

Office Bldg Plant Options Time Of Use (TOU) Utility Rates ConEd - NYC

Floor Dimensions = 240' x 180' = 43,200 sf

40 Offc Flrs (VAVS-PIU) = 1,728,000 sf

3 Lobby-Retail Flrs (VAVS-PIU) = 129,600

3 Mech Flrs (H&V) = 129,600 sf

2 Parkg Flrs (Vent) = 86,600 sf

Total = 2,073,600 sf

Above Ground 45 Flrs = 1,944,000 sf

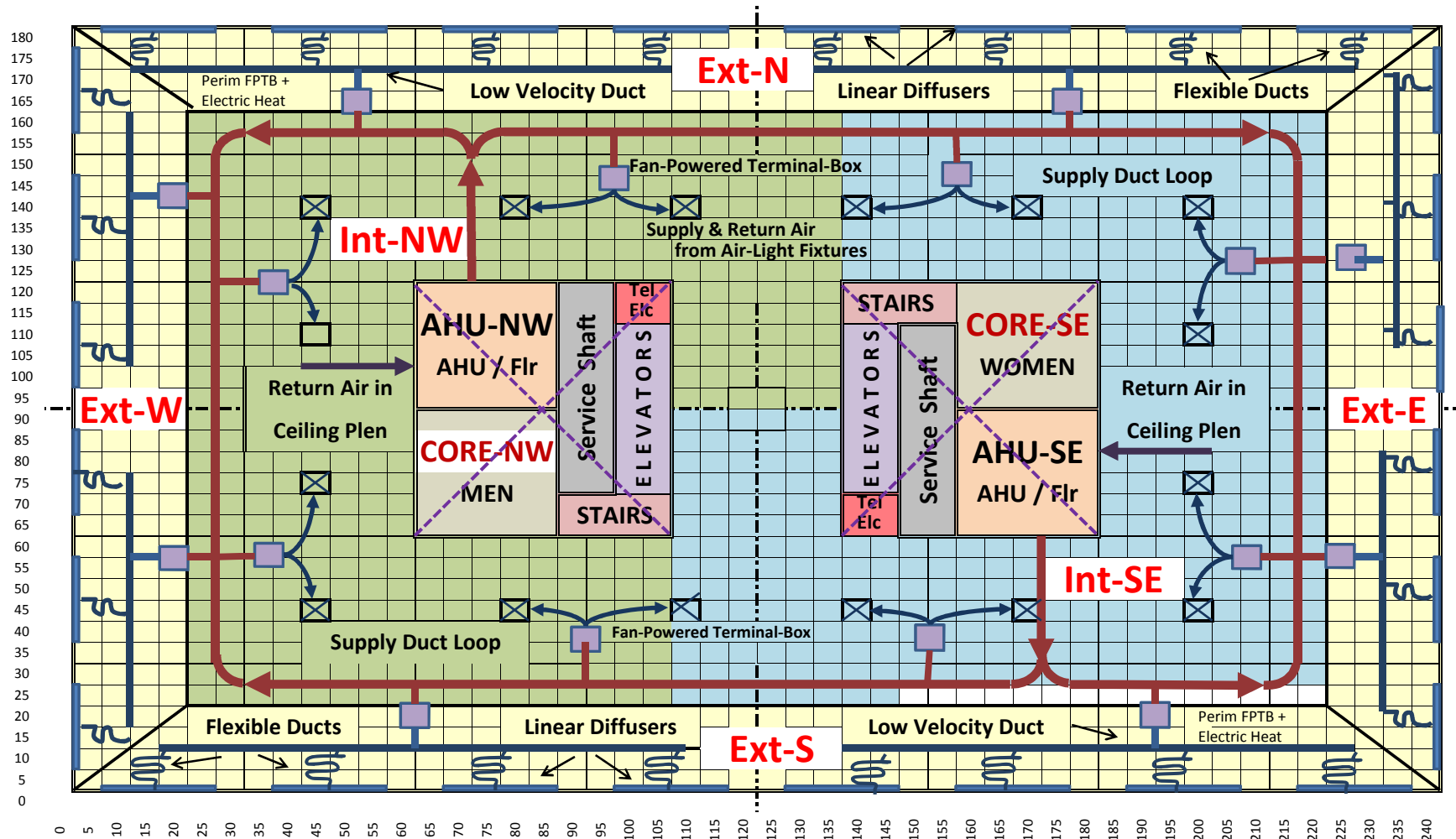
Flr-Flr Hgts: Office = 13.5', Lobby/Retail = 15', Mechanical = 20', Parking = 10'

