

Security watch over the transmission lines should be intensified to reduce vandalization.

Equipment bought and used should be authentic and not inferior to reduce the rate of machine failures.

Preventive maintenance should be carried out frequently on the network.

Faulty/defective equipment should be repaired or replaced as the situation demands as soon as possible to reduce the outage rate on the network.

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Appendix

OUTAGES STATISTICAL SUMMARY (132KV LINE)

MONTH	YEAR													
	2006		2007		2008		2009		2010		2011		2012	
	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C
JANUARY	230	230	278	278	412	412	205	205	246	246	161	161	137	137
FEBRUARY	364	594	405	683	424	836	253	458	321	567	182	343	179	316
MARCH	427	1021	320	1003	435	1271	429	887	192	759	233	576	326	642
APRIL	472	1493	218	1221	527	1798	372	1259	231	990	233	809	342	984
MAY	542	2035	361	1582	577	2375	373	1632	274	1264	308	1117	460	1444
JUNE	581	2616	452	2034	486	2861	597	2229	198	1462	357	1474	318	1762
JULY	585	3201	619	2653	223	3084	464	2693	227	1689	348	1822	282	2044
AUGUST	415	3616	386	3039	202	3286	408	3101	184	1873	253	2075	148	2192
SEPTEMBER	221	3837	234	3273	177	3463	306	3407	165	2038	203	2278	183	2375
OCTOBER	227	4064	503	3776	199	3662	292	3699	291	2329	256	2534	209	2584
NOVEMBER	243	4307	381	4157	207	3869	231	3920	256	2585	166	2700	324	2908
DECEMBER	229	4536	319	4476	280	4149	171	4101	251	2836	243	2943	274	3182

OUTAGES STATISTICAL SUMMARY (330KV LINE)

MONTH	YEAR													
	2006		2007		2008		2009		2010		2011		2012	
	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C	T/OUT	T/C
JANUARY	51	51	50	50	60	60	48	48	70	70	79	79	19	19
FEBRUARY	49	100	57	107	58	118	51	98	158	60	60	139	51	70
MARCH	46	146	72	179	50	168	79	178	201	61	61	200	51	121
APRIL	44	190	30	209	42	210	52	230	256	54	54	254	62	183
MAY	37	227	42	251	77	287	44	274	312	70	70	324	100	283
JUNE	52	279	26	277	66	353	107	381	375	60	60	384	83	366
JULY	30	309	35	312	60	413	70	451	440	71	71	455	56	422
AUGUST	39	348	32	344	36	449	52	503	484	57	57	512	67	489
SEPTEMBER	44	392	60	404	38	487	78	581	548	70	70	582	98	587
OCTOBER	42	434	49	453	33	520	49	630	614	113	113	695	74	661
NOVEMBER	62	496	37	490	72	592	54	684	672	71	71	766	70	731
DECEMBER	40	536	20	510	63	655	64	748	733	68	68	834	66	797

T/OUT= TOTAL OUTAGES; T/C = TOTAL CUMULATIVES

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