SANDIA REPORT
SAND2012-0379
Unlimited Release
Printed January 2012

Demand Response Pilot Event Conducted August 25, 2011 Summary Report

Donald Lincoln
Christopher Evans

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Approved for public release; further dissemination unlimited.

Sandia National Laboratories

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

NOTICE: This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof, or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865) 576-8401
Facsimile: (865) 576-5728
E-Mail: reports@adonis.osti.gov
Online ordering: http://www.osti.gov/bridge

Available to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Rd.
Springfield, VA 22161

Telephone: (800) 553-6847
Facsimile: (703) 605-6900
E-Mail: orders@ntis.fedworld.gov
Online order: http://www.ntis.gov/help/ordermethods.asp?loc=7-4-0#online

SAND2012-0379
Unlimited Release
Printed December 2011

Demand Response Pilot Event Conducted August 25, 2011 Summary Report

Donald Lincoln
Christopher Evans
Facilities Management and Operations Center (FMOC)
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-MS0924

Abstract

Energy management in a commercial facility can be segregated into two areas: energy efficiency and demand response (DR). Energy efficiency focuses on steady-state load minimization. Demand response reduces load for event driven periods during the peak load. Demand-response-driven changes in electricity use are designed to be short-term in nature, centered on critical hours during the day when demand is high or when the electricity supplier's reserve margins are low.

Due to the recent Federal Energy Regulatory Commission (FERC) Order 745, *Demand Response Compensation in Organized Wholesale Energy Markets* the potential annual compensation to Sandia National Laboratories (SNL) from performing DR ranges from $300K to $2,400K. While the current energy supply contract does not offer any compensation for participating in DR, there is benefit in understanding the issues and potential value in performing a DR event. This Report will be helpful in upcoming energy supply contract negotiations to quantify the energy savings and power reduction potential from DR at SNL.

On August 25, 2011 the Facilities Management and Operations Center (FMOC) performed the first DR pilot event at SNL/NM. This report describes the details and results of this DR event.

ACKNOWLEDGMENTS

The authors wish to acknowledge Mike Rocco (4844) and Mike Rymarz (4844) for their assistance in identifying the facilities to include in the demand response (DR) pilot event, programming of the Facilities Control System (FCS) to control the event, and operating the FCS system during the dynamic implementation on August 25, 2011. We also wish to acknowledge the insightful assistance of Lucille Roybal (4821) in planning the event. We wish to thank the FMOC Operations Leads, especially Wayne Potter (4824), for assisting with customer notification, and Technologists for providing the customer interface to communicate the plan for the DR pilot event to the facility occupants and negotiating adjustments to our plans during the performance period. We wish to thank Mary Bultmann (4853) and John Rathbun (4824) for their assistance in gathering the energy data for each facility participating in the event. We must also thank Jack Mizner (4853) and Stan Harrison (4850) for providing management support to the authors in the planning and communicating the event. We acknowledge and thank Mike Quinlan (4870) and the Laboratories' Management for authorizing the DR pilot event. And last, we wish to thank the building occupants affected by the elevated temperatures in their work spaces on the afternoon of August 25, 2011 for tolerating this inconvenience.

CONTENTS

1. Introduction 7
1.1 Choosing Included Facilities 9
1.2 United States Air Force Participation 10
1.3 Specific Targets 10
1.4 Estimated Cost 10
1.5 Communication Strategy 10
2. Data Acquisition, Analysis, and Results 10
3. Conclusions 12
4. References 13

Appendix A: Specific Facilities Considered 15
Appendix B: Demand Response Pilot Event Summary Data 17

FIGURES

Figure 1-1: Annual Hourly CAISO Electric Energy Use for FY 2006 7
Figure 1-2: Organized Wholesale Energy Markets. 8

TABLES

Table 1-1: Organized Wholesale Energy Market Price Caps. 9
Table 1-2: SNL Demand Response Annual Compensation Potential. 9

ACRONYMS

Acronym	Definition
BLP	Baseline Load Profile
CAISO	California ISO
DR	Demand Response
ERCOT	Electric Reliability Council of Texas
FCS	Facilities Control System
FMOC	Facilities Management and Operations Center
FERC	Federal Energy Regulatory Commission
HVAC	Heating, Ventilating, and Air Conditioning
ISO	Independent System Operator
ISONE	ISO New England
LBNL	Laurence Berkeley National Laboratory
MISO	Midwest ISO
NYISO	New York ISO
PJM	PJM Interconnection
SNL	Sandia National Laboratories
SPP	Southwest Power Pool

1. Introduction

Energy management in a commercial facility can be segregated into energy efficiency and demand response (DR). Energy efficiency focuses on steady state load minimization. Demand response reduces load for event-driven periods during the peak load (Kiliccote et al. 2006). Commercial facility DR refers to voluntary actions by customers that change their consumption of electric power in response to price signals, incentives, or directions from grid operators at times of high wholesale market prices or when electric system reliability is jeopardized. Demand-response-driven changes in electricity use are designed to be short-term and centered on critical hours during the day when demand is high or when the electricity supplier's reserve margins are low (FERC 2007).

