



The Palestra Building

London, England



APPENDIX D: Trace Output

The Palestra Building
London, England



Existing Systems Energy Simulation

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Lights													
Electric (kWh)	135,459.5	122,510.0	145,343.4	129,495.7	140,401.4	139,379.6	130,517.6	145,343.4	129,495.7	140,401.4	134,437.6	130,517.6	1,623,302.8
Peak (kW)	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7	439.7
MISC LD													
Electric (kWh)	234,034.4	211,696.4	253,279.4	223,381.2	243,657.1	242,625.8	224,412.1	253,279.4	223,381.3	243,657.1	233,003.5	224,412.1	2,810,820.0
Peak (kW)	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2
AHU 1													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	266,006.9	254,985.8	306,652.6	263,462.2	336,715.3	345,809.9	404,881.2	433,306.1	344,123.8	313,433.8	266,362.5	251,983.3	3,787,723.3
Peak (kW)	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,500.0	1,500.0	1,500.0	1,425.0	1,425.0	1,425.0	1,425.0	1,500.0
AHU 2													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	251,393.2	229,756.5	278,262.3	243,554.5	272,396.3	273,698.9	263,497.0	294,199.0	251,853.8	286,334.8	252,604.0	240,197.4	3,137,747.8
Peak (kW)	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0
AHU 3													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	5,364.1	3,898.3	4,612.9	3,854.4	2,920.2	2,904.0	2,902.6	3,037.7	2,695.7	3,074.8	4,348.7	4,114.1	43,727.5
Peak (kW)	55.0	55.0	55.0	55.0	38.5	38.5	40.2	38.5	38.5	38.5	55.0	55.0	55.0
AHU 4													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	6,044.0	4,274.3	4,922.9	3,904.2	2,929.2	2,912.6	3,419.0	3,066.5	2,727.9	3,182.5	4,816.4	4,466.5	46,666.0
Peak (kW)	55.0	55.0	55.0	55.0	38.5	38.5	55.0	38.5	38.5	38.5	55.0	55.0	55.0
AHU 7													

EQUIPMENT ENERGY CONSUMPTION

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----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
AHU 7													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	76,020.0	68,780.0	83,260.0	72,400.0	79,640.0	79,640.0	72,400.0	83,260.0	72,400.0	79,640.0	76,020.0	72,400.0	915,860.0
Peak (kW)	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Cpl 1: CHILLERS													
Chiller 2 (Cooling Equipment)													
Electric (kWh)	225.8	170.5	223.3	414.3	1,479.8	2,236.1	17,037.9	5,798.3	2,895.4	1,269.4	266.1	250.4	32,267.2
Peak (kW)	30.5	30.4	30.3	41.3	41.3	41.3	148.6	118.7	84.1	41.3	34.2	41.3	148.6
Eq5221 - Condenser fan													
Electric (kWh)	829.9	747.5	944.4	941.5	2,252.7	2,138.4	4,785.9	4,138.8	2,750.6	1,381.3	852.9	796.1	22,559.8
Peak (kW)	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	11.0	5.5	7.3	14.7	132.1	181.6	238.4	232.0	167.8	134.8	11.0	8.3	1,144.4
Peak (kW)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	96.8	48.4	64.6	129.1	1,161.9	1,597.6	2,097.8	2,041.3	1,476.5	1,186.1	96.8	72.6	10,069.4
Peak (kW)	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	1.2	0.6	0.8	1.6	14.4	19.8	26.0	25.3	18.3	14.7	1.2	0.9	124.8
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chiller 3 (Cooling Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	5,856.1	0.0	0.0	0.0	0.0	0.0	5,856.1
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	148.6	118.7	0.0	0.0	0.0	0.0	148.6
Eq5221 - Condenser fan													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	673.1	0.0	0.0	0.0	0.0	0.0	673.1
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	16.1	13.7	0.0	0.0	0.0	0.0	16.1
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	55.0	0.0	0.0	0.0	0.0	0.0	55.0
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.9

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: CHILLERS													
Eq5012 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	581.3	0.0	0.0	0.0	0.0	0.0	581.3
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	9.7	9.7	0.0	0.0	0.0	0.0	9.7
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	6.0
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Chiller 4 (Cooling Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	148.5	0.0	0.0	0.0	0.0	0.0	148.5
Eq5221 - Condenser fan													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	16.1
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	8.1
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Chiller 5 (Cooling Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	148.5	0.0	0.0	0.0	0.0	0.0	148.5
Eq5221 - Condenser fan													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	16.1
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	8.1
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Chiller 6 (Cooling Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	148.5	0.0	0.0	0.0	0.0	0.0	148.5
Eq5221 - Condenser fan													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	16.1

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----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: CHILLERS													
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Chiller 7 (Cooling Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	134.9	0.0	0.0	0.0	0.0	0.0	134.9
Eq5221 - Condenser fan													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	14.8	0.0	0.0	0.0	0.0	0.0	14.8
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Chiller 1 (Cooling Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	135.0	0.0	0.0	0.0	0.0	0.0	135.0
Eq5221 - Condenser fan													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	14.8	0.0	0.0	0.0	0.0	0.0	14.8
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Hpl 1: BOILERS													
Boiler 1 (Heating Equipment)													
Gas (kWh)	287,220.4	281,241.8	338,255.3	240,878.6	167,499.1	165,143.7	51,019.5	98,907.3	102,842.2	162,823.1	262,783.5	234,140.6	2,392,755.3
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	294,450.0	268,125.0	340,275.0	253,500.0	196,950.0	193,050.0	63,375.0	123,825.0	122,850.0	214,500.0	286,650.0	273,000.0	2,630,550.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Hpl 1: BOILERS													
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	824.6	750.9	952.9	709.9	551.5	540.6	177.5	346.8	344.0	600.7	802.7	764.5	7,366.6
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	151.0	137.5	174.5	130.0	101.0	99.0	32.5	63.5	63.0	110.0	147.0	140.0	1,349.0
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boiler 2 (Heating Equipment)													
Gas (kWh)	278,048.9	265,365.8	321,951.3	232,376.6	139,441.6	113,490.8	34,944.8	74,469.3	76,375.6	138,526.9	237,073.3	220,487.8	2,132,552.8
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	249,600.0	222,300.0	246,675.0	175,500.0	128,700.0	111,150.0	43,875.0	93,600.0	86,775.0	128,700.0	216,450.0	200,850.0	1,904,175.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	699.0	622.5	690.8	491.5	360.4	311.3	122.9	262.1	243.0	360.4	606.2	562.5	5,332.5
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	128.0	114.0	126.5	90.0	66.0	57.0	22.5	48.0	44.5	66.0	111.0	103.0	976.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boiler 3 (Heating Equipment)													
Gas (kWh)	268,825.0	256,255.0	291,909.8	218,536.6	116,359.2	111,219.5	19,512.2	35,386.3	60,698.7	115,316.5	237,073.3	220,487.8	1,951,579.8
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	249,600.0	222,300.0	228,150.0	159,900.0	111,150.0	111,150.0	19,500.0	48,750.0	67,275.0	128,700.0	216,450.0	200,850.0	1,763,775.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	699.0	622.5	638.9	447.8	311.3	311.3	54.6	136.5	188.4	360.4	606.2	562.5	4,939.3
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	128.0	114.0	117.0	82.0	57.0	57.0	10.0	25.0	34.5	66.0	111.0	103.0	904.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Hpl 1: BOILERS													
Boiler 4 (Heating Equipment)													
Gas (kWh)	257,550.5	235,986.4	280,975.7	218,452.8	111,945.3	98,637.2	19,512.2	5,717.9	36,875.7	100,372.3	232,103.8	213,651.8	1,811,781.6
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	233,025.0	206,700.0	209,625.0	159,900.0	111,150.0	111,150.0	19,500.0	7,800.0	41,925.0	112,125.0	216,450.0	200,850.0	1,630,200.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	652.6	578.8	587.0	447.8	311.3	311.3	54.6	21.8	117.4	314.0	606.2	562.5	4,565.2
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	119.5	106.0	107.5	82.0	57.0	57.0	10.0	4.0	21.5	57.5	111.0	103.0	836.0
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	2,005,564	1,819,345	2,105,694	1,692,834	1,633,466	1,621,389	1,280,122	1,502,611	1,353,867	1,659,670	1,911,922	1,807,670	20,394,152
On-Pk Demand (kW)	7,543	7,687	7,687	7,456	7,352	7,316	7,321	7,349	7,306	7,317	7,454	7,694	7,694
Gas													
On-Pk Cons. (kWh)	1,091,644	1,038,849	1,233,092	910,244	535,245	488,491	124,989	214,481	276,792	517,039	969,033	888,768	8,288,669
On-Pk Demand (kW)	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902	3,902

