Clement Fung
Advisor: Ted Dannerth
Lighting/ Electrical
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University of California Santa Barbara

Student Resource Building

Technical Assignment 2

"Electrical Systems Existing Conditions and Building Load Summary Report"

Clement Fung

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Executive Summary

The following report seeks to analyze the existing electrical distribution system at the University of California Santa Barbara's Student Resource Building (SRB). All system loads that feed off the incoming 12.47 KV will be identified. Information will be presented in the following order:

1. Single Line Diagram (*please refer to attachments)*
2. Electrical System Overview
3. Utility Connection Point
4. Voltage System Overview
5. Transformer Schedule
6. Emergency Power System
7. Overcurrent Protection Devices
8. Equipment Locations
9. Lighting System Overview
10. ASHRAE 90.1/ IESNA Shut off Requirements
11. Power Factor Corrections
12. Electrical System Design Requirements
13. Primary Lamp and Ballast Operating Characteristics
14. Mechanical Equipment Load Summary
15. NEC Building Design Load Summary
16. Communication Systems
17. Fire Alarm Systems
18. Utilities Management

The NEC Building Design Load Summary in section 15 of this report will first provide a comparison of the lighting electrical allowances under both California's Title-24 as well as the NEC (2005). This is followed by an analysis of each distribution board in the system. A breakdown of the electrical loads associated with each one will be presented followed by a load summary which will compare the actual feeder design with what is necessary per this report's calculations.

The goal of this report is to provide a thorough understanding of electrical system that is currently designed for this building and to establish a basis for future redesign work that will aim at optimizing it.

NOTE: All data tables presented in this report are also included in the PDF attachment found under "Technical Assignment 2" of my thesis webspace.

1. Single Line Diagram

(Please refer to attachments)

2. Electrical System Overview

The 12.47 KV incoming service is distributed to the different loads in the building via a series of 480/277V and 208/120V transformers. The main 480/277V transformer directs power to the main switchboard which houses 14 switches, 3 of which distribute power to separate 208Y/120V distribution system. An additional switch also provides power to the emergency distribution board and the remaining providing power directly to a proportion of the panelboards in the building. Also located on-site is a 250KW 408/277V diesel emergency generator which provides power to the emergency distribution board in the event that the normal power system experiences an outage.

3. Utility Connection Point

The building's electrical system receives power via a connection established with the existing campus service at the south west corner of the building. (6) 5" conduits runs 3'-0" beneath grade and connect with a 4-section 15 KV switch gear which then provides power to the building's main 12.47 KV-480/277V transformer.

(Please refer to attachments)

4. Voltage System Overview

The building utilizes the 480Y/277V main switchboard to distribute power to service most of the loads in the building. Although some items such as the elevator system, major spaces and roof top mechanical systems are supplied directly from the main switchboard, the rest is diverted to the three 208Y/120V distribution boards that supply power to the panel boards connected to them.

Loads serviced by the two systems include but are not limited to:

480Y/277V

- some luminaires (interior and exterior) regulated by lighting control panels
- mechanical pumps
- exit signs
- transformers that service emergency panel boards
- roof top air handling units
- restroom equipment

208Y/120V

- some luminaires (interior and exterior) regulated by lighting control panels
- communications equipment
- mechanical pumps, smoke louvers
- kitchen appliances
- office/presentation-related equipment
- receptacle loads
- dimming panels

The Transient Voltage Surge Suppression (TVSS) system is also supplied directly by the main switchboard.

5. Transformer Schedule

UCSB STUDENT RESOURCE CENTER - TRANSFORMER SCHEDULE

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
-	12470V,3PH,4W	480Y/277V,3PH,4W	N/A	N/A	N/A	N/A	PAD MOUNTED ON GRADE	1
T-1A	480V,3PH,4W.	208Y/120V,3PH,4W	225	DRY TYPE	115 DEGREE C	(4) 2.5%	FLOOR MOUNTED	-
T-1B	480V,3PH,4W.	208Y/120V,3PH,4W	112.5	DRY TYPE	115 DEGREE C	(4) 2.5%	FLOOR MOUNTED	-
T-1C	480V,3PH,4W.	208Y/120V,3PH,4W	75	DRY TYPE	115 DEGREE C	(4) 2.5%	FLOOR MOUNTED	-
T-3A	480V,3PH,4W.	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	SURFACE MOUNTED	-
ET-1A	480V,3PH,4W.	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	SURFACE MOUNTED	-
ET-1B	480V,3PH,4W.	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	SURFACE MOUNTED	-
ET-3A	480V,3PH,4W.	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	SURFACE MOUNTED	-
ET-3B	480V,3PH,4W.	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	SURFACE MOUNTED	-

NOTE:
1. Liquid Filled Pad Mount

6. Emergency Power System

The building has an emergency power system. In the event of failure, a 4-pole 150A automatic transfer switch changes position allowing an on-site 250KW 480Y/277V standby diesel generator to provide power. It will supply power to an emergency distribution board (EDB) which will maintain emergency life safety systems such as emergency lighting. The EDB has 5 3-pole molded case circuit breakers all sized at 100A, one of which is a spare.

7. Overcurrent Protective Devices

The electrical distribution system in the building features molded case circuit breakers as the predominant overcurrent protective device, with fuses that are sized accordingly to protect individual circuits on each panelboard. The main switchboard is protected from the main 12.47KV transformer by a 1200A, 3-pole circuit breaker. Subsequent distribution boards LD1A, LD1B and LD1C in the building are protected from an oversurge by 800A, 400A and 250A circuit breakers respectively. All are 3-pole.

A mixture of 150A and 100A circuit breakers protects the panelboards connected to distribution board LD1A. Only 100A circuit breakers protect those that are connected to LD1B. As for LD1C, circuit breaker sizes vary from 20A to 150A.

Subsequent circuits on each of the different panelboards are protected by fuses which are sized accordingly. Most fuses are time-delay, high interrupting (200 K AIC) fuses with the exception of those used in motor branch circuits which are class RK-5, dual element time delay fuses.

8. Equipment Locations

The main transformer feeds power into the building via the main 15 KV switch located on the West side of the building. It then subsequently transfers power to adjacent main 12.47KV-480/277V transformer. Electricity is then fed to the main distribution board located in the ground floor electrical room located on the west end of the building. From here, power is directed primarily to the three sub- distribution boards. LD1C is located in the same room, LD1A is located in the electrical room in the center of the building, and LD1B is located on the northern side. Panelboards are located in similar locations on all three floors. Some of the panelboards located on the third floor run circuits up to the roof level to supply power to the 6 roof-top air handlers and 2 exhaust fans. With regards to the emergency diesel generator, it is also located on the exterior next to the main transformer. Emergency panel boards are located in similar locations throughout the building.

9. Lighting System Overview

Lighting in this building uses predominately fluorescent and compact fluorescent sources that operate on 277V. Metal halide and tungsten halogen sources in the building are used conservatively to satisfy California's Title 24 lighting power density requirements. Tungsten halogen sources operate on 120V. Specifications calls for the usage of electronic ballast which have a high power factor (>90%) and ballast factor (>87%).

10. ASHRAE 90.1/ IESNA Shutoff Requirements

To satisfy both California Title 24 and ASHRAE 90.1-2004 requirements for automatic shut off, occupancy sensors provided by Watt Stopper have been installed in areas required by code. Ceiling and wall sensors utilize infrared technology and ultrasonic sensors are used in areas such as bathrooms and non-occupied areas. A roof top low-voltage photocell has also been installed facing north to monitor daylight levels. Lutron's Grafik Eye System has also been utilized to regulate the dimming panel that controls the lighting in the multipurpose room. A typical lighting control panel also features 5 control schedules which allow it to regulate the level of artificial illumination provided during different times of the day.

11. Power Factor Corrections

No capacitors are used in this building's electrical distribution system.

12. Electrical System Design Requirements

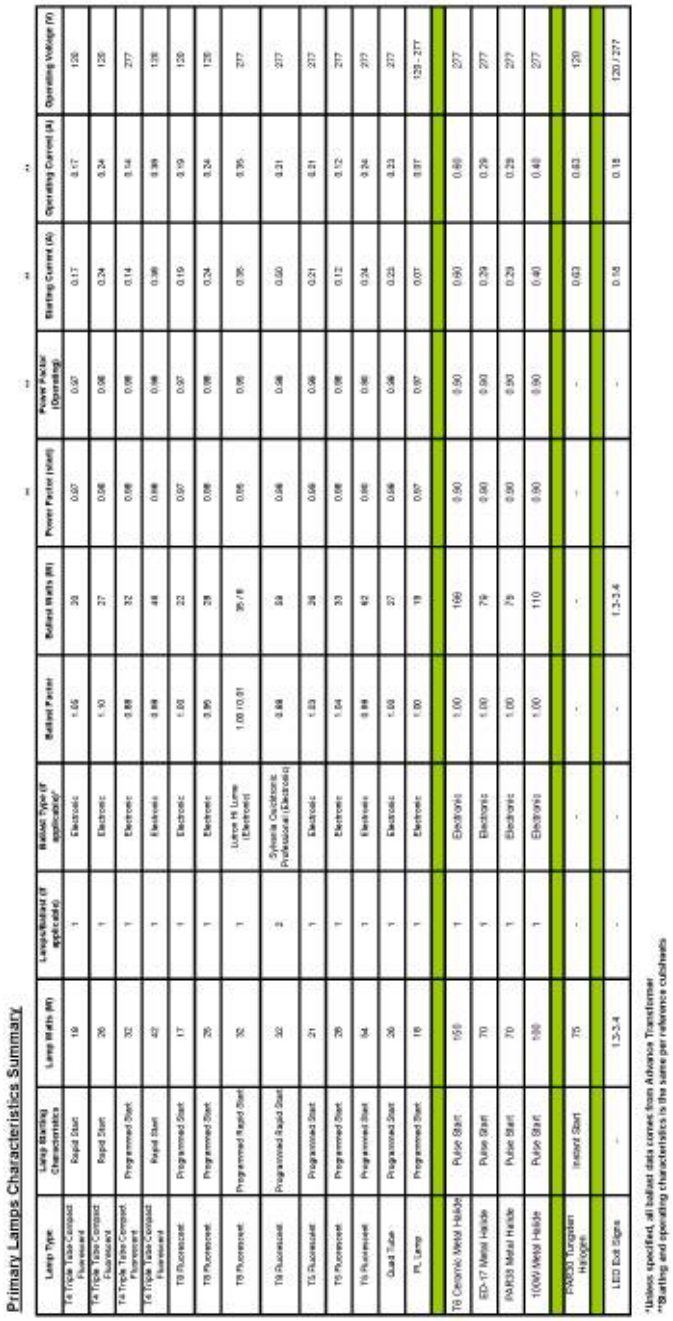
As this building is located in California, it will be important to observe Title 24 requirements in addition to ASHRAE 90.1 when considering the necessary automatic shut-off controls necessary as well as power allowances. The California Electric Code will also need to be reviewed beside the NEC. At present, it seems as though that the there are a lot of spare circuits available on the different panel boards in the building. Although room should be allocated for growth, there seems to be more than that provided for that purpose. In some cases this percentage is above 50% of the total number of circuits available on the panelboard in the question.

