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ENERGY MANAGEMENT SYSTEM FOR MULTI-LEVEL ELECTRICAL DISTRIBUTION SYSTEMS

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ABSTRACT
Load Management (LM) is an optimization problem which constrained by time of electricity use, peak demand, minimum load and electricity tariffs. The general objective of this research is to study the subject of LM techniques, especially rescheduling the load or part of it to other periods of the day and time of use (TOU) pricing on real industrial plant to evaluate the benefits of applying such management techniques. This thesis will focus on the development of two mathematical models for different types of end users.

These models will enable the utility planner to design a DSM in which demand, time and electricity prices will be used as the control variable of an objective function representing the target of the DSM program. The amount of energy, cost and time of use will reflect the state variables of the system. The first model is a DSM priority selection technique and the second model is an optimal tariff formulation. The applications of peak clipping, valley filling, load shifting, energy conservation and load building programs will be studied and evaluated.

KEYWORDS: Load management, DSM, TOU, Load shifting, Load building, Energy Conservation,

1- INTRODUCTION

Energy in all its forms is essential to life; and human society cannot survive without continuity of it. The demand for energy in Egypt has been increasing rapidly over many years and large capital investments are needed to satisfy this demand. Demand is affected by climate, economic growth and customer's consumption patterns.

These factors make the demand to fluctuate at different times. The imbalance in power supply and demand leads to shortage problems which will be uncomfortable to both suppliers and customers. Therefore, Demand Side Management (DSM) is the effective, efficient and economic use of energy by an organization. DSM has become widely accepted practice in industrial and commercial sectors in the world [1]. The following six-methods are the main principal means by which modem DSM programs can influence customer's demand for electricity as shown in table 1:

Table (1): Standard DSM load objectives effect on load curve, description and means of implementation

DSM OBJECTIVE	Description & Effect on load shape	Means of Implementation
PEAK CLIPPING	Refers to the reduction of utility loads during peak demand periods. The net effect is a reduction in both peak demand and total energy consumption	Direct utility control on consumer appliances or end-use equipment
VALLEY FILLING	It entails building of off-peak loads. This is often the case when there is under-utilized capacity that can operate on low cost fuels. The net effect is an increase in total energy consumption, but no increase in peak demand	Creation of new off-peak electric loads that previously operated on non-electric fuels, such as overnight charging of electric cars and thermal energy storage
LOAD SHIFTING	It involves shifting load from on- peak to off-peak periods. The net effect is a decrease in peak demand, but no change in total energy consumption.	Time of use rates and/or use of storage devices that shifts the timing of conventional electric appliances operation
STRATEGIC CONSERVA.	Refers to reduction in end-use consumption, there are net reductions in both peak demand and total energy consumption.	End use efficiency
LOAD BUILDING	It consists of an increase in overall sales; the net effect is an increase in in both peak demand and total energy consumption	Increased energy intensity and/or the addition of new customers.
FLEXIBLE LOAD SHAPE	Implementation of interruptible rates. Leading to a varying load shape. This allows the utility to interrupt the load when necessary and allow end users to be charged at a lower rate. Possibly will reduce peak demand	Load shape can be. flexible-if customers are presented with options as to the variations in quality of service that they are willing to allow in Possibly exchange for various incentives

A study on the concept of Demand Side management (**DSM**) for electric utilities is prepared by [2, 3, 4]. This study describes demand side management for electric utilities and discusses the evolution of this concept for load management, strategic conservation and marketing. A study on load management which covered the basis for load management, communication and load management, and implementation of load management in France have been published in [6].

2- IMPLEMENTATION OF DSM

Customer sensitivity to energy costs (Fuel costs) is one of the problems which caused the electric utility to consider demand-side option as main factor in planType equation here.ning the electric power station [5]. Demand-side management (DSM) involves planning analysis, and implementation of utility activities to influence customer load shapes. For implementation of utility DSM programs, there are 4 steps used as keys in this Process, these steps are:

- Establishment of DSM goal.
- Identification of appropriate end uses.
- Assessment of technical options.
- Development of implementation strategies.

