

Technical Assignment 2

Electrical Systems Existing Conditions and Building Load Summary



The Pennsylvania Academy of Music
Lancaster, PA

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Lighting/Electrical Option

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TABLE OF CONTENTS

Executive Summary	3
Power Distribution Systems	4
Power Distribution Overview.....	4
Point of Responsibility Transfer	4
Voltage Systems	4
Transformers.....	5
Emergency Power Systems	5
Overcurrent Protection Devices.....	6
Electrical Device Locations	6
Lighting Systems	6
Occupancy Control.....	6
Power Factor Correction	7
Special Design Requirements	7
Primary Lamps and Ballasts	8
Major Mechanical Equipment	9
NEC Design Loads.....	10
Distribution Calculations	13
Utility Rate Structure	14
Communication Systems	15
Communications Systems Overview.....	15
Voice and Data System.....	15
Security System	16
Audio-Visual System	16
Appendix.....	17
One-Line Diagram.....	17
Rate Structure	19

EXECUTIVE SUMMARY

In this Technical Report, I have analyzed the electrical loads and distribution system for The Pennsylvania Academy of Music. I researched the types of devices that went into the building and how they interconnected to form complete systems. I then analyzed the systems to see if they meet the requirements set forth in the 2005 National Electric Code. Complete load and demand factor calculations were applied to every load of the building. These loads were used to analyze the feeder circuits that sent power throughout the building. The design drawings and specifications were used to get much of this information, though they are not yet complete versions of what will go into the building as the building is still under construction. I gathered additional information through manufacturers and I ultimately had to make several assumptions which I have noted. After analysis, I have concluded that the electrical distribution system is sized appropriately for the current loads and the loads

The communications systems were also analyzed. The importance of the audio/visual, fire protection, security, and voice/data systems are integral to the functionality of The Pennsylvania Academy of Music. In addition, the communications systems and power distribution system must be designed to not interfere with each other. After analysis, it is clear that care was taken in the design to create a symbiotic relationship between the communications systems and the power distribution system.

POWER DISTRIBUTION SYSTEMS

Power Distribution Overview

The electric utility company, Pennsylvania Power and Light (PPL), provides a 12.47 KV service from an overhead power line via underground concrete-encased conduit to an underground vault just outside of the building. In this vault, a PPL-provided transformer steps the voltage down to 480Y/277V for use within the building. Through another concrete-encased conduit, power enters the building in the Electrical Switchgear Room. The main switchboard is rated at 2500A and has connections to the fire pump, elevator, automatic transfer switches, motor control centers, and distribution panels. Transformers step down the voltage from several high voltage distribution panels to supply low voltage distribution panels. From these distribution panels, loads are connected to the system.

Point of Responsibility Transfer

The civil contractor is to provide conduits from a utility pole to an underground vault. The underground vault is furnished and installed by the electrical contractor, as well as the conduit leaving the vault and going into the building. The utility company provides the transformer to step down the voltage for use in the building.

Voltage Systems

There are two voltage levels used in the building, 480Y/277 and 208Y/120. Most of the motors in the building operate at 480 V including the elevators, fans, pumps, overhead door, and chiller. The lower voltage is used for all of the lights, receptacles, wheelchair lift, coat rack, pipe tracing, audio/visual equipment, communication, and security.

Transformers

The schedule of transformers and related information are given in Table 1. Transformer T-1 is furnished and owned by PPL. The rest of the transformers are provided by the electrical contractor and are owned by the Pennsylvania Academy of Music (PAM). The specific information about the PPL-furnished transformer was not available.

Tag	Primary Voltage	Secondary Voltage	Size (KVA)	Type	Temp. Rise	Taps	Mounting	Owner
TR-1	12470V, 3PH, 3W	480Y/277V, 3PH, 4W	N/A	N/A	N/A	N/A	PAD MOUNTED BY PPL IN VAULT	PPL
TR-2	480V, 3PH, 3W	208Y/120V, 3PH, 4W	30	DRY TYPE	115°C	(6) 2.5%	PAD MOUNTED ON FLOOR	PAM
TR-3	480V, 3PH, 3W	208Y/120V, 3PH, 4W	150	DRY TYPE	115°C	(6) 2.5%	PAD MOUNTED ON FLOOR	PAM
TR-4	480V, 3PH, 3W	208Y/120V, 3PH, 4W	225	DRY TYPE	115°C	(6) 2.5%	PAD MOUNTED ON FLOOR	PAM
TR-5	480V, 3PH, 3W	208Y/120V, 3PH, 4W	112.5	DRY TYPE	115°C	(6) 2.5%	PAD MOUNTED ON FLOOR	PAM

Table 1: Individual Transformer Schedule

Emergency Power Systems

There is both an automatic backup generator and a UPS system on the site. The automatic generator is a 250 KW generator operating at 480Y/277V. The generator provides power for lighting, some emergency receptacles, and certain mechanical loads. Most of the emergency lighting load consists of incandescent lamps that are wired to emergency circuits. An uninterruptible power supply (UPS) system keeps the communications (telephone, data, and security) systems online within the telecom room in the basement. In addition, there is a secondary UPS system built into the security system.

Overcurrent Protection Devices

Overcurrent protection is used as outlined by the National Electric Code. Fuses are used by the main switchboard. Fused switches are used by the fire pump service switch, the air handling units, and exhaust fans. Circuit breakers are used on every distribution panel and panelboard.

