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Electric Power Energy Distribution Estimate using Visualization Technique

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Abstract：The power energy distribution process is one of the great challenges, which both the consumers and power energy distributors normally face. Visualization has been recommended as useful approach to solve this problem. MATLAB is used to showcase the visualization via analysis of the data of energy production for the month of December 2012 and this was used to predict the energy estimate for each day in the month of January 2013.With the patterns generated, the pattern of energy distribution can easily be modeled. Such will assist in proper planning, sharing and management of energy to sustain the national need.

Keywords: Energy distribution, Visualization, MATLAB, Energy production

I.INTRODUCTION

Electric energy is energy newly derived from electrical potential energy. It is sometimes loosely used to describe energy absorbed or delivered by an electrical circuit for instance, one provided by an electrical power utility. Electrical energy refers to energy which has been converted *from* electrical potential energy. This energy is supplied by the combination of electric current and electrical potential that is delivered by the circuit. At the point that this electrical potential energy has been converted to another type of energy, it ceases to be electrical potential energy. Thus, all electrical energy is potential energy before it is delivered to the end-user. Once converted from potential energy, electrical energy can always be described as another type of energy i.e heat, light, motion, etc (Buchmann, 2008).

Power estimation generally refers to the problem of estimating the average power dissipation of a digital circuit. This is different from estimating the worst case instantaneous power often referred to as the voltage drop problem (Chowdhury & Barkatullah ,1990; Kriplani, Najm & Hajj, 1992. Chip heating and temperature are directly related to the average power.

It has been revealed that the most straight tforward method of power estimation is simulation with emphasis on circuit simulation of the design to monitor the power supply using current waveform. Subsequently, the average of the current waveform is computed and used to provide the average power; the advantage of this technique is its accuracy. It can be used to estimate the power of any circuit regardless of technology design style, functionality or architecture. The simulation results however are directly related to the specific input signals used to drive the simulator. Furthermore, complete and specific information about the input signals is required in the form of voltage waveforms. The researchers hereby describe these simulation-based techniques as being strong and pattern dependent.

Farid (2007) suggested that there are many ways of estimating the electrical power in which simulation one of them. Electric energy is very important in human life for home usage, industrial usage and many others. as a result, it is very important to know the patterns by which the electric power distribution is taken place which is the major focus of the paper. For estimation to be more meaningful, MATLAB program was used for analyzing the data in form of 2D visualization. Visualization according to Turfle (2001) is the systematic and visual display of information in the form of tables, diagrams and graphs.

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II. MATERIALS AND METHODS

The material used in this work is the hourly power distribution for the month of December 2012 as shown in Table 1.1 while MATLAB is used to analyze the energy distribution for the month of December 2012 in order to forecast the distribution for everyday in the month of January 2013.

Table 1.1:Power energy distribution for month of December 2012 at Sawmell Power Distribution Unit of PHCN Ilorin.