The main component block of the D-STATCOM is the voltage-sourced inverter that converts an input dc voltage into a three-phase output voltage with desired magnitude and frequency.

2-1 EVALUATION OF DSM

Electric utility demand-side alternative is being evaluated in the utility resource planning process to increasing levels of complexity. Electric system planning requires the forest of electricity demands combined with the availability of supply-side recourses. Recourses were planned with a. suitable reserve margin to meet a regularly increasing demand. Growth was consistent and low cost supply-side resources were continuously being added [7]. DSM benefits both customer and utility alike. Demand-side planning assists the utility in meeting its objectives of matching supply required to meet the customer's demand. For utilities using DSM techniques, demand growth is limited to a manageable rate.

DSM results in lower costs than new supply-side recourses. Therefore, DSM planning process is important to utilities and customer. DSM planning becomes more important a menu of DSM alternatives evolves; each alternative in the menu is subjected to evaluation to prove cost-effectiveness. Evaluation of cost-effectiveness may be continuous.

2-2 DSM AND LEAST-COST PLANNING (LCP)

Demand-side management (DSM) is the process of supplying customers demand throw 24 hours by encouraging use of electrical energy when prices are low, or by, assisting customers to employ conservation measures such that their overall energy bill is low. But this will reduce the income to the supplier, and then costs of generation, transmission and distribution of energy will reduce. So, when planning new stations, reduction of the overall costs for the two sides must be considered [8]. When the two sides are included (supply-side, demand side) this process is known as Least-Cost Planning (LCP). So, LCP requires cooperation between the two sides to get maximum benefits for all of them.

3 – DISCUSSION AND PREPARING DATA OF EGYPTIAN ELECTRICAL POWER SYSTEM

According to the definitions of DSM programs, the five programs of DSM can be applied on the Egyptian Electrical Power System. The maximum summer load profile (maximum annual day load profile) for fiscal year (2011/2012) will be taken and the five programs will be applied on it. The hourly load curve will be divided into 4 parts, the first part will have 7 hours, the second part will have 5-hours; the third part will have 9 hours and the forth part will have 3 hours. Each part will have a length (L) and Share (S) where,

L = Number of hours/24 hours so,

$L_1 = 7/24 = 0.292$ $L_2 = 5/24 = 0.2$ $L_3 = 9/24 = 0.375$ $L_4 = 3/24 = 0.125$

S = Percentage of load in the part to the all load during the day.

For example if the loads during the part fours are 24301, 23068 and 22535 MW then

$$S_4 = \frac{24301 + 23068 + 22535}{All\ loads\ during\ the\ day\ (24\ hours)} = 0.134$$

$S_1 = 0.264$ $S_2 = 0.201$ $S_3 = 0.3999$

3-1 ENERGY CONSERVATION METHOD

In Energy Conservation method the demand will be decreased during the all load period of the day. Therefore, the load will be decreased during all parts of the day and the share will be decreased for all parts of the day. For example, if the demand will be decreased by a value of 4% then the load will be decreased by the value of 4% during the all hours of the day. Each load will be decreased by 4% as shown in Table (2) where, load before decreasing (LB) and loads after decreasing are shown in the Table (2). The resultant curve will be shown in Fig. (1).

Table (2): Application of Energy Conservation on Load curve before (LB) and load after (LA)

Time (hr) .	$L_{(B)}$ (MW)	$L_{(A)}$ (MW)
1	21470	**20611.2**
2	21105	**20260.8**
3.	20105	**19300.8**
4	19385	**18609.6**
5	18525	**17184.0**
6	18410	**17673.6**
7	18385	**17649.6**
8	19480	**18700.8**
9	20265	**19454.4**
10	21160 .	**20313.6**
11	21685	**20817.6**
12	22165.	**21278.4**
13	21965	**21086.4**
14	22085	**21201.6**
15	32522	**21432.0**
16	22575	**21672.0**
17	22425	**21528.0**
18	22300	**21408.0**
19	23861	**22906.56**
20	25705	**24676.8**
21	24786	**23794.56**
22	24301	**23328.96**
23	23068	**22145.28**
24	22535	**21633.6**