Electrical Device Locations

The main switchgear is located in the Main Switchgear Room in the basement of the building. This is the room where electrical service enters the building. Also located in this room are five distribution panels and four transformers. There is a motor control center and three distribution panels in the mechanical room in the basement. Other panelboards are located in electrical closets, in the backstage area, in storage rooms, the recording studio, the projection room, and the theater dimming room.

Lighting Systems

All of the lighting in the building runs on single-phase 120V due to the amount of incandescent used. There are two specialized systems in the building: the recital hall theater and the lobby. Both of these systems use an ETC dimming rack with programmable wallstations to control the light levels and to program scenes. There are incandescent loads only in these spaces. The system also has an emergency lighting system transfer switch for emergency lighting conditions. Other spaces have switch- and occupancy sensor-controlled fluorescent lighting.

Occupancy Control

In order to meet ASHRAE/IESNA 90.1 electricity use shutoff requirements, occupancy controls must turn off lights when a space is no longer occupied. This building uses

several types of Lightolier Insight occupancy sensors, including wall box passive infrared, wall box passive infrared with dimming capability, and ceiling mounted infrared occupancy sensors. Multiple devices are to be used in conjunction to cover large areas. Exact quantities and locations are to be determined by the electrical contractor so that they may be mounted while taking into account actual field conditions.

Power Factor Correction

There are no capacitor power correction banks currently attached to the motor control center or the main switchgear. After completion of the building, this may be confirmed by studying the power usage of the building.

Special Design Requirements

One large special design consideration for this building would be the requirement of clean power and low harmonic distortion. Without these, the highly sensitive audio/visual and recording equipment may end up with undesirable background noise due to harmonic distortion.

Primary Lamps and Ballasts

A table of the primary lamps along with their electrical operating conditions and ballast performance is given in Table 2.

Lamp Type	Lamp Watts (W)	Lamps per Ballast	Voltage (V)	Ballast Factor	Power Factor	Input Watts (W)	Starting Current (A)	Operating Current (A)
250W PAR38 Incandescent	250		120			250	2.08	2.08
75W PAR30L Incandescent	75		120			75	0.63	0.63
32W T4 Triple Tube CFL	32	1	120	0.98	0.98	36	0.30	0.30
39W PAR20 Metal Halide	39	1	120	1.00	>0.90	54	0.55	0.60
50W PAR20 Halogen	50		120			50	0.42	0.42
54W T5HO Fluorescent	54	2	120	0.99	0.98	118	0.99	0.99
39W T5HO Fluorescent	39	1	120	1.02	0.98	43	0.36	0.36
F32 T8 Fluorescent	32	2	120	0.98	0.98	30	0.25	0.25
20W Xenon Bi-Pin	20		12			20	1.67	1.67
39W T6 Metal Halide	39	1	120	1.00	>0.90	54	0.55	0.60
150W T4 Halogen	150		120			150	1.25	1.25
42W T4 Triple Tube CFL	42	2	120	1.00	0.98	98	0.82	0.82
27W T4 Biax Fluorescent	27	2	120	1.00	0.98	52	0.44	0.44
100W PAR38 Incandescent	100		120			100	0.83	0.83
50W MR16 Halogen	50		12			50	4.17	4.17
150W High Pressure Sodium	150	1	120	1.00	>0.90	188	2.00	1.65
10W Xenon Festoon	10		30			10	0.33	0.33
575W HPL Incandescent	575		120			575	4.79	4.79
70W MR16 Halogen	70		12			70	5.83	5.83

Table 2: Primary Lamp and Ballast Information

Major Mechanical Equipment

The electrical operating conditions of the major electrical equipment are provided in

Table 3.

Equipment Tag	Equipment Type	Location	HP	KVA	Voltage	Phase
AHU-1	Air Handler	Lower Level	20.0	12.4	460	3
AHU-2	Air Handler	Lower Level	25.0	15.6	460	3
AHU-3	Air Handler	Lower Level	10.0	6.4	460	3
AHU-4	Air Handler	Lower Level	1.0	0.97	460	3
AHU-5	Air Handler	Lower Level	2.0	1.6	460	3
AHU-6	Air Handler	Lower Level	2.0	1.6	460	3
AHU-7	Air Handler	Lower Level	0.75	0.74	460	3
AHU-8	Air Handler	Lower Level	3.0	2.2	460	3
AC-1	Air Conditioner	Roof	2	1.6	460	3
AC-2	Air Conditioner	Roof	1.5	1.4	460	3
AC-3	Air Conditioner	Roof	2	1.6	460	3
AC-4	Air Conditioner	Roof	5	3.5	460	3
AC-5	Air Conditioner	Roof	3	2.2	460	3
AC-6	Air Conditioner	Roof	1.5	1.4	460	3
AC-7	Air Conditioner	Roof	2	1.6	460	3
AC-8	Air Conditioner	Roof	15	9.7	460	3
AC-9	Air Conditioner	Roof	2	1.6	460	3
AC-10	Air Conditioner	Roof	5	3.5	460	3
AC-11	Air Conditioner	Roof	2	1.6	460	3
AC-12	Air Conditioner	Roof	2	1.6	460	3
EF-1	Exhaust Fan	Lower Level	1.0	0.97	460	3
EF-2	Exhaust Fan	Lower Level	7.5	5.1	460	3
EF-3	Exhaust Fan	Lower Level	0.5	0.51	460	3
EF-4	Exhaust Fan	Lower Level	0.5	0.51	460	3
EF-5	Exhaust Fan	Lower Level	0.5	0.51	460	3
EF-6	Exhaust Fan	Lower Level	0.5	0.51	460	3
EF-7	Exhaust Fan	Lower Level	0.5	0.51	460	3
SF-1	Supply Fan	Lower Level	0.75	0.74	460	3
SF-2	Supply Fan	Lower Level	1.5	1.4	460	3
SF-3	Supply Fan	Lower Level	5	3.7	460	3
SF-4	Supply Fan	Lower Level	1.0	0.97	460	3
SF-5	Supply Fan	Lower Level	1.0	0.97	460	3
SF-6	Supply Fan	Lower Level	0.5	0.51	460	3
SF-7	Supply Fan	Lower Level	0.5	0.51	460	3
SF-8	Supply Fan	Lower Level	0.5	0.51	460	3
RF-1	Return Fan	Lower Level	10.0	6.4	460	3
RF-2	Return Fan	Lower Level	10.0	6.4	460	3
RF-3	Return Fan	Lower Level	2.0	1.6	460	3
TEF-1	Toilet Exhaust Fan	Roof	1.0	0.97	460	3
CHWP-1	Chilled Water Pump	Lower Level	15.0	9.7	460	3