Building Energy Consumption = 3,332 MJ/(m2-year)
 Source Energy Consumption = 8,123 MJ/(m2-year)
 Floor Area = 30,992 m2

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (kwh)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Primary heating				
Primary heating	26,269.6	8,288,669.0	29.0 %	8,803,731.0
Primary cooling				
Cooling Compressor	38,123.2		0.1 %	114,381.1
Tower/Cond Fans	23,232.9		0.1 %	69,705.7
Condenser Pump	10,650.8		0.0 %	31,955.5
Other CLG Accessories	130.8		0.0 %	392.4
Cooling Subtotal....	72,137.7		0.3 %	216,434.7
Auxiliary				
Supply Fans	7,931,724.5		27.7 %	23,797,552.0
Circ Pumps	7,929,899.5		27.7 %	23,792,076.0
Base Utilities			0.0 %	0.0
Aux Subtotal....	15,861,624.0		55.3 %	47,589,628.0
Lighting				
Lighting	1,623,302.6		5.7 %	4,870,394.5
Receptacle				
Receptacles	2,810,820.3		9.8 %	8,433,304.0
Heating plant load				
Base Utilities			0.0 %	0.0
Cogeneration				
Cogeneration			0.0 %	0.0
Totals				
Totals**	20,394,154.0	8,288,669.0	100.0 %	69,913,488.0

* Note: Resource Utilization factors are included in the Total Source Energy value.

** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

MONTHLY UTILITY COSTS

By ae

Alternative: 1

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Electric													
On-Pk Cons. (\$)	165,872	150,480	174,149	140,023	135,116	134,118	105,910	124,300	112,006	137,282	158,132	149,515	1,686,906
Off-Pk Cons. (\$)	101	101	101	101	101	101	101	101	101	101	101	101	1,207
Total (\$):	165,973	150,581	174,249	140,124	135,217	134,219	106,011	124,401	112,106	137,383	158,233	149,616	1,688,113
Gas													
On-Pk Cons. (\$)	3,466	3,299	3,916	2,890	1,700	1,551	397	681	879	1,642	3,077	2,822	26,320
Monthly Total (\$):	169,440	153,880	178,165	143,014	136,917	135,770	106,408	125,082	112,985	139,025	161,310	152,438	1,714,433

ELECTRICAL PEAK CHECKSUMS

By ae

Alternative: 1 Palestra Building
 Yearly Time of Peak: 14(Hr) 7(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
Chiller 2	0.74	0.01
Sub total	0.74	0.01
Heating Equipment		
Boiler 1	978.23	12.72
Sub total	978.23	12.72
Fan Equipment		
SUMMATION OF FAN ELECTRICAL DEMAND	1,350.00	17.56
SUMMATION OF FAN ELECTRICAL DEMAND	1,350.00	17.56
SUMMATION OF FAN ELECTRICAL DEMAND	40.00	0.52
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	0.72
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	0.72
Sub total	2,850.00	37.08
Miscellaneous		
Lights	329.39	4.28
Base Utilities	0.00	0.00
Misc Equipment	601.41	7.82
Sub total	930.80	12.10
Total	4,759.77	62

YEARLY CASH FLOW

By ae

Alternative: 1
 Life Cycle Cost: 31,868,440.64

Year	Utility Cost (\$)	Maint. Cost (\$)	Interest Cost (\$)	Principal Cost (\$)	Property Taxes (\$)	Insurance Cost (\$)	Revenue Penalty (\$)	Replace. Expenses (\$)	Deprec. Tax (\$)	Cash Flow Effect (\$)	Present Value (\$)
0	0	0	0	17,826,732	0	0	0	0	0	17,826,732	17,826,732
1	1,714,433	306,000	0	0	0	0	0	0	891,337	1,438,079	1,250,504
2	1,714,433	367,200	0	0	0	0	0	0	891,337	1,487,039	1,124,415
3	1,714,433	440,640	0	0	0	0	0	0	891,337	1,545,791	1,016,383
4	1,714,433	528,768	0	0	0	0	0	0	891,337	1,616,294	924,121
5	1,714,433	634,522	0	0	0	0	0	0	891,337	1,700,897	845,646
6	1,714,433	761,426	0	0	0	0	0	0	891,337	1,802,420	779,236
7	1,714,433	913,711	0	0	0	0	0	0	891,337	1,924,248	723,396
8	1,714,433	1,096,453	0	0	0	0	0	0	891,337	2,070,442	676,831
9	1,714,433	1,315,744	0	0	0	0	0	0	891,337	2,245,875	638,418
10	1,714,433	1,578,893	0	0	0	0	0	0	891,337	2,456,394	607,183
11	1,714,433	1,894,671	0	0	0	0	0	0	891,337	2,709,016	582,285
12	1,714,433	2,273,605	0	0	0	0	0	0	891,337	3,012,164	562,995
13	1,714,433	2,728,326	0	0	0	0	0	0	891,337	3,375,941	548,685
14	1,714,433	3,273,992	0	0	0	0	0	0	891,337	3,812,473	538,812
15	1,714,433	3,928,790	0	0	0	0	0	0	891,337	4,336,311	532,909
16	1,714,433	4,714,548	0	0	0	0	0	0	891,337	4,964,918	530,575
17	1,714,433	5,657,457	0	0	0	0	0	0	891,337	5,719,245	531,466
18	1,714,433	6,788,949	0	0	0	0	0	0	891,337	6,624,439	535,289
19	1,714,433	8,146,739	0	0	0	0	0	0	891,337	7,710,670	541,793
20	1,714,433	9,776,086	0	0	0	0	0	0	891,337	9,014,148	550,767

TRACE® 700 Economic Summary

By ae

Project Information

Weather file Heathrow, England
 Project Name
 Location London, England
 Building Owner Balckfriars Investment
 User
 Company Penn State University
 Comments