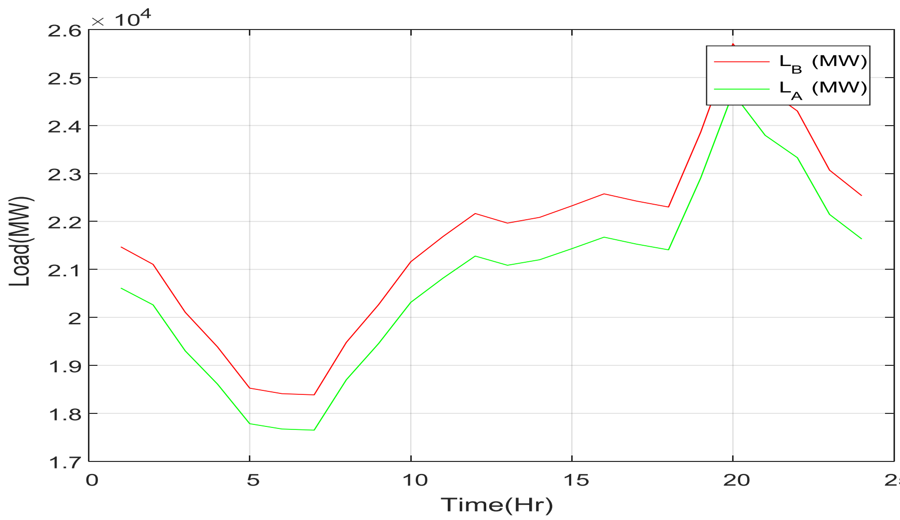

Fig. (1) Application of Energy Conservation on Load Curve Before (LB) and Load Curve after (LA)

3-2 Load Building Method

Load building means increasing the load during the all load period (during 24-hours). If the demand is increased by 4% then the load is increased by 4% during the all period. Each load will be increased by a value of 4% as shown in Table (3-2). The resultant curve will be shown in Fig. (2). Generally, load building will be applied after energy conservation was applied, if there is not enough energy, load-building will not be applied because this will increase the load during the all load period, which loads to increase in the total consumed power and total system cost for the utility.

Table (3): Application of Load Building Method on Egyptian electrical power system.

Time (hr)	$L_{(B)}$ (MW)	$L_{(A)}$ (MW)
1	21470	**22328.8**
2·	21105	**21949.2**
3	20105	**20909.2**
4	19385	**20160.4**
5	18525	**19266.0**
6	18410	**19146.4**
7	18385	**19120.4**
8	19480	**20259.2**
9	20265	**21075.6**
10	21160	**22006.4**
11	21685	**22552.4**
12	22165	**23051.6**
13	21965	**22843.6**
14	22085	**22968.4**
15	22325	**23218.0**
16	22575	**23478.0**
17	22425	**23322.0**
18	22300	**22300.0**
19	23861	**24815.44**
20	25705	**26733.2**
21	24786	**25777.44**
22	24301	**25273.04**
23	23068	**23990.72**
24	22535	**23436.4**