Equipment Tag	Equipment Type	Location	HP	KVA	Voltage	Phase
CHWP-2	Chilled Water Pump	Lower Level	15.0	9.7	460	3
HWP-1	Hot Water Pump	Lower Level	10.0	6.4	460	3
HWP-2	Hot Water Pump	Lower Level	10.0	6.4	460	3
HWP-3	Hot Water Pump	Lower Level	10.0	6.4	460	3
HWP-4	Hot Water Pump	Lower Level	3.0	2.2	460	3
HWP-5	Hot Water Pump	Lower Level	3.0	2.2	460	3
FOP-1	Fuel Oil Pump	Lower Level	0.33	0.51	460	3
CH-1	Water Chiller	Roof	95.0	57.0	460	3
FP-1	Fire Pump	Lower Level	100.0	57.0	460	3
JP-1	Jockey Pump	Lower Level	5.0	3.5	460	3

Table 3: Major Mechanical Equipment Information

NEC Design Loads

The following calculations are to determine the design loads for the Pennsylvania Academy of Music. The code followed in these calculations is the NFPA 70 National Electric Code (NEC), 2005 edition.

Since this building is mainly a music school, an NEC design load of 3 VA/ft² without any demand factor was assumed to obtain the general lighting load. This calculation is based on the information available in NEC table 220.12 and NEC table 220.40. This calculation is outlined in Table 4.

Specific receptacle loads were not available so they were all assumed to be 180VA per requirements of NEC article 220.14. The receptacle demand factor of 50% of the receptacle load over 10KVA is based on NEC table 220.44. The receptacle load calculation is given in Table 5 and Table 6.

Table 7 and Table 8 show the calculations of the mechanical loads in this building. These loads are taken from Table 3 above. In addition to these loads a demand factor of 125% was applied to the largest motor, and a demand factor of 80% was applied to the

pumps in the building. Other calculations are per NEC article 430 and NEC article 440. The building has gas-fired boiler and heating units.

Elevator loads are summarized in Table 9. There is a single elevator in this building and thus it is on a single feeder, so the demand load as determined in NEC table 620.14 is 1.00.

Miscellaneous known loads including the Audio/Visual system, minor mechanical equipment, security system power supplies, pipe tracing, intercom systems, fan power boxes, a wheelchair lift, coat racks, and fire pump and elevator controller power supplies are tabulated in Table 10. Because detailed panelboard schedules are unavailable at the present time, all miscellaneous loads aside from the Audio/Visual system and overhead door were estimated based on the maximum current allowed by the wire size running to the connection. Since these are calculated loads, there are no demand factors associated with them.

The totals of all of these calculations are given in Table 11. I calculated the total demand load for the system to be 735.02KVA. In this system, the total demand current entering the main distribution panel is 884.11A, which is less than the 2500A overcurrent protection on the 3000A frame of the panel.

Occupancy Type	Area (ft²)	Unit Load (VA/ft²)	Total Load (KVA)
School	63,120	3.0	189.36
TOTAL			189.36

Table 4: General NEC Lighting Loads by Occupancy

Floor	Number of Receptacles	Receptacle Load (KVA)
Lower Level	92	16.56
First Floor	108	19.44
Second Floor	61	10.98
Third Floor	145	26.10
Roof	7	1.26
TOTAL		74.34

Table 5: Receptacle Loads

Receptacle Demand Factor	Receptacle Demand Load (KVA)	
First 10 KVA at 1.00	10.00	
Remaining 63.62 KVA at 0.5	31.81	
TOTAL		41.81

Table 6: Receptacle Demand Loads

Mechanical Equipment Type	Total Load (KVA)	
Air Handlers	47.51	
Air Conditioners	32.00	
Exhaust Fans	8.76	
Supply Fans	31.46	
Return Fans	16.50	
Toilet Exhaust Fan	0.75	
Chilled Water Pumps	22.40	
Hot Water Pumps	26.90	
Fuel Oil Pump	0.25	
Water Chiller	70.80	
Fire Pumps	80.10	
TOTAL		337.43

Table 7: Mechanical Loads

Mechanical Demand Factor	Mechanical Demand Load (KVA)	
Total Load	337.43	
Add 25% of Largest Motor	17.7	
Subtract 20% of Non-Fire Pump Load	(9.91)	
TOTAL		345.22