	1 HR	2 HR	3 HR	4 HR	5 HR	6 HR	7 HR	8 HR	9 HR	10 HR	11 HR	12 HR	13 HR	14 HR	15 HR	16 HR	17 HR	18 HR	19 HR	20 HR	21 HR	22 HR	23 HR	24 HR
DAY 1	455	435	485	485	300	320	320	290	290	300	290	350	360	520	520	580	750	785	600	570	360	520	740	445
DAY2	660	680	680	800	840	540	680	690	720	816	771	838	825	564	590	600	620	400	650	500	300	400	660	640
DAY3	640	610	600	620	580	600	580	440	490	490	490	578	666	563	764	699	590	740	740	446	346	410	610	520
DAY4	700	660	660	710	770	790	710	520	360	473	433	741	762	804	810	612	740	830	780	680	470	600	590	790
DAY5	720	720	400	400	450	300	400	400	430	606	691	496	513	384	479	490	500	520	480	440	400	410	385	350
DAY6	310	310	370	370	370	370	455	455	500	490	625	493	558	728	600	580	620	660	400	400	340	505	205	410
DAY7	700	550	365	285	530	530	535	530	550	470	460	420	520	670	680	700	605	640	600	580	520	500	610	700
DAY8	537	456	564	523	342	345	344	344	523	415	253	390	405	567	645	678	567	645	590	547	456	456	617	698
DAY9	676	567	608	490	539	750	500	390	450	510	390	564	600	489	673	600	670	599	670	617	500	450	527	723
DAY10	555	654	457	765	455	554	635	534	546	457	356	345	465	764	354	345	417	519	712	567	664	457	710	567
DAY11	455	435	485	485	300	320	320	290	290	300	290	350	360	520	520	580	750	785	600	570	360	520	740	445
DAY12	660	680	680	800	840	540	680	690	720	816	771	838	825	564	590	600	620	400	650	500	300	400	660	640
DAY13	640	610	600	620	580	600	580	440	490	490	490	578	666	563	764	699	590	740	740	446	346	410	610	520
DAY14	700	660	660	710	770	790	710	520	360	473	433	741	762	804	810	612	740	830	780	680	470	600	590	790
DAY15	720	720	400	400	450	300	400	400	430	606	691	496	513	384	479	490	500	520	480	440	400	410	385	350
DAY16	310	310	370	370	370	370	455	455	500	490	625	493	558	728	600	580	620	660	400	400	340	505	205	410
DAY17	700	550	365	285	530	530	535	530	550	470	460	420	520	670	680	700	605	640	600	580	520	500	610	700
DAY18	537	456	564	523	342	345	344	344	523	415	253	390	405	567	645	678	567	645	590	547	456	456	617	698
DAY19	676	567	608	490	539	750	500	390	450	510	390	564	600	489	673	600	670	599	670	617	500	450	527	723
DAY20	555	654	457	765	455	554	635	534	546	457	356	345	465	764	354	345	417	519	712	567	664	457	710	567
DAY21	455	435	485	485	300	320	320	290	290	300	290	350	360	520	520	580	750	785	600	570	360	520	740	445
DAY22	660	680	680	800	840	540	680	690	720	816	771	838	825	564	590	600	620	400	650	500	300	400	660	640
DAY2	640	610	600	620	580	600	580	440	490	490	490	578	666	563	764	699	590	740	740	446	346	410	610	520

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DAY24	700	660	660	710	770	790	710	520	360	473	433	741	762	804	810	612	740	830	780	680	470	600	590	790
DAY25	720	720	400	400	450	300	400	400	430	606	691	496	513	384	479	490	500	520	480	440	400	410	385	350
DAY26	310	310	370	370	370	370	455	455	500	490	625	493	558	728	600	580	620	660	400	400	340	505	205	410
DAY27	700	550	365	285	530	530	535	530	550	470	460	420	520	670	680	700	605	640	600	580	520	500	610	700
DAY28	537	456	564	523	342	345	344	344	523	415	253	390	405	567	645	678	567	645	590	547	456	456	617	698
DAY29	676	567	608	490	539	750	500	390	450	510	390	564	600	489	673	600	670	599	670	617	500	450	527	723
DAY30	555	654	457	765	455	554	635	534	546	457	356	345	465	764	354	345	417	519	712	567	664	457	710	567
DAY31	345	455	635	624	422	455	645	245	566	356	687	456	666	345	465	753	533	445	555	444	444	445	554	422

III. RESULTS AND DISCUSSION

The analysis to predict the daily power energy estimate for the month of January is given below ranging from figures 1.1 to 1.32. Figure 1.1 above, shows the power energy distribution estimate for the month of January