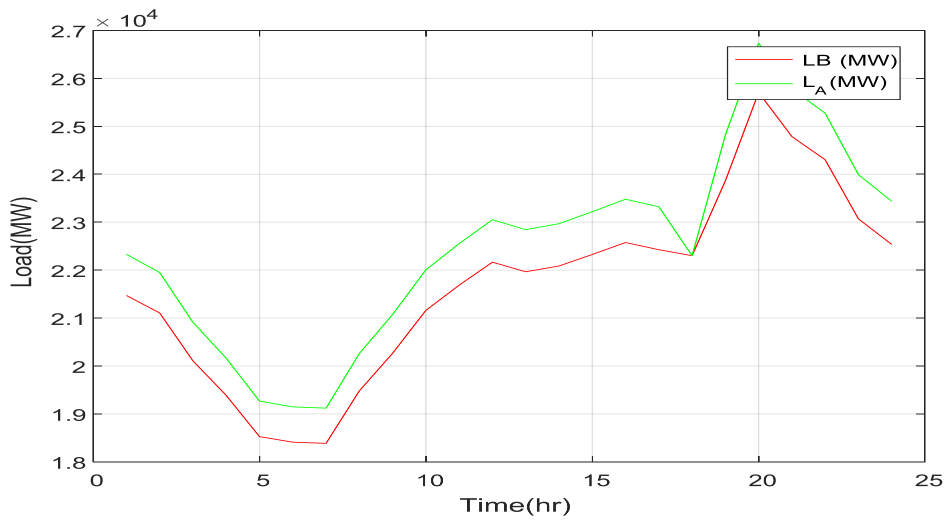

Fig. (2): Application Load building Method on Egyptian Electrical Power System

3-3 VALLEY FILLING METHOD

Valley Filling method means increasing the load during the valley period. In the Egyptian electrical power system, the valley period during the period from 3 am to 9 am. So, if the demand will be increased by a value 6% the increasing will be in the valley period (3-9 am). Each load in this period will be increased by a value of 6%. In this case share will be affected by this increasing. If the total load = 528150.3 MW.

The valley loads are

at 3 :00 am load = 21311.3 MW

at 4:00am load = 20548.1 MW
at 5:00 am load = 19 636.5 MW
at 6:00 am load = 19514.6 MW
at 7:00 am load = 19488.1 MW
at 8:00 am load = 20648.8 MW
at 9:00 am load = 21586.9 MW

$S_1 = \frac{142734.6}{528150.3} = 0.271$ $S_2 = \frac{107245.7}{528150.3} = 0.271$

$S_3 = 0.394$ $S4 = 0.132$

Each -load will be increased in the interval from 3 am to 9 am as shown in Table (4). The resultant curve will be shown in Fig. (3).

Table. (4): Application of Valley Filling Method on Egyptian electrical power system.

Time (hr)	$L_{(B)}$ (MW)	$L_{(A)}$ (MW)
1	21470	21470
2	21105	21105
3	20105	**21311.3**
4	19385	**20548.1**
5	18525	**19636.5**
6	18410	**19514.6**
7	18385	**19488**
8	19480	**20648.8**
9	20265	**21586.9**
10	21160	21160
11	21685	21685
12	22165	22165
13	21965	21965
14	22085	22085
15	22325	22325
16	22575	22575
17	22425	22425
18	22300	22300
19	23861	23861
20	25705	25705
21	24786	24786
22	24301	24301
23	23068	23068
24	22535	22535

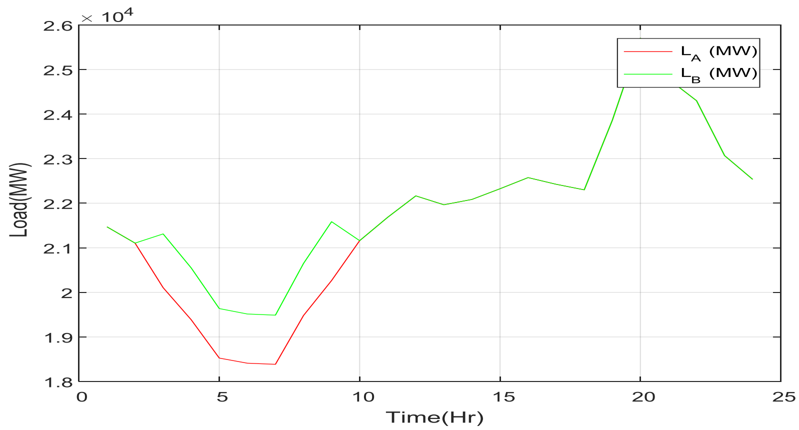

Fig. (3): Application of Valley Filling Method on Egyptian Electrical Power System

3-4 PEAK CLIPPING METHOD

In Peak Clipping method the load will be clipped during the peak period. If the demand is decreased by a value of 5% then each load during the peak period will be decreased by a value of 5% peak period in the interval from 19 - 23 hour. Loads after clipping 5% of each them

at 19:00 load = 23861xO.95 = 22667.95 MW
at 20:00 load = 25705xO.95 = 24419.75 MW
at 21:00 load = 24786xO.95 =.23546.70 MW
at 22:00 load = 24301xO.95 = 23085.95 MW
at 23:00 load = 23068xO.95 = 21914.60 MW

Shares will be changed for each part and became

S1=0.267 S2=0.204 S3= 0.397 S4= 0.131

Loads before and after clipping the load will be shown in Table. (5) and the resultant curve will be shown in Fig. (4).