Figure 1-1 illustrates the focus of DR. This curve is the hourly energy demand for the California Independent System Operator (CAISO), the organization that manages and operates the California transmission system and wholesale energy market. During FY 2006 CAISO sorted from highest energy demand hour to the lowest energy demand hour. This curve is typical of electric supply throughout the world.

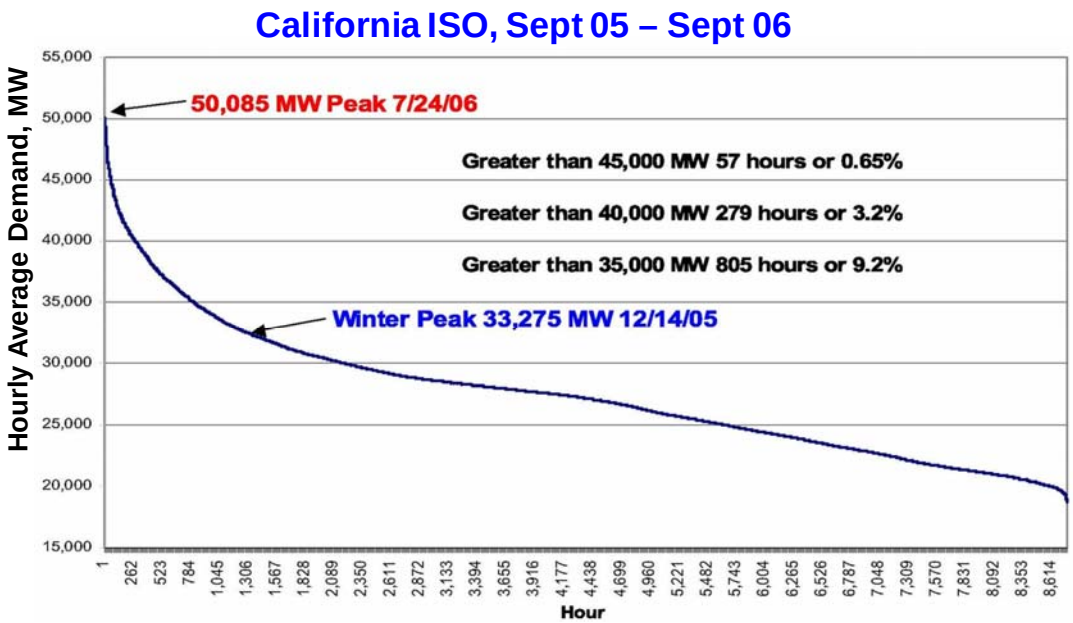

Figure 1-1: Annual Hourly CAISO Electric Energy Use for FY 2006.

This curve shows that if the CAISO reduced demand by 10% for approximately 60 hours during the year, the California electric system would reduce total generation needs by 5000 megawatts (MW). This equates to eliminating the need for approximately 50 natural gas-fired-100 MW-peaking generating units.

Demand Response events are typically scheduled between 12:00 p.m. and 7:00 p.m. on eight to 15 days during the hottest period of the year. Analysis has determined that automated DR

programs are more efficient and effective than manually controlled DR programs due to persistence (Piette et al. 2009).

The FERC estimates the 2009 nationwide reduction in peak demand from DR programs to be 37 gigawatts, and by 2019 to possibly be as much as 188 gigawatts or 20% (FERC 2009) of the nationwide peak demand. The benefits from this on-peak reduction in energy use include:

- Reduction in wholesale power prices
- More efficient operation of power markets
- Enhanced power system reliability
- Environmental benefits from reduced generation
- Operational and capital cost savings from avoided new generation and deferred transmission and distribution costs (FERC 2009)

These benefit society as a whole, not just the participants. Without a DR mechanism, the electric supplier is forced to assume all customers have an inelastic demand for energy and will pay any price for it (Aalami et al. 2008).