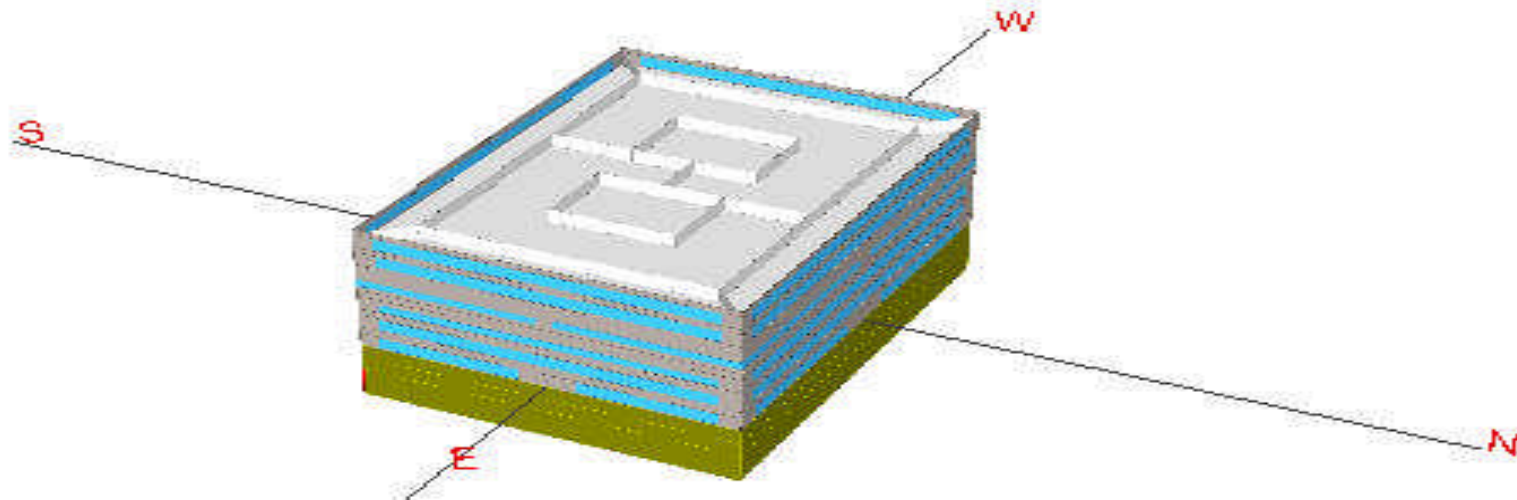
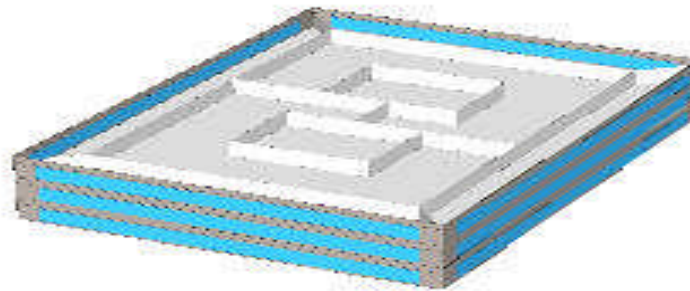
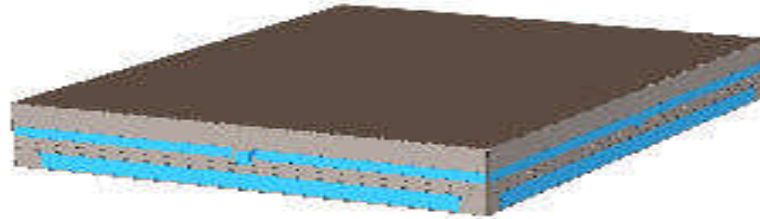
Flr-Clg Hgts (Offices, Lobby, Retail) = 10'

Windows: Height (Offices & Lobby) = 8' Width (overall, excluding columns, etc. 25'/30' module): Side-1 = 220' Side-2 = 160'

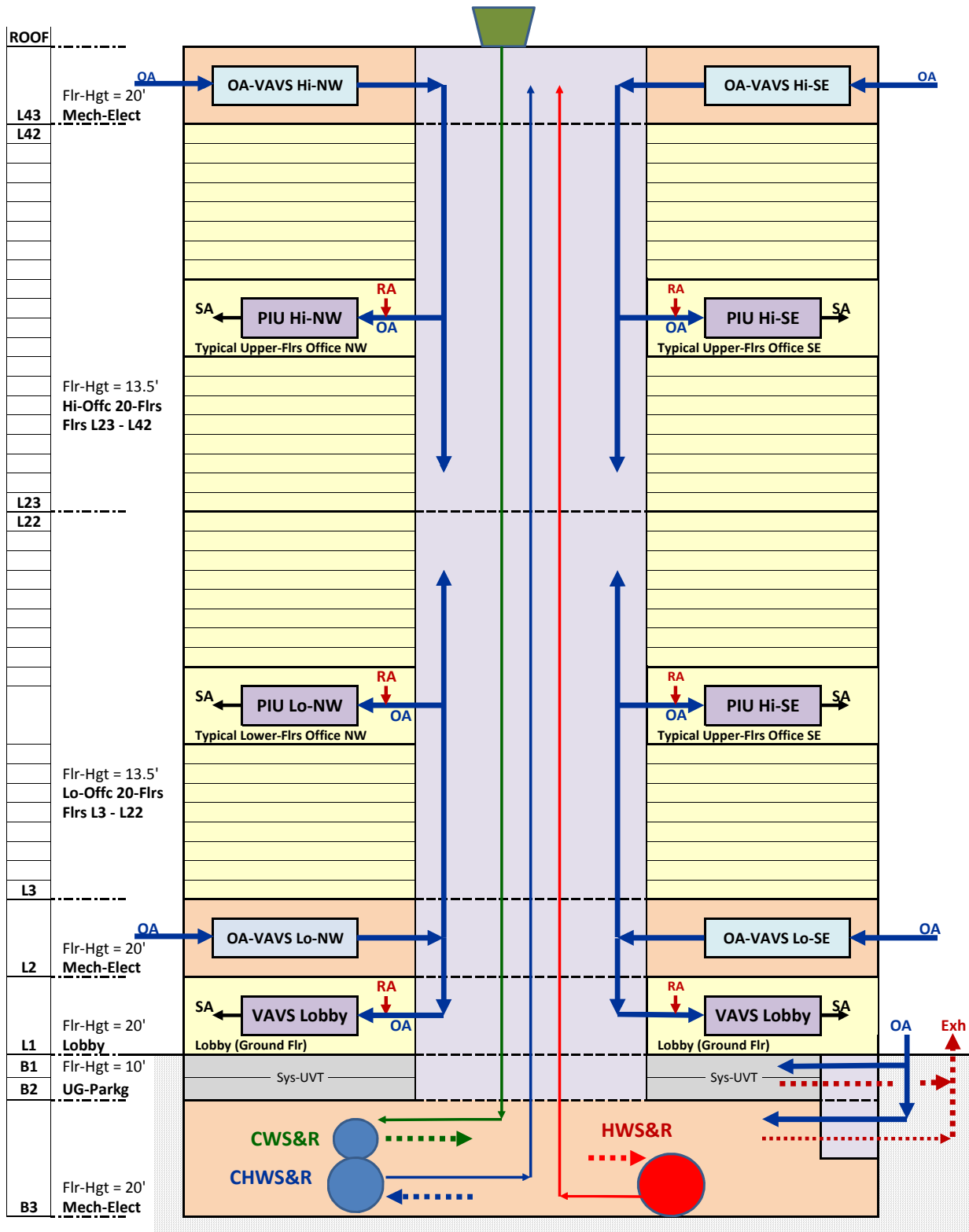
Wall Origins: N (240,180), E (240,0), S (0,0), W (0,180)