Table (5): Application of Peal Clipping Method on Egyptian Electrical power system.

Time (hr)	$L_{(B)}$ (MW)	$L_{(A)}$ (MW)
1	21470	21470
2	21105	21105
3	20105	20105
4	19385	19385
5	18525	18525
6	18410	18410
7	18385	18385
8	1948	19480
9	20265	20265
10	.2116	21160
11	21685	21685
12	22165	22165
13	21965	21965
14	22085	22085
15	22325	22325
16	22575	22575
17	22425	22425
18	22300	22300
19	23861	**22667.95**
20	25705	**24419.75**
21	24786	***23546.7***
·22	24301	**23089.95**
23	23068	**21914.6**
24	22535	22535

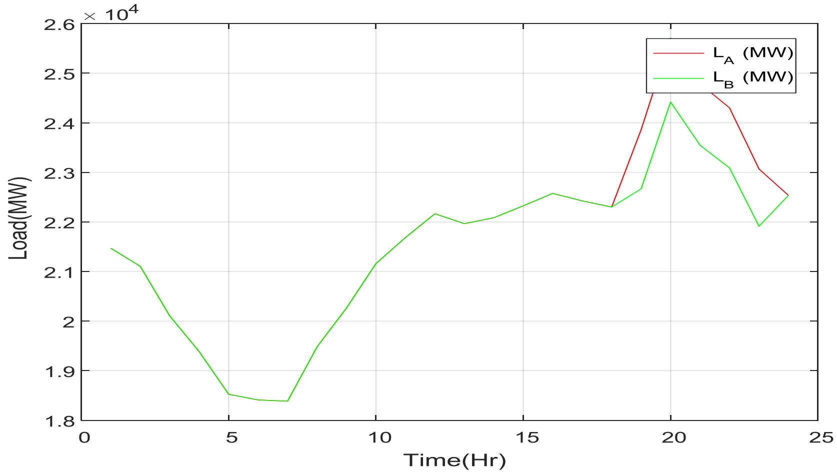

Fig. (4): Application of Peak Clipping of Egyptian Electrical Power System

3-5 LOAD SHIFTING METHOD

Load Shifting method means shift the load from the peak period to the off peak period. In this case if the load is increased by a value of 4% in the valley period, the load will be decreased by a value of 4% in the peak period. Each load in the valley period will be increased by 4%and each load in the peak period will be decreased by a value of 4%. The loads before increasing and decreasing will be shown in Table (6) and the resultant curve will be shown in Fig. (5).

Shares will be changed for each part of day

$S_1 = 0.272$ $S_2 = 0.203$

$S_3 = 0.395$ $S_4 = 0.131$

Table (6): Application of Load Shifting Method on Egyptian Electrical power system.

Time (hr)	**$L_{(B)}$ (MW)**	**$L_{(A)}$ (MW)**
1	21470	21470
2	21105	21105
3	20105	**20909.2**
4	19385	**20160.44**
5	18525	**19266.0**
6	18410	**19146.4**
7	18385	**19120.4**
8	19480	**20259.2**
9	20265	20265
10	21160	21160
11	21685	21685
12	22165	22165
13	21965	21965
14	22085	22085
15	22325	22325
16	22575	22575
17	22425	22425
18	22300	22300
19	23861	**22906.56**
20	52570	**24676.8**
21	24786	**23794.8**
22	24301	**23328.96**
23	23068	**22145.28**
24	22535	22535