In March 2012, the FERC issued final Order 745, *Demand Response Compensation in Organized Wholesale Energy Markets* (FERC 2011). This order states that demand response suppliers must be compensated by the energy market at the current hour's local market price for energy. This helps ensure organized wholesale energy market competition and removes barriers to the participation of DR resources. FERC also directed compensation costs be allocated among those customers who benefit from the lower prices for energy resulting from the demand response. FERC has allowed the organized wholesale energy markets to establish implementation details for DR compensation over the next two years following the final order issue date. Figure 1-2 shows these organized wholesale energy markets.

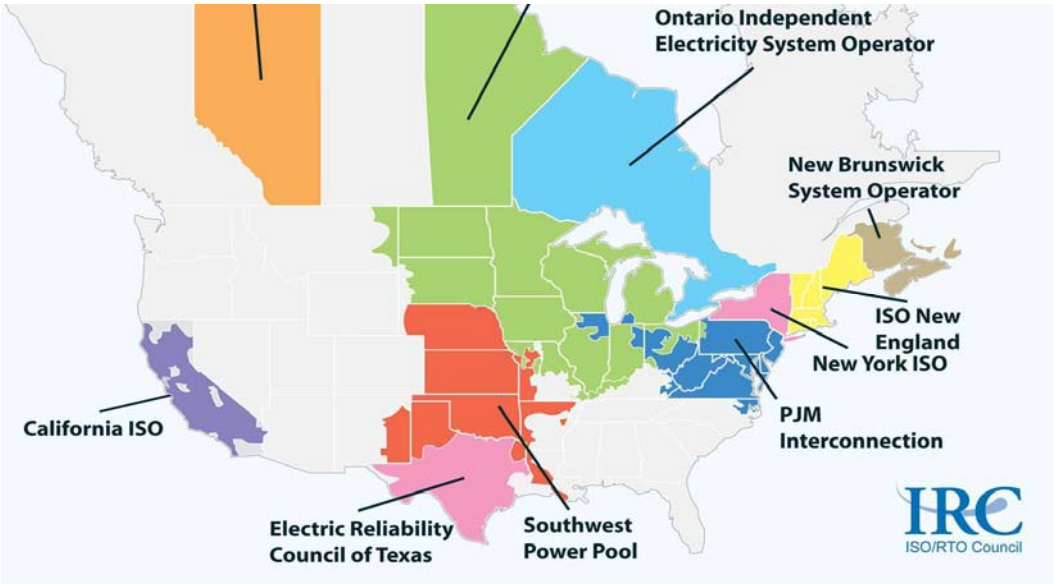

Figure 1-2: Organized Wholesale Energy Markets.

Each of these markets has established peak energy prices in conjunction with FERC. These peak energy prices, shown in Table 1-1, are an indicator of the potential value, at least as an upper bound, of DR because demand response events typically occur during these peak periods.

Table 1-1: Organized Wholesale Energy Market Price Caps.

		$/MWH
1.	California ISO (CAISO)	1000
2.	Electric Reliability Council of Texas (ERCOT)	5000
3.	Southwest Power Pool (SPP)	1000
4.	Midwest ISO (MISO)	1000
5.	PJM Interconnection (PJM)	2700
6.	New York ISO (NYISO)	1000
7.	ISO New England (ISO NE)	1000

The potential annual compensation to SNL-NM from performing DR is shown in Table 1-2 and ranges from $300K to $2,400, based on the following assumptions:

- SNL Peak Electric Use – 45.3 MW
- 12 DR events per year at 6 hours duration each
- 5% to 10% from HVAC DR
- Computing & Network Services (C&NS) – 6 MW with 1/3 reduction
- DR valued at wholesale market price cap per MWH ($1000, $2500, $5000)

Table 1-2: SNL Demand Response Annual Compensation Potential.

$/MWH Price Cap	$1,000	$2,500	$5,000
5% from HVAC DR, 33% C&NS	$300K	$770K	$1500K
10% from HVAC DR, 33% C&NS	500K	$1200K	$2400K

While the SNL/NM current energy supply contract does not offer any compensation for participating in DR, there is potential value in performing a DR event. This information would be helpful in negotiating the new energy supply contract.

Sections 1.1 through 1.5 describe the issues that needed evaluation before SNL management approved the performance of the DR pilot event.

1.1 Facilities Included in DR Event

SNL has 44 facilities with HVAC systems that allow automated zone temperature control. Automated control of DR events ensures persistence in future events and is considered the best long term approach (Koch and Piette, 2007). We chose to focus the DR event on office facilities with FCS-automated HVAC controls.