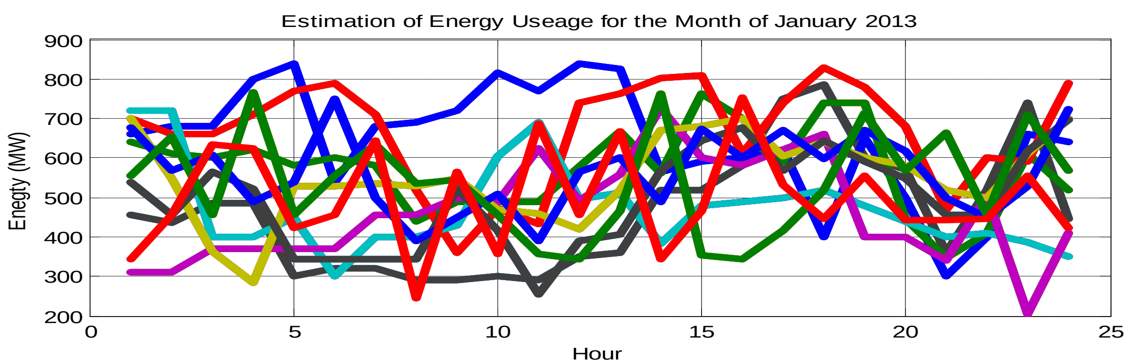

Figure 1.1: Estimation of energy Usage for the Month of January 2013

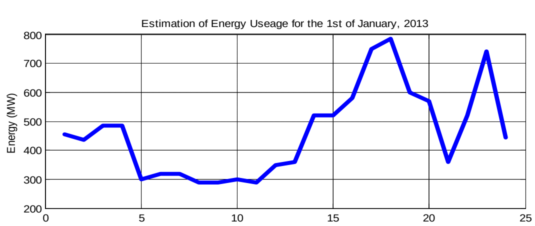

Figure 1.2: Estimation of Energy Usage for the 1st of January, 2013

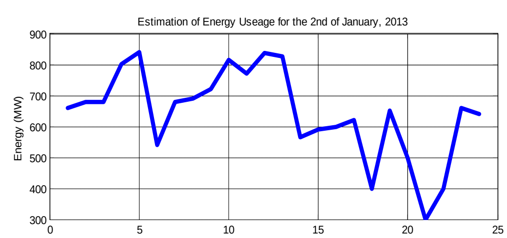

Figure 1.3: Estimation of Energy Usage For the 2nd of January, 2013

Figure 1.2 above, shows the energy distribution estimate for 1st Of January, 2013. The 18hr has the highest energy estimate while the lowest energy estimate is between the 7^{hr} and 11th hour. Figure 1.3 above, shows the energy distribution estimate for 2nd of January, 2013. The 5th hour has the highest energy estimate while the lowest energy estimate is 21st hour.

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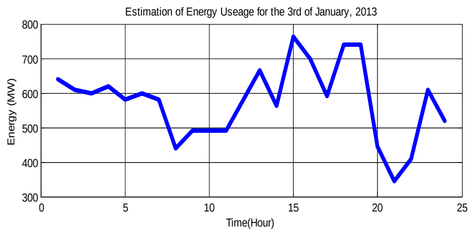

Figure 1.4 Estimation of Energy Usage for the 3rd of January, 2013

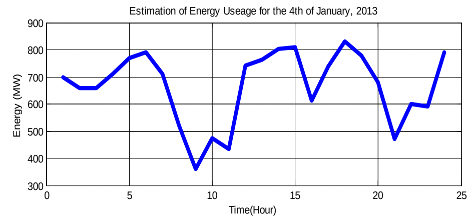

Figure 1.5 Estimation of Energy Usage for the 4th of January, 2013

Figure 1.4 above, shows the energy distribution estimate for 3rd of January, 2013. The 15th hour has the highest energy estimate while the lowest energy estimate is 21st hour. Figure 1.5 above shows the energy distribution estimate for 4th of January, 2013. The 18th hour has the highest energy estimate while the lowest energy estimate is 9th hour.

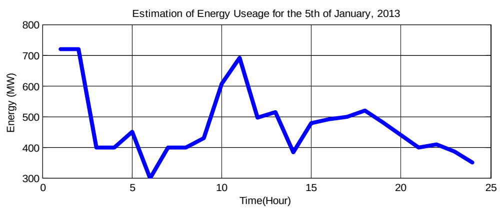

Figure 1.6 Estimation of Energy Usage for the 5th of January, 2013

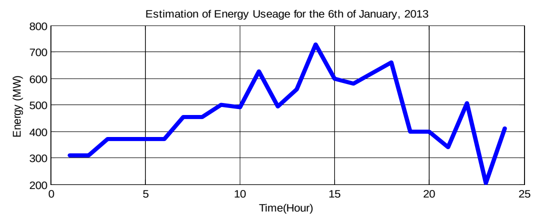

Figure 1.7 Estimation of Energy Usage for the 5th of January, 2013

Figure 1.6 above shows the energy distribution estimate for 5th of January, 2013. The 2nd hour has the highest energy estimate while the lowest energy estimate is 6th hour. Figure 1.7 above shows the energy distribution estimate for 6th of January, 2013. The 14th hour has the highest energy estimate while the lowest energy estimate is 23rd hour.