Total harmonic distortions (THD) should also be minimized by selecting appropriately rated equipment to reduce the amount of non-linear load onto the electrical system. THD is caused by non-linear loads that is part of the power system as well as equipment that operates on three phase power. The ballasts used in this building are electronic and are specified to have a total harmonic distortion of between 10 and 20 percent. The rest of the report should be able to provide a summary of how much of the total power each system consumes. Conclusions can then be drawn to figure out ways in which the system can be optimized during the redesign process.

Special provisions should also be made to ensure that these systems are capable of functioning during natural disasters such as earthquakes. The San Andreas Fault line runs directly beneath the State of California; therefore, equipment needs to be sufficiently protected to prevent damage in the event of such and event. Under the California Department of Conservation, Santa Barbara fault zone classification is under "Zaca Creek".

13. Primary Lamps and Ballasts Operating Characteristics

(Please refer to attachments)



Primary Lamps Characteristics Summary

Lamp Type	Lamp Starting Characteristics	Lamp Watts (W)	Lamps/Ballast (if applicable)	Ballast Type (if applicable)*	Ballast Factor	Ballast Watts (W)	Power Factor (shirt)	Power Factor (Operating)	Starting Current (A)	Operating Current (A)	Operating Voltage (V)
T4 Triple Tube Compact Fluorescent	Rapid Start	18	1	Electronic	1.00	20	0.97	0.97	0.17	0.17	120
T4 Triple Tube Compact Fluorescent	Rapid Start	26	1	Electronic	1.10	27	0.98	0.98	0.24	0.24	120
T4 Triple Tube Compact Fluorescent	Programmed Start	32	1	Electronic	0.88	32	0.98	0.98	0.14	0.14	277
T4 Triple Tube Compact Fluorescent	Rapid Start	42	1	Electronic	0.88	48	0.98	0.98	0.36	0.39	120
T8 Fluorescent	Programmed Start	17	1	Electronic	1.00	22	0.97	0.97	0.19	0.19	120
T8 Fluorescent	Programmed Start	25	1	Electronic	0.95	28	0.98	0.98	0.24	0.24	120
T8 Fluorescent	Programmed Rapid Start	32	1	Lutron Hi Lume (Electronic)	1.00/0.91	35/ 8	0.95	0.98	0.35	0.35	277
T8 Fluorescent	Programmed Rapid Start	32	2	Sylvania Quicktronic Professional (Electronic)	0.88	59	0.98	0.98	0.60	0.31	277
T5 Fluorescent	Programmed Start	21	1	Electronic	1.03	24	0.99	0.99	0.21	0.21	277
T5 Fluorescent	Programmed Start	28	1	Electronic	1.04	33	0.98	0.98	0.12	0.12	277
T5 Fluorescent	Programmed Start	54	1	Electronic	0.99	62	0.98	0.98	0.24	0.24	277
Quad Tube	Programmed Start	26	1	Electronic	1.00	27	0.96	0.96	0.23	0.23	277
PL Lamp	Programmed Start	18	1	Electronic	1.00	19	0.97	0.97	0.07	0.07	120 - 277
T6 Ceramic Metal Halide	Pulse Start	150	1	Electronic	1.00	166	0.90	0.90	0.60	0.60	277
ED-17 Metal Halide	Pulse Start	70	1	Electronic	1.00	79	0.90	0.90	0.29	0.29	277
PAR38 Metal Halide	Pulse Start	70	1	Electronic	1.00	79	0.90	0.90	0.29	0.29	277
100W Metal Halide	Pulse Start	100	1	Electronic	1.00	110	0.90	0.90	0.40	0.40	277
PAR30 Tungsten Halogen	Instant Start	75	-	-	-	-	-	-	0.63	0.63	120
LED Exit Signs	-	1.5-3.4	-	-	-	1.5-3.4	-	-	0.18	0.18	120 / 277

*Unless specified, all ballast data comes from Advance Transformer
**Starting and operating characteristics is the same per reference cutsheets

14. Mechanical Equipment Load Summary

(Please refer to attachments)

Level	Panel	Equipment Designation	Description	Voltage	Phase	Power	Power Factor	Connected Load (KVA)	Demand Factor	Demand Load (KVA)
1	H1C	P-1	End Section Centrifugal Pump	460	3	3 hp	0.90	4.05	1.00	4.05
		P-2	End Section Centrifugal Pump	460	3	3 hp	0.90	4.05	1.00	4.05
		P-3	End Section Centrifugal Pump	460	3	3 hp	0.90	4.90	1.00	4.90
		P-4	End Section Centrifugal Pump	460	3	2 hp	0.90	5.74	1.00	5.74
	L1Aa	P-5	In-line	115	1	55 W	0.80	0.05	1.00	0.05
		P-9	In-line	115	1	92 W	0.80	0.05	1.00	0.05
		EF-3	Ceiling Exhaust Fan	120	1	48 W	0.80	0.05	1.25	0.06
		FC-3	Chilled Water Fan Coil Unit	120	1	0.5 hp	0.85	1.14	1.25	1.43
		FC-6	Chilled Water Fan Coil Unit	120	1	0.33 hp	0.85	0.84	1.25	1.05
		FC-8	Chilled Water Fan Coil Unit	120	1	0.5 hp	0.85	1.14	1.25	1.43
	L1Ab	FC-1	Chilled Water Fan Coil Unit	120	1	0.75 hp	0.85	1.61	1.25	2.01
		FC-2	Chilled Water Fan Coil Unit	120	1	0.75 hp	0.85	1.61	1.25	2.01
		B-1	Hot Water Boiler	120	1	-	-	0.10	1.00	0.10
		P-6	In-line	115	1	55 W	0.80	0.05	1.00	0.05
		P-7	In-line	115	1	55 W	0.80	0.05	1.00	0.05
		EF-3	Ceiling Exhaust Fan	120	1	48 W	0.80	0.05	1.25	0.06
	L1Ad	P-10	In-line	115	1	55 W	0.80	0.05	1.00	0.05
		FC-4	Chilled Water Fan Coil Unit	120	1	0.5 hp	0.85	1.14	1.25	1.43
	L1Ba	P-10	In-line	115	1	55 W	0.80	0.05	1.00	0.05
		FC-5	Chilled Water Fan Coil Unit	120	1	0.75 hp	0.85	1.61	1.25	2.01
		FC-7	Chilled Water Fan Coil Unit	120	1	0.33 hp	0.85	0.84	1.25	1.05
		FC-9	Chilled Water Fan Coil Unit	120	1	0.33 hp	0.85	0.84	1.25	1.05
	L1Bb	-	Kitchen HVAC Control	120	1	-	-	0.10	1.25	0.13
	EL1A	-	Mech. Rm. Smoke Louvers	120	1	-	-	0.12	1.00	0.12
		-	Elec. Rm. Smoke Louvers	120	1	-	-	0.12	1.00	0.12
		-	Lvl 1. Smoke Fire Damper Control	120	1	-	-	0.30	1.00	0.30
		-	Lvl 1. Smoke Fire Damper Control	120	1	-	-	0.30	1.00	0.30
		-	Lvl 2. Smoke Fire Damper Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 2. Smoke Fire Damper Control	120	1	-	-	0.30	1.00	0.30
		-	Lvl 3. Smoke Fire Damper Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 3. Smoke Fire Damper Control	120	1	-	-	0.30	1.00	0.30
	EL1B	-	Elec. Rm. Smoke Louvers	120	1	-	-	0.12	1.00	0.12
		-	SRC. Smoke Fire Damper Control	120	1	-	-	0.10	1.00	0.10
		-	Lvl 2. Smoke Fire Damper Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 2. Smoke Fire Damper Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 3. Smoke Fire Damper Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 3. Smoke Fire Damper Control	120	1	-	-	0.30	1.00	0.30
2	L2Ab	-	Lvl 2. HVAC Control	120	1	-	-	0.60	1.00	0.60
		-	Lvl 2. HVAC Control	120	1	-	-	0.50	1.00	0.50
	L2Bb	-	Lvl 2. HVAC Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 2. HVAC Control	120	1	-	-	0.20	1.00	0.20

	H3Ab	AH-3	Supply Fan	460	3	7.5 hp	0.90	9.29	1.25	11.61
		AH-3	Return Fan	460	3	3 hp	0.90	4.05	1.25	5.06
		AH-4	Supply Fan	460	3	10 hp	0.90	11.82	1.25	14.77
		AH-4	Return Fan	460	3	5 hp	0.90	6.42	1.25	8.02
		**AH-5	Supply Fan	460	3	15 hp	0.90	17.73	0.31	5.50
		AH-5	Return Fan	460	3	5 hp	0.90	6.42	1.25	8.02
		AH-6	Supply Fan	460	3	7.5 hp	0.90	9.29	1.25	11.61
		AH-6	Return Fan	460	3	3 hp	0.90	4.05	1.25	5.06
	H3Bb	AH-1	Supply Fan	460	3	5 hp	0.90	6.42	1.25	8.02
		AH-1	Return Fan	460	3	2 hp	0.90	2.87	1.25	3.59
		AH-2	Supply Fan	460	3	5 hp	0.90	6.42	1.25	8.02
		AH-2	Return Fan	460	3	2 hp	0.90	2.87	1.25	3.59
	L3Ab	-	Lvl 3. HVAC Control	120	1	-	-	0.40	1.00	0.40
		-	Lvl 3. HVAC Control	120	1	-	-	0.30	1.00	0.30
	L3Ad	EF-2	Roof. Utility Fan	120	1	0.33 hp	0.85	0.84	1.00	0.84
	L3Bb	-	Lvl 3. HVAC Control	120	1	-	-	0.20	1.00	0.20
		-	Lvl 3. HVAC Control	120	1	-	-	0.20	1.00	0.20
		EF-1	Roof. Utility Fan	120	1	0.25 hp	0.85	1.14	1.00	1.14
3	EL3A	-	Roof. Smoke Evac Windows	120	1	-	-	0.12	1.00	0.12
		-	Roof. Smoke Evac Windows	120	1	-	-	0.12	1.00	0.12
		-	Roof. HVAC Control	120	1	-	-	0.20	1.00	0.20
		-	Roof. HVAC Control	120	1	-	-	0.20	1.00	0.20
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
	EL3B	-	Roof. Smoke Evac Windows	120	1	-	-	0.12	1.00	0.12
		-	Roof. Smoke Evac Windows	120	1	-	-	0.12	1.00	0.12
		-	Roof. HVAC Control	120	1	-	-	0.20	1.00	0.20
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04
		-	Forum Window Actuators	120	1	-	-	0.04	1.00	0.04

TOTALS: 126.85 KVA 134.83 KVA

NOTES

1 **Demand Factors Included for AH-5 (supply):**
Continous Load x Largest Motor
1.25 x 0.25 = 0.31

2 **To calculate motor loads, the following power factors were assumed:**

3-phase motors:	0.90
1-phase motors, 1/10 HP and above:	0.85
1-phase motors, 1/12 HP and below:	0.80

15. NEC Building Design Load Calculations

Lighting Power Allowances

The following interior lighting power allowances were determined first by using the space-by-space method as outlined by California's Title-24 (2005) and then per NEC (2005) requirements. In the first analysis, unit loads were assumed an average power factor of 0.95.