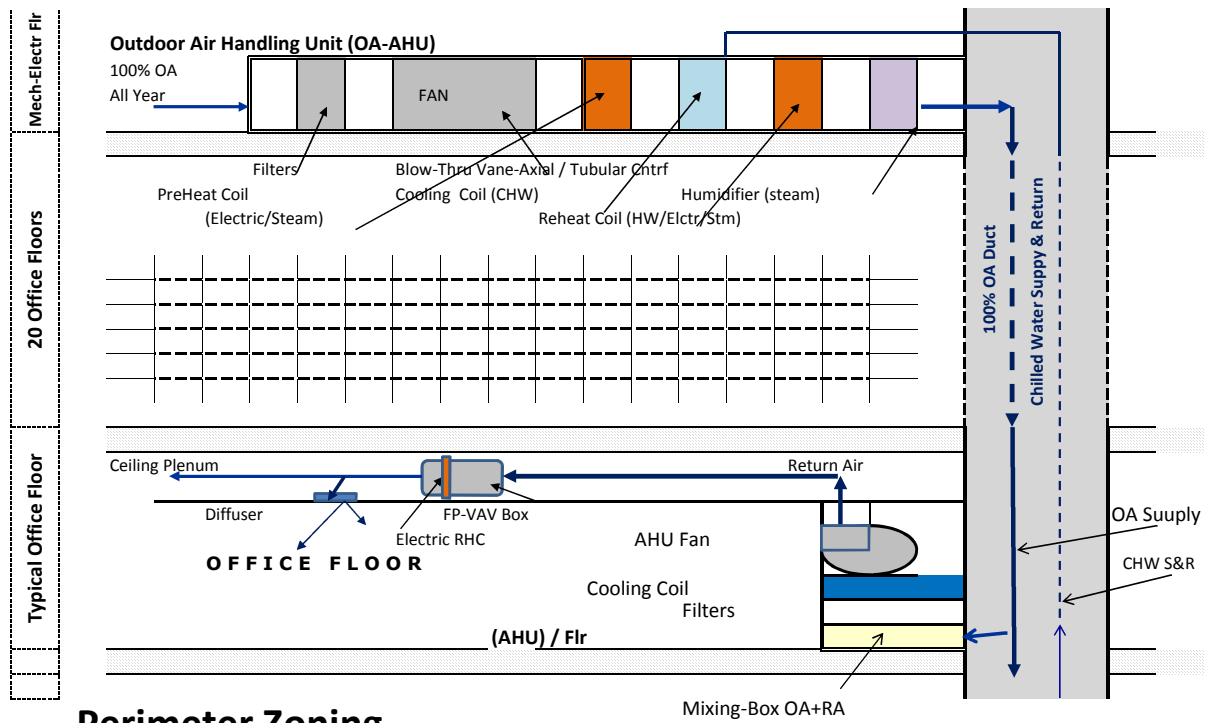
Window Origins: All (Y) = 2'. Side-1 (X) = 20', Side-2 (X) = 15'