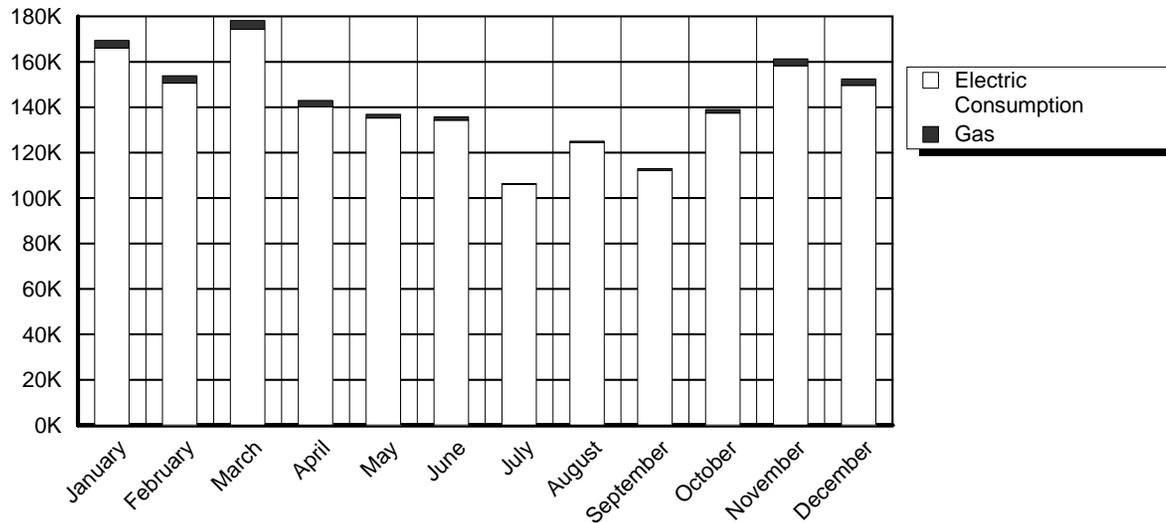
Alternative 1 - - Palestra Building

Economic Summary

Alternative Number	Installed Cost	First Year Util. Cost	Final Year Util. Cost	First Year Maint. Cost	Final Year Maint. Cost	Life Cycle Cost
1	17,826,732.00	1,714,433.42	1,714,433.42	306,000.00	9,776,086.14	31,868,440.64

Monthly Utility Costs per Utility

(1 alternative)



Equipment Energy Consumption by Alternative

	Elect Cons. (kWh)	Gas Cons. (kwh)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Alternative: 1 - Palestra Building				
Primary heating	26,269.6	8,288,669.0	29.0%	8,803,731.0
Cooling Compressor	38,123.2		0.1%	114,381.1
Tower/Cond Fans	23,232.9		0.1%	69,705.7
Condenser Pump	10,650.8		0.0%	31,955.5
Other CLG Accessories	130.8		0.0%	392.4
Supply Fans	7,931,724.5		27.7%	23,797,552.0
Circ Pumps	7,929,899.5		27.7%	23,792,076.0
Lighting	1,623,302.6		5.7%	4,870,394.5
Totals	20,394,154.0	8,288,669.0	100.0%	69,913,488.0

* Note: Resource Utilization factors are included in the Total Source Energy value.



The Palestra Building

London, England



Natural Gas Engine Driven Chiller Plant Energy Simulation

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Lights													
Electric (kWh)	171,215.5	154,884.0	185,958.4	163,314.5	178,587.0	178,057.5	163,844.0	185,958.4	163,314.5	178,587.0	170,686.0	163,844.0	2,058,250.8
Peak (kW)	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1	640.1
MISC LD													
Electric (kWh)	234,034.4	211,696.4	253,279.4	223,381.2	243,657.1	242,625.8	224,412.1	253,279.4	223,381.3	243,657.1	233,003.5	224,412.1	2,810,820.0
Peak (kW)	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2	816.2
AHU 1													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	1,773.4	1,699.9	2,044.4	1,756.4	2,244.8	2,305.4	2,699.2	2,888.7	2,294.2	2,089.6	1,775.8	1,679.9	25,251.5
Peak (kW)	9.5	9.5	9.5	9.5	9.5	10.0	10.0	10.0	9.5	9.5	9.5	9.5	10.0
AHU 2													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	1,676.0	1,531.7	1,855.1	1,623.7	1,816.0	1,824.7	1,756.7	1,961.3	1,679.0	1,908.9	1,684.0	1,601.3	20,918.3
Peak (kW)	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
AHU 3													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	350.5	289.4	368.2	355.0	436.5	364.5	554.6	473.5	372.2	377.4	314.1	344.8	4,600.6
Peak (kW)	4.9	5.1	4.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	5.1	5.0	5.1
AHU 4													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	350.3	338.7	418.4	345.5	524.5	515.4	832.2	792.6	563.3	400.8	360.3	331.1	5,773.0
Peak (kW)	5.5	5.5	5.5	5.3	5.4	4.7	5.5	5.0	4.7	4.9	5.5	5.5	5.5
AHU 7													

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
AHU 7													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	1,900.5	1,719.5	2,081.5	1,810.0	1,991.0	1,991.0	1,810.0	2,081.5	1,810.0	1,991.0	1,900.5	1,810.0	22,896.5
Peak (kW)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Cpl 1: IC Engine Chiller Plant													
IC Chiller 1 (Cooling Equipment)													
Gas (kWh)	622.7	467.9	621.4	1,056.5	5,550.6	8,379.2	32,928.5	16,273.2	9,352.1	4,416.9	710.3	662.4	81,041.5
Peak (kW)	80.3	80.2	80.1	94.5	94.5	94.5	393.7	193.9	141.8	94.5	85.6	94.5	393.7
Eq5100 - Cooling tower													
Electric (kWh)	2,260.9	2,026.9	2,450.6	2,311.0	4,401.3	4,531.9	6,880.6	6,962.3	4,951.1	4,005.2	2,342.0	2,252.0	45,375.5
Peak (kW)	13.6	13.9	14.2	16.8	21.5	21.5	21.5	21.5	21.5	18.1	14.1	15.1	21.5
Eq5100 - Cooling tower													
Make Up Water (kL)	124.3	112.1	143.0	145.9	392.4	364.8	1,294.6	708.0	456.7	216.4	128.3	119.0	4,205.4
Peak (kL/Hr)	3.6	3.8	4.1	4.8	5.5	6.0	11.3	8.0	6.5	4.8	3.7	3.7	11.3
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	14.6	10.9	14.6	29.2	262.7	361.2	474.3	461.5	328.3	268.2	21.9	16.4	2,263.7
Peak (kW)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Eq5010 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	25.1	18.8	25.1	50.1	451.1	620.2	814.4	792.5	563.8	460.5	37.6	28.2	3,887.3
Peak (kW)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Eq5300 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	8.0	6.0	8.0	16.0	144.0	198.0	260.0	253.0	180.0	147.0	12.0	9.0	1,241.0
Peak (kW)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
EDC Heater (Misc Accessory Equipment)													
Electric (kWh)	110.4	99.9	110.4	105.6	90.0	78.3	72.6	73.7	81.0	89.6	106.2	110.3	1,127.9
Peak (kW)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
IC Chiller 2 (Cooling Equipment)													
Gas (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	7,500.0	0.0	0.0	0.0	0.0	0.0	7,500.0
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	393.7	193.9	0.0	0.0	0.0	0.0	393.7