Power Density Allowances from Title 24 - Table 146-C (2005)

Level	Space Type	Area (sf)	Power Density Allowance (W/sf)	Unit Load (VA/sf) **	Load Allowance (VA/sf)	
1	Offices	3026	1.2	1.26	3822.32	
	Hallways	687	0.6	0.63	433.89	
	Conference Rm.	1085	2.4	2.53	2741.05	*
	Student Resource Centers	4144	2.4	2.53	10469.05	*
	Storage Rms.	824	0.6	0.63	520.42	
	Electrical Rm.	517	0.7	0.74	380.95	
	Mechanical Rm.	1035	0.7	0.74	762.63	
	Pump Rm.	65	0.6	0.63	41.05	
	Communication Rm.	296	0.6	0.63	186.95	
	Kitchen	599	1.6	1.68	1008.84	
	Restrooms	853	0.6	0.63	538.74	
	Childcare Center Reception	477	2.5	2.63	1255.26	*
	Tech./Comp. Rm.	1000	1.2	1.26	1263.16	*
	Entry	292	0.6	0.63	184.42	
	Classrooms	2414	1.2	1.26	3049.26	
	Nap Rm.	363	0.6	0.63	229.26	
	Forum	4611	2.3	2.42	11647.68	*
	Stair Well	727	0.6	0.63	459.16	
	Lactation	96	0.6	0.63	60.63	
	Multipurpose Rm.	1718	2.4	2.53	4340.21	*

*** Additional 1 W/sf allowed is included**
**** Assumed PF = 0.95**

Subtotal (lvl 1): 43394.95 **VA**

Subtotal (lvl 1): 43.39 **KVA**

Power Density Allowances from Title 24 - Table 146-C (2005)

Level	Occupancy	Area (sf)	Power Density Allowance (W/sf)	Unit Load (VA/sf) **	Load Allowance (VA/sf)	
2	Office	9232	1.2	1.26	11661.47	
	Reception	507	2.5	2.63	1334.21	*
	Work Area	651	1.2	1.26	822.32	
	Restrooms	271	0.6	0.63	171.16	
	Conference Area	2132	2.4	2.53	5396.11	*
	Filing	327	0.6	0.63	206.53	
	Mail Rm.	81	0.6	0.63	51.16	
	Stair Well	583	0.6	0.63	368.21	
	Electrical Rm.	184	0.7	0.74	135.58	
	Communication Rm.	657	0.6	0.63	414.95	
	Hallway	2621	0.6	0.63	1655.37	
	Lobby	72	2.5	2.63	189.47	*
	Storage	203	0.6	0.63	128.21	
	Copy/Print	327	0.6	0.63	206.53	
	Second Floor Forum	657	2.3	2.42	1590.63	*

*** Additional 1 W/sf allowed is included**
**** Assumed PF = 0.95**

Subtotal (lvl 2): 24321.89 VA

Subtotal (lvl 2): 24.32 **KVA**

Power Density Allowances from Title 24 - Table 146-C (2005)

Level	Occupancy	Area (sf)	Power Density Allowance (W/sf)	Unit Load (VA/sf) **	Load Allowance (VA/sf)	
3	Office	4927	1.2	1.26	6223.58	
	Student Resource Center	590	2.4	2.53	1490.53	*
	Storage	376	0.6	0.63	237.47	
	Restrooms	279	0.6	0.63	176.21	
	Tutorial/ Seminar Rm.	4367	1.2	1.26	5516.21	
	Electrical Rm.	183	0.7	0.74	134.84	
	Communication Rm.	174	0.6	0.63	109.89	
	Conference Rm.	508	2.4	2.53	1283.37	*
	Copy/Print	201	0.6	0.63	126.95	
	Reception	136	2.5	2.63	357.89	*
	Common Area	401	2.3	2.42	970.84	*
	Hallway	3087	0.6	0.63	1949.68	
	Third Floor Forum	591	2.3	2.42	1430.84	*
	Stair Well	564	0.6	0.63	356.21	
	Bio/Chem Drop-in Lab	86	1.2	1.26	108.63	

*** Additional 1 W/sf allowed is included**
**** Assumed PF = 0.95**

Subtotal (lvl 3): 20473.16 VA

Subtotal (lvl 3): 20.47 **KVA**

Per Title 24 - Table 146-C (2005)

Level	Area (sf)	Subtotal (KVA)
1	25029	43.39
2	18505	24.32
3	16470	20.47
Totals:	**60004 sf**	**88.19 KVA**

Per NEC - Table 220.12 (2005)

Level	Area (sf)	Unit Load VA/sf	Subtotal (KVA)
1	25029	3.00	75087.00
2	18505	3.00	55515.00
3	16470	3.00	49410.00
Totals:	**60004 sf**		**180.01 KVA**

(Occupancy type: school)

These analysis shows that lighting allowances per NEC is significantly higher than that which is required under California's Title-24. NEC allows approximately 180 KVA to be allocated for interior lighting usage whereas approximately 88 KVA is allowed by the later. However, it should be noted that the two codes serve different purposes. The value calculated per NEC is used for equipment sizing whereas Title 24 is for energy requirements.

Distribution Boards Load Analysis

The actual loads associated with each distribution board was first analyzed and then factored into the total load connected to the main switchboard. Loads that are part of the emergency distribution board were also accounted for. The distribution boards and their respective loads will be analyzed in the following order:

1. Distribution Board “LD1A”
2. Distribution Board “LD1B”
3. Distribution Board “LD1C”
4. Emergency Distribution Board “EHDB”
5. Main Switchboard “MS”

In each case, the loads were estimated using the data provided in the panelboard and mechanical equipment schedules. A load summary is provided at the end of each section along with a comparison of the existing feeder size versus what was calculated. Circuit breaker sizes were also compared.

Distribution Board: LD1A

Receptacle Load Summary

Distribution Board	Panel	Voltage	No. of 180VA Receptacles	Load from all 180VA recept. (KVA)
LD1A	L1Aa	208/120	34	6.12
	L1Ab	208/120	32	5.76
	L1Ac	208/120	65	11.70
	L1Ad	208/120	11	1.98
	L2Aa	208/120	51	9.18
	L2Ab	208/120	47	8.46
	L2Ac	208/120	57	10.26
	L3Aa	208/120	52	9.36
	L3Ab	208/120	51	9.18
	L3Ac	208/120	35	6.30

Connected Load Subtotal (KVA): 78.30

Distribution Board	Panel	Voltage	No. of dedicated receptacles	Load from all dedicated recept. (KVA)
LD1A	L1Aa	208/120	6	6.25
	L1Ab	208/120	9	5.86
	L1Ac	208/120	15	6.80
	L1Ad	208/120	5	2.80
	L2Aa	208/120	23	10.34
	L2Ab	208/120	24	10.16
	L2Ac	208/120	23	9.16
	L3Aa	208/120	17	8.80
	L3Ab	208/120	18	9.88
	L3Ac	208/120	4	1.60

Connected Load Subtotal (KVA): 71.65

Note: Majority of items that are connected to dedicated receptacles include but is not limited to: office equipment, washer/dryers, utility meters, etc.

Kitchen Equipment Load Summary

Distribution Board	Panel	Voltage	Kitchen Equipment	Load (KVA)
LD1A	L1Aa	208/120	U. Ref	0.50
		208/120	Lt/ Co	0.48
		208/120	Dishwasher	1.00
		208/120	Microwave	1.00
		208/120	U. Ref	0.50
		208/120	Lt/ Co	0.48
		208/120	Dishewasher	1.00
		208/120	Microwave	1.00
		208/120	Garbage Disposal	1.65
		208/120	Garbage Disposal	1.65
	L1Ad	208/120	R. Hood/ Co	0.54
		208/120	Microwave	1.00
		208/120	Coffee Maker	1.00
		208/120	Refrig/ Co	1.08
		208/120	Dishwasher	1.00
		208/120	Garbage Disposal	1.65

Connected Load Subtotal (KVA): 15.53

Lighting Load Summary

Distribution Board	Panel	Voltage	Lighting Connected Load (KVA)
LD1A	L1Aa	208/120	0.33
	L1Ab	208/120	0
	L1Ac	208/120	0
	L1Ad	208/120	0.2
	L2Aa	208/120	0
	L2Ab	208/120	0
	L2Ac	208/120	0
	L3Aa	208/120	0
	L3Ab	208/120	0
	L3Ac	208/120	0

Connected Load Subtotal (KVA): 0.53

Load Summary

Distribution Board	Item	Total Connected Load (KVA)	Total Demand Load (KVA)	Notes
LD1A	Total Recept. Loads From All Panels	149.95	79.98	1
	Kitchen Equipment	15.53	9.32	2
	Lighting Equipment	0.53	0.66	3
	Mechanical Equipment	10.44	12.90	4
	Totals (KVA):	**176.45**	**102.86**	

Notes:

1	Receptacle Loads Demand Factor: 1.0 for 1st 10 KVA, 0.5 for > 10KVA	Per NEC 220.44
2	Kitchen Equipment Demand Factor: more than 2 items = 0.60	Per NEC 220.20
3	Continuous Load Demand Factor (1.25)	Per NEC 210.20 (A)
4	See "Mechanical Load Summary" for assumptions	

	Amps	Poles	Voltage System
Switchboard Size	800	3	208Y/120V
Allowed KVA:	KVA = I x √3 x KV	(eqn.)	
	288.21	**KVA**	

288.21 KVA > 102.86 KVA , therefore distribution board LD1A is sized appropriately.

Based on total demand load for this distribution board:

Total Demand Load (KVA):	102.86
Total Amps (A):	285.51

X 1.25 for growth = **356.88 A < 800 A**

Therefore, circuit breaker for this distribution board is sized appropriately. If the spare branch (#11) is used, then:

Total Amps = 356.88 A + 100 A = **456.88 A** (*Assuming max loading on spare)*

The specified 800 A, 3-pole circuit breaker will be sufficient.