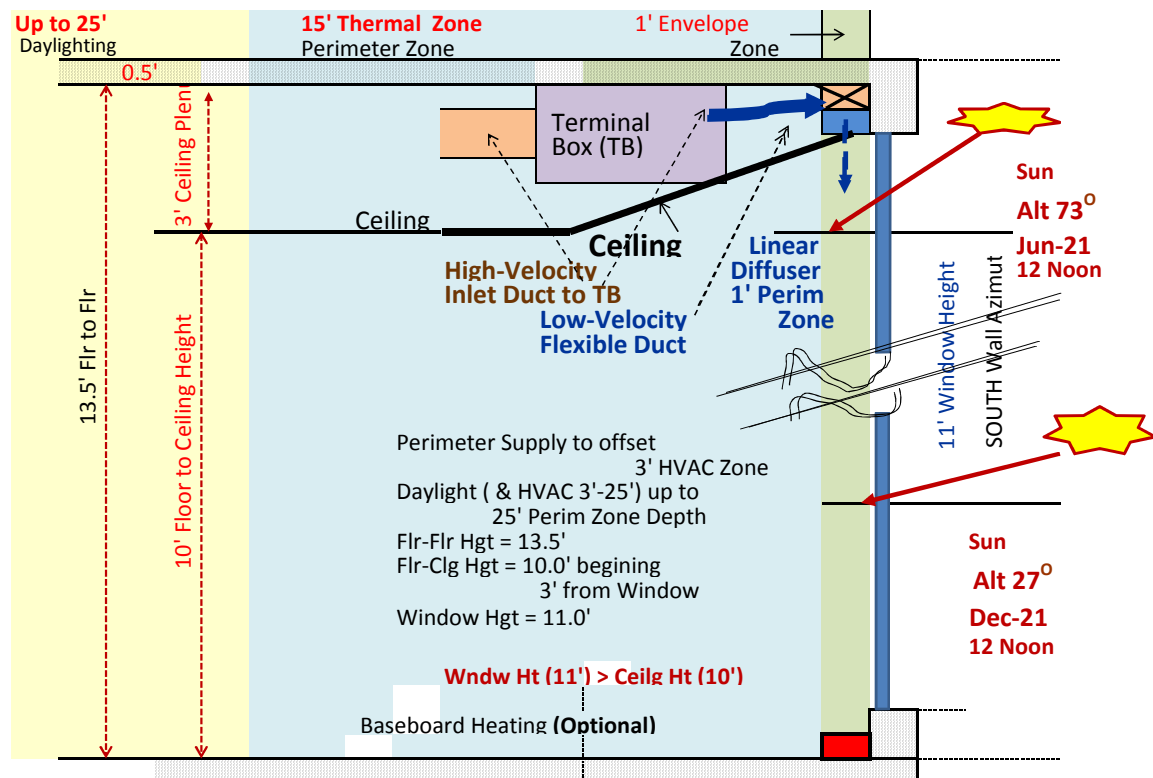


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Perimeter Zoning



Perimeter Zones

25' Total Perimeter

1' Envelope Zone from wall (to control Inside Surface Temp)

15' Thermal Zone from Wall (Solar, Internal heat gains)

25' Daylighting Zone from Wall

Daylighting Controls for 0'-15' and 15'-25'

Consolidated Edison (Con-Ed) Company of New York, Inc.**YEAR: MAY 2003 to APR 2004****Con-Ed Electricity Rates for New York****Consolidated Edison, Service Classification 9****Rate II : General Large, Time of Day**

Time of Day	Peak: Weekdays 8:00 AM to 10:00 PM
(12 Months)	Off-Peak: All other Days and Hours

Year	Mon	Demand (\$/Kw)		Energy (\$/Kwh)	
		Peak	Off-Pk	Peak	Off-Pk
2004	Jan	14.20	3.17	0.0974	0.0709
2004	Feb	14.26	3.17	0.0977	0.0711
2004	Mar	14.48	3.17	0.0893	0.0635
2004	Apr	14.47	3.17	0.0918	0.0660
2003	May	15.87	3.17	0.0868	0.0618
2003	Jun	23.98	9.79	0.0991	0.0640
2003	Jul	23.42	9.79	0.1163	0.0697
2003	Aug	23.42	9.79	0.1149	0.0676
2003	Sep	23.90	9.79	0.0898	0.0594
2003	Oct	15.83	3.17	0.0826	0.0580
2003	Nov	14.37	3.17	0.0838	0.0635
2003	Dec	14.42	3.17	0.0871	0.0647

Year	Mon	Demand (\$/Kw)		Energy (\$/Kwh)	
Season Average		Peak	Off-Pk	Peak	Off-Pk
WNTR	Dec-Feb	14.33	3.17	0.0894	0.0664
SPRG	Mar-May	14.94	3.17	0.0893	0.0638
SMMR	Jun-Aug	23.61	9.79	0.1101	0.0671
FALL	Sep-Nov	18.03	5.38	0.0854	0.0603
YEAR	Jan-Dec	17.72	5.38	0.0947	0.0650

Natural Gas Rates for New York**Consolidated Edison, Service Class 2****General Firm****Rate II : Customers who use any portion
of their gas for space heating****1-Oct-03**

Time of Use	All hours of the year	
Usage Range	Therms	\$/Therm
For the first	3	3.7000
For the next	87	0.4434
For the next	2910	0.3414
For excess over	3000	0.2273

Steam Rates for New York**Consolidated Edison, General Service****Service Classification 1****All Purposes, Continuous supplied at
average gauge pressure > 125 pounds****8-Dec-00**

Minimum Charge per Month \$366.78

Time of Use	All hours of the year	
Usage Range	1000 lbs	\$/1000 lbs
For the first	20	7.5100
For the next	30	19.7960
For the next	950	15.8460
For excess over	1000	15.3170

Consolidated Edison (Con-Ed) Company of New York, Inc.**YEAR: NOV 2000 to OCT 2001****Con-Ed Electricity Rates for New York****Consolidated Edison, Service Classification 9****Rate II : General Large, Time of Day**

Time of Day	Peak: Weekdays 8:00 AM to 10:00 PM
(12 Months)	Off-Peak: All other Days and Hours

Year	Mon	Demand (\$/Kw)		Energy (\$/Kwh)	
		Peak	Off-Pk	Peak	Off-Pk
2001	Jan	15.95	3.17	0.1113	0.0488
2001	Feb	16.43	3.17	0.0923	0.0509
2001	Mar	17.34	3.17	0.0847	0.0548
2001	Apr	17.01	3.17	0.0779	0.0551
2001	May	14.24	3.17	0.0861	0.0701
2001	Jun	12.51	9.79	0.1104	0.0718
2001	Jul	11.70	9.79	0.1516	0.0671
2001	Aug	11.71	9.79	0.1518	0.0673
2001	Sep	12.83	9.79	0.0891	0.0735
2001	Oct	14.34	3.17	0.0785	0.0707
2000	Nov	17.70	3.17	0.0893	0.0554
2000	Dec	17.08	3.17	0.0964	0.0508

