Fermi National Accelerator Laboratory

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Experimental Area Power Monitoring During Shutdown

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EXPERIMENTAL AREA POWER MONITORING DURING SHUTDOWN

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EXPERIMENTAL AREA POWER MONITORING

PURPOSE

The power consumption at the site is increasing every year and the power consumption in the fixed target beamlines is constantly changing for each run. Since we do not have an energy monitoring program in effect in the experimental areas; we are not in a position to tell whether we are using the electrical energy efficiently. The purpose of this study is to find the summer and winter base load of the three experimental areas while the beamlines are off and also to identify what kind loads are on. The most important purpose was to find the base loads in each of the big experimental halls during the shutdown.

PROCEDURE

Transformer 83 located at the Fermilab main substation is feeding seventy -three substations all throughout the three experimental areas. Twenty-two of these substations are feeding only power supplies and the remaining fifty-one are feeding buildings and power supplies. Since the lab is not equipped with a substation monitoring system; the DOE mobile energy laboratory was used to monitor each substation. The DRANETZ electrical load analyzer and the TECHTRAN data recorder were connected to each substation for an average two days taking KW and PF every fifteen minutes. All the loads fed by each substation were identified. It was hard to hook up the instruments to the compad substations during the winter monitoring due to the lack of space in the substations. The data was taken to the mobile energy laboratory and the plots were done. Kilowatt hour summary for some of the big winter power consuming buildings and a list of power consumption by substation is attached.

CONCLUSION

Every experimental area tunnel and building, except wide band, new muon lab, operations center and meson assembly building are all electrically heated. Experimental area power monitoring during the winter months has identified that 50-60% of the power was used for electrical heating. Labs A,B,C,D,E,MP9,NWA,TPL,Meson Det. Building,PS5, and Pagoda use a lot of heating power. More studies are needed to find the exact power consumption for each building. Service building heaters are all set at $80^{o}F$ - $90^{o}F$.

It is very reasonable to assume that 25KW is used for lighting for each of the 18 big buildings (experimental halls, PAB, MAB and OPS center) and 10 KW from each of the 24 substations feeding the tunnels and service buildings; thus a total of 16.5MWHR/day is used for lighting. It is my understanding that these lights are "ON" for twenty-four hours a day. There are 88, four foot fluorescent lamps in M01, which uses $1.7K/year for power only. There are at least 30, eight foot fluorescent lamps in each of the service buildings which uses $1.3K/year. These are some of the typical examples of the lighting system throughout the beamlines.

Looking at the power consumption April 1988-March 1989 graph, we could conclude the following.

Max. monthly electrical heating load in Jan.	=2100MWHR	
Total annual heating cost Oct.-May	=9600MWHR*$50/MWHR	= $480K
Total annual A/C cost. July-Aug.	=400MWHR*$50/MWHR	= $20K
Total annual lighting & misc. load	=12*2000MWHR*$50/MWHR	=$1200K
Total annual base power consumption	=$1700K	

RECOMMENDATIONS

If there are no safety problems, then we should consider gas heating for TPL,NWA,LAB B,C,D,E,MP9, which should save 65% of the annual heating cost. Since the experiments are changing over the years, we should leave the electrical heaters. In case of future safety problems, we could use the electric heating. Lab A and Meson Det. Building are already funded for gas conversion. By converting to gas, we are not only saving electrical power, but will also reduce substation and feeder loading. This will release capacity for future expansion. Some feeders are approaching their rating limits. Service Building heaters should be set at a lower temperature.

The lab should come up with lighting control for the experimental area buildings and tunnels. By installing motion sensors in the service buildings and by turning off the unnecessary lights during the night we will be able to save at least 40% of the lighting bill.

The window A/C units are a major power consuming element during the summer months. By installing economizers in the service buildings we should be able to save some during the summer months.