LD1A Feeder Size and Overcurrent Protection Device Check

**Based on "285.51 A" load:*

	Calculated*	Specified	Notes
Conductor size:	(4) – 350 MCM	2 sets of 600 MCM	Per NEC (2005) Table 310.16
Ground wire size:	(1) - #4 G.	(2) – 1/0 G.	Per NEC (2005) Table 250.95
Conduit size:	3"C	(2) - 4"C	Per NEC Table C8
Molded-case circuit breaker:	300 A, 3-pole	800 A, 3-pole	-

Calculations show that the specified feeder is significantly oversized. However, this can be justified by the potential for future growth on this distribution board.

Distribution Board: LD1B

Receptacle Load Summary

Distribution Board	Panel	Voltage	No. of 180VA Receptacles	Load from all 180VA recept. (KVA)
LD1B	L1Ba	208/120	53	9.54
	L1Bb	208/120	20	3.60
	L2Ba	208/120	46	8.28
	L2Bb	208/120	37	6.66
	L3Ba	208/120	33	5.94
	L3Bb	208/120	26	4.68

Connected Load Subtotal (KVA): 38.70

Distribution Board	Panel	Voltage	No. of dedicated receptacles	Load from all dedicated recept. (KVA)
LD1B	L1Ba	208/120	16	6.40
	L1Bb	208/120	3	0.58
	L2Ba	208/120	20	7.66
	L2Bb	208/120	15	7.48
	L3Ba	208/120	12	6.88
	L3Bb	208/120	19	5.78

Connected Load Subtotal (KVA): 34.78

Note: Majority of items that are connected to dedicated receptacles includes but is not limited to: office equipment, washer/dryers, utility meters, etc.

Kitchen Equipment Load Summary

Distribution Board	Panel	Voltage	Kitchen Equipment	Load (KVA)
LD1B	L1Bb	208/120	Appliance	0.50
		208/120	Appliance	0.50
		208/120	Dishwasher	1.00
		208/120	Lt/ Co	0.66
		208/120	Refrig.	0.90
		208/120	Refrig.	0.90
		208/120	Appliance	0.36
		208/120	Oven	3.60
		208/120	R. Hood	0.18
		208/120	Stove	6.00
		208/120	Garbage Disposal	1.00

Connected Load Subtotal (KVA): 15.60

Load Summary

Distribution Board	Item	Total Connected Load (KVA)	Total Demand Load (KVA)	Notes
LD1B	Total Recept. Loads From All Panels	73.48	41.74	1
	Kitchen Equipment	15.60	9.36	2
	Mechanical Equipment	10.44	6.26	4
	Totals (KVA):	**99.52**	**57.36**	

Notes:

1	Receptacle Loads Demand Factor: 1.0 for 1st 10 KVA, 0.5 for > 10KVA	Per NEC 220.44
2	Kitchen Equipment Demand Factor: more than 2 items = 0.60	Per NEC 220.20
3	Continuous Load Demand Factor (1.25)	Per NEC 210.20 (A)
4	See "Mechanical Load Summary" for assumptions	

	Amps	Poles	Voltage System
Switchboard Size	400	3	208Y/120V
Allowed KVA:	KVA = I x √3 x KV	(eqn.)	
	144.11	**KVA**	

144.11 KVA > 57.36 KVA , therefore distribution board LD1B is sized appropriately.

Based on total demand load for this distribution board:

Total Demand Load (KVA):	57.36
Total Amps (A):	159.21

X 1.25 for growth = **199.02 A < 400 A**

Therefore, circuit breaker for this distribution board is sized appropriately. If the spare branches (#11 and 8) is used, then:

Total Amps = 199.02 A + (2 x 100 A) = **399.02 A** (*Assuming max loading on spares)*

The specified 400 A, 3-pole circuit breaker marginally meets the requirement. A bigger circuit breaker size is recommended.

LD1B Feeder Size and Overcurrent Protection Device Check

**Based on "199.02 A" load:*

	Calculated*	Specified	Notes
Conductor size:	(4) – #4/0 THW	(4)- 500 MCM	Per NEC (2005) Table 310.16
Ground wire size:	(1) - #4 G.	(1) – 1/0 G.	Per NEC (2005) Table 250.95
Conduit size:	2.5"C	4"C	Per NEC Table C8
Molded-case circuit breaker:	225 A, 3-pole	400 A, 3-pole	-

Calculations show that the specified feeder is significantly oversized. However, this can be justified by the potential for future growth on this distribution board.

Distribution Board: LD1C

Receptacle Load Summary

Distribution Board	Panel	Voltage	No. of 180VA Receptacles	Load from all 180VA recept. (KVA)	Notes
LD1C	L1At	208/120	13	2.34	-
	L1Bt	208/120	12	2.16	-

Connected Load Subtotal (KVA): 4.50

Distribution Board	Panel	Voltage	No. of dedicated receptacles	Load from all dedicated recept. (KVA)	Notes
LD1C	L1At	208/120	20	24.00	Provides service to communication racks
	L1Bt	208/120	18	18.00	

Connected Load Subtotal (KVA): 42.00

Note: Majority of items that are connected to dedicated receptacles includes but is not limited to: office equipment, washer/dryers, utility meters, etc.

Load Summary

Distribution Board	Item	Total Connected Load (KVA)	Total Demand Load (KVA)	Notes
LD1C	Total Recept. Loads From All Panels	46.50	28.25	1
	Totals (KVA):	**46.50**	**28.25**	

Notes:
1 Receptacle Loads Demand Factor: 1.0 for 1st 10 KVA, 0.5 for > 10KVA Per NEC 220.44

	Amps	Poles	Voltage System
Switchboard Size	250	3	208Y/120V
Allowed KVA:	KVA = I x √3 x KV	(eqn.)	
	90.07	**KVA**	

90.07 KVA > 28.25 KVA , therefore distribution board LD1C is sized appropriately.

Based on total demand load for this distribution board:

Total Demand Load (KVA): 28.25
Total Amps (A): 78.41

X 1.25 for growth = **98.02 A < 250 A**

Therefore, circuit breaker for this distribution board is sized appropriately. If the spare branches (#11 and 8) is used, then:

Total Amps = 78.41 A + 20 A + 100 A + 125 A = **323.41 A** (*Assuming max loading on spares)*

The specified 250 A, 3-pole circuit breaker does not meet the requirements. A bigger circuit breaker size will be required.

LD1C Feeder Size and Overcurrent Protection Device Check

**Based on "78.41 A" load:*

	Calculated*	**Specified**	**Notes**
Conductor size:	(4) – #3	(4) – 250MCM	Per NEC (2005) Table 310.16
Ground wire size:	(1) - #8 G.	(1) – #2 G.	Per NEC (2005) Table 250.95
Conduit size:	1.25"C	3"C	Per NEC Table C8
Molded-case circuit breaker:	80 A, 3-pole	250 A, 3-pole	-

Calculations show that the specified feeder is significantly oversized. However, this can be justified by the potential for future growth on this distribution board.

Emergency Distribution Board: EHDB

Receptacle Load Summary

Distribution Board	Panel	Voltage	No. of 180VA Receptacles	Load from all 180VA recept. (KVA)
EHDB	EL1B	208/120	1	0.18
	EL1A	208/120	1	0.18
	EL3B	208/120	1	0.18
	EL3A	208/120	1	0.18

Connected Load Subtotal (KVA): 0.72

Distribution Board	Panel	Voltage	No. of dedicated receptacles	Load from all dedicated recept. (KVA)
EHDB	EL1B	208/120	6	0.90
	EL1A	208/120	4	1.10

Connected Load Subtotal (KVA): 2.00

Note: Majority of items that are connected to dedicated receptacles includes but is not limited to: office equipment, washer/dryers, utility meters, etc.

Transformer Load Summary

Distribution Board	Xfmr	Connected Load (KVA)
EHDB	ET1A	3.44
	ET1B	5.48
	ET3A	0.76
	ET3B	0.62

Connected Load Subtotal (KVA): 10.30

Lighting Load Summary

Distribution Board	Panel	Voltage	Lighting Connected Load (KVA)
EHDB	EH1B	208/120	2.67
	EL1B	208/120	2.59
	EH1A	208/120	2.72
	EL1A	208/120	1.09
	INV/H1B	208/120	3.67
	EH3B	208/120	2.02
	EL3B	208/120	0.53
	EH3A	208/120	3.4
	EL3A	208/120	0.97

Connected Load Subtotal (KVA): 19.66

Miscelleneous Load Summary

Distribution Board	Panel	Item	Connected Load (KVA)
EHDB	EH1B	Xfmr Door Opener	0.6
		EDPL1B	0.44
	EDP1B	-	0.44
	EL1B	FATC1B	0.2
		ELCP1B	0.2
	EH1A	Xfmr Door Opener	1.2
		Exit Signs	0.07
	EL1A	Elevator Power/Lgts	0.28
		FACP	0.2
		FAAP	0.2
		ELCP1A	0.2
	EH3B	Exit Signs	0.07
	EL3B	ELCP3B	0.2
	EH3A	Exit Signs	0.11
	EL3A	ELCP3A	0.2

Connected Load Subtotal (KVA): 24.27

Load Summary

Distribution Board	Item	Total Connected Load (KVA)	Total Demand Load (KVA)	Notes
EHDB	Total Recept. Loads From All Panels	2.72	2.72	1
	Transformers	10.30	12.88	3
	Lighting Equipment	19.66	24.58	3
	Mechanical Equipment	4.52	4.92	4
	Miscellenous Equipment	24.27	30.34	3
	Totals (KVA):	61.47	75.43	

Notes:

1	Receptacle Loads Demand Factor: 1.0 for 1st 10 KVA, 0.5 for > 10KVA	Per NEC 220.44
2	Kitchen Equipment Demand Factor: more than 2 items = 0.60	Per NEC 220.20
3	Continuous Load Demand Factor (1.25)	Per NEC 210.20 (A)
4	See "Mechanical Load Summary" for assumptions	

	Amps	Poles	Voltage System
Switchboard Size	250	3	480Y/277V
Allowed KVA:	KVA = I x √3 x KV	(eqn.)	
	207.85	KVA	

207.85 KVA > 75.43 KVA , therefore distribution board EHDB is sized appropriately.

Based on total demand load for this distribution board:

Total Demand Load (KVA): 75.43
Total Amps (A): 90.73

X 1.25 for growth = **113.4 A < 250 A**

Therefore, circuit breaker for this distribution board is sized appropriately. If the spare branches (#11 and 8) is used, then:

Total Amps = 90.73 A + 100 A = **190.73 A** (*Assuming max loading on spare)*

The specified 250 A, 3-pole circuit breaker will be sufficient.