Year	Mon	Demand (\$/Kw)		Energy (\$/Kwh)	
		Peak	Off-Pk	Peak	Off-Pk
WNTR	Dec-Feb	16.91	3.17	0.0990	0.0517
SPRG	Mar-May	16.20	3.17	0.0829	0.0600
SMMR	Jun-Aug	11.97	9.79	0.1379	0.0687
FALL	Sep-Nov	14.96	5.38	0.0856	0.0665
YEAR	Jan-Dec	14.90	5.38	0.1016	0.0614

Natural Gas Rates for New York**Consolidated Edison, Service Class 2****General Firm****Rate II : Customers who use any portion of their gas for space heating****8-Dec-00**

Minimum Charge per Month \$11.82

Time of Use	All hours of the year	
Usage Range	Therms	\$/Therm
For the first	3	11.8200
For the next	87	0.7840
For the next	2910	0.6855
For excess over	3000	0.5716

Steam Rates for New York**Consolidated Edison, General Service****Service Classification 1****All Purposes, Continuous supplied at average gauge pressure > 125 pounds****8-Dec-00**

Minimum Charge per Month \$367.78

Time of Use	All hours of the year	
Usage Range	1000 lbs	\$/1000 lbs
For the first	20	7.5100
For the next	30	19.7960
For the next	950	15.8460
For excess over	1000	15.3170

DOE2.1E / EnergyPlus (E+) : Commercial Office Building - Envelope, Systems and Plant Testing Plan**2002****HVAC SYSTEMS OPTIONS**

0. Constant Volume Reheat: All-Electric Heating

0A. Like 0: All Hot Water Heating except Electric/Steam Pre-Heat

1. Central VAV: All-Electric Heating, Preimeter-Heat = Baseboard

1A. Like 1 except Perimeter-Heat = Ceiling Supply Air

2 & 2A. Like 1 & 1A System = VAVS (Standard VAV Boxes)

3 & 3A. Like 2 & 2A System = VAVS- PIU (parallel-flow Fan Powered Terminal Boxes)

4. Like 3, Add Air and Water Side Economizers

5. Like 4. Add Air to Air Heat Recovery for high OA Systems (runaround coils at 40% efficiency)

6. Like 5 except DeCentralized Floor by Floor Systems served by Central CV Outdoor (OA) Air System

6A. Like 6 except Direct Outdoor Air per System

7. Packaged AC Units (above ceiling) per Zone , Heat Reject to Condenser Water Loop, Central OA System

8. Packaged Terminal AC (through the wall) Units (Direct OA, Direct Heat Reject to Outdoors)

9. Radiant Ceiling Panels on Perimeter (a) Hot water heating (b) Chilled water cooling + (c) OA System

10. Two-Pipe Fan Coil Units (CHW-Summer & HW-Winter Changeover) + Central CV Outdoor Air Supply

11. Four-Pipe Fan Coil Units (CHW and HW Coils) + Central CV Outdoor Air Supply System

13. Water Source Heat Pumps

14. Ground Source Heat Pumps

OTHERS**CENTRAL PLANT OPTIONS**

1. District Chilled Water

2. Electric Centrifugal Chillers

3. Double-Bundle Centrifugal Chillers

4. Grnd Source Heat Pump Cntrf. Chillers

5. Centrifugal Chillers + Part Ice Storage

5a. Centrif Chllrs + Full Ice Storage

6. District Steam Absorption Chillers

7. Gas Fired Absorption Chillers

8. Solar Powered Absorption Chillers

9. Gas Fired Absorption Chiller - Heaters

10. Cntrf @ Peak Elctr, Absorpt @ OffPk

11. District Steam / HX - Hot Water

12. District High Temp (250 F) Hot Water

13. Gas Fired Hot Water Boilers & DHW

14. Oil Fired Hot Water Boilers & DHW

15. Electric Hot Water Boilers & DHW

16. Gas Cogeneration

Waste Heat HW Boilers & DHW

Absorption Chillers

17. Oil Cogeneration (Absrptn Chillers)

BUILDING ENVELOPE OPTIONS

1. Wall U-Value = 0.07 Roof U-Value = 0.05 (medium construction, 2 hour time lag)
2. Glass Types: (a) Single Clear (b) Double Clear (c) Double Tint (d) Double Low-E
3. Double Clear Glazing Percent : (a) 70% (b) 60% (c) 50% (d) 40% (e) 30%
4. 40% Glass + Daylighting + (b) Double Clear (c) Double Tint (d) Double Low-E
5. 50% Solar Photo-Voltaic Panels on South Exposure (50% Double Low-E Glass)
6. Light Shelves (50% Double Low-E Glass)
7. 24" Continuous Overhang Projection, 12' above Top of Window

Exhaust

Telecom Closet	Apartments
Electrical Closet	Laundry
Janitors Room	Kitchen
General / Smoke	Toilets
Corridor / Smoke	
Trash Room/Chute	

Supply-Pressurization

Vestibule	Corridors
Stairwells	
Fireman's Elevator	

Ventil: Supply & Exhaust

Underground Parking

PLANT OPTIONS (For locations with high electric demand rates during peak hrs)