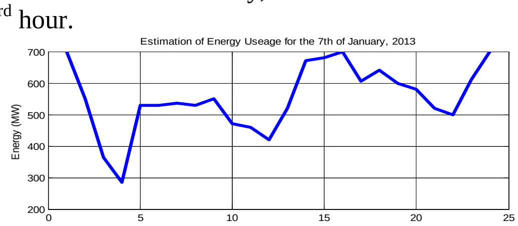

Figure 1.8 Estimation of Energy Usage for the 7th of January, 2013

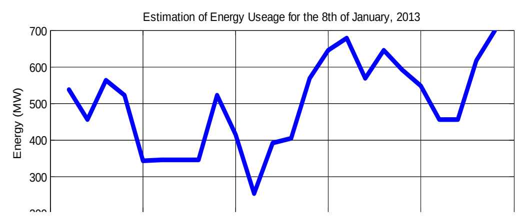

Figure 1.9 Estimation of Energy Usage for the 8th of January, 2013

Figure 1.8 above shows the energy distribution estimate for 7th of January, 2013. The 2nd hour, 16th hour and2 4th hour has the highest energy estimate while the lowest energy estimate is 4th hour. Figure 1.9 above shows the energy distribution estimate for 8th of January, 2013. The 24th hour has the highest energy estimate while the lowest energy estimate is 11th hour.

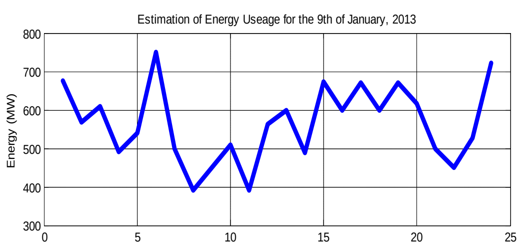

Figure 1.10 Estimation of Energy Usage for the 9th of January, 2013

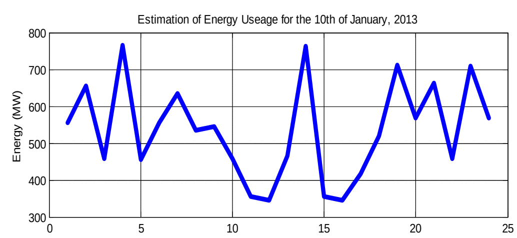

Figure 1.11 Estimation of Energy Usage for the 10th of January, 2013

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Figure 1.10 above shows the energy distribution estimate for 9th of January, 2013. The 6th hour has the highest energy estimate while the lowest energy estimate is 8th hour and 11th hour respectively. Figure 1.11 above shows the energy distribution estimate for 10th of January, 2013. The 4th hour and 14th hour has the highest energy estimate while the lowest energy estimate is 12th and 16th hour respectively.

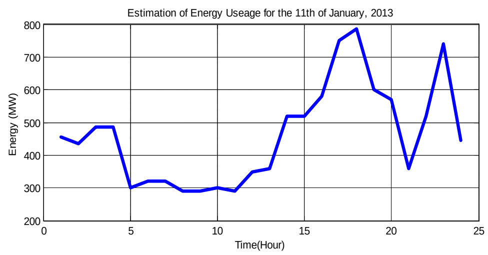

Figure 1.12 Estimation of Energy Usage for the 5th of January, 2013

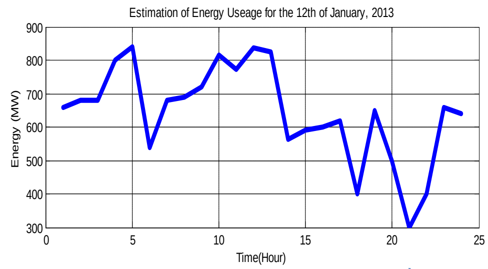

Figure 1.13 Estimation of Energy Usage for the 12th of January, 2013

Figure 1.12 above, shows the power energy distribution estimate for 11th of January, 2013. The 19th hour has the highest energy estimate while the lowest energy estimate is 9th hour. Figure 1.13 above shows the power energy distribution estimate for 12th of January, 2013. The 5hr mark has the highest energy estimate while the lowest energy estimate is 21st hour.