1.2 United States Air Force Participation

Sandia National Laboratories and Kirtland Air Force Base share a common site and a common electric energy supply contract although the electric supply for each is metered separately. A joint DR event would be ideal; however, the Air Force has minimal automated HVAC controls in their facilities and the difficulty of performing a DR event led them to choose not to participate this year.

1.3 Specific Targets

Typically DR focuses on reductions in electric energy use for HVAC, lighting, water heating, and similar functions, but SNL has only minimal lighting controls and essentially no water heating, so these were excluded. SNL does have a large computer operations center that uses approximately six megawatts of electricity. When we met with this organization (9300) they proposed several methods for reducing computer usage during a DR event. Organization 9300 plans to perform a test to evaluate the impact on their operations and demonstrate the actual electric use reduction. They estimate a potential reduction of approximately two megawatts. We chose not to include their test of these reductions in the HVAC portion of the DR event because their reduction is not weather dependent. Their computer operations reduction test will be performed later and included as an addendum to this report.

1.4 Estimated Cost

We chose to not allow the DR pilot event to drive any control system upgrades. The only direct cost of the event was the reprogramming of the automatic FCS, estimated not to exceed three person-weeks of effort resulting in minimal cost.

1.5 Communication Strategy

FMOC notified the SNL staff of the plan for the DR pilot event in the *Sandia Daily News*. Finally, we provided email notification to the occupants of the facilities included in the DR pilot event the afternoon before the event day. None of these issues proved detrimental to proceeding with the DR pilot event and FMOC management directed us to proceed with event planning.

2. Data Acquisition, Analysis, and Results

This section describes the facilities included in the DR pilot event, the control strategy for these facilities, the data collected during the event, the calculations performed in determining the electric energy reduction during the event, and the energy reduction results.

The FCS Team developed the software to perform the DR pilot event by raising the zone temperatures from the normal summer level of 78°F to 82°F for the period of the event and entering date, start, and end times for the DR pilot event. We planned to perform the pilot event on the hottest day of the summer still available after completing the necessary preparations. By the time we had completed all preparations for the event it was August 10th and the hottest days of the summer had passed. We then attempted to identify the hottest day remaining in the season

by carefully monitoring the National Weather Service forecast and finally chose August 25, 2011.

The 46 facilities originally chosen for inclusion, the facilities actually included in the DR pilot event, and the reasons some facilities were excluded are listed in Appendix A. Some facilities were excluded for the following reasons:

- Power meter out of service
- Power meter provided no data on the day of the event (8/25/2011)
- The building occupants requested they be excluded
- The building HVAC was out of service the day of the event
- The building had no or minimal office space
- FCS was not operational in the building

The baseline load profile (BLP) is the amount of energy a facility would have used during the DR event during this time period. Industry has developed many methods for calculating the BLP over the history of demand response. The California Energy Commission funded research (Coughlin et al. 2008) to assess the accuracy of algorithms for determining estimates for building electric load usage profiles (BLP) for commercial facilities participating in DR programs. This research, performed by Laurence Berkeley National Laboratory (LBNL), tested seven BLP algorithms on a sample of 33 buildings located in California for actual energy use data from May 2005 through October 2006. LBNL selected proxy DR event days as the hottest 25 percent of the non-holiday or weekend days in this May through October period. After performing statistical analysis of each BLP algorithm on the conditions of the proxy event days, LBNL determined the "simple average over the highest three out of 10 previous days with morning adjustment" to be most accurate (Coughlin et al., 2008). We followed this methodology with one exception. We used the simple average of the three most similar weather days to our event day since our DR event day was not one of the hottest days of the summer.

Appendix B shows the energy use data collected prior to and during the DR pilot event. The energy use data for August 16, 17, and 18, 2011 are presented in this table because these three days best represent the weather of August 25, 2011 and are used in the calculations presented in this section and Appendix B.

In the calculated values shown in Appendix B, "d" represents the day associated with the data and "h" represents the hour and the following definitions apply:

- pl(d,h) – the average of the 3 hourly loads (kW) for the similar weather days of the previous 10 days
- c(d) – the morning adjustment factor
- al(d,10) – the actual load (kW) on this day at 10:00 am used in calculating c(d)
- al(d,11) – the actual load (kW) on this day at 11:00 am used in calculating c(d)
- pl'(d,h) – the BLP with the morning adjustment factor applied (kW)
- Δp(h) – the decrease in energy use due to the DR pilot event in hour "h"