A WORD OF THANKS

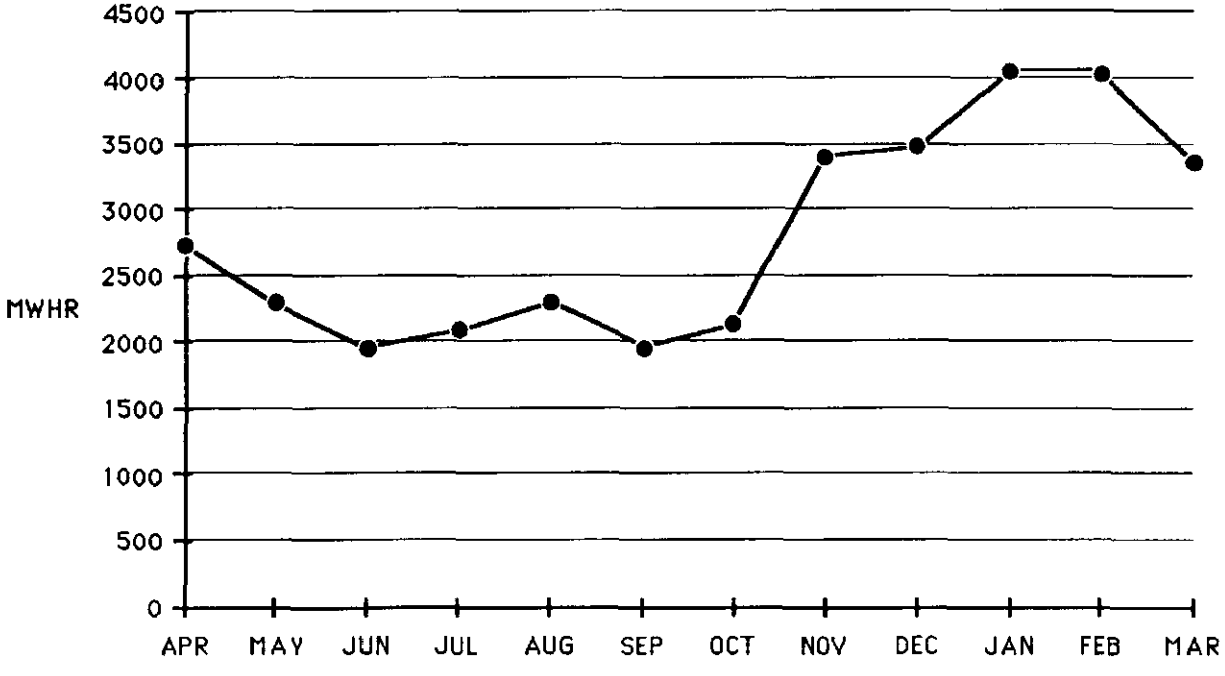
I would like to thank Bill Riches for his valuable time and effort in helping to put the instruments in each of the substations and helping me to solve the problems with the instruments. I like to extent my thanks to Robert Biester and his crew for all the help they gave to Riches and me.

EXPERIMENTAL AREA POWER CONSUMPTION DURING SHUTDOWN: APRIL 1988-MARCH 1989

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
FEEDER	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.	TOTAL	DEM.
#	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW	MWHR	MW
30	317	0.60	309	0.60	300	0.60	327	0.65	320	0.65	289	0.55	309	0.65	473	1.30	457	0.85	530	1.10	552	1.00	508	1.30
31	519	1.10	318	0.95	195	0.50	194	0.50	201	0.50	167	0.45	227	0.75	668	1.30	721	1.60	850	1.60	721	1.55	566	1.60
32	241	0.95	193	0.50	160	0.40	162	1.00	189	0.55	148	0.30	204	0.60	414	0.80	426	0.90	492	0.90	491	0.95	421	1.00
33	192	0.50	162	0.35	145	0.40	160	0.55	158	0.40	146	0.35	172	0.40	398	0.80	444	0.90	485	0.95	518	1.00	415	1.00
35	748	1.50	722	1.20	662	1.20	723	1.80	792	1.45	676	1.20	688	1.30	607	1.30	524	1.00	608	1.05	625	1.10	580	1.80
36	435	0.80	368	0.65	324	0.65	327	0.65	404	0.80	345	0.60	328	0.65	479	0.80	503	1.05	572	1.05	545	1.05	444	1.05
37	272	0.50	224	1.10	175	0.50	197	0.40	241	0.45	194	0.40	219	0.65	366	0.80	405	0.85	519	1.25	585	1.55	434	1.55
TOTAL	2724		2296		1961		2090		2305		1965		2147		3405		3480		4056		4037		3368	