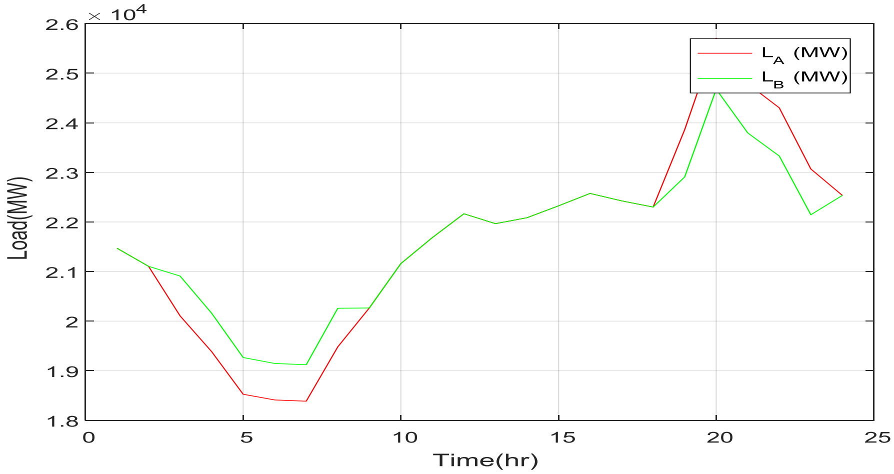

Fig. (5): Application Load Shifting Method on Egyptian Electrical Power System

4- Other Application of DSM Techniques:

Two applications of load shifting and peak clipping programs will be studied and evaluated. These will be done by describing the problem, then presenting the proposed Demand Side Management (DSM) programs besides the corresponding mathematical formulations, and finally, highlighting on the impact, of implementing such programs. These applications shall be done for weaving & textiles and mining & refractory industries. Two DSM programs are identified for a large textile factory. The first will utilize a load shifting technique, while the second will utilize peak Clipping technique [27].

4-1 The First DSM Technique: (Load Shifting)

The data obtained from the engineering team of the factory shows that all the machines can run at partial load mode, and the total demands of all the machines at any time interval must not exceed 2700 kW, provided that the total electricity energy consumption will remain at the level of 16,600 kWh. The electrical data and load curve before and after applying Demand Side Management technique are shown in Tables (7,8)

Table (3.6): Electrical Demands for the motors and its associated electrical data and parameters before applying any DSM Programs

Time duration number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Duration Data/Parameter**		
Time / Machine No.	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**P.Avg.**	**P.Max.**	**Machine L.F.**
1	0.00	0.00	400.00	400.00	400.00	400.00	400.00	400.00	0.00	0.00	240	400	0.6
2	0.00	0.00	0.00	0.00	350.00	350.00	350.00	350.00	350.00	350.00	210	350	0.6
3	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	0.00	0.00	350	500	0.7
4	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250	250	1
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.00	600.00	600.00	240	600	0.4
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80	800	0.1
7	0.00	0.00	400.00	400.00	400.00	400.00	400.00	0.00	0.00	0.00	200	400	0.5
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90	900	0.1
Total	750	750	1.550	1.550	2.800	2.700	2.500	1.600	1.200	1.200	1.660	2.800	0.59

Total consumed energy = 16600 kwh/day
Average demand = 1.660 kw
Max. Demand = 2.800 kw   System load factor = 0.59

The price of the electricity bill for the factory before applying DSM programs can be calculated as follows:
Demand Cost = 2800 (kW) x 87.6 (LE/kW) = 245,280 LE
Energy Cost = 16600 (kWh/day) x365 (day/year) x 0.1535 (LE/kWh) = 930,056.5 LE
Total Cost/year = 1.175.336.5 L. E
Total Cost/month = 97.944.7 L. E
The mathematical formulations reflecting the objective and constraints of the technique can be on the following form:

$$\text{Max. L.F.} = \frac{\left[\left|\frac{\sum_{j=1}^{10} PTO(j) x\, t(j)}{\sum_{j=1}^{10} t(j)}\right|\right]}{PTO(K)}$$