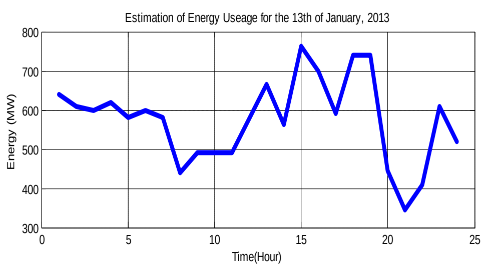

Figure 1.14 Estimation of Energy Usage for the 13th of January, 2013

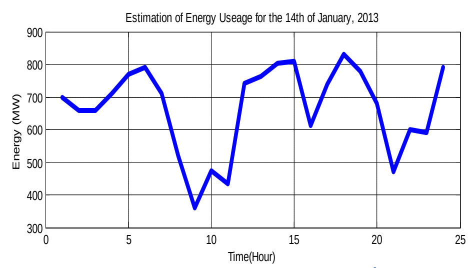

Figure 1.15 Estimation of Energy Usage for the 14th of January, 2013

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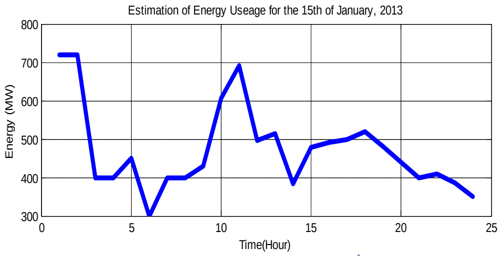

Figure 1.16 Estimation of Energy Usage for the 15th of January, 2013

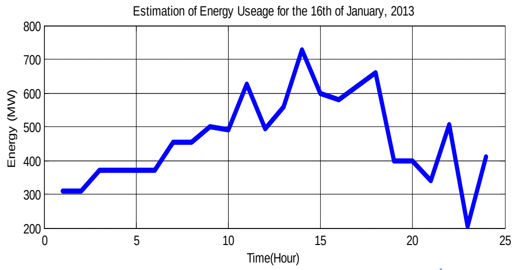

Figure 1.17 Estimation of Energy Usage for the 16th of January, 2013

Figure 1.16 above, shows the power energy distribution estimate for 15th of January, 2013. The 1st hour mark has the highest energy estimate while the lowest energy estimate is 6th hour. Figure 1.17 above, shows the power energy distribution estimate for 16th of January, 2013. The 14th hour has the highest energy estimate while the lowest energy estimate is 23rd hour.

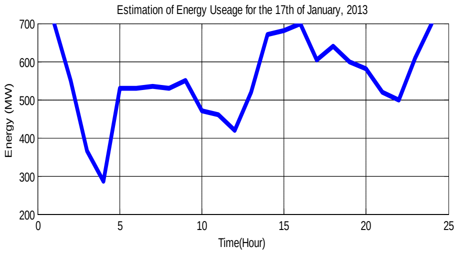

Figure 1.18 Estimation of Energy Usage for the 17th of January, 2013

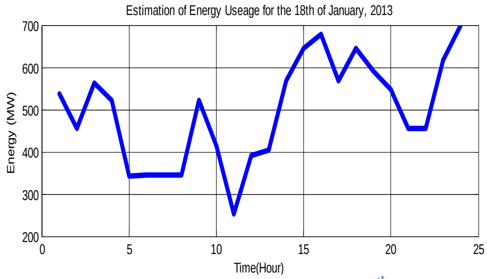

Figure 1.19 Estimation of Energy Usage for the 19th of January, 2013

Figure 1.18 above shows the energy distribution estimate for 17th of January, 2013. The 1st hour, 16th hour and 24th hour has the highest energy estimate while the lowest energy estimate is 4th hour. Figure 1.19 above, shows the power energy distribution estimate for 18th of January, 2013. The 24th hour has the highest energy estimate while the lowest energy estimate is 11th hour.

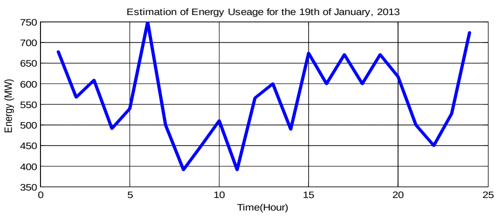

Figure 1.20 Estimation of Energy Usage for the 19th of January, 2013

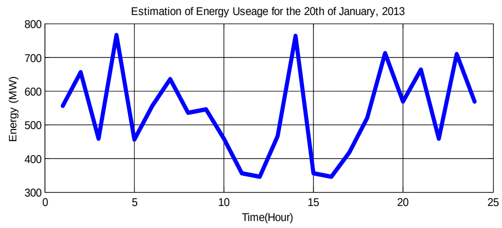

Figure 1.21 Estimation of Energy Usage for the 20th of January, 2013

Figure 1.20 above shows the energy distribution estimate for 19th of January, 2013. The 6th hour mark has the highest energy estimate while the lowest energy estimate is 8hr and 11th hour. Figure 1.21 above, shows the power energy distribution estimate for 20th of January, 2013. The 4th hour and14th hour has the highest energy estimate while the lowest energy estimate is 12th hour and 16th hour.