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: IC Engine Chiller Plant													
Eq5100 - Cooling tower													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	965.3	0.0	0.0	0.0	0.0	0.0	965.3
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	21.5	21.5	0.0	0.0	0.0	0.0	21.5
Eq5100 - Cooling tower													
Make Up Water (kL)	0.0	0.0	0.0	0.0	0.0	0.0	79.3	0.0	0.0	0.0	0.0	0.0	79.3
Peak (kL/Hr)	0.0	0.0	0.0	0.0	0.0	0.0	3.3	2.0	0.0	0.0	0.0	0.0	3.3
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	82.1	0.0	0.0	0.0	0.0	0.0	82.1
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	0.0	0.0	0.0	0.0	1.8
Eq5010 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	141.0	0.0	0.0	0.0	0.0	0.0	141.0
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1	0.0	0.0	0.0	0.0	3.1
Eq5300 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	0.0	0.0	0.0	0.0	45.0	0.0	0.0	0.0	0.0	0.0	45.0
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0
EDC Heater (Misc Accessory Equipment)													
Electric (kWh)	111.6	100.8	111.6	108.0	111.6	108.0	104.9	111.6	108.0	111.6	108.0	111.6	1,307.3
Peak (kW)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
IC Chiller 3 (Cooling Equipment)													
Gas							393.7	0.0	0.0	0.0	0.0	0.0	393.7
Eq5100 - Cooling tower													
Electric							21.5	0.0	0.0	0.0	0.0	0.0	21.5
Eq5100 - Cooling tower													
Make Up Water							3.3	0.0	0.0	0.0	0.0	0.0	3.3
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric							1.8	0.0	0.0	0.0	0.0	0.0	1.8
Eq5010 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric							3.1	0.0	0.0	0.0	0.0	0.0	3.1
Eq5300 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric							1.0	0.0	0.0	0.0	0.0	0.0	1.0

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: IC Engine Chiller Plant													
EDC Heater (Misc Accessory Equipment)													
Electric (kWh)	111.6	100.8	111.6	108.0	111.6	108.0	111.6	111.6	108.0	111.6	108.0	111.6	1,314.0
Peak (kW)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
IC Chiller 4 (Cooling Equipment)													
Gas							393.7						393.7
Eq5100 - Cooling tower													
Electric							21.5						21.5
Eq5100 - Cooling tower													
Make Up Water							3.3						3.3
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric							1.8						1.8
Eq5010 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric							3.1						3.1
Eq5300 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric							1.0						1.0
EDC Heater (Misc Accessory Equipment)													
Electric (kWh)	111.6	100.8	111.6	108.0	111.6	108.0	111.6	111.6	108.0	111.6	108.0	111.6	1,314.0
Peak (kW)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
IC Chiller 5 (Cooling Equipment)													
Gas							393.7						393.7
Eq5100 - Cooling tower													
Electric							21.5						21.5
Eq5100 - Cooling tower													
Make Up Water							3.3						3.3
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric							1.8						1.8
Eq5010 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric							3.1						3.1
Eq5300 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric							1.0						1.0

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: IC Engine Chiller Plant													
EDC Heater (Misc Accessory Equipment)													
Electric (kWh)	111.6	100.8	111.6	108.0	111.6	108.0	111.6	111.6	108.0	111.6	108.0	111.6	1,314.0
Peak (kW)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Hpl 1: BOILERS													
Boiler 1 (Heating Equipment)													
Gas (kWh)	287,220.4	279,779.7	337,934.0	244,647.7	171,879.6	159,275.1	51,019.5	101,100.0	100,938.4	163,548.8	256,205.4	232,689.0	2,386,237.8
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	294,450.0	265,200.0	321,750.0	253,500.0	235,950.0	210,600.0	63,375.0	142,350.0	158,925.0	193,050.0	286,650.0	273,000.0	2,698,800.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	824.6	742.7	901.0	709.9	660.8	589.8	177.5	398.6	445.1	540.6	802.7	764.5	7,557.8
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	151.0	136.0	165.0	130.0	121.0	108.0	32.5	73.0	81.5	99.0	147.0	140.0	1,384.0
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boiler 2 (Heating Equipment)													
Gas (kWh)	264,735.0	255,915.5	304,971.0	228,864.8	131,597.7	114,175.3	33,527.9	74,469.3	76,375.6	131,404.7	235,156.8	220,487.8	2,071,681.4
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	233,025.0	225,225.0	273,000.0	175,500.0	132,600.0	115,050.0	43,875.0	93,600.0	86,775.0	128,700.0	179,400.0	164,775.0	1,851,525.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	652.6	630.7	764.5	491.5	371.3	322.2	122.9	262.1	243.0	360.4	502.4	461.4	5,185.0
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	119.5	115.5	140.0	90.0	68.0	59.0	22.5	48.0	44.5	66.0	92.0	84.5	949.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Hpl 1: BOILERS													
Boiler 3 (Heating Equipment)													
Gas (kWh)	257,561.1	242,992.9	280,975.7	218,536.6	115,121.9	111,219.5	19,512.2	34,470.0	60,869.8	112,195.1	227,055.0	218,329.6	1,898,839.4
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	216,450.0	209,625.0	235,950.0	175,500.0	115,050.0	111,150.0	19,500.0	48,750.0	67,275.0	112,125.0	175,500.0	164,775.0	1,651,650.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	606.2	587.0	660.8	491.5	322.2	311.3	54.6	136.5	188.4	314.0	491.5	461.4	4,625.3
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	111.0	107.5	121.0	90.0	59.0	57.0	10.0	25.0	34.5	57.5	90.0	84.5	847.0
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boiler 4 (Heating Equipment)													
Gas (kWh)	247,156.2	231,219.4	280,975.7	208,181.2	113,339.2	97,531.8	19,512.2	6,035.5	35,733.9	90,007.1	216,585.4	191,049.7	1,737,327.1
Peak (kW)	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	216,450.0	194,025.0	235,950.0	175,500.0	115,050.0	111,150.0	19,500.0	7,800.0	41,925.0	112,125.0	175,500.0	161,850.0	1,566,825.0
Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	606.2	543.4	660.8	491.5	322.2	311.3	54.6	21.8	117.4	314.0	491.5	453.3	4,387.8
Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	111.0	99.5	121.0	90.0	59.0	57.0	10.0	4.0	21.5	57.5	90.0	83.0	803.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	1,377,723	1,271,762	1,519,245	1,178,114	1,035,685	983,671	552,818	749,894	756,026	982,237	1,232,433	1,163,818	12,803,427
On-Pk Demand (kW)	5,395	5,396	5,397	5,397	5,404	5,407	5,222	5,352	5,346	5,409	5,396	5,399	5,409
Gas													
On-Pk Cons. (kWh)	1,057,295	1,010,376	1,205,477	901,287	537,489	490,581	164,000	232,348	283,270	501,573	935,713	863,219	8,182,627
On-Pk Demand (kW)	3,983	3,983	3,982	3,997	3,997	3,997	3,997	3,997	3,997	3,997	3,988	3,997	3,997
Water													
Cons. (kL)	124	112	143	146	392	365	1,374	708	457	216	128	119	4,285

Building Energy Consumption = 2,438 MJ/(m2-year)
 Source Energy Consumption = 5,464 MJ/(m2-year)
 Floor Area = 30,992 m2