Alt.	Cooling					Heating					Service HW	
A	Centrifugal Chillers (Water-Cooled)					District HTHW @ 300 - 200 F + HX					District HTHW + HX	
B	Centrifugal Chillers (Water-Cooled)					District Steam + HX					District Steam + HX	
C	Gas Fired Absorption Chiller-Heaters					Gas Fired Absorption Chiller-Heaters					Gas Fired SHW Heater	
D	Cntrf comes on first and then Absrpt					Gas Fired Hot Water Boilers					Gas Fired SHW Heater	
E	Use: Absrpt at Pk-Elec, Cntrf at OffPk-Elec					Gas Fired Hot Water Boilers					Gas Fired SHW Heater	
F	Ground Source Chiller Heat Pumps					Ground Source Chiller Heat Pumps					Electric SHW Heater	
G	Centrif Chillers + Ice Storage at Pk-Elec Rate					Electric Hot Water Boilers					Electric SHW Heater	
H	Double Bundle Chillers (Ht Recov to DHW)					Gas Fired Hot Water Boilers					Chiller Heat Recovery	

SYSTEM For All Plant Options Above

Variable Air Volume System, Parallel Flow Fan Powered Terminal Boxes + HW Heatg Coil
Air and Water Side Economizer

H&V Supply & Exhaust

LV Switchgear
HV Switchgear
Emergency Generators
Emergency Switchboard
Battery Room
Sprinkler Pump Room
Drinking Water Pump Room
Domestic Water Pump Rm
Boiler Plant & Pump Room
Chiller Plant & Pump Room
Gray Waste Room
Toilets Lockers
Elevator Machine Room

Project: 26Office Flrs ASHRAE Standard 90.1-2004 Climate Zone = 3A

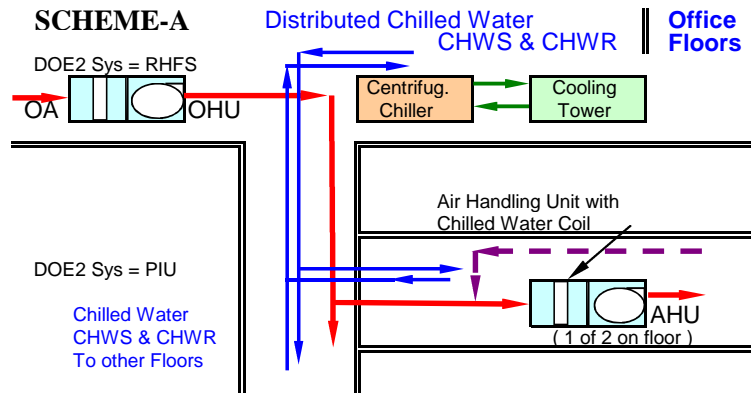
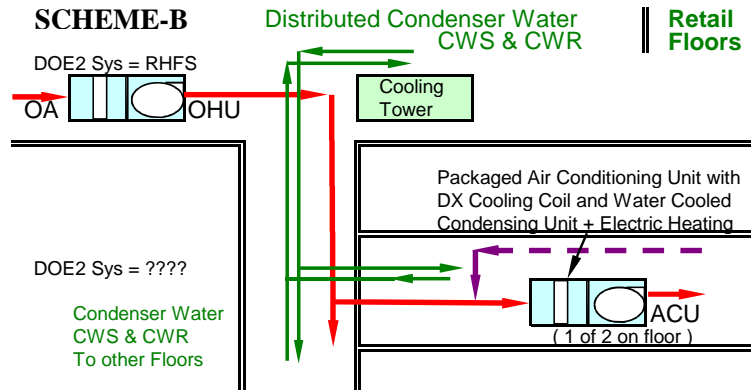
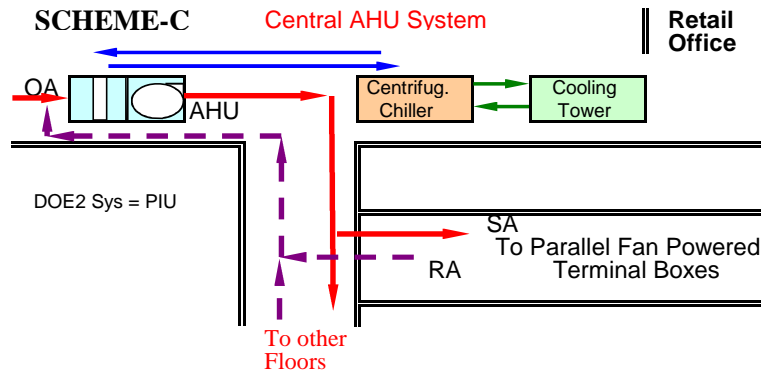
26 OFFICE Floors					Million BTUH per Year				Million BTUH per Year				% Of	
ECM-#	Energy Conservation Measure (ECM)			Lights	Equipt	Heatng	Cooling	Ht-Rej	Pumps	Fans	DHW	Total	Base	
ECM-0N	STDs 90.1-04 62.1-04 //FPB 40% Glass			AZ= -35	10,601	8,377	5,623	3,715	855	1,013	3,639	463	34,287	100
ECM-0E	ECM-0N Azimuth rotated 90 degs			AZ = 55	10,601	8,377	3,800	3,788	872	1,024	3,641	463	32,567	95
ECM-0S	ECM-0N Azimuth rotated 180 degs			AZ = 145	10,601	8,377	4,745	3,841	882	1,043	3,676	463	33,628	98
ECM-0W	ECM-0N Azimuth rotated 270 degs			AZ = 235	10,601	8,377	6,847	3,807	877	1,040	3,707	463	35,720	104
ECM-0	Average of N+E+S+W Building Orientations				10,601	8,377	5,254	3,788	872	1,030	3,666	463	34,050	99
ECM-1	ECM-0 + Prop Envelope 77% Glass				10,601	8,377	5,514	4,985	1,181	1,275	4,559	463	36,956	108
ECM-2	ECM-1 + Auto-Blinds for Sun Radiation Cntrl				10,601	8,377	4,175	4,898	1,153	1,250	4,439	463	35,357	103
ECM-3	ECM-2 + Day-Lighting Controls				8,065	8,377	4,754	4,600	1,070	1,211	4,292	463	32,833	96
ECM-4	ECM-3 + Air-Side Economizer				8,065	8,377	4,864	3,996	941	998	4,300	463	32,005	93
ECM-5	ECM-4 + Occupancy based Lighting Controls				5,742	8,377	5,105	3,798	895	969	4,250	463	29,600	86
ECM-6	ECM-5 + //FPB & UFAD				5,742	8,377	3,975	3,568	863	851	4,266	463	28,106	82
ECM-7	ECM-6 + Occupancy based Ventil Controls				5,742	8,377	3,048	3,472	851	878	4,234	463	27,066	79
ECM-8	ECM-7 + AHU Heat Recovery				5,742	8,377	2,938	3,470	850	875	4,234	463	26,950	79
ECM-9	ECM-8 + Chllr Eff from 0.58 to 0.55 kw/ton													