Table 8: Mechanical Demand Loads

Elevator	Load (KVA)	Demand Factor	Demand Load (KVA)
Elevator 1	38.15	Single Elevator: 1.00	38.15
TOTAL			38.15

Table 9: Elevator Loads

Floor	Miscellaneous Loads (KVA)	
Lower Level	31.86	
First Floor	38.70	
Second Floor	11.52	
Third Floor	38.40	
Roof	0	
TOTAL		120.48

Table 10: Miscellaneous Equipment Loads

Load Type	Load (KVA)	
Lighting	189.36	
Receptacles	41.81	
Mechanical Equipment	345.22	
Elevator	38.15	
Miscellaneous Equipment	120.48	
TOTAL		735.02

Table 11: Total Building Loads

Distribution Calculations

The calculations of the feeders coming off of the main distribution panel are shown in Table 12. The connected loads which include distribution panels have been sized at 125% to allow for future expansion. All of the connected loads are less than the overcurrent protection, and all of the wire capacities are higher than the overcurrent protection. This means that in the case of too much current being drawn, the overcurrent protection will stop the flow of current before the feeder wires are damaged. The wires are assumed to be copper with 75°C insulation.

The main building transformer is PPL-provided, and its size estimated by the 24#500 kcmil feeders coming off of it into the building. The capacity of these wires are significantly more than enough to satisfy the connected load of the building.

#	Description	Switch Size	Overcurrent Size	Feeder	Allowable Feeder Current	Connected Load	Connected Current
1	Main Switch	2500A	2500A	24#500 kcmil	9120A	918.78 KVA	1105.1A
2	Fire Pump	400A	400A	3#4	255A	36.7 KVA	44.14A
3	DPH-RA	800A	800A	8#500 kcmil	3040A	295 KVA	354.84A
4	Elevator	200A	125A	3#1	390A	36.7 KVA	44.14A
5	ATS#1	400A	400A	4#500 kcmil	1520A	142.2 KVA	171.0A
6	TR-4	400A	350A	3#500 kcmil	1140A	225KVA	270.1A
7	MCC-LA	400A	400A	3#500 kcmil	1140A	199.5KVA	240.0A
8	DPH-LA	600A	400A	4#500 kcmil	1520A	38.0KVA	45.7A
9	SPARE	600A	-	-	-	-	-

Table 12: Feeder and Distribution Calculations

Utility Rate Structure

The Pennsylvania Academy of Music qualifies as General Service 3 in the PPL rate schedule. PPL uses an approximate fee scale of \$8.60 per KW and \$0.06/KWH to estimate payment for this service. The precise PPL rate structure is given in the Appendix starting on page 19. The building is presently under construction so exact usage data is not yet available.

COMMUNICATION SYSTEMS

Communications Systems Overview

Most of the head-ends for the communications systems are located in the basement telecommunications main distribution frame room. The main components in this room are ten 45U (7'-0") racks fed by overhead UPS-backed twist-lock receptacles. Cable trays support all of the cables from the ceiling and keep them out of the way for maintenance. This room contains: two racks for private branch exchange (PBX) equipment, one rack for general incoming services, two racks for computer servers, one rack for security, one rack for AV equipment, one rack for CATV, an empty rack for future use, and a rack to hold equipment for monitoring the status of the other racks and UPS system. The UPS batteries are wall-mounted in this same room.

Voice and Data System

The voice and data systems use standard PBX voice equipment that will be furnished by the telephone provider. The system uses CAT 5e cable for voice with RJ-45 terminals for standard telephone cables. There will be a terminal on each floor for the telephone system located within the intermediate distribution frame room in the core of each floor. The data system uses incoming service from an internet service provider, and will be furnished by the owner. Distribution for the data also comes from the intermediate distribution frame rooms, which are connected to the main distribution frame room with fiber optic cable. Wall-mounted Ethernet jacks are located throughout the building and are also wired with CAT 5e cable. Space is provided in the basement for computer servers and data distribution. Only the framework and cabling for these systems are provided, not equipment.

Security System

The security system is used to monitor and secure the building. The head-end unit of the security system is in the main distribution frame room. In the rack are a monitor, network switch, secondary UPS system, an MTRX console, an ACAM console, and a digital video recorder. Additional equipment include a keyboard/video/mouse switch to switch between the digital video recorder and the consoles in the system. The security system is fed information from door contacts, motion detectors, cameras, door panic bars, keypads, and video intercoms. The system also controls magnetic release door locks.