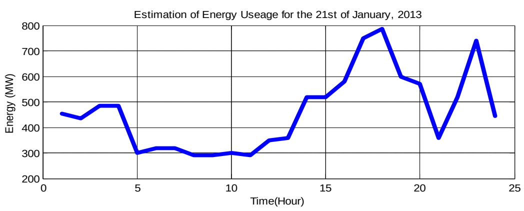

Figure 1.22 Estimation of Energy Usage for the 21st of January, 2013

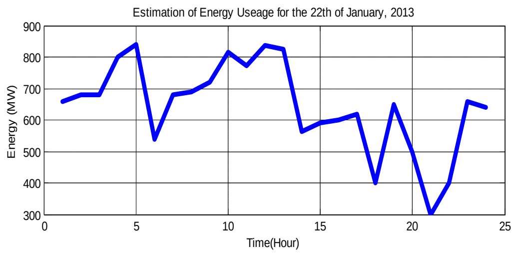

Figure 1.23 Estimation of Energy Usage for the 22nd of January, 2013

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Figure 1.22 above shows the energy distribution estimate for 21st of January, 2013. The 18th hour has the highest energy estimate while the lowest energy estimate is 9th hour. Figure 1.23 above, shows the energy distribution estimate for 22nd of January, 2013. The 5th hour has the highest energy estimate while the lowest energy estimate is 21st hour

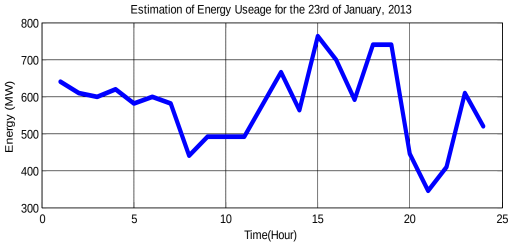

Figure 1.24 Estimation of Energy Usage for the 23rd of January, 2013

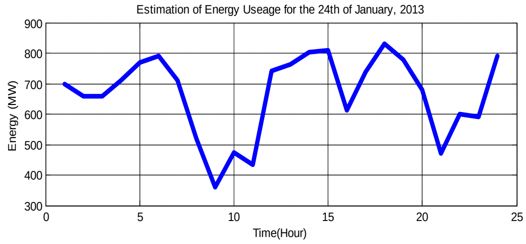

Figure 1.25 Estimation of Energy Usage for the 24th of January, 2013

Figure 1.24 above shows the energy distribution estimate for 23rd of January, 2013. The 15th hour has the highest energy estimate while the lowest energy estimate is 21st hour. Figure 1.25 above shows the energy distribution estimate for 24th of January, 2013. The 18th hour has the highest energy estimate while the lowest energy estimate is 9th hour.