BaseLine System:		Non-Residential & More than 5 Floors or > 150,000 ft2			Air Economizer Not Required for Climate Zone 3A (STD90-04)							
HW Fossil Fuel Boiler Heating		Sytem 7 VAVS+RH		Electric Heatg		System 8 VAV + Parallel Fan Powered Boxes (DOE2 Type PIU)						
BaseLine Parallel Fan Powered Boxes		Primary Air Coil Leaving Temp = 53F for Ceiling Supply. Supply Air Temp = 55F.				20% Light Heat to Plenum						
Proposed Parallel Fan Powered Boxes		Primary Air Coil Leaving Temp = 48F for UFAD. Supply Air Temp = 65F.			70% Light Heat to Plenum							
MODELING NOTES (for ECM analysis options not available in DOE2.1E)												
Under-Floor Air Distribution (UFAD)		Average Summer Space VolumeTemp = 78F			Average Winter Space VolumeTemp = 72F							
Occupancy based Lighting		Based on 10CFR435 Table 401.3.3. Lighting Schedule = Max Design Lighting * Base Lighting Schedule * 0.7										
Occup based Ventilation - CO2 Sensors		Percent Outdoor Air for Hour = Maximum Design Percent Outdoor Air * Occupancy Schedule Fraction										
UFAD: 75F from 0' to 7'		85F from 7.1' to 10'		Average Summer Space Volume Temp = 78F			Ceiling: Baseline Summer Space Temp = 75F					
UFAD: 75F from 0' to 7'		65F from 7.1' to 10'		Average Winter Space Volume Temp = 72F			Ceiling: Baseline Winter Space Temp = 75F					
SYSTEM-CONTROL		MIN-SUPPLY-T (Room Supply Temp)			Base	55F	HU-CFM/Flr		Proposed	65F	HU-CFM/Flr	
		COOL-SET-T (CHW Coil Leavg Temp)			Base	53F	29,872		Proposed	48F	38,698	
ZFR = ZONE-FAN-RATIO				Ceiling: RA=75F SA=55F PA=53F Ceiling=76F 1 + (55-53)/(76-55) = ZFR = 1.1								
ZONE-FAN-RATIO * Primay-CFM = FPB Supply-CFM				UFAD: RA=75F SA=65F PA=48F Ceiling=78F 1 + (65-48)/(78-55) = ZFR = 1.74								

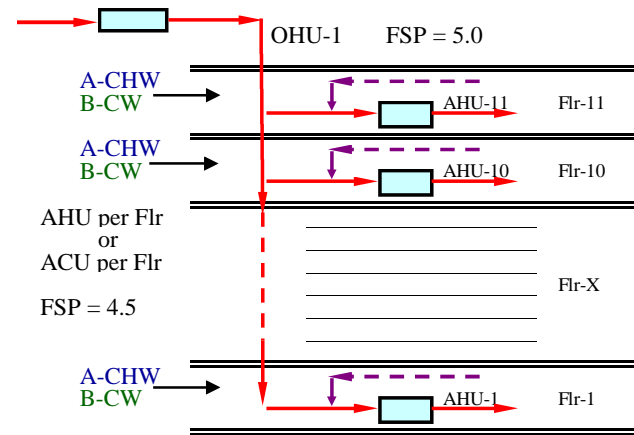
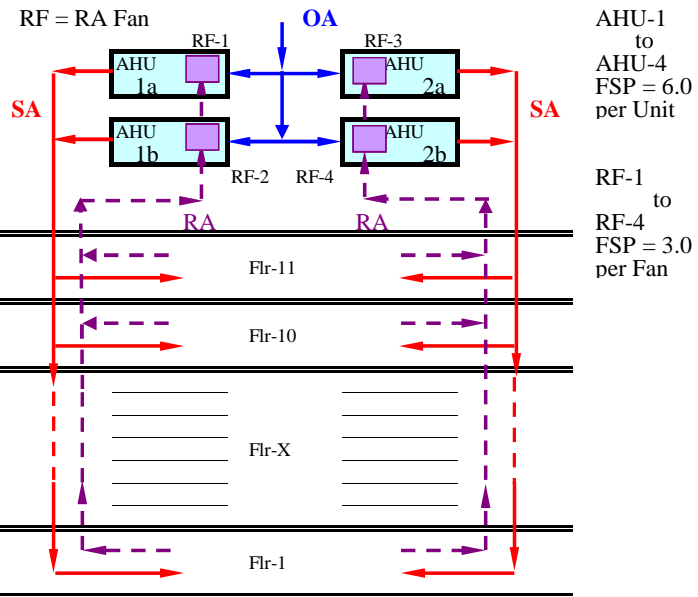
Rate Options for Life-Cycle	Maxim	Option	Option	Opt-	Opt-	Opt-	Opt-	Opt-	Opt-	Opt-
Performance	Points	1	2	3	4	5	6	7	8	9
First Cost	10									
Energy Cost	10									
Maintenance Cost	8									
Ease of Maintenance	5									
Availability of Mainten. Engrs.	5									
Availability of Parts / Materials	5									
Reliability of Systems / Plant	5									
Durability of Systems / Plant	5									
Ease of Operation	5									
Positive Acoustic Impact	2									
Positive Environmental Impact	2									
Positive Architectural Impact	1									
TOTAL POINTS										