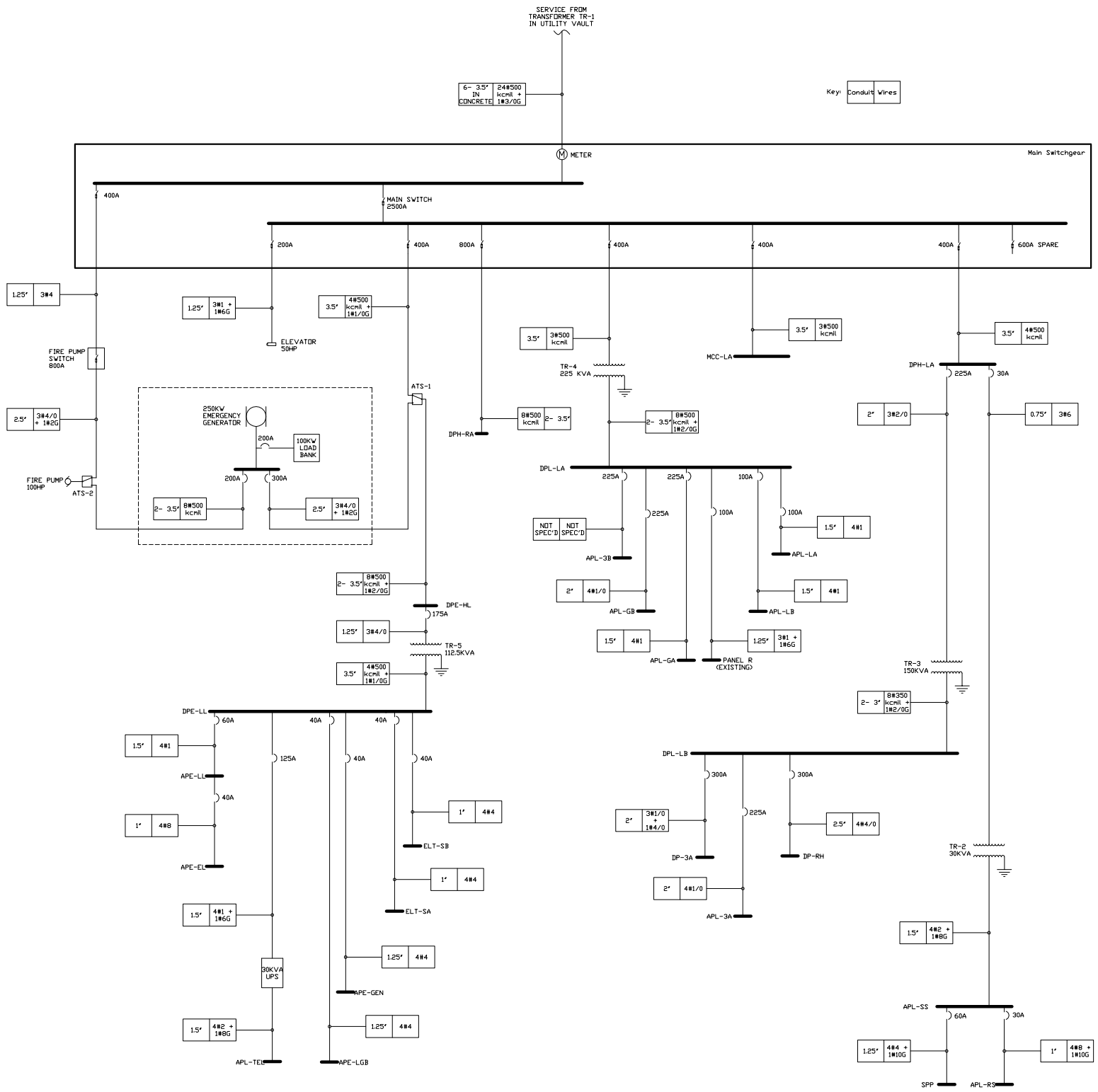
Audio-Visual System

The building also employs an extensive AV and recording system. The digital signal processors are located in the main distribution frame room, but other equipment is located in the projection room. The system has intercom stations throughout the backstage area of the recital hall for communication. In the projection room, there are mixing boards, pre-amps, wireless microphone inputs, patch panels, listening assist transmitters, splitters, patching equipment, video input, audio players, and audio monitors. This system is fed from microphones in the recital hall as well as from the recording studio and the “Institute” performing space.

APPENDIX

One-Line Diagram

A one-line diagram based off of the riser diagram of the building is included on the next page.



6- 3.5" 24#500
IN
CONCRETE 1#3/0G

Key: Conduit Wires

SERVICE FROM
TRANSFORMER TR-1
IN UTILITY VAULT

METER

Main Switchgear

MAIN SWITCH
2500A

400A

200A

400A

800A

400A

400A

400A

600A SPARE

1.25' 3#4

1.25' 3#1 + 1#6G

3.5' 4#500
kcmil + 1#1/0G

3.5' 3#500
kcmil

3.5' 3#500
kcmil

3.5' 4#500
kcmil

FIRE PUMP
SWITCH
800A

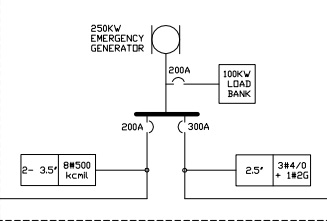
ELEVATOR
50HP

TR-4
225 KVA

MCC-LA

DPH-LA

2.5' 3#4/0 + 1#2G



FIRE PUMP
100HP

2- 3.5' 8#500 kcmil

2.5' 3#4/0 + 1#2G

8#500 kcmil 2- 3.5'

2- 3.5' 8#500 kcmil + 1#2/0G

2" 3#2/0

0.75" 3#6

DPL-LA

225A

225A

100A

NDT SPEC'D

225A

100A

100A

1.5' 4#1

APL-3B

225A

100A

1.5' 4#1

2" 4#1/0

APL-GB

100A

1.5' 4#1

1.5' 4#1

APL-GA

100A

1.25' 3#1 + 1#6G

PANEL R
(EXISTING)

TR-3
150KVA

2- 3" 8#250 kcmil + 1#2/0G

DPE-LL

60A

40A

40A

1.5' 4#1

APE-LL

125A

40A

40A

1" 4#8

APE-EL

40A

40A

40A

ELT-SB

1" 4#4

ELT-SA

1" 4#4

1.25' 4#4

APE-GEN

1.25' 4#4

30KVA UPS

1.5' 4#2 + 1#6G

APL-TEL

1.25' 4#4

APE-LGB

DPL-LB

300A

300A

2" 3#1/0 + 1#4/0

225A

2.5' 4#4/0

DP-3A

2" 4#1/0

DP-RH

2" 4#1/0

APL-3A

TR-2
30KVA

1.5' 4#2 + 1#6G

APL-SS

60A

30A

1.25' 4#4 + 1#6G

APL-RS

1" 4#8 + 1#10G

SPP

Rate Structure

The detailed PPL rate structure applicable to The Pennsylvania Academy of Music (Rate Schedule GS-3) is included on the next page.