EHDB Feeder Size and Overcurrent Protection Device Check

**Based on "90.73 A" load:*

	Calculated*	Specified	Notes
Conductor size:	(4) – #3	(4) – #1/0	Per NEC (2005) Table 310.16
Ground wire size:	(1) - #8 G.	(1) – #6 G.	Per NEC (2005) Table 250.95
Conduit size:	1.25"C	2"C	Per NEC Table C8
Molded-case circuit breaker:	100 A, 3-pole	250 A, 3-pole	-

Calculations show that the specified feeder is significantly oversized. However, this can be justified by the potential for future growth on this distribution board.

Main Switchboard: MS

Receptacle Load Summary

Distribution Board	Panel	Voltage	No. of dedicated receptacles	Load from all dedicated recept. (KVA)
MS	L3Ad	208/120	16	2.70

Connected Load Subtotal (KVA): 2.70

Note: Majority of items that are connected to dedicated receptacles includes but is not limited to: office equipment, washer/dryers, utility meters, etc.

Lighting Load Summary

Distribution Board	Panel	Voltage	Lighting Connected Load (KVA)
MS	H1A	480/277	12.43
	H1B	480/277	10.00
	DP1B	480/277	0.44
	H2A	480/277	11.61
	H2B	480/277	5.95
	H3Aa	480/277	14.77
	H3B	480/277	8.64

Connected Load Subtotal (KVA): 63.84

Elevator Load

Distribution Board	Panel	Equipment Description	Voltage	Power	Power Factor	Connected Load (KVA)	Notes
MS	Elevator	3-phase hydraulic AC Elevator	208	15 hp	0.9	39.00	see below

Connected Load Subtotal (KVA): 39.00

The following assumptions were made to calculate the electrical load of the elevator:
3-phase motors: 0.90

Information pertaining to the electrical consumption of the elevator motor was not given.
Therefore, the motor horsepower was estimated using the following equation (source: www.greenspun.com)

Unbalanced Load(lbs) x Speed(fpm) divided by 33000 x Efficiency = Elevator motor HP

(3500 lbs x 150 fpm) x 0.9 / 33000 = 14.32 HP (assume 15 HP)

Transformer Load Summary

Distribution Board	Xfmr	Capacity (KVA)
MS	T-1A	225
	T-1B	112.5
	T-1C	75
	T-3A	30
	Connected Load Subtotal (KVA):	**442.5**

Load Summary

Distribution Board	Item	Total Connected Load (KVA)	Total Demand Load (KVA)	Notes
MS	Total Recept. Loads From All Panels	2.70	2.70	1
	Lighting Equipment	63.84	79.80	3
	Mechanical Equipment	107.20	112.46	4
	Elevator	39.00	48.75	3
EHDB	Total Recept. Loads From All Panels	2.72	2.72	1
	Transformers	10.30	12.88	3
	Lighting Equipment	19.66	24.58	3
	Mechanical Equipment	4.52	4.92	4
	Miscellenous Equipment	24.27	30.34	3
LD1A	Total Recept. Loads From All Panels	149.95	79.98	1
	Kitchen Equipment	15.53	9.32	2
	Lighting Equipment	0.53	0.66	3
	Mechanical Equipment	15.13	17.87	4
LD1B	Total Recept. Loads From All Panels	73.48	41.74	1
	Kitchen Equipment	15.60	9.36	2
	Mechanical Equipment	10.44	6.26	4

LD1C	Total Recept. Loads From All Panels	46.50	46.50	1
	Totals (KVA):	601.37	530.83	

Notes:

1	Receptacle Loads Demand Factor: 1.0 for 1st 10 KVA, 0.5 for > 10KVA	Per NEC 220.44
2	Kitchen Equipment Demand Factor: more than 2 items = 0.60	Per NEC 220.20
3	Continuous Load Demand Factor (1.25)	Per NEC 210.20 (A)
4	See "Mechanical Load Summary" for assumptions	

	Amps	Poles	Voltage System
Switchboard Size	1200	3	480Y/277v
Allowed KVA:	KVA = I x √3 x KV	(eqn.)	
	997.66	KVA	

997.66 KVA > 530.83 KVA , therefore main switchboard is sized appropriately.

Based on total demand load for the main switchboard:

Subtotal Demand Load (KVA):	530.83
Subtotal Amps (A):	638.49

NOTE: Since the TVSS's electrical load is unknown, the following calculations assume that it is less than that of the circuit breaker rating of 100 A for that branch (#14) on the main switchboard.

Therefore: total amps = **738.49 A**

X 1.25 for growth = **923.11 A < 1200 A**

Therefore, circuit breaker for this main switchboard is sized appropriately. If the spare branches (#11,12 and 13) is used, then:

Total Amps = 738.49 A + 125 A + 150 A + 225 A = **1238.49 A** (*Assuming max loading on spare)*

The specified 1200 A, 3-pole circuit breaker does not meet the requirements. A bigger circuit breaker size will be required.

MS Feeder Size and Overcurrent Protection Device Check

**Based on "738.49 A" load:*

	Calculated*	Specified	Notes
Conductor size:	2 sets of 500 MCM	3 sets of 600 MCM	Per NEC (2005) Table 310.16
Ground wire size:	(2) - #3 G.	(3) – 3/0 G.	Per NEC (2005) Table 250.95
Conduit size:	(2) – 4.5"C	(3) - 4"C	Per NEC Table C8
Molded-case circuit breaker:	800 A, 3-pole	1200 A, 3-pole	-

Calculations show that the specified feeder is significantly oversized. However, this can be justified by the potential for future growth in this electrical system.

16. Communication Systems

The building is designed to support three common types of data communication. These include fiber optics, voice and data communication networks. The system is connected to the campus wide network via the two 3" underground conduits that come into the ground floor communication room on the west side of the building. From here it is networked to other communication rooms in the building which then subsequently branch out to provide these services to the rest of the building. The spaces in the adjacent Childcare center are connected to the central communication room on the first floor via identical 24"x24"x8" pull boxes located in the storage rooms on both wings. A similar pull box can also be found in the storage room located next to the Multipurpose Room on the north-eastern end of the building.

With the exception of the tech/computer room on the ground floor, most spaces are serviced via 12" cable trays that are located on the North and South wing of the building. The tech/computer room utilizes 24" cable trays. The three communication rooms on the ground floor are connected via a set of three 3" underground conduits. 4" riser conduits establish a connection between floors.

Upper level communication rooms located on the north and south wing on the upper levels are connected via a 4" conduit which links the two cable trays on either end. In the intermediate distribution room, communication terminals are all rack mounted.

Most rooms have wall mounted communication outlets that consist of (3) RJ45 Category 6 connectors. These are typically mounted 1'-0"AFF. Other spaces such as the student resource centers, tech/computer room as well as the open office on the first floor have flush communications floor box installed.

17. Fire Alarm Systems

Fire alarm control and speaker amp panels are located on the ground floor in the electrical room towards the west end of the building. Located on each level is also a fire alarm terminal cabinet which has an established connection with the 120V circuit on the on the emergency power system. In the event of a fire, signals picked up by the strategically located smoke and heat sensors throughout the building will relay the signal to the fire alarm visual and audible system that will in turn provide warning to the building's occupants. A signal will also be sent to the circuit breakers at the corresponding distribution board to shut off power to the individual elevators.

18. Utilities Management

UCSB has a special agreement with "Southern California Edison" (SCE). The utility rate structure is shown below. At the time this report is written, the building is not yet in operation and as such, no utility bill is available.

Schedule TOU-8 — Sheet 1
TIME-OF-USE - GENERAL SERVICE - LARGE

APPLICABILITY

Applicable to general service including lighting and power, except agricultural water pumping accounts as described in Special Condition 12. This Schedule is applicable to and mandatory for all customers whose monthly maximum demand, in the opinion of SCE, is expected to exceed 500 kW or has exceeded 500 kW in any three months during the preceding 12 months, except that customers served on this Schedule may elect service under any applicable schedules optional hereto. Except for interruptible service customers, any existing customer on this Schedule whose monthly maximum demand has registered 500 kW or less for 12 consecutive months is ineligible for service under this Schedule (See Special Condition 10). Service under this Schedule is subject to meter availability.

TERRITORY

Within the entire territory served.

RATES

The following rates are set forth for service metered and delivered at secondary, primary, and subtransmission voltages.

SERVICE METERED AND DELIVERED AT VOLTAGES BELOW 2 KV

	Delivery Service							Gen[8]	
	Trans[1]	Distrbtn[2]	NDC[3]	PPPC[4]	PUCRF[5]	DWRBC[6]	Total[7]	URG*	DWR
Energy Charge - $/kWh/Meter/Month									
Summer Season – On-Peak	0.00209 (I)	0.00105	0.00048	0.00746	0.00012	0.00485	0.01605 (I)	0.11340	0.10369
Mid-Peak	0.00209 (I)	0.00105	0.00048	0.00746	0.00012	0.00485	0.01605 (I)	0.08319	0.10369
Off-Peak	0.00209 (I)	0.00105	0.00048	0.00746	0.00012	0.00485	0.01605 (I)	0.04358	0.10369
Winter Season – On-Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid-Peak	0.00209 (I)	0.00105	0.00048	0.00746	0.00012	0.00485	0.01605 (I)	0.08623	0.10369
Off-Peak	0.00209 (I)	0.00105	0.00048	0.00746	0.00012	0.00485	0.01605 (I)	0.04771	0.10369
Customer Charge - $/Meter/Month		346.00					346.00		
Demand Charge-$/kW of Billing Demand/Meter/Month									
Facilities Related	1.28	7.03					8.31		
Time Related									
Summer Season – On-Peak		0.00					0.00	16.91	
Mid-Peak		0.00					0.00	5.71	
Off-Peak		0.00					0.00	0.00	
Winter Season – On-Peak		N/A					N/A	N/A	
Mid-Peak		0.00					0.00	0.00	
Off-Peak		0.00					0.00	0.00	
Power Factor Adjustment - $/KVA		0.18					0.18		

* The ongoing Competition Transition Charge (CTC) of $0.00909 is recovered in the URG component of Generation.