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (kwh)	Water Cons. (kL)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Primary heating					
Primary heating	25,739.8	8,094,085.5		38.7 %	8,597,317.0
Primary cooling					
Cooling Compressor		88,541.5		0.4 %	93,201.6
Tower/Cond Fans	46,340.8		4,284.7	0.2 %	139,036.2
Condenser Pump	4,028.2			0.0 %	12,085.9
Other CLG Accessories	7,663.1			0.0 %	22,991.6
Cooling Subtotal....	58,032.1	88,541.5	4,284.7	0.7 %	267,315.3
Auxiliary					
Supply Fans	79,439.9			0.4 %	238,343.6
Circ Pumps	7,771,146.0			37.0 %	23,315,768.0
Base Utilities				0.0 %	0.0
Aux Subtotal....	7,850,586.0			37.4 %	23,554,112.0
Lighting					
Lighting	2,058,250.8			9.8 %	6,175,369.5
Receptacle					
Receptacles	2,810,820.3			13.4 %	8,433,304.0
Heating plant load					
Base Utilities				0.0 %	0.0
Cogeneration					
Cogeneration				0.0 %	0.0
Totals					
Totals**	12,803,429.0	8,182,627.0	4,284.7	100.0 %	47,027,416.0

* Note: Resource Utilization factors are included in the Total Source Energy value.

** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

MONTHLY UTILITY COSTS

By ae

Alternative: 1

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Electric													
On-Pk Cons. (\$)	113,978	105,219	125,675	97,479	85,706	81,407	45,794	62,084	62,591	81,288	101,969	96,297	1,059,487
Off-Pk Cons. (\$)	101	101	101	101	101	101	101	101	101	101	101	101	1,207
Total (\$):	114,078	105,320	125,776	97,579	85,807	81,507	45,895	62,184	62,691	81,389	102,069	96,398	1,060,694
Gas													
On-Pk Cons. (\$)	3,357	3,208	3,828	2,862	1,707	1,558	521	738	900	1,593	2,971	2,741	25,984
Monthly Total (\$):	117,436	108,528	129,604	100,441	87,514	83,065	46,416	62,922	63,591	82,982	105,040	99,139	1,086,678

ELECTRICAL PEAK CHECKSUMS

By ae

Alternative: 1 Palestra Building
 Yearly Time of Peak: 17(Hr) 7(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
IC Chiller 1	15.36	0.28
IC CHiller 2	0.15	0.00
IC Chiller 3	0.15	0.00
IC CHiller 4	0.15	0.00
IC Chiller 5	0.15	0.00
Sub total	15.96	0.28
Heating Equipment		
Boiler 1	978.23	18.13
Sub total	978.23	18.13
Fan Equipment		
SUMMATION OF FAN ELECTRICAL DEMAND	2.04	0.04
SUMMATION OF FAN ELECTRICAL DEMAND	0.47	0.01
SUMMATION OF FAN ELECTRICAL DEMAND	10.00	0.19
SUMMATION OF FAN ELECTRICAL DEMAND	2.45	0.05
SUMMATION OF FAN ELECTRICAL DEMAND	0.85	0.02
Sub total	15.81	0.31
Miscellaneous		
Lights	640.05	11.86
Base Utilities	0.00	0.00
Misc Equipment	816.20	15.12
Sub total	1,456.25	26.98
Total	2,466.25	46

YEARLY CASH FLOW

By ae

Alternative: 1
 Life Cycle Cost: 28,724,974.84

Year	Utility Cost (\$)	Maint. Cost (\$)	Interest Cost (\$)	Principal Cost (\$)	Property Taxes (\$)	Insurance Cost (\$)	Revenue Penalty (\$)	Replace. Expenses (\$)	Deprec. Tax (\$)	Cash Flow Effect (\$)	Present Value (\$)
0	0	0	0	17,826,732	0	0	0	0	0	17,826,732	17,826,732
1	1,086,678	306,000	0	0	0	0	0	0	891,337	935,875	813,804
2	1,086,678	367,200	0	0	0	0	0	0	891,337	984,835	744,677
3	1,086,678	440,640	0	0	0	0	0	0	891,337	1,043,587	686,175
4	1,086,678	528,768	0	0	0	0	0	0	891,337	1,114,089	636,984
5	1,086,678	634,522	0	0	0	0	0	0	891,337	1,198,692	595,962
6	1,086,678	761,426	0	0	0	0	0	0	891,337	1,300,215	562,119
7	1,086,678	913,711	0	0	0	0	0	0	891,337	1,422,044	534,599
8	1,086,678	1,096,453	0	0	0	0	0	0	891,337	1,568,237	512,660
9	1,086,678	1,315,744	0	0	0	0	0	0	891,337	1,743,670	495,660
10	1,086,678	1,578,893	0	0	0	0	0	0	891,337	1,954,189	483,046
11	1,086,678	1,894,671	0	0	0	0	0	0	891,337	2,206,812	474,339
12	1,086,678	2,273,605	0	0	0	0	0	0	891,337	2,509,959	469,129
13	1,086,678	2,728,326	0	0	0	0	0	0	891,337	2,873,736	467,062
14	1,086,678	3,273,992	0	0	0	0	0	0	891,337	3,310,268	467,836
15	1,086,678	3,928,790	0	0	0	0	0	0	891,337	3,834,107	471,191
16	1,086,678	4,714,548	0	0	0	0	0	0	891,337	4,462,713	476,907
17	1,086,678	5,657,457	0	0	0	0	0	0	891,337	5,217,041	484,798
18	1,086,678	6,788,949	0	0	0	0	0	0	891,337	6,122,234	494,708
19	1,086,678	8,146,739	0	0	0	0	0	0	891,337	7,208,466	506,505
20	1,086,678	9,776,086	0	0	0	0	0	0	891,337	8,511,944	520,082

TRACE® 700 Economic Summary

By ae

Project Information

Weather file Heathrow, England
 Project Name
 Location London, England
 Building Owner Balckfriars Investment
 User
 Company Penn State University
 Comments

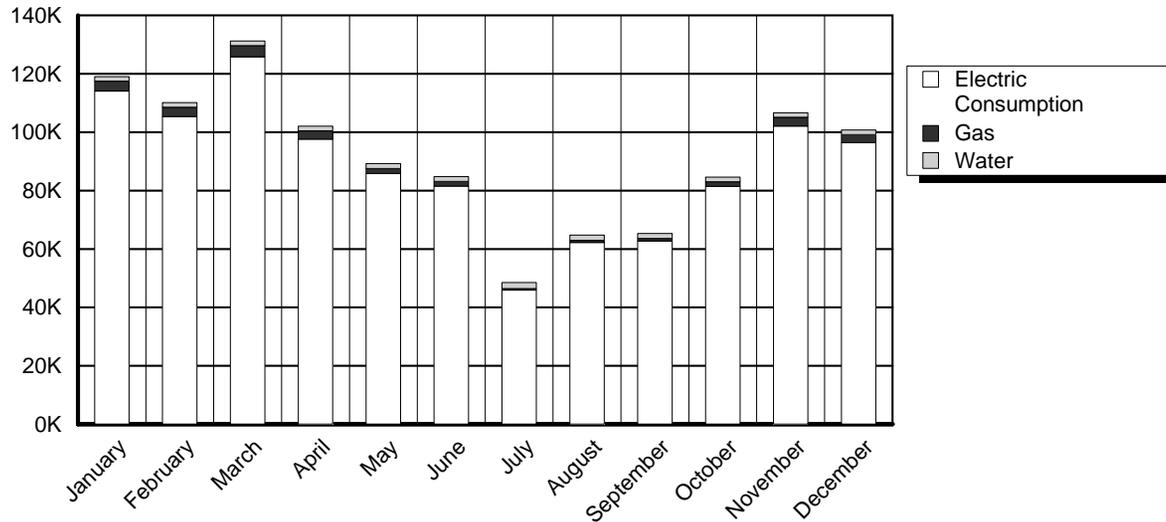
Alternative 1 - - Palestra Building

Economic Summary

Alternative Number	Installed Cost	First Year Util. Cost	Final Year Util. Cost	First Year Maint. Cost	Final Year Maint. Cost	Life Cycle Cost
1	18,112,724.00	1,107,063.98	1,107,063.98	306,000.00	9,776,086.14	29,095,149.96