**RATE SCHEDULE GS-3
LARGE GENERAL SERVICE
AT SECONDARY VOLTAGE**

(C)

APPLICATION RATE SCHEDULE GS-3

This Rate Schedule is for large general service at secondary voltage. Where necessary, the Company furnishes and maintains one transformation from line voltage to a lower Company standard service voltage. New applications with voltage levels higher than the secondary voltage will not be accepted after January 1, 2005.

NET MONTHLY RATE

Distribution Charge

\$4.466 per kilowatt for all kilowatts of the Billing KW

0.092 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW

0.073 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW

0.060 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-05 through 12-31-05)

0.213 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.167 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.161 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-06 through 12-31-06)

0.243 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW. **(I)**

0.192 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW. **(I)**

0.185 cts. per KWH for all additional KWH. **(I)**

Competitive Transition Charge (Effective 1-1-07 through 12-31-07)

0.223 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.174 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.167 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-08 through 12-31-08)

0.196 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.154 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.148 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-09 through 12-31-09)

1.168 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.914 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.879 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-05 through 12-31-05)

1.262 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.989 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.950 cts. per KWH for all additional KWH.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

Intangible Transition Charge (Effective 1-1-06 through 12-31-06)

1.231 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW. **(I)**

0.962 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW. **(I)**

0.924 cts. per KWH for all additional KWH. **(I)**

Intangible Transition Charge (Effective 1-1-07 through 12-31-07)

1.087 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.852 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.818 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-08 through 12-31-08)

1.055 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.826 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.794 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-09 through 12-31-09)

0.000 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

0.000 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

0.000 cts. per KWH for all additional KWH.

The Company will provide capacity (KW) and energy (KWH) under this Rate Schedule for customers who receive Basic Utility Supply Service from the Company.

Capacity and Energy Charge (Effective 1-1-05 through 12-31-05)

\$4.148 per kilowatt for all kilowatts of the Billing KW.

4.423 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

3.362 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

3.212 cts. per KWH for all additional KWH.

Capacity and Energy Charge (Effective 1-1-06 through 12-31-06)

\$4.461 per kilowatt for all kilowatts of the Billing KW.

4.762 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

3.620 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

3.458 cts. per KWH for all additional KWH.

Capacity and Energy Charge (Effective 1-1-07 through 12-31-07)

\$4.461 per kilowatt for all kilowatts of the Billing KW.

4.844 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

3.684 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

3.519 cts. per KWH for all additional KWH.

Capacity and Energy Charge (Effective 1-1-08 through 12-31-08)

\$4.461 per kilowatt for all kilowatts of the Billing KW.

4.940 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW.

3.760 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW.

3.593 cts. per KWH for all additional KWH.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

Capacity and Energy Charge (Effective 1-1-09 through 12-31-09)

\$4.451 per kilowatt for all kilowatts of the Billing KW. **(I)**

5.073 cts. per KWH for the first 200 KWH per kilowatt of the Billing KW. **(I)**

3.864 cts. per KWH for the next 200 KWH per kilowatt of the Billing KW. **(I)**

3.693 cts. per KWH for all additional KWH. **(I)**

Transmission Charge **(C)**

The Company will provide and charge for transmission service consistent with the PJM Open Access Transmission Tariff approved or accepted by the Federal Energy Regulatory Commission for customers who receive Basic Utility Supply Service from the Company unless such customers obtain transmission service from another provider. The Transmission Service Charge included in this Tariff applies to all kWh billed under this Rate Schedule.

MONTHLY MINIMUMS **(I)**

The Minimum Billing Demand is 25 KW.

The Monthly Minimum Distribution Charge is 25 KW times the demand step of the effective Distribution Charge, and the Monthly Minimum Capacity and Energy Charge is 25 KW times the demand step of the effective Capacity and Energy Charge.

Monthly Minimums apply to services provided by the Company.

BILLING KW

The Billing KW is the average number of kilowatts supplied during the 15 minute period of maximum use during the current billing period.

Time-of-Day metering and billing is available on request for an additional charge of \$15.00 per month for a minimum period of one year. The Billing KW applicable to the charges under this Rate Schedule is the average number of kilowatts supplied during the 15 minute period of maximum use during the on-peak hours of the current billing period. For new applications, this provision is limited to customers of the Company who have not had the opportunity to purchase capacity and energy from their choice of electric generation supplier pursuant to the enrollment procedures contained in the Commission's order at Docket Nos. M-00960890F.0014 and M-00960890F.0015. No new applications will be accepted after January 1, 2000. **(I)**

ON-PEAK HOURS

On-peak hours for billing purposes are 7 a.m. to 3 p.m., 8 a.m. to 4 p.m., or 9 a.m. to 5 p.m. local time at the option of the customer, Mondays to Fridays inclusive, except New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. The Company's system on-peak period is 7 a.m. to 9 p.m. local time.