Subject to :
$P_{(i,j)} \geq 0$ i = 1,8 , j=1,10
$P_{(1,j)} \leq 400$ j = 1,10
$P_{(2,j)} \leq 350$ j = 1,10
$P_{(3,j)} \leq 500$ j = 1,10
$P_{(4,j)} \leq 250$ j = 1,10
$P_{(5,j)} \leq 600$ j = 1,10
$P_{(6,j)} \leq 800$ j = 1,10
$P_{(7,j)} \leq 400$ j = 1,10
$P_{(8,j)} \leq 900$ j = 1,10
$P_{TG(j)} \leq 2700$ j = 1,10
TEN = 16.600

Table (3.7): Electrical Demands for the motors and its associated electrical data and parameters after applying Load Shifting Technique

Time duration number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**electrical Data/Parameter**		
Time / Machine No.	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**P.Avg.**	**P.Max.**	**Machine L.F.**
1	0.00	73.27	400.00	400.00	395.29	341.48	357.50	400.00	73.27	81.22	252.200	400.00	0.63
2	0.00	73.27	73.27	0.00	346.31	319.19	350.00	350.00	350.00	216.74	350.00	0.62	
3	500.00	500.00	500.00	500.00	492.64	413.66	437.42	69.23	73.27	73.27	355.95	500.00	0.71
4	250.00	250.00	250.00	250.00	248.15	238.22	233.41	250.00	250.00	250.00	245.96	250.00	0.98
5	73.27	73.27	73.27	0.00	0.00	0.00	172.74	600.00	600.00	600.00	219.26	600.00	0.37
6	73.27	73.27	73.27	400.00	400.00	895.29	357.50	69.23	73.27	73.27	102.41	588.48	0.17
7	73.27	73.27	400.00	400.00	895.29	0.00	357.50	69.23	73.27	73.27	191.51	400.00	0.48
8	73.27	73.27	73.27	324.00	0.00	0.00	0.00	69.23	73.27	73.27	75.96	324.06	0.23
Total	1043.08	1189.62	1843.08	1874.06	1877.77	1877.15	1877.76	1876.92	1566.35	1574.30	1660.01	1877.77	0.88

Total consumed energy = 16600 kwh/day
Average demand = 1.660 kw
Max. Demand = 1.878 kw
System load factor = 0.88
The resultant electricity bill due to load shifting technique will be calculated as follows:
Demand Cost = 1877.76 (kW) x 87.6 (L. LE/kW) = 164,491.75 LE
Energy Cost=16600 (kWb/day) x 365 (day/year) x 0.1535 (LE/kWh) = 930,056.5 LE
Total Cost/year = 1,094.548.2 L.E
Total Cost/month = 91,212.35 L.E
Difference in electricity bill/month = 97.944.7 – 91,212.35 = 6,732.35 LE
Both the electrical consumed energy and the averaged demand will remain without change at the value of 16.600 kWh and 1660 kW
respectively, but the system load factor will have increased from 0.59 to 0.88

4-2 THE SECOND DSM TECHNIQUE: (PEAK CLIPPING):

The engineering team of the factory found that according to the production policy and other considerations it is possible to operate all the machines of the factory at maximum demand of 2300 kW from the fifth to the seventh time duration. The mathematical formulations reflecting the objective and constraints of the technique can be on the following form:

Max. L.F. =$\left[\left[\sum_{j=1}^{10} [PTO(j) \times t(j)] \right] / \sum_{j=1}^{10} t(j) \right] / P_{TO}(K)$

Subject to:

$P_{(i,j)} \geq 0$ i = 1,8, j=1,10
$P_{(1,j)} \leq 400$ j = 1,10
$P_{(2,j)} \leq 350$ j = 1,10
$P_{(3,j)} \leq 500$ j = 1,10
$P_{(4,j)} \leq 250$ j = 1,10
$P_{(5,j)} \leq 600$ j = 1,10
$P_{(6,j)} \leq 800$ j = 1,10
$P_{(7,j)} \leq 400$ j = 1,10
$P_{(8,j)} \leq 900$ j = 1,10
$P_{TO(j)} = 2300$ j = 5,6,7

Table (3.8) shows the electric data for the machines after applying DSM programs, also, Figure (3.8) shows the load curve after peak clipping.