The calculated values are determined as follows:

$$c(d) = \frac{al(d,10) + al(d,11)}{pl(d,10) + pl(d,11)} \quad (2\text{-}1)$$

$$pl'(d,h) = c(d) \times pl(d,h) \quad (2\text{-}2)$$

$$\Delta p(h) = pl'(d,h) - [\text{actual energy use on the day and hour of the DR event}] \quad (2\text{-}3)$$

where d = August 25, 2011 in equations (2-2) and (2-3)

The spreadsheet shown in the table in Appendix B performs these calculations and shows their results. The BLP for the 19 facilities during the DR pilot event (1:00 p.m. to 5:00 p.m. on August 25, 2011) totaled 13,800 kilowatt hours with a reduction of 980 kilowatt hours from the event or a 7.1 percent reduction. This compares favorably with our estimate of 5 to 10 percent reduction from the HVAC systems. If all of the FCS-controlled facilities containing significant office space were included in the DR pilot event then, based on building square footage, the event would have produced a reduction of 1940 kilowatt hours. This is somewhat less than the 2270 kilowatt hours we estimated for the DR pilot event, probably because we were unable to perform the DR pilot event on one of the hottest days of the summer.

3. Conclusions

On August 25, 2011 the FMOC performed the first DR pilot event at SNL-NM. The BLP represents the amount of energy a facility would have used during the DR event in the absence of the DR event. The BLP for the 19 facilities during the DR pilot event (1:00 to 5:00 PM on August 25, 2011) totaled 13,800 kilowatt hours with a reduction of 980 kilowatt hours from the event or a 7.1 percent reduction. This compares favorably with our estimate of 5 to 10 percent reduction. This data is shown in detail in Appendix B.

We originally chose 46 facilities with FCS control to potentially participate in the DR pilot event. Seven were excluded because they had minimal office space, fourteen were excluded due to power meter problems, four were excluded due to other maintenance issues, and two opted out due to operational needs that day, leaving 19 facilities that participated in the DR pilot event. This is shown in Appendix A.

If all of the FCS-controlled facilities containing significant office space were included in the DR pilot event then, based on building square footage, the event could have produced a reduction of 1940 kilowatt hours. This is somewhat less than the 2270 kilowatt hours we estimated for the DR pilot event, probably because we were unable to perform the DR pilot event on one of the hottest days of the summer.

SNL has a large computer operations center that uses approximately six megawatts of electricity. Organization 9300, the operator of the computer center, proposed several methods for reducing computer usage during a DR event. Organization 3900 plans to perform a test to evaluate the impact on their operations and demonstrate the actual electric reduction. We chose not to include their test of these reductions in the HVAC portion of the DR event as their reduction is not

weather dependent. Their computer operations reduction test will be performed later and included as an addendum to this report.

While the results of the August 25, 2011 demand response pilot event were positive, we recommend performing another DR event in the summer of 2012 under the appropriate weather conditions. We should also include the organization 9300 computer operations center in the event to better demonstrate the capability of SNL-NM to perform in normal demand response conditions.

4. References

Aalami, H., Yousefi, G., Moghadam, M., April 21-24, 2008, "Demand response model considering EDRP and TOU programs." IEEE/PES Transmission and Distribution Conference and Exposition, pp 1-6.

Coughlin, Katie, Piette, Mary Ann, Goldman, Charles, & Kiliccote, Sila, January 2008, "Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-Residential Buildings in California." Lawrence Berkeley National Laboratory, LBNL-63728.

Federal Energy Regulatory Commission (FERC) Staff Report, September 2007, "Assessment of Demand Response and Advanced Metering."

Federal Energy Regulatory Commission (FERC) Staff Report, August 2009, "Assessment of Demand Response and Advanced Metering."

Federal Energy Regulatory Commission (FERC) 134FERC 61,187, 18 CFR Part 35, [Docket No. RM10-17-00; Order No. 745], Issued March 15, 2011, "Demand Response Compensation in Organized Wholesale Energy Markets."

Kiliccote, S., Piette, M. A., Watson, D., Hughes, G., August 2006, "Dynamic controls for energy efficiency and demand response: framework concepts and a new construction study case in New York." Lawrence Berkeley National Laboratory, LBNL-60615.

Koch, E., Pietti, M. A., October 2007, "Architecture concepts and technical issues for an open, interoperable automated demand response infrastructure." Lawrence Berkeley National Laboratory, LBNL-63664.

Piette, M. A., Ghatikar, G., Kiliccote, S., Watson, D., Koch, E., Hennage, D., May 2009, "Design and operation of an open, interoperable automated demand response infrastructure for commercial buildings." ASME Journal of Computing and Information Science in Engineering, Vol. 9.