Monthly Utility Costs per Utility

(1 alternative)



Equipment Energy Consumption by Alternative

	Elect Cons. (kWh)	Gas Cons. (kwh)	Water Cons. (liters)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Alternative: 1 - Palestra Building					
Primary heating	25,739.8	8,094,085.5		38.7%	8,597,317.0
Cooling Compressor		88,541.5		0.4%	93,201.6
Tower/Cond Fans	46,340.8		4,284.7	0.2%	139,036.2
Condenser Pump	4,028.2			0.0%	12,085.9
Other CLG Accessories	7,663.1			0.0%	22,991.6
Supply Fans	79,439.9			0.4%	238,343.6
Circ Pumps	7,771,146.0			37.0%	23,315,768.0
Lighting	2,058,250.8			9.8%	6,175,369.5
Totals	12,803,429.0	8,182,627.0	4,284.7	100.0%	47,027,416.0

* Note: Resource Utilization factors are included in the Total Source Energy value.



The Palestra Building

London, England



Dedicated Outdoor Air System Energy Simulation

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Lights													
Electric (kWh)	26,869.5	24,305.9	29,140.7	25,636.5	28,005.2	27,907.7	25,733.9	29,140.7	25,636.5	28,005.1	26,772.1	25,733.9	322,887.8
Peak (kW)	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7
MISC LD													
Electric (kWh)	42,556.8	38,494.9	46,056.4	40,619.6	44,306.7	44,119.2	40,807.1	46,056.4	40,619.7	44,306.7	42,369.4	40,807.1	511,119.9
Peak (kW)	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4	148.4
AHU 3 DOAS													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	9,933.0	9,244.8	10,208.7	6,768.3	3,557.9	3,255.1	5,253.7	3,083.8	3,823.7	7,507.6	10,277.8	9,804.8	82,719.2
Peak (kW)	55.0	55.0	55.0	55.0	55.0	55.0	54.9	51.4	55.0	55.0	55.0	55.0	55.0
AHU 4 DOAS													
Eq4372 - Unit vent supply fan (Main Clg Fan)													
Electric (kWh)	9,933.0	9,358.5	10,454.2	6,422.3	3,255.6	3,075.7	5,880.5	3,224.1	3,071.8	7,064.3	10,282.4	9,537.8	81,560.2
Peak (kW)	55.0	55.0	55.0	55.0	55.0	53.4	55.0	43.6	55.0	55.0	55.0	55.0	55.0
AHU DOAS 1													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	285,833.6	258,752.1	316,639.5	288,376.0	353,275.5	366,008.5	354,184.3	403,746.6	333,903.9	332,078.9	289,910.3	276,110.4	3,858,819.8
Peak (kW)	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0
AHU DOAS 2													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	285,021.1	257,552.2	311,965.2	281,604.2	327,899.3	332,123.8	349,410.6	385,116.4	313,078.7	316,818.9	280,214.3	272,554.4	3,713,359.0
Peak (kW)	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0	1,425.0
AHU DOAS 7													

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
AHU DOAS 7													
Eq4371 - Fan coil supply fan (Main Clg Fan)													
Electric (kWh)	76,020.0	68,780.0	83,260.0	72,400.0	79,640.0	79,640.0	72,400.0	83,260.0	72,400.0	79,640.0	76,020.0	72,400.0	915,860.0
Peak (kW)	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Cpl 1: CHILLERS													
Chiller 2 (Cooling Equipment)													
Electric (kWh)	74,462.7	67,254.1	74,462.5	72,071.4	74,708.3	72,858.9	75,280.6	77,756.5	73,316.3	74,553.4	72,061.5	74,462.0	883,248.2
Peak (kW)	104.1	104.1	104.1	104.6	121.0	128.2	133.3	133.2	137.9	122.0	104.2	104.4	137.9
Eq5221 - Condenser fan													
Electric (kWh)	9,929.7	9,017.1	10,065.8	9,674.0	10,207.6	9,876.1	9,503.0	10,756.8	10,166.6	10,119.5	9,705.8	9,963.0	118,984.9
Peak (kW)	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	682.2	616.2	682.2	660.2	682.2	660.2	682.2	682.2	660.2	682.2	660.2	682.2	8,032.8
Peak (kW)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	6,002.9	5,422.0	6,002.9	5,809.3	6,002.9	5,809.3	6,002.9	6,002.9	5,809.3	6,002.9	5,809.3	6,002.9	70,679.6
Peak (kW)	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	74.4	67.2	74.4	72.0	74.4	72.0	74.4	74.4	72.0	74.4	72.0	74.4	876.0
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chiller 3 (Cooling Equipment)													
Electric (kWh)	416.4	312.3	416.3	418.3	419.5	420.2	18,143.0	1,959.1	315.2	523.8	416.8	313.3	24,074.2
Peak (kW)	104.1	104.1	104.1	104.6	104.9	105.1	131.8	118.2	105.1	104.8	104.2	104.4	131.8
Eq5221 - Condenser fan													
Electric (kWh)	51.8	38.8	51.7	52.0	52.2	52.3	2,141.0	245.5	39.2	65.1	51.8	38.9	2,880.2
Peak (kW)	12.9	12.9	12.9	13.0	13.0	13.1	14.8	13.6	13.1	13.0	13.0	13.0	14.8
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	3.7	2.8	3.7	3.7	3.7	3.7	183.4	21.1	2.8	4.6	3.7	2.8	239.3
Peak (kW)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: CHILLERS													
Eq5012 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	38.8	29.1	38.8	38.8	38.8	38.8	1,937.8	222.9	29.1	48.4	38.8	29.1	2,528.8
Peak (kW)	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.4	0.3	0.4	0.4	0.4	0.4	20.0	2.3	0.3	0.5	0.4	0.3	26.1
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chiller 4 (Cooling Equipment)													
Electric (kWh)	416.2	312.2	416.1	418.1	419.2	420.0	2,480.4	421.5	315.0	523.5	416.6	313.1	6,871.8
Peak (kW)	104.1	104.1	104.0	104.5	104.8	105.0	131.7	105.4	105.0	104.7	104.2	104.4	131.7
Eq5221 - Condenser fan													
Electric (kWh)	51.7	38.8	51.7	52.0	52.1	52.2	290.4	52.4	39.2	65.1	51.8	38.9	836.5
Peak (kW)	12.9	12.9	12.9	13.0	13.0	13.1	14.5	13.1	13.1	13.0	13.0	13.0	14.5
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	3.7	2.8	3.7	3.7	3.7	3.7	22.9	3.7	2.8	4.6	3.7	2.8	61.4
Peak (kW)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric (kWh)	32.3	24.2	32.3	32.3	32.3	32.3	201.7	32.3	24.2	40.3	32.3	24.2	540.6
Peak (kW)	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.4	0.3	0.4	0.4	0.4	0.4	2.5	0.4	0.3	0.5	0.4	0.3	6.7
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chiller 5 (Cooling Equipment)													
Electric							113.9	0.0	0.0	0.0	0.0	0.0	113.9
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eq5221 - Condenser fan													
Electric							12.4	0.0	0.0	0.0	0.0	0.0	12.4
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eq5001 - Cnst vol chill water pump (Misc Accessory Equipment)													
Electric							0.9	0.0	0.0	0.0	0.0	0.0	0.9
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eq5011 - Cnst vol cnd water pump (Misc Accessory Equipment)													
Electric							8.1	0.0	0.0	0.0	0.0	0.0	8.1
Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Cpl 1: CHILLERS														
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)														
Electric	Peak (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Hpl 1: BOILERS														
Boiler 1 (Heating Equipment)														
	Gas (kWh)	150,923.0	139,198.3	163,219.6	93,904.9	39,733.7	38,581.3	10,992.3	19,381.0	26,485.3	78,093.5	126,214.7	130,800.2	1,017,527.9
	Peak (kW)	975.6	975.6	975.6	975.6	938.9	963.1	340.0	491.4	912.1	969.4	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)														
	Electric (kWh)	307,125.0	280,800.0	358,800.0	202,800.0	187,200.0	208,650.0	53,625.0	97,500.0	109,200.0	245,700.0	307,125.0	275,925.0	2,634,450.0
	Peak (kW)	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)														
	Electric (kWh)	860.1	786.4	1,004.8	567.9	524.2	584.3	150.2	273.0	305.8	688.1	860.1	772.7	7,377.5
	Peak (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)														
	Electric (kWh)	157.5	144.0	184.0	104.0	96.0	107.0	27.5	50.0	56.0	126.0	157.5	141.5	1,351.0
	Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boiler 2 (Heating Equipment)														
	Gas (kWh)	34,884.7	33,547.3	36,369.7	7,086.8	0.0	0.0	0.0	0.0	0.0	0.0	32,597.3	24,106.5	168,592.4
	Peak (kW)	975.6	975.6	975.6	356.0	0.0	0.0	0.0	0.0	0.0	0.0	975.6	975.6	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)														
	Electric (kWh)	48,750.0	42,900.0	52,650.0	23,400.0	0.0	0.0	0.0	0.0	0.0	0.0	48,750.0	28,275.0	244,725.0
	Peak (kW)	975.0	975.0	975.0	975.0	0.0	0.0	0.0	0.0	0.0	0.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)														
	Electric (kWh)	136.5	120.1	147.4	65.5	0.0	0.0	0.0	0.0	0.0	0.0	136.5	79.2	685.3
	Peak (kW)	2.7	2.7	2.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)														
	Electric (kWh)	25.0	22.0	27.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	14.5	125.5
	Peak (kW)	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5