1 Trans = Transmission and the Transmission Owners Tariff Charge Adjustments (TOTCA) which are FERC approved. The TOTCA represents the Transmission Revenue Balancing Account Adjustment (TRBAA) of negative $(0.00061) per kWh, Reliability Services Balancing Account Adjustment (RSBAA) of $0.00188 per kWh, (I) and Transmission Access Charge Balancing Account Adjustment (TACBAA) of $0.00082 per kWh.

2 Distrbtn = Distribution

3 NDC = Nuclear Decommissioning Charge

4 PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge where applicable.)

5 PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.

6 DWRBC = Department of Water Resources (DWR) Bond Charge. The DWR Bond Charge is not applicable to exempt Bundled Service and Direct Access Customers, as defined in and pursuant to D.02-10-063, D.02-02-051, and D.02-12-082.

7 Total = Total Delivery Service rates that are applicable to both Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) customers, except DA and CCA Service customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

8 Gen = Generation – The Gen rates are applicable only to Bundled Service Customers. When calculating the Energy Charge, the Gen portion is calculated as described in the Billing Calculation Special Condition of this Schedule.

(Continued)

Schedule TOU-8 Sheet 2
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

RATES (Continued)

SERVICE METERED AND DELIVERED AT VOLTAGES FROM 2 kV THROUGH 50 KV

	Delivery Service							Gen[8]	
	Trans[1]	Distrbtn[2]	NDC[3]	PPPC[4]	PUCRF[5]	DWRBC[6]	Total[7]	URG*	DWR
Energy Charge - $/kWh/Meter/Month									
Summer Season – On-Peak	0.00185 (I)	0.00101	0.00048	0.00716	0.00012	0.00485	0.01547 (I)	0.11549	0.10369
Mid-Peak	0.00185 (I)	0.00101	0.00048	0.00716	0.00012	0.00485	0.01547 (I)	0.08487	0.10369
Off-Peak	0.00185 (I)	0.00101	0.00048	0.00716	0.00012	0.00485	0.01547 (I)	0.04468	0.10369
Winter Season – On-Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid-Peak	0.00185 (I)	0.00101	0.00048	0.00716	0.00012	0.00485	0.01547 (I)	0.08798	0.10369
Off-Peak	0.00185 (I)	0.00101	0.00048	0.00716	0.00012	0.00485	0.01547 (I)	0.04891	0.10369
Customer Charge - $/Meter/Month		208.25					208.25		
Demand Charge-$/kW of Billing Demand/Meter/Month									
Facilities Related	1.21	6.66					7.87		
Time Related									
Summer Season – On-Peak		0.00					0.00	17.18	
Mid-Peak		0.00					0.00	5.82	
Off-Peak		N/A					N/A	N/A	
Winter Season – On-Peak		N/A					N/A	N/A	
Mid-Peak		0.00					0.00	0.00	
Off-Peak		0.00					0.00	0.00	
Power Factor Adjustment - $/KVA		0.18					0.18		

* The ongoing Competition Transition Charge (CTC) of $0.00827 is recovered in the URG component of Generation.

1 Trans = Transmission and the Transmission Owners Tariff Charge Adjustments (TOTCA) which are FERC approved. The TOTCA represents the Transmission Revenue Balancing Account Adjustment (TRBAA) of negative $(0.00061) per kWh, Reliability Services (I) Balancing Account Adjustment (RSBAA) of $0.00164 per kWh, and Transmission Access Charge Balancing Account Adjustment (TACBAA) of $0.00082 per kWh.

2 Distrbtn = Distribution

3 NDC = Nuclear Decommissioning Charge

4 PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge where applicable.)

5 PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.

6 DWRBC = Department of Water Resources (DWR) Bond Charge. The DWR Bond Charge is not applicable to exempt Bundled Service and Direct Access Customers, as defined in and pursuant to D.02-10-063, D.02-02-051, and D.02-12-082.

7 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) customers, except DA and CCA Service customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

8 Gen = Generation – The Gen rates are applicable only to Bundled Service Customers. When calculating the Energy Charge, the Gen portion is calculated as described in the Billing Calculation Special Condition of this Schedule.

(Continued)

Schedule TOU-8 Sheet 3
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

RATES (Continued)

SERVICE METERED AND DELIVERED AT VOLTAGES ABOVE 50 KV

	Delivery Service							Gen[8]	
	Trans[1]	Distrbtn[2]	NDC[3]	PPPC[4]	PUCRF[5]	DWRBC[6]	Total[7]	URG*	DWR
Energy Charge - $/kWh/Meter/Month									
Summer Season – On-Peak	0.00166 (I)	0.00126	0.00048	0.00597	0.00012	0.00485	0.01434 (I)	0.08237	0.10369
Mid-Peak	0.00166 (I)	0.00126	0.00048	0.00597	0.00012	0.00485	0.01434 (I)	0.05854	0.10369
Off-Peak	0.00166 (I)	0.00126	0.00048	0.00597	0.00012	0.00485	0.01434 (I)	0.02716	0.10369
Winter Season – On-Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid-Peak	0.00166 (I)	0.00126	0.00048	0.00597	0.00012	0.00485	0.01434 (I)	0.06120	0.10369
Off-Peak	0.00166 (I)	0.00126	0.00048	0.00597	0.00012	0.00485	0.01434 (I)	0.03064	0.10369
Customer Charge - $/Meter/Month		1833.50					1833.50		
Demand Charge-$/kW of Billing Demand/Meter/Month									
Facilities Related	1.34	0.95					2.29	0.00	
Time Related									
Summer Season – On-Peak		0.00					0.00	13.56	
Mid-Peak		0.00					0.00	4.67	
Off-Peak		N/A					N/A	N/A	
Winter Season – On-Peak		N/A					N/A	N/A	
Mid-Peak		0.00					0.00	0.00	
Off-Peak		0.00					0.00	0.00	
Power Factor Adjustment - $/KVA		0.20					0.20		
Voltage Discount, Demand, 220 kV - $/kW									
Facilities Related		(0.95)					(0.95)		
Time Related									
Summer		0.00					0.00	(0.10)	
Voltage Discount, Energy, 220 kV - $/kWh		0.00000					0.00000	(0.00097)	

* The ongoing Competition Transition Charge (CTC) of $0.00665 is recovered in the URG component of Generation.

1 Trans = Transmission and the Transmission Owners Tariff Charge Adjustments (TOTCA) which are FERC approved. The TOTCA represents the Transmission Revenue Balancing Account Adjustment (TRBAA) of negative $(0.00061) per kWh, Reliability Services (I) Balancing Account Adjustment (RSBAA) of $0.00145 per kWh, and Transmission Access Charge Balancing Account Adjustment (TACBAA) of $0.00082 per kWh.

2 Distrbtn = Distribution

3 NDC = Nuclear Decommissioning Charge

4 PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge where applicable.)

5 PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.

6 DWRBC = Department of Water Resources (DWR) Bond Charge. The DWR Bond Charge is not applicable to exempt Bundled Service and Direct Access Customers, as defined in and pursuant to D.02-10-063, D.02-02-051, and D.02-12-082.

7 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) customers, except DA and CCA Service customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

8 Gen = Generation – The Gen rates are applicable only to Bundled Service Customers. When calculating the Energy Charge, the Gen portion is calculated as described in the Billing Calculation Special Condition of this Schedule.

(Continued)

Schedule TOU-8 Sheet 4
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

RATES (Continued)

(D) (L)

SPECIAL CONDITIONS

1. Time periods are defined as follows:

On-Peak:	Noon to 6:00 p.m. summer weekdays except holidays
Mid-Peak:	8:00 a.m. to Noon and 6:00 p.m. to 11:00 p.m. summer weekdays except holidays 8:00 a.m. to 9:00 p.m. winter weekdays except holidays
Off-Peak:	All other hours.

Holidays are New Year's Day (January 1), Washington's Birthday (third Monday in February), Memorial Day (last Monday in May), Independence Day (July 4), Labor Day (first Monday in September), Veterans Day (November 11), Thanksgiving Day (fourth Thursday in November), and Christmas (December 25).

See Special Condition 15 for Time Periods applicable to Qualifying Facilities.

When any holiday listed above falls on Sunday, the following Monday will be recognized as an off-peak period. No change will be made for holidays falling on Saturday.

The summer season shall commence at 12:00 a.m. on the first Sunday in June and continue until 12:00 a.m. of the first Sunday in October of each year. The winter season shall commence at 12:00 a.m. on the first Sunday in October and continue until 12:00 a.m. of the first Sunday in June of the following year.

(Continued)

Schedule TOU-8 Sheet 5
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

2. Voltage: Service will be supplied at one standard voltage.

3. Maximum Demand: Maximum demands shall be established for the On-Peak, Mid-Peak, and Off-Peak periods. The maximum demand for each period shall be the measured maximum average kilowatt input indicated or recorded by instruments, during any 15-minute metered interval, but, where applicable, not less than the diversified resistance welder load computed in accordance with the section designated Welder Service in Rule 2. Where the demand is intermittent or subject to violent fluctuations, a 5-minute interval may be used.