Appendix A: Specific Facilities Considered

#	Area	Building No.	Description	Gross Sq. Ft.
1	I	700	Advanced Manufacturing Prototype Facility	23,759
2	I	701	PETL - Processing & Environmental Technology Lab	151,055
3	I	702	SMIGPP (S. of 888)	23,817
4	I	703	Design & Eng. Sci. Integration for Generating Neutrons Bldg.	12,869
5	I	720	Ion Beam Lab	27,854
6	I	725	Super Computer Annex (SCA)	25,232
7	I	727	INSRC - Integrated Network Security and Reliability Center	19,949
8	I	729	Limited Office Building Two - IGPP #8	18,669
9	I	750	TAOS MOB (S. of 832)	14,683
10	I	751	TAOS SOB (S. of 864) [A/C recirculation fan out of service]	17,296
11	I	752	Secure General Office Bldg.	17,167
12	I	753	Integ'd Systems Support Group	8,366
13	I	755	Mfg. Science Surety Components Instr Lab	18,667
14	I	758	Limited Office Building One - IGPP #7	19,336
15	I	770	Limited Office Building Three - IGPP #9,	15,699
16	I	800	Administration	27,786
17	I	802	Administration and DOE Offices	160,897
18	I	808	Research - Development Labs	10,382
19	I	809	High Bay Laboratory and Machine Shop	15,401
20	I	810	Center for National Security & Arms Control (CNSAC)	51,723
21	I	811	Administrative Office Building	10,560
22	I	821	Nuclear Safeguards Security Laboratory	85,594
23	I	825	Steve Schiff Auditorium	14,587
24	I	827	Weapons Production Primary Standards Lab	58,683
25	I	857	CRM Office Building	39,139
26	I	858N	MESA Microelectronics Development Lab	178,728
27	I	858EF	MESA	111,122

#	Area	Building No.	Description	Gross Sq. Ft.
28	I	858EL	MESA	171,500
29	I	858S	MESA Office and Light Lab	73,452
30	I	859	CAE/RSDL (Rocket Systems Development Lab)	21,031
31	I	864	Glass Development Lab	13,667
32	I	868	Systems Research Building	26,290
33	I	898	Weapons Integration facility - WIF	177,662
34	I	899	Joint Computational Engineering Laboratory - JCEL	62,201
35	II	957	Shipping / Receiving / Reclamation	53,323
36	IV	965	Strategic Defenses Facility (SDF)	9,344
37	IV	969	Security Office Bldg.	17,987
38	IV	971	Emerging Threats	18,672
39	II	1008	NISAC - National Infrastructure Simulation & Analysis Center	24,880
40	II	1090	ES&H IGPP 9th & Ordinance Rd	15,960
41	III	6584	Administrative Center For Test Engineering	18,842
42	III	6585	Technology Support Center (TSC)	98,193
43	III	6587	Maintenance and Shop Building	13,082
44	III	9926	Explosive Research Laboratory	3,794
45	III	9972	Radar Cross Section (RCS) Facility	9,600
46	III	9981	5MW Solar Control Building	17,167
		Total DR Pilot		**821,050**
		Total in FCS	(less buildings with minimal office space)	**1,627,853**
		Total NM		**5,287,013**

	Buildings included in pilot DR event - 19
	Meter out of service - 5
	Meter provided no data during pilot event - 9
	Building opted out - 2
	Building AC out of service day of test - 1
	Minimal office space in building - 7
	FCS not operational in building - 3