EQUIPMENT ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Consumption -----

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Hpl 1: BOILERS													
Boiler 3 (Heating Equipment)													
Gas (kWh)	14,936.6	14,530.4	13,203.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4,037.2	4,234.1	50,941.6
Peak (kW)	975.6	975.6	502.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	975.6	586.3	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	24,375.0	21,450.0	26,325.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7,800.0	22,425.0	102,375.0
Peak (kW)	975.0	975.0	975.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	975.0	975.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	68.3	60.1	73.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8	62.8	286.7
Peak (kW)	2.7	2.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.7	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	12.5	11.0	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	11.5	52.5
Peak (kW)	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5
Boiler 4 (Heating Equipment)													
Gas (kWh)	3,902.4	219.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	950.5	0.0	5,072.2
Peak (kW)	975.6	73.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	237.6	0.0	975.6
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	3,900.0	2,925.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,900.0	0.0	10,725.0
Peak (kW)	975.0	975.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	975.0	0.0	975.0
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	10.9	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	0.0	30.0
Peak (kW)	2.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	2.7
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	2.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	5.5
Peak (kW)	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	1,213,757	1,098,855	1,339,253	1,038,082	1,120,458	1,155,772	1,024,439	1,149,685	992,888	1,154,644	1,193,964	1,126,604	13,608,401
On-Pk Demand (kW)	7,331	6,632	5,594	4,463	4,046	4,046	3,697	4,022	4,046	4,046	6,839	5,658	7,331
Gas													
On-Pk Cons. (kWh)	204,647	187,495	212,792	100,992	39,734	38,581	10,992	19,381	26,485	78,093	163,800	159,141	1,242,134
On-Pk Demand (kW)	3,902	3,000	2,454	1,332	939	963	340	491	912	969	3,164	2,537	3,902

Building Energy Consumption = 4,792 MJ/(m2-year)
 Source Energy Consumption = 13,597 MJ/(m2-year)
 Floor Area = 11,158 m2

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (kwh)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Primary heating				
Primary heating	9,914.1	1,242,134.0	8.4 %	1,337,254.8
Primary cooling				
Cooling Compressor	914,194.2		6.2 %	2,742,856.8
Tower/Cond Fans	122,701.5		0.8 %	368,141.3
Condenser Pump	73,749.0		0.5 %	221,269.0
Other CLG Accessories	908.8		0.0 %	2,726.7
Cooling Subtotal....	1,111,553.4		7.5 %	3,334,993.5
Auxiliary				
Supply Fans	8,652,317.0		58.3 %	25,959,544.0
Circ Pumps	3,000,608.5		20.2 %	9,002,725.0
Base Utilities			0.0 %	0.0
Aux Subtotal....	11,652,926.0		78.5 %	34,962,272.0
Lighting				
Lighting	322,887.8		2.2 %	968,760.1
Receptacle				
Receptacles	511,120.0		3.4 %	1,533,513.1
Heating plant load				
Base Utilities			0.0 %	0.0
Cogeneration				
Cogeneration			0.0 %	0.0
Totals				
Totals**	13,608,400.0	1,242,134.0	100.0 %	42,136,788.0

* Note: Resource Utilization factors are included in the Total Source Energy value.

** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

MONTHLY UTILITY COSTS

By ae

Alternative: 1

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Electric													
On-Pk Cons. (\$)	100,425	90,928	110,798	85,904	92,713	95,632	84,777	95,129	82,169	95,539	98,789	93,221	1,126,023
Off-Pk Cons. (\$)	101	101	101	101	101	101	101	101	101	101	101	101	1,207
Total (\$):	100,525	91,028	110,898	86,005	92,814	95,733	84,877	95,230	82,269	95,639	98,889	93,322	1,127,230
Gas													
On-Pk Cons. (\$)	650	595	676	321	126	123	35	62	84	248	520	505	3,944
Monthly Total (\$):	101,175	91,623	111,574	86,326	92,940	95,855	84,912	95,291	82,353	95,887	99,410	93,827	1,131,174