INDUSTRIAL DEVELOPMENT INITIATIVES RIDER

The Industrial Development Initiatives Rider included in this Tariff applies to eligible customers served under this Rate Schedule, except for customers served under the Economic Development Initiatives Rider.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

ECONOMIC DEVELOPMENT INITIATIVES RIDER

The Economic Development Initiatives Rider included in this Tariff applies to eligible customers served under this Rate Schedule, except for customers served under the Industrial Development Initiatives Rider.

OFF-PEAK SPACE CONDITIONING AND WATER HEATING (Effective 1-1-05)

For customers served under this Rate Schedule, off-peak energy for storage space conditioning and/or water heating may be supplied exclusively through a separate meter and billed separately at a charge of \$15.00 per month, plus a Distribution Charge of 1.220 cts. per KWH, plus the following Competitive Transition Charge, Intangible Transition Charge and, for customers who receive Basic Utility Supply Service from the Company, the following Capacity and Energy Charge, with a monthly minimum charge of \$15.00. Any Billing KW resulting from usage during on-peak hours is billed at the rate of \$20.20 per KW. For new applications, this provision is limited to customers of the Company who have not had the opportunity to purchase capacity and energy from their choice of electric generation supplier pursuant to the enrollment procedures contained in the Commission's order at Docket Nos. M-00960890F.0014 and M-00960890F.0015. No new applications will be accepted after January 1, 2000.

(I)
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<u>Effective</u>	<u>Competitive Transition Charge</u>	<u>Intangible Transition Charge</u>	<u>Capacity and Energy Charge</u>
1-1-05 through 12-31-05	0.209 cts. per KWH (I)	1.037 cts. per KWH (I)	1.542 cts. per KWH (I)
1-1-06 through 12-31-06	0.211 cts. per KWH (I)	1.029 cts. per KWH (I)	2.632 cts. per KWH (I)
1-1-07 through 12-31-07	0.199 cts. per KWH (I)	0.977 cts. per KWH (I)	1.738 cts. per KWH (I)
1-1-08 through 12-31-08	0.176 cts. per KWH (I)	0.948 cts. per KWH (I)	1.828 cts. per KWH (I)
1-1-09 through 12-31-09	1.050 cts. per KWH (I)	0.000 cts. per KWH	1.95 cts. per KWH (I)

Transmission Charge

(C)

The Company will provide and charge for transmission service consistent with the PJM Open Access Transmission Tariff approved or accepted by the Federal Energy Regulatory Commission for customers who receive Basic Utility Supply Service from the Company unless such customers obtain transmission service from another provider. The Transmission Service Charge included in this Tariff applies to all kWh billed under this Rate Schedule.

Service through the separate meter may be used between the off-peak hours of 7 p.m. to 7 a.m. local time, Mondays to Fridays inclusive, and all day Saturday, Sunday and the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

SERVICE TO VOLUNTEER FIRE COMPANIES NON-PROFIT SENIOR CITIZEN CENTERS NON-PROFIT RESCUE SQUADS, AND NON-PROFIT AMBULANCE SERVICES

Upon application and acceptance by the Company, Volunteer Fire Companies, Non-Profit Senior Citizen Centers, Non-Profit Revenue Squads, and Non-Profit Ambulance Services may for a minimum one-year period, elect to have electric service rendered pursuant to the following charges.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

Distribution Charge

\$8.00 per month plus
2.193 cts. per KWH for the first 200 KWH
1.984 cts. per KWH for the next 600 KWH.
1.862 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-05 through 12-31-05)

0.230 cts. per KWH for the first 200 KWH.
0.203 cts. per KWH for the next 600 KWH.
0.188 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-06 through 12-31-06)

0.237 cts. per KWH for the first 200 KWH.
0.210 cts. per KWH for the next 600 KWH.
0.194 cts. per KWH for all additional KWH.

(D)
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Competitive Transition Charge (Effective 1-1-07 through 12-31-07)

0.241 cts. per KWH for the first 200 KWH.
0.213 cts. per KWH for the next 600 KWH.
0.197 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-08 through 12-31-08)

0.214 cts. per KWH for the first 200 KWH.
0.190 cts. per KWH for the next 600 KWH.
0.175 cts. per KWH for all additional KWH.

Competitive Transition Charge (Effective 1-1-09 through 12-31-09)

1.293 cts. per KWH for the first 200 KWH.
1.147 cts. per KWH for the next 600 KWH.
1.059 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-05 through 12-31-05)

1.099 cts. per KWH for the first 200 KWH.
0.975 cts. per KWH for the next 600 KWH.
0.900 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-06 through 12-31-06)

1.124 cts. per KWH for the first 200 KWH.
0.996 cts. per KWH for the next 600 KWH.
0.920 cts. per KWH for all additional KWH.

(D)
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Intangible Transition Charge (Effective 1-1-07 through 12-31-07)

1.180 cts. per KWH for the first 200 KWH.
1.047 cts. per KWH for the next 600 KWH.
0.967 cts. per KWH for all additional KWH.

Intangible Transition Charge (Effective 1-1-08 through 12-31-08)

1.154 cts. per KWH for the first 200 KWH.
1.024 cts. per KWH for the next 600 KWH.
0.946 cts. per KWH for all additional KWH.

(Continued)

(I) Indicates Increase **(D)** Indicates Decrease **(C)** Indicates Change

RATE SCHEDULE GS-3 (CONTINUED)

(C)

Intangible Transition Charge (Effective 1-1-09 through 12-31-09)

- 0.000 cts. per KWH for the first 200 KWH.
- 0.000 cts. per KWH for the next 600 KWH.
- 0.000 cts. per KWH for all additional KWH.