Appendix B: Demand Response Pilot Event Summary Data

		Building Power Use Each Hour, kW																		
Date (d)	**Time (h)**	**700**	**701**	**720**	**727**	**752**	**753**	**755**	**758**	**770**	**811**	**857**	**858EL**	**858S**	**898**	**957**	**971**	**1090**	**6587**	**9981**
16-Aug	10:00 AM	163	639	178	69	104	32	89	105	55	18	303	418	281	477	100	60	118	39	101
16-Aug	11:00 AM	156	636	186	73	102	24	91	108	68	17	309	419	280	471	107	62	116	49	117
16-Aug	12:00 PM	160	645	198	69	106	25	89	108	69	17	311	422	278	462	115	60	121	42	135
16-Aug	1:00 PM	158	638	202	70	108	34	93	106	73	18	301	422	273	465	112	53	120	51	134
16-Aug	2:00 PM	151	642	190	72	111	33	92	105	75	19	321	425	274	467	111	60	124	50	155
16-Aug	3:00 PM	152	637	195	71	118	33	91	104	72	19	309	437	283	465	121	62	147	51	166
16-Aug	4:00 PM	150	629	197	73	118	32	89	101	72	18	294	433	276	460	111	62	151	50	143
16-Aug	5:00 PM	149	611	185	65	110	24	89	100	72	18	277	423	263	432	85	61	139	49	140
16-Aug	6:00 PM	142	563	172	55	83	22	78	93	69	15	271	386	238	381	66	44	121	35	117
17-Aug	10:00 AM	165	624	172	72	103	33	89	107	56	18	303	434	278	466	98	55	117	40	116
17-Aug	11:00 AM	166	626	184	70	104	36	88	104	63	18	298	423	275	463	96	61	119	41	122
17-Aug	12:00 PM	160	641	188	68	104	27	90	108	61	18	287	426	281	455	109	59	127	49	150
17-Aug	1:00 PM	155	641	188	69	106	33	89	109	63	19	298	422	281	461	123	60	120	52	132
17-Aug	2:00 PM	161	644	193	72	116	34	89	111	69	20	291	421	281	472	126	62	135	38	151
17-Aug	3:00 PM	159	626	180	73	81	28	89	110	45	20	301	423	279	456	112	51	112	42	120
17-Aug	4:00 PM	156	618	174	69	117	32	88	108	60	19	301	422	277	446	114	60	136	49	137
17-Aug	5:00 PM	148	602	163	65	98	28	86	110	57	17	272	408	265	434	83	56	113	38	116
17-Aug	6:00 PM	141	555	148	58	71	20	80	96	60	14	248	388	244	395	65	42	110	34	96
18-Aug	10:00 AM	154	637	175	69	98	27	89	108	66	20	295	412	284	455	95	51	80	40	109
18-Aug	11:00 AM	142	651	180	67	79	27	93	109	67	18	276	420	278	454	113	60	157	41	95
18-Aug	12:00 PM	143	655	181	68	104	29	93	110	70	17	275	431	278	446	110	59	131	42	126
18-Aug	1:00 PM	147	656	182	70	106	31	93	113	70	17	294	430	279	458	104	57	130	49	110
18-Aug	2:00 PM	147	692	196	71	104	31	94	113	63	17	292	435	277	466	123	59	129	51	114
18-Aug	3:00 PM	150	695	209	72	114	35	94	110	65	17	292	431	279	458	121	60	130	50	110
18-Aug	4:00 PM	148	655	213	72	89	33	95	109	75	17	271	430	277	449	121	59	122	49	135
18-Aug	5:00 PM	150	639	192	64	99	30	89	103	72	16	256	413	242	426	82	58	115	50	145
18-Aug	6:00 PM	141	555	179	56	85	20	86	92	63	14	227	400	238	388	68	48	110	37	107
25-Aug	10:00 AM	178	626	169	68	100	30	92	102	55	18	332	425	271	468	106	49	123	38	94
25-Aug	11:00 AM	168	653	192	70	104	32	92	104	59	16	328	428	272	461	108	58	128	39	112
25-Aug	12:00 PM	158	631	195	64	103	31	95	104	61	16	327	423	268	454	107	51	125	39	124
25-Aug	1:00 PM	154	638	194	66	96	34	88	99	74	15	300	422	263	453	114	55	131	48	130
25-Aug	2:00 PM	154	652	191	62	76	25	89	103	55	16	310	424	263	431	96	41	128	32	134
25-Aug	3:00 PM	172	655	181	62	78	28	87	96	54	16	316	433	257	425	104	47	125	33	111
25-Aug	4:00 PM	137	638	197	61	82	32	85	96	58	15	296	421	259	418	101	55	121	31	124
25-Aug	5:00 PM	133	598	178	57	70	25	84	96	51	14	275	400	244	399	68	44	109	31	107
25-Aug	6:00 PM	139	558	165	56	96	19	76	97	44	11	253	379	229	380	44	43	105	34	90