Time duration number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Electrical Data/Parameter**		
Time / Machine No.	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**P.Avg.**	**P.Max.**	**Machine L.F.**
1	0.00	0.00	400.00	400.00	316.67	333.33	373.54	400.00	0.00	0.00	222.35	400.00	0.56
2	0.00	0.00	0.00	0.00	226.46	283.33	316.67	350.00	350.00	350.00	187.65	350.00	0.54
3	500.00	500.00	500.00	500.00	416.67	433.33	466.67	0.00	0.00	0.00	331.67	500.00	0.66
4	250.00	250.00	250.00	250.00	126.46	143.13	176.46	250.00	250.00	250.00	219.60	250.00	0.88
5	0.00	0.00	0.00	0.00	0.00	0.00	600.00	600.00	600.00	600.00	240.00	600.00	0.40
6	0.00	0.00	0.00	0.00	0.00	773.54	0.00	0.00	0.00	0.00	77.35	773.54	0.10
7	0.00	0.00	400.00	400.00	316.67	333.33	366.67	0.00	0.00	0.00	181.67	400.00	0.45
8	0.00	0.00	0.00	0.00	897.00	0.00	0.00	0.00	0.00	0.00	89.71	897.08	0.10
Total	750.00	750.00	1550.00	1500.00	2300.00	2300.00	2300.00	1600.00	1200.00	1200.00	1550.00	2300.00	0.67

Total consumed energy = 16.600 kwh/day
Average demand = 1.550 kw
Max. Demand = 2,300 kw
System load factor = 0.67

The new electricity bill due to the reduction of applying peak clipping technique will be calculated as follows:

Demand Cost = 2300 (kW) x 87.6 (LE/kW) = 201,480 LE
Energy Cost = 15,500 (kWh/day) x 365 (day/year) x 0.1535 (LE/kWh) = 868,426.25 LE
Total Cost/year = 1,069,906.25 L.E
Total Cost/month = 89,158.85 L.E
Difference in electricity bill/month = 97.944.7 – 89,158.85 =8,785.85 LE

Both the electrical consumed energy and average demand were decreased to 15,500 kWh and 1550 kW respectively, but the system load factor will increased to be 0.67 instead of 0.59.

5 – Conclusion

After application of DSM programs on Egyptian Electrical Power System, it can be noted that the load was reduced during the all load period as shown in Fig. (1), the total consumed power will be decreased. Also, total system cost will be decreased Energy Conservation can be made during the peak period only. This takes place as a result of using CFLs Lamps. Peak Clipping case different from Energy conservation that, Energy Conservation is deliberated. But peak clipping is necessary.

In case of Load Building, the load is increase during the all load period (24-hours) as shown in Fig. (2) the total consumed power and total system cost will be increased. So, it is preferring to make load building after making Energy Conservation.In case of Valley Filling, the load is increased during the valley period in the interval from 3 am to 9 am as shown in Fig. (3).

In case of Peak Clipping the load is decreased during the peak period in the interval from hour 6 pm to 12 pm as shown in Fig. (4). In case of Load Shifting; the load is increased in the off-peak period (valley period) in the interval from 3 am to 9 am. But the load is decreased in the peak period during the interval from-hour 6 pm to 12 pm as shown in Fig. (5).

Several impacts are attainable on different levels when implementing DSM programs. Actually the impacts on the end users and the electric utility are different according to the selected DSM mechanisms. For end users, when applying load shifting and conservation technique, peak demand, energy cost and demand cost will be lower than before applying the programs. But energy consumption in load shifting programs will be the same before and after program implementation. Impact of load growth programs will be an increase in the peak demand, energy consumption and energy cost, where conservation programs are decreasing in peak demand, energy consumption and demand cost.

Two applications of Demand Side Management (DSM) programs were-presented, the first and the second have been applied for a large textile factory. The first demand side management program using a Load Shifting technique has succeeded to reduce the cost by 6.87% and increase the load factor from 0.59 to 0.88, while the second demand side management (DSM) program utilizes Peak Clipping formulation has succeeded to reduce the cost by 8.97% and increase the load factor from 0.5 to, reach 0.67.

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