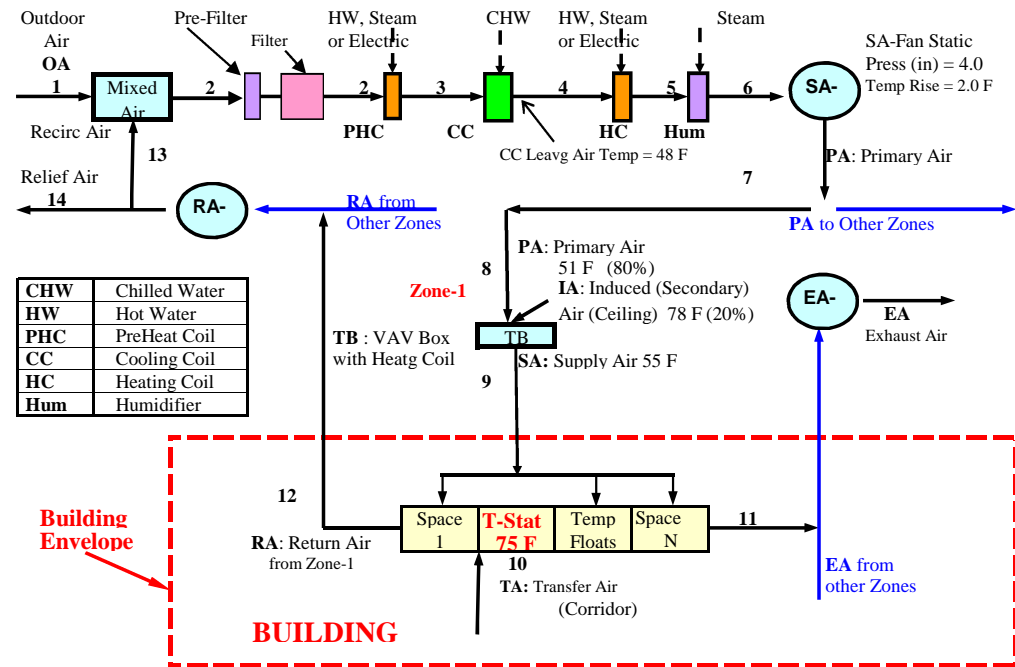
KUWAIT 70 Story Office Building

Systems Study

SCHEME-A**SCHEME-B****SCHEME-C****AIR SYSTEM for SCHEMES A and B**

100% Outdoor Air (OA) Unit serves 11 AHUs

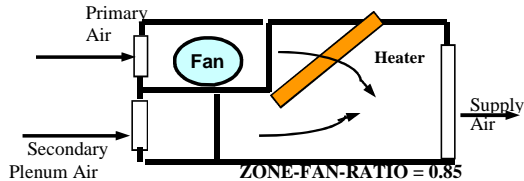
**AIR SYSTEM for SCHEMES C**



CHW	Chilled Water
HW	Hot Water
PHC	PreHeat Coil
CC	Cooling Coil
HC	Heating Coil
Hum	Humidifier

System - Plant Data		(F)		(F)
Condenser Entg Wtr Temp =	85	Cooling Coil Lvg Air Temp =	48.5	
Condenser Lvg Wtr Temp =	100	Temp Rise Supply Air Fan =	2.0	
Cooling Coil Entg Wtr Temp =	56	Temp Rise Ductwork =	0.5	
Cooling Coil Lvg Wtr Temp =	40	Space / Room Air Temp =	75	

Parallel Fan-Powered VAV Terminal Box



Series Fan-Powered VAV Terminal Box

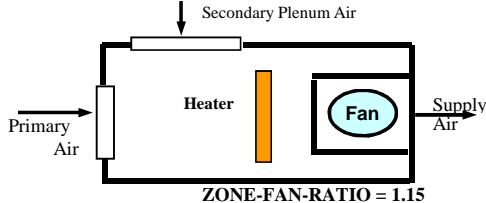
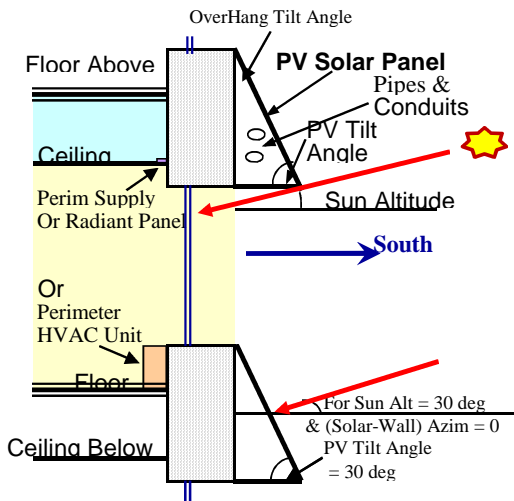


Photo-Voltaic Solar Panel System



ZONE-FAN-RATIO	1.15	
	(cfm)	(F)
Primary Air Supply =	1,000	0.0
Secondary Air =	150	80
Supply Air (total) =	1,150	10.4
Temp Diff (Room-Supply) =		-10.4