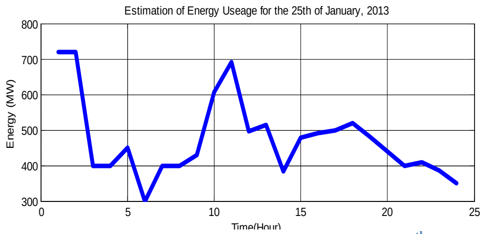

Figure 1.26 Estimation of Energy Usage for the 25th of January, 2013

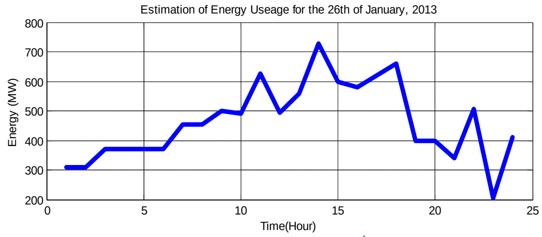

Figure 1.27 Estimation of Energy Usage for the 26th of January, 2013

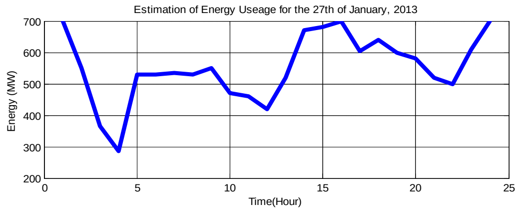

Figure 1.28 Estimation of Energy Usage for the 27th of January, 2013

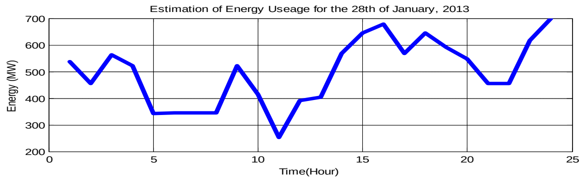

Figure 1.29 Estimation of Energy Usage for the 28th of

Figure 1.26 above, shows the power energy distribution estimate for 25th of January, 2013. The 2nd hour has the highest energy estimate while the lowest energy estimate is 24th hour. Figure 1.27 above shows the power energy distribution estimate for 26th of January, 2013. The 14th hour has the highest energy estimate while the lowest energy estimate is 23rd hour. Figure 1.28 above shows the energy distribution estimate for 27th of January, 2013. The 1st hour, 16th hour and 24th hour has the highest energy estimate while the lowest energy estimate is 4hr mark. Figure 1.29 above shows the power energy distribution estimate for 28th of January, 2013. The 24th hour mark has the highest energy estimate while the lowest energy estimate is 11th hour.

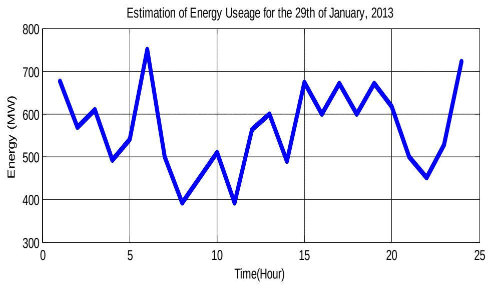

Figure 1.30 Estimation of Energy Usage for the 29th of January, 2013

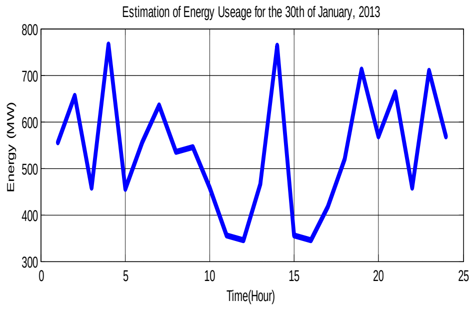

Figure 1.31 Estimation of Energy Usage for the 30th of January, 2013

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Figure 1.30 above shows the energy distribution estimate for 29th of January, 2013. The 6th hour has the highest energy estimate while the lowest energy estimate is 8th hour and 11th hour. Figure 1.31 above shows the power energy distribution estimate for 30th of January, 2013. The 4th and 14th hour has the highest energy estimate while the lowest energy estimate is 12th hour and 16th hour.

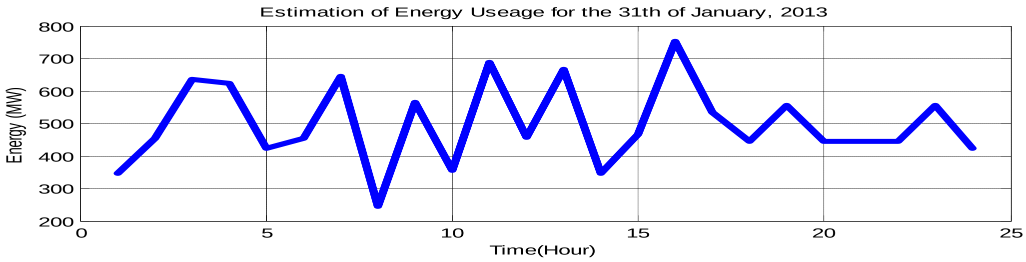

Fig 1.32: Estimation of Energy Usage for the 31st of January, 2013

Figure 1.32 above, shows the power energy distribution estimate for 31st of January, 2013. The 16th hour has the highest energy estimate while the lowest energy estimate is 7th hour.

IV.CONLUSION AND RECOMMENDATION

With the importance of electrical energy distribution, a proper way must be channeled to determine the patterns of energy distributions so as to ensure efficient planning and management of the scarce resources. From the findings, it can be observed that one cannot say one time is the peak or lowest as the supply varies from time to time. It is therefore concluded that estimation should be a continuous process.

The recommendations are as follows:

1. This type of program can be used to know the particular hour that energy is much needed
2. It can be used for proper planning in order to avoid overloading of energy distribution and dropping of energy supply.
3. It gives a summary report for all the energy distribution within the day.

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