pl @	10:00 AM	161	633	175	70	102	31	89	107	59	19	300	421	281	466	98	55	105	40	109
pl @	11:00 AM	155	638	183	70	95	29	91	107	66	18	294	421	278	463	105	61	131	44	111
pl @	12:00 PM	154	647	189	68	105	27	91	109	67	17	291	426	279	454	111	59	126	44	137
pl @	1:00 PM	153	645	191	70	107	33	92	109	69	18	298	425	278	461	113	57	123	51	125
pl @	2:00 PM	153	659	193	72	110	33	92	110	69	19	301	427	277	468	120	60	129	46	140
pl @	3:00 PM	154	653	195	72	104	32	91	108	61	19	301	430	280	460	118	58	130	48	132
pl @	4:00 PM	151	634	195	71	108	32	91	106	69	18	289	428	277	452	115	60	136	49	138
pl @	5:00 PM	149	617	180	65	102	27	88	104	67	17	268	415	257	431	83	58	122	46	134
pl @	6:00 PM	141	558	166	56	80	21	81	94	64	14	249	391	240	388	66	45	114	35	107
al 10		178	626	169	68	100	30	92	102	55	18	332	425	271	468	106	49	123	38	94
al 11		168	653	192	70	104	32	92	104	59	16	328	428	272	461	108	58	128	39	112
c(d)		1.097	1.006	1.007	0.986	1.037	1.039	1.024	0.964	0.912	0.936	1.110	1.013	0.972	1.000	1.054	0.920	1.065	0.924	0.936
pl' @	1:00 PM	168	649	192	69	111	34	94	105	63	17	330	430	270	461	119	52	131	47	117
pl' @	2:00 PM	168	663	194	71	114	34	94	106	63	17	334	433	270	469	127	55	138	43	131
pl' @	3:00 PM	169	657	196	71	108	33	94	104	55	17	334	436	272	460	124	53	138	44	124
pl' @	4:00 PM	166	638	196	70	112	34	93	102	63	17	320	434	269	452	122	55	145	46	130
pl' @	5:00 PM	163	621	181	64	106	28	90	101	61	16	298	420	249	431	88	54	130	42	125
Δp, kW	2:00 PM	13.9	11.5	3.8	8.6	38.4	8.9	4.9	2.7	7.9	1.5	24.4	8.6	6.6	37.5	30.5	14.5	9.7	10.8	-2.9
Δp, kW	3:00 PM	-3.4	1.8	15.1	9.0	30.2	5.3	6.5	8.1	1.3	1.5	17.7	3.0	15.5	35.3	20.4	6.0	13.6	11.0	12.6
Δp, kW	4:00 PM	29.1	0.0	-0.9	9.3	30.0	1.6	7.9	6.2	4.9	1.8	24.4	12.9	9.9	33.8	20.6	0.5	24.2	14.6	5.5
Δp, kW	5:00 PM	30.5	23.2	3.2	6.7	36.1	3.4	6.1	4.6	10.1	1.9	23.3	20.1	5.5	31.8	19.8	9.7	21.3	11.2	18.2
ΔE, kWh	Total Day	70.0	36.5	21.2	33.7	134.8	19.2	25.4	21.6	24.3	6.7	89.8	44.5	37.4	138.5	91.3	30.7	68.8	47.6	33.4

2:00 PM	Total Energy Use this Hour, kWh	3,524
3:00 PM	Total Energy Use this Hour, kWh	3,490
4:00 PM	Total Energy Use this Hour, kWh	3,463
5:00 PM	Total Energy Use this Hour, kWh	3,269
	Total Energy Use, kWh	13,746
2:00 PM	Total Energy Reduced this Hour, kWh	242
3:00 PM	Total Energy Reduced this Hour, kWh	211
4:00 PM	Total Energy Reduced this Hour, kWh	236
5:00 PM	Total Energy Reduced this Hour, kWh	287
	Total Energy Reduced, kWh	976
	Percent Reduction During Event	7.10%
	Estimated Reduction For All Facilities in FCS Based on Floor Space, kWh	1938.5

Distribution:

1	MS 0801	John Zepper, 9300
1	MS 0801	Tom Klitsner, 9320
1	MS 0823	Phillip Cox, 9324
1	MS 0823	David J. Martinez, 9324
1	MS 0905	Donald Lincoln, 4847
1	MS 0905	Pamela McKeever, 4820
1	MS 0906	Anthony M. Baca, 4826
1	MS 0906	Wayne Potter, 4824
1	MS 0907	John Norwalk, 4827
1	MS 0908	Israel Martinez, 4821
1	MS 0908	Lucille Roybal, 4821
1	MS 0924	Jack Mizner, 4853
1	MS 0924	Christopher Evans, 4853
1	MS 0924	Mary Bultmann, 4853
1	MS 0928	Mike Rocco, 4844
1	MS 0928	Mike Rymarz, 4844
1	MS 0934	Lynnwood Dukes, 4840
1	MS 1469	Art Ratzel, 4800
1	MS 1470	Stanley Harrison, 4870
1	MS 1470	Stephen Ward, 4850
1	MS0899	RIM-Reports Management, 9532