4. Billing Demand: The Billing Demand shall be the kilowatts of Maximum Demand, determined to the nearest kW. The Demand Charge shall include the following billing components. The Time Related Component shall be for the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period for each of the On-Peak, Mid-Peak, and Off-Peak Time Periods. The Facilities Related Component shall be for the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period. However, when SCE determines the customer's meter will record little or no energy use for extended periods of time or when the customer's meter has not recorded a Maximum Demand in the preceding eleven months, the Facilities Related Component of the Demand Charge may be established at 50 percent of the customer's connected load. Separate Demand Charge(s) for the On-Peak, Mid-Peak, and Off-Peak Time Periods shall be established for each monthly billing period. The Demand Charge for each time period shall be based on the Maximum Demand for that time period occurring during the respective monthly billing period. (D) (D) (D)

(Continued)

Schedule TOU-8 Sheet 6
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

5. Power Factor Adjustment: The customer's bill will be increased each month for power factor by the amount shown in the Rates section above for service metered and delivered at the applicable voltage level, based on the per kilovar of maximum reactive demand imposed by SCE. (T)

   The maximum reactive demand shall be the highest measured maximum average kilovar demand indicated or recorded by metering during any 15 minute metered interval in the month. The kilovars shall be determined to the nearest unit. A device will be installed on each kilovar meter to prevent reverse operation of the meter.

6. Temporary Discontinuance of Service: Where the use of energy is seasonal or intermittent, no adjustments will be made for a temporary discontinuance of service. Any customer prior to resuming service within twelve months after such service was discontinued will be required to pay all charges which would have been billed if service had not been discontinued. (T)

(Continued)

Schedule TOU-8 Sheet 7
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

7. Supplemental Visual Demand Meter: Subject to availability, and upon written application by the customer, SCE will, within 180 days, supply and install a SCE-owned supplemental visual demand meter. The customer shall provide the required space and associated wiring beyond the point of interconnection for such installation. Said supplemental visual demand meter shall be in parallel with the standard billing meter delineated in Special Condition 3 above. The readings measured or recorded by the supplemental visual demand meter are for customer information purposes only and shall not be used for billing purposes in lieu of meter readings established by the standard billing meter. If a meter having visual capability of displaying real time demand is installed by SCE as the standard billing meter, no additional metering will be installed pursuant to this Special Condition. (T)

   One of the following types of supplemental visual demand meters will be provided in accordance with provisions above at no additional cost to the customer: Dial Wattmeter or ty Electronic Demand Monitor.

   If the customer desires a supplemental visual demand meter having features not available in any of the above listed meters, such as an electronic microprocessor-based meter, SCE will provide such a supplemental visual demand meter subject to a monthly charge, if the meter and its associated equipment have been approved for use by SCE. Upon receipt from the customer of a written application SCE will design the installation and will thereafter supply, install, and maintain the supplemental visual demand meter subject to all conditions stated in the first and last paragraph of this Special Condition. For purposes of computing the monthly charge, any such supplemental visual demand meter and associated equipment shall be treated as Added Facilities in accordance with Rule 2, Paragraph H, Section 1 and 2 of the tariff rules. Added investment for computing the monthly charge shall be reduced by SCE's estimated total installed cost at the customer location of the Electronic Demand Monitor offered otherwise herein at no additional cost.

   SCE shall have sole access for purposes of maintenance and repair to any supplemental visual demand meter installed pursuant to this Special Condition and shall provide all required maintenance and repair. Periodic routine maintenance shall be provided at no additional cost to the customer. Such routine maintenance includes making periodic adjustments, lubricating moving parts and making minor repairs. Non-routine maintenance and major repairs or replacement shall be performed on an actual cost basis with the customer reimbursing SCE for such cost.

8. Contracts: An initial three-year facilities contract may be required where applicant requires new or added serving capacity exceeding 2,000 kVA.

(Continued)

Schedule TOU-8 — Sheet 8
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

9. Customer-Owned Electrical Generating Facilities: (T)

a. Where customer-owned electrical generating facilities are used to meet a part or all of the customer's electrical requirements, service shall be provided concurrently under the terms and conditions of Schedule S and this Schedule. Parallel operation of such generating facilities with SCE's electrical system is permitted. A generation interconnection agreement is required for such operation.

b. Customer-owned electrical generating facilities used solely for auxiliary, emergency, or standby purposes (auxiliary/emergency generating facilities) to serve the customer's load during a period when SCE's service is unavailable and when such load is isolated from the service of SCE are not subject to Schedule S. However, upon approval by SCE, momentary parallel operation may be permitted to allow the customer to test the auxiliary/emergency generating facilities. A Momentary Parallel Generation Contract is required for this type of service.

10. Removal From Schedule: Customers receiving service under this Schedule whose monthly Maximum Demand has registered 500 kW or less for 12 consecutive months shall be changed to an applicable rate schedule effective with the date the customer became ineligible for service under this Schedule. This Special Condition is not applicable to customers taking service under Schedule I-6. (T)

(D)

11. Agricultural Water Pumping Accounts: Large individual water agency and other large water pumping accounts with 70% or more of the water pumped used for agricultural purposes are not eligible for service under this Schedule and must take service on an agricultural class rate schedule. (T)

(Continued)

Schedule TOU-8 Sheet 9
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

12. Qualifying Facilities Time Periods: Time Periods for power purchase payments to a cogeneration or small power production source which meets the criteria for a Qualifying Facility as defined under 18 CFR, Chapter 1, part 292, subpart B of the Federal Energy Regulatory Commission regulations and whose power purchase payments are based on the time-of-use periods set forth in this Schedule, shall be as defined under Special Condition 1 herein, except that: 1) consistent with the effective dates listed in the table below, the summer season shall commence at 12:00 a.m. on June 1 and continue until 12:00 a.m. on October 1 of each year; 2) consistent with the effective dates listed in the table below, the winter season shall commence at 12:00 a.m. on October 1 of each year and continue until 12:00 a.m. on June 1 of the following year; 3) for the winter season a Super Off-Peak time period of midnight to 6:00 a.m., everyday, shall apply. (T)

The Summer and Winter Season modifications defined above shall become effective for each Qualifying Facility based on its date of Firm Operation (or initial operation for non-firm Qualifying Facilities) as shown on the table below. Qualifying Facilities that began operation after the end of the Summer Season will be considered to have begun operation in the next year.

Firm Operation	Effective June 1
1985 and prior years	1994
1986	1993
1987	1992
1988	1992
1989	1993
1990	1994
1991	1993
1992 and years beyond	1992

Qualifying Facilities may elect, on a one-time basis, to receive metered kWh hourly deliveries rather than the above time periods. Those Qualifying Facilities not electing to make this change shall continue to receive power purchase payments for energy and capacity based on time-of-use and seasonal periods as defined above.

(Continued)

Schedule TOU-8 Sheet 10
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

13. Compensated Metering. This provision is applicable to service metered and delivered at voltages above 50 kV. Where customer/applicant requests and SCE agrees, SCE may install a transformer loss compensating device (Compensated Metering) acceptable to SCE in order to provide high voltage (over 50 kV) metered service. Where provided, this service will be considered as metered and delivered on SCE's side of the serving transformer. SCE shall rely on transformer loss data provided by the transformer manufacturer or transformer loss tests performed by SCE to calibrate the compensating device. Service under this provision is contingent upon customer/applicant's entering into an agreement which requires payment for the serving transformer and related substation equipment in accordance with Rule 2, Section H, Added Facilities, except where such transformer equipment is owned, operated, and maintained by the customer/applicant. Where the transformer equipment is owned, operated, and maintained by the customer/applicant, the customer/applicant is required to pay for the Compensated Metering and related equipment in accordance with Rule 2, Section H, Added Facilities, and shall also agree to provide SCE unrestricted access to the serving transformer, metering, and compensating equipment. (T)

(D)

(Continued)

Schedule TOU-8 Sheet 11
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

(D)
14. Rate Eligibility Criteria for Energy Efficiency (RECEE) (T)

The purpose of the RECEE is to determine a customer's continued eligibility for service under this Schedule. The RECEE is applicable to customers currently receiving service under this Schedule and who have implemented energy efficiency measures on or after June 5, 1994 which have reduced the customer's monthly Maximum Demand to 500 kW or less. The RECEE is a fixed level of demand, determined by SCE, based on the customer's permanent demand reduction resulting from the implementation of energy efficiency measures. The RECEE demand is set forth in the Energy Efficiency Declaration, Form No.16-327.

The RECEE demand plus the customer's actual demand will be evaluated each billing period for purposes of determining the customer's continued eligibility for service under this Schedule. If the RECEE demand plus the customer's actual demand equals 500 kW or less for 12 consecutive months, the customer is ineligible for service under this Schedule and ineligible for application of the RECEE. The RECEE demand will not be used for purposes of calculating the customer's demand charge.

(Continued)

Schedule TOU-8 Sheet 12
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

15. Voltage Discount: Bundled Service and Direct Access Customers receiving service at 220 kV will have the Distribution rate component of the applicable Delivery Service charges reduced by the corresponding Voltage Discount amount for service metered and delivered at the applicable voltage level as shown in the Rates section above. In addition, Bundled Service Customers will have the Utility Retained Generating (URG) rate component of the applicable Generation charges reduced by the corresponding Voltage Discount amount for service metered and delivered at the applicable voltage level as shown in the Rates section. (C)

16. Optimal Billing Period Service: This Special Condition provides for the voluntary use of an Optimal Billing Period (OBP) which allows for a customer's billing cycle(s) to coincide with the customer's high seasonal production cycle. The customer designates the OBP by selecting a specific month and day for the start of the OBP and a specific month and day for the end of the OBP. The start and end dates must fall within the customer's high seasonal production cycle. In no event shall any revised billing period exceed 45 days or be less than 15 days. (T) (T)

    To qualify for this option, the duration of the customer's high seasonal production cycle must be 6 months or less, and the average of the customer's monthly maximum demand during it's OBP must be at least double the average of its monthly maximum demand during it's non-OBP period. Customers may not discontinue this option before the end date of their OBP.

    Prior to receiving OBP service, the customer shall sign the "Optimal Billing Period Service Agreement," Form No. 14-689 and pay an OBP fee of $160.00 per meter. To continue service under this Special Condition the customer must sign a new OBP Agreement and pay the OBP fee each year. (T)

(D)

17. Billing Calculation: A customer's bill is calculated according to the rates and conditions above.

    Except for the Energy Charge, the charges listed in the Rates section are calculated by multiplying the Total Delivery Service rates and the Generation rates, when applicable, by the billing determinants (e.g., per kilowatt [kW], kilowatthour [kWh], kilovar [kVa] etc.), (T)

    The Energy Charge, however, is determined by multiplying the total kWhs by the Total Delivery Service per kWh rates to calculate the Delivery Service amount of the Charge. To calculate the Generation amount, SCE determines what portion of the total kWhs is supplied by the Utility Retained Generation (URG) and the Department of Water Resources (DWR). The kWhs supplied by the URG are multiplied by the URG per kWh rates and the kWhs supplied by the DWR are multiplied by the DWR per kWh rate and the two products are summed to arrive at the Generation amount. The Energy Charge is the sum of the Delivery Service amount and the Generation amount.