FEEDER 30 & 31 FEED MESON BEAMLINE
FEEDER 32, 33 & 35 FEED NEUTRINO BEAMLINE
FEEDER 36 & 37 FEED PROTON BEAMLINE

EXPERIMENTAL AREA POWER CONSUMPTION DURING SHUTDOWN : APRIL 1988-MARCH 1989



EXPERIMENTAL HALL: WINTER POWER CONSUMPTION DURING SHUTDOWN

BUILDING	DATE	KWHR/DAY	LOAD
TPL	1/28/89	3583	LIGHTS, HEAT, RELAY RACKS,A/C
LAB A	2/7/89	6000	LIGHTS, HEAT, M/C SHOP
LAB E&F	2/7/89	3307	HEAT, LIGHT
NWA	2/9/89	7388	LIGHT, HEAT, NS4 AND PK
LAB D	2/9/89	4974	HEAT, LIGHT, PK
LAB B	2/23/89	4008	HEAT, LIGHT
MESON DET.BUIL	2/27/89	9673	HEAT,LIGHT
MP9	3/8/89	2987	HEAT,LIGHT,RELAY RACKS
MW9	3/8/89	5913	HEAT,LIGHT,COUNTING ROOM
LAB C	3/18/89	1788	HEAT ONLY
TOTAL		49621	KWHR/DAY

BEAMLINE SHUTDOWN BASE LOAD: SUMMER AND WINTER 1988/1989 J.PATHIYIL

PROTON SHUTDOWN BASE LOAD				NEUTRINO SHUTDOWN BASE LOAD				MESON SHUTDOWN BASE LOAD			
SUB NAME	SUB LOCA.	SUMMER KW/HR	WINTER KW/HR	SUB NAME	SUB LOCA.	SUMMER KW/HR	WINTER KW/HR	SUB NAME	SUB LOCA.	SUMMER KW/HR	WINTER KW/HR
PL1	PS1	75	176	NL1	NS1	27	44	ML1	MS1	16	66
PL1A	PS1	0	0	NL1A	NS1	12	25	ML11	MS1	0	0
				NL1B	NS1	0	0				
PL8	PS2	20	25	NL2	NS2	5	19	ML2	MS2	23	49
				NL2A	NS2	25	35	ML3	MS2	0	0
								ML3A	MS2	0	0
PL3	PS3	26	63	NL3	NS3	12	24	ML4	MS3	29	58
PL4	PS3	19	90					ML4A	MS3	0	0
PL5	PS3	14	52								
PL2	PS4	46	74	NL6	NS4	135	307	ML5	MS4	0	0
PL2A	PS4	33	55	NL6A	NS4	17	5	ML6	MS4	67	403
PL2C	PS4	25	30	NL6B	NS4	0	0	ML10	MS4	7	7
PL2D	PS4	0	0								
PL11	PS5	16	85	NL8	NEB	11	45	ML12A	MS5	25	158
								ML13A	MS5	30	120
PL18	PS6	15	65	NL4	NW7	120	82	ML9A	MS6	20	75
PL19	PS6	0	0	NL4A	NW7	0	0				
PL9	HIL	89	91	NL10A	LAB F	118	138	ML7	MDE	0	0
PL10	HIL	0	0	NL10	LAB B	118	167	ML8	MDE	0	0
PL12	HIL	0	0	NL11	LAB B	73	60	ML8A	MDE	25	30
PL13	WBL	0	0	NL15	JON L	229	265	ML18	MW9	140	246
PL14	WBL	98	112	NL15A	JON L	0	0	ML19	MP9	145	125
PL15	WBL	90	110								
PL17	NS7	21	53	NL9	LAB G	0	0	ML15	MS7	10	20
				NL9A	LAB G	0	0	ML16	MS7	0	0
				NL9B	LAB G	15	65	ML17	MS7	0	0
				NL9C	LAB G	0	10				
PL6	TPL	63	149	NL5	NW8	12	100	ML14	CRYO	0	0
PL7	TPL	49	61	NL13	LAB D	55	207	ML14A	CRYO	18	56
				NL12	LAB A	211	450				
				CASEY	LAB D			ML9B	MAB	5	40
PL16	MAG	5	20								
SITE 50	PS6	50	75								
SITE 52	PS6	50	75								
TOTAL		804	1461			1195	2048			560	1453