The Company will provide capacity (KW) and energy (KWH) under this Rate Schedule for customers who receive Basic Utility Supply Service from the Company.

Capacity and Energy Charge (Effective 1-1-05 through 12-31-05)

- 5.182 cts. per KWH for the first 200 KWH. (I)
- 4.554 cts. per KWH for the next 600 KWH. (I)
- 4.178 cts. per KWH for all additional KWH. (I)

Capacity and Energy Charge (Effective 1-1-06 through 12-31-06)

- 5.663 cts. per KWH for the first 200 KWH. (I)
- 4.975 cts. per KWH for the next 600 KWH. (I)
- 4.564 cts. per KWH for all additional KWH. (I)

Capacity and Energy Charge (Effective 1-1-07 through 12-31-07)

- 5.728 cts. per KWH for the first 200 KWH. (I)
- 5.034 cts. per KWH for the next 600 KWH. (I)
- 4.618 cts. per KWH for all additional KWH. (I)

Capacity and Energy Charge (Effective 1-1-08 through 12-31-08)

- 5.819 cts. per KWH for the first 200 KWH. (I)
- 5.114 cts. per KWH for the next 600 KWH. (I)
- 4.692 cts. per KWH for all additional KWH. (I)

Capacity and Energy Charge (Effective 1-1-09 through 12-31-09)

- 5.949 cts. per KWH for the first 200 KWH. (I)
- 5.231 cts. per KWH for the next 600 KWH. (I)
- 4.800 cts. per KWH for all additional KWH. (I)

Transmission Charge

(C)

The Company will provide and charge for transmission service consistent with the PJM Open Access Transmission Tariff approved or accepted by the Federal Energy Regulatory Commission for customers who receive Basic Utility Supply Service from the Company unless such customers obtain transmission service from another provider. The Transmission Service Charge included in this Tariff applies to all kWh billed under this Rate Schedule.

VOLUNTEER FIRE COMPANY is defined as a separately metered service location consisting of a building, sirens, a garage for housing vehicular fire fighting equipment, or a facility certified by the Pennsylvania Emergency Management Agency (PEMA) for fire fighter training. The use of electric service by the customer of record at this location shall be to support the activities of the volunteer fire company.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

NON-PROFIT SENIOR CITIZEN CENTER is defined as a separately metered service location consisting of a facility for the use of senior citizens coming together as individuals or groups where access to a wide range of service to senior citizens is provided, which is qualified by the Internal Revenue Service (IRS) as non-profit and recognized by the Pennsylvania Department of Aging as an operator of a senior citizen center. The use of electric service by the customer of record at this location shall be to support the activities of the non-profit senior citizen center.

NON-PROFIT RESCUE SQUAD is defined as a separately metered service location consisting of a building, sirens, a garage for housing vehicular rescue equipment, or a facility that is qualified by the IRS as non-profit and recognized by PEMA and the Departments of Health as a provider of rescue services. The use of electric service by the customer of record at this location shall be to support the activities of the non-profit rescue squad.

NON-PROFIT AMBULANCE SERVICE is defined as a separately metered service location consisting of a building, sirens, a garage for housing vehicular ambulance equipment, or a facility that is qualified by the IRS as non-profit and certified by Pennsylvania Department of Health as a provider of ambulance services. The use of electric service by the customer of record at this location shall be to support the activities of the non-profit ambulance service.

BUDGET BILLING

Budget Billing is available at the option of the customer for charges under this Rate Schedule.

COMPETITIVE TRANSITION CHARGE RECONCILIATION RIDER

The Competitive Transition Charge Reconciliation Rider included in this Tariff applies to the Competitive Transition Charges under this Rate Schedule.

INTANGIBLE TRANSITION CHARGE RECONCILIATION RIDER

The Intangible Transition Charge Reconciliation Rider included in this Tariff applies to the Intangible Transition Charges under this Rate Schedule.

SUSTAINABLE ENERGY FUND RIDER

The Sustainable Energy Fund Rider included in this Tariff applies to the Distribution Charges under this Rate Schedule.

RENEWABLE ENERGY DEVELOPMENT RIDER

The Renewable Energy Development Rider included in this Tariff applies to the Distribution Charges under this Rate Schedule.

METERING AND BILLING CREDIT RIDER

The Metering and Billing Credit Rider included in this Tariff applies to the Distribution Charges under this Rate Schedule.

GENERATION RATE ADJUSTMENT RIDER

The Generation Rate Adjustment Rider included in this Tariff is available to eligible customers served under this Rate Schedule.

(Continued)

RATE SCHEDULE GS-3 (CONTINUED)

(C)

STATE TAX ADJUSTMENT SURCHARGE

The State Tax Adjustment Surcharge included in this Tariff is applied to charges under this Rate Schedule, except for charges under the Generation Rate Adjustment Rider.

PAYMENT

The above net rate applies when bills are paid on or before the due date specified on the bill, which is not less than 15 days from the date bill is mailed. When not so paid the gross rate applies which is the above net rate plus 5% on the first \$200.00 of the then unpaid balance of the monthly bill and 2% on the remainder thereof.

CONTRACT PERIOD

Service under this Rate Schedule is for an initial term of one (1) year from the date service is first rendered, unless the Company and the customer mutually agree to a different term in the contract for service.