(Continued)

Schedule TOU-8 Sheet 13
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

17. Billing Calculation: (Continued)

For each billing period, SCE determines the portion of total kWhs supplied by SCE's URG and by the DWR. This determination is made by averaging the daily percentages of energy supplied to SCE's Bundled Service Customers by SCE's URG and by the DWR.

a. Bundled Service Customers receive Delivery Service from SCE and receive supply (Gen) service from both SCE's URG and the DWR. The customer's bill is the sum of the charges for Delivery Service and Gen determined, as described in this Special Condition, and subject to applicable discounts or adjustments provided under SCE's tariff schedules.

b. Direct Access Customers receive Delivery Service from SCE and purchase energy from an Energy Service Provider. The customer's bill is the sum of the charges for Delivery Service determined as described in this Special Condition except that the DWRBC rate component is subtracted from the Total Delivery Service rates before the billing determinants are multiplied by such resulting Total rates; plus the applicable charges as shown in Schedule DA and subject to applicable discounts or adjustments provided under SCE's tariff schedules.

18. Customers with Service Metered and Delivered at Voltages above 50 kV (Sub-transmission customers) Included in Rotating Outages.

Sub-transmission customers, except for those customers exempt from rotating outages, are to be included in controlled, rotating outages when required by the Independent System Operator (ISO) and/or SCE. To the extent feasible, SCE will coordinate rotating outages applicable to Sub-transmission customers who are fossil fuel producers and pipeline operators and users to minimize disruption to public health and safety. SCE shall not include a Sub-transmission customer in an applicable rotating outage group if the customer's inclusion would jeopardize electric system integrity. Sub-transmission customers who are not exempt from rotating outages, and seek such exemption, may submit an Optional Binding Mandatory Curtailment (OBMC) Plan to SCE in accordance with Schedule OBMC. If SCE approves a customer's OBMC Plan, the customer will become exempt from rotating outages and will be subject to the terms and conditions of Schedule OBMC and its associated contract. (T)

Non-exempt Sub-transmission customers shall be required to drop their entire electrical load during applicable rotating outages by either (1) implementing the load reduction on their own initiative, in accordance with subsection a, below; or (2) having SCE implement the load reduction through remote-controlled load drop equipment (control equipment) in accordance with subsection b, below. A Sub-transmission customer shall normally be subject to the provisions of subsection a. If SCE approves a customer's request to have SCE implement the load reduction or if the customer does not comply with prior required load reductions, as specified in subsection c, the customer will be subject to the provisions of subsection b.

a. Customer-Implemented Load Reduction.

(i) Notification of Required Load Reduction. At the direction of the ISO or when SCE otherwise determines there is a need for Rotating Outage, SCE shall notify each Sub-transmission customer in an affected rotating outage group to drop its entire load. Within 30 minutes of such notification, the customer must drop its entire load. The customer shall not return the dropped load to service until 90 minutes after SCE sent the notification to the customer to drop its load, unless SCE notifies the customer that it may return its load to service prior to the expiration of the 90 minutes. (T) (T)

(Continued)

Schedule TOU-8 Sheet 14
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

18. Customers with Service Metered and Delivered at Voltages above 50 kV (Sub-transmission customers) Included in Rotating Outages. (Continued) (T)

a. Customer-Implemented Load Reduction. (Continued)

(i) Notification of Required Load Reduction. At the direction of the ISO, SCE shall notify each Sub-transmission customer in an affected rotating outage group to drop its entire load. Within 30 minutes of such notification, the customer must drop its entire load. The customer shall not return the dropped load to service until 90 minutes after SCE sent the notification to the customer to drop its load, unless SCE notifies the customer that it may return its load to service prior to the expiration of the 90 minutes.

(ii) Method of Notification. SCE will notify Sub-transmission customers who are required to implement their own load reduction via telephone, by either an automated calling system or a manual call to a business telephone number or cellular phone number designated by the customer. The designated telephone number will be used for the sole purpose of receiving SCE's rotating outage notification and must be available to receive the notification at all times. When SCE sends the notification to the designated telephone number the customer is responsible for dropping its entire load in accordance with subsection a. (i), above. The customer is responsible for informing SCE, in writing, of the telephone number and contact name for purposes of receiving the notification of a rotating outage.

(iii) Excess Energy Charges. If a Sub-transmission customer fails to drop its entire load within 30 minutes of notification by SCE, and/or fails to maintain the entire load drop until 90 minutes after the time notification was sent to the customer, unless SCE otherwise notified the customer that it may return its load to service earlier in accordance with subsection a. (i) above, SCE shall assess Excess Energy Charges of $6 per kWh for all kWh usage in excess of the Authorized Residual Ancillary Load. Such charges will be based on the total kWh usage during the applicable rotating outage penalty period, less the product of Authorized Residual Ancillary Load in kW and the applicable rotating outage penalty period in hours. Excess Energy Charges will be determined and applied by SCE subsequent to the Sub-transmission customer's regularly scheduled meter read date following the applicable rotating outage.

(iv) Authorized Residual Ancillary Load. Authorized Residual Ancillary Load is load that is deemed to be equivalent to five percent of the Sub-transmission customer's prior billing month's recorded Maximum Demand. This minimum load level is used as a proxy to allow for no-load transformer losses and/or load attributed to minimum grid parallel operation for generators connected under Rule 21.

(Continued)

Schedule TOU-8 — Sheet 15
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

18. Customers with Service Metered and Delivered at Voltages above 50 kV (Sub-transmission customers) Included in Rotating Outages. (Continued) (T)

b. SCE-Implemented Load Reduction.

Non-exempt Sub-transmission customers may request, in writing, to have SCE drop the customer's entire load during all applicable rotating outages using SCE's remote-controlled load drop equipment (control equipment). If SCE agrees to such arrangement, SCE will implement the load drop by using one of the following methods:

(i) Control Equipment Installed. For a Sub-transmission customer whose load can be dropped by SCE's existing control equipment, SCE will implement the load drop during a rotating outage applicable to the customer. The customer will not be subject to the Notification and Excess Energy Charge provisions set forth in subsection a, above.

(ii) Control Equipment Pending Installation. For a Sub-transmission customer whose load can not be dropped by SCE's existing control equipment, the customer must request the installation of such equipment at the customer's expense in accordance with SCE's Rule 2, Section H, Added Facilities. Pending the installation of the control equipment, the customer will be responsible for dropping load in accordance with the provisions of subsection a, above, including the Notification and Excess Energy Charge provisions.

c. Non-compliance: A non-exempt Sub-transmission customer subject to subsection a, above, who fails to drop load during three rotating outages in a three year period to a demand level of 20% or less of the customer's prior billing month's recorded Maximum Demand averaged over the applicable rotating outage period, is not in compliance with this tariff. The three year period shall commence with the first failure to drop load as specified in this subsection. A customer not in compliance with this condition will be placed at the top of the Sub-transmission customer rotating outage group list and will be expected to comply with subsequent applicable rotating outages. In addition, the customer must select one of the two options below within fifteen days after receiving written notice of non-compliance from SCE. A customer failing to make a selection within the specified time frame will be subject to subsection c. (ii) below.

(i) Subject to Schedule OBMC: The customer shall submit an OBMC Plan, in accordance with Schedule OBMC, within 30 calendar days of receiving written notice of non-compliance from SCE. Pending the submittal of the OBMC Plan by the customer and pending the review and acceptance of the OBMC Plan by SCE, the customer will remain responsible for dropping load in accordance with the provisions of subsection a, above, including the Notification and Excess Energy charge provisions. If the customer fails to submit an OBMC Plan within 30 days of receiving notice of non-compliance from SCE, or if the customer's OBMC Plan is not approved by SCE, or if the customer fails to meet the requirements of Schedule OBMC once the OBMC Plan is approved, the customer shall be subject subsection c. (ii), below.

(Continued)

Schedule TOU-8 — Sheet 16
TIME-OF-USE - GENERAL SERVICE - LARGE

(Continued)

SPECIAL CONDITIONS (Continued)

18. Customers with Service Metered and Delivered at Voltages above 50 kV (Sub-transmission customers) Included in Rotating Outages. (Continued) (T)

c. Non-compliance: (Continued)

(ii) Installation of Control Equipment. The customer shall be subject to the installation of control equipment at the customer's expense in accordance with SCE's Rule 2, Section H, Added Facilities, if such equipment is not currently installed. If such switching capability is installed, SCE will drop the customer's load for all applicable subsequent rotating outages in accordance with the provisions of subsection b, above. Pending the installation of control equipment, the customer will remain responsible for dropping load in accordance with the provisions of subsection a, above, including the Notification and Excess Energy Charge provisions.

d. Net-Generators

Sub-transmission customers who are also net-generators are normally exempt from rotating outages, but they must be net suppliers of power to the grid during all rotating outages. For the purpose of this Special Condition, a net-generator is an SCE customer who operates an electric generating facility as part of its industrial or commercial process, and the generating facility normally produces more electrical power than is consumed in the industrial or commercial process, with the excess power supplied to the grid. Sub-transmission customers whose primary business purpose is to generate power are not included in this Special Condition.

(i) Notification of Rotating Outages. SCE will notify sub-transmission customers who are net-generators of all rotating outages applicable to customers within SCE's service territory. Within 30 minutes of notification, the customer must ensure it is a net supplier of power to the grid throughout the entire rotating outage period. Failure to do so will result in the customer losing its exemption from rotating outages, and the customer will be subject to Excess Energy Charges, as provided below.

(ii) Excess Energy Charges. Net generators who are not net suppliers to the grid during each rotating outage period will be subject to Excess Energy Charges of $6 per kWh for all kWh usage in excess of the Authorized Residual Ancillary Load. Such charges will be based on the total kWh usage during a rotating outage penalty period, less the product of Authorized Residual Ancillary Load in kW and the applicable rotating outage period hours. Excess Energy Charges will be determined and applied by SCE subsequent to the customer's regularly scheduled meter read date following the applicable rotating outage. Excess Energy Charges shall not apply during periods of verifiable scheduled generator maintenance or if the customer's generator suffers a verifiable forced outage. The scheduled maintenance must be approved in advance by either the ISO or SCE, but approval may not be unreasonably withheld.

(Continued)