ELECTRICAL PEAK CHECKSUMS

By ae

Alternative: 1 Palestra Building
 Yearly Time of Peak: 9(Hr) 1(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
Chiller 2	123.28	2.34
Sub total	123.28	2.34
Heating Equipment		
Boiler 1	978.23	18.56
Boiler 2	978.23	18.56
Boiler 3	978.23	18.56
Boiler 4	978.23	18.56
Sub total	3,912.92	74.24
Fan Equipment		
SUMMATION OF FAN ELECTRICAL DEMAND	1,225.63	23.25
SUMMATION OF FAN ELECTRICAL DEMAND	1,325.00	25.14
SUMMATION OF FAN ELECTRICAL DEMAND	400.00	7.59
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	1.04
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	1.04
Sub total	3,060.63	58.06
Miscellaneous		
Lights	93.63	1.78
Base Utilities	0.00	0.00
Misc Equipment	140.61	2.67
Sub total	234.24	4.45
Total	7,331.07	139

YEARLY CASH FLOW

By ae

Alternative: 1
 Life Cycle Cost: 28,947,790.94

Year	Utility Cost (\$)	Maint. Cost (\$)	Interest Cost (\$)	Principal Cost (\$)	Property Taxes (\$)	Insurance Cost (\$)	Revenue Penalty (\$)	Replace. Expenses (\$)	Deprec. Tax (\$)	Cash Flow Effect (\$)	Present Value (\$)
0	0	0	0	17,826,732	0	0	0	0	0	17,826,732	17,826,732
1	1,131,174	306,000	0	0	0	0	0	0	891,337	971,472	844,758
2	1,131,174	367,200	0	0	0	0	0	0	891,337	1,020,432	771,593
3	1,131,174	440,640	0	0	0	0	0	0	891,337	1,079,184	709,581
4	1,131,174	528,768	0	0	0	0	0	0	891,337	1,149,687	657,337
5	1,131,174	634,522	0	0	0	0	0	0	891,337	1,234,289	613,660
6	1,131,174	761,426	0	0	0	0	0	0	891,337	1,335,813	577,509
7	1,131,174	913,711	0	0	0	0	0	0	891,337	1,457,641	547,981
8	1,131,174	1,096,453	0	0	0	0	0	0	891,337	1,603,835	524,296
9	1,131,174	1,315,744	0	0	0	0	0	0	891,337	1,779,267	505,779
10	1,131,174	1,578,893	0	0	0	0	0	0	891,337	1,989,786	491,845
11	1,131,174	1,894,671	0	0	0	0	0	0	891,337	2,242,409	481,991
12	1,131,174	2,273,605	0	0	0	0	0	0	891,337	2,545,556	475,783
13	1,131,174	2,728,326	0	0	0	0	0	0	891,337	2,909,333	472,848
14	1,131,174	3,273,992	0	0	0	0	0	0	891,337	3,345,866	472,867
15	1,131,174	3,928,790	0	0	0	0	0	0	891,337	3,869,704	475,565
16	1,131,174	4,714,548	0	0	0	0	0	0	891,337	4,498,311	480,711
17	1,131,174	5,657,457	0	0	0	0	0	0	891,337	5,252,638	488,106
18	1,131,174	6,788,949	0	0	0	0	0	0	891,337	6,157,831	497,584
19	1,131,174	8,146,739	0	0	0	0	0	0	891,337	7,244,063	509,006
20	1,131,174	9,776,086	0	0	0	0	0	0	891,337	8,547,541	522,257

TRACE® 700 Economic Summary

By ae

Project Information

Weather file Heathrow, England
 Project Name
 Location London, England
 Building Owner Balckfriars Investment
 User
 Company Penn State University
 Comments

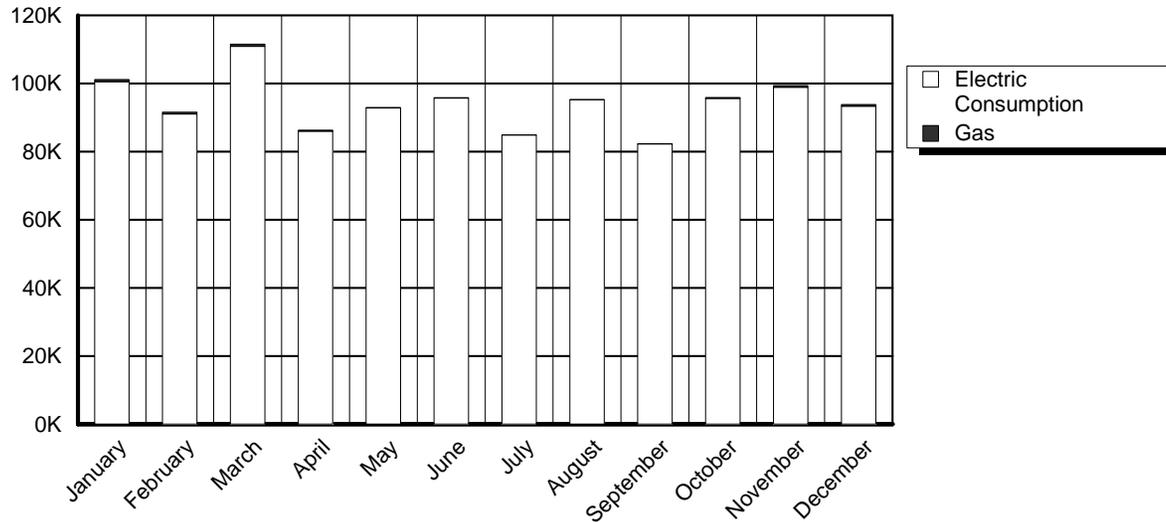
Alternative 1 - - Palestra Building

Economic Summary

Alternative Number	Installed Cost	First Year Util. Cost	Final Year Util. Cost	First Year Maint. Cost	Final Year Maint. Cost	Life Cycle Cost
1	17,436,428.00	1,131,174.34	1,131,174.34	306,000.00	9,776,086.14	28,581,917.36

Monthly Utility Costs per Utility

(1 alternative)



Equipment Energy Consumption by Alternative

	Elect Cons. (kWh)	Gas Cons. (kwh)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Alternative: 1 - Palestra Building				
Primary heating	9,914.1	1,242,134.0	8.4%	1,337,254.8
Cooling Compressor	914,194.2		6.2%	2,742,856.8
Tower/Cond Fans	122,701.5		0.8%	368,141.3
Condenser Pump	73,749.0		0.5%	221,269.0
Other CLG Accessories	908.8		0.0%	2,726.7
Supply Fans	8,652,317.0		58.3%	25,959,544.0
Circ Pumps	3,000,608.5		20.2%	9,002,725.0
Lighting	322,887.8		2.2%	968,760.1
Totals	13,608,400.0	1,242,134.0	100.0%	42,136,788.0

* Note: Resource Utilization factors are included in the Total Source Energy value.

The Palestra Building
London, England



DOAS and Gas Engine Driven Chiller Plant Energy Simulation

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 Palestra Building

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	1,134,612	1,027,392	1,259,927	961,879	1,043,115	1,080,925	928,984	1,070,529	918,740	1,077,373	1,117,477	1,048,064	12,669,017
On-Pk Demand (kW)	7,225	6,526	5,250	4,360	3,943	3,943	3,592	3,923	3,946	3,943	6,734	5,553	7,225
Gas													
On-Pk Cons. (kWh)	329,670	300,139	337,815	222,079	165,275	161,187	177,088	156,263	148,989	203,775	284,854	283,721	2,770,855
On-Pk Demand (kW)	4,068	3,166	2,998	1,675	1,114	1,143	752	671	1,092	1,522	3,330	2,705	4,068
Water													
Cons. (kL)	1,508	1,367	1,537	1,486	1,610	1,564	2,003	1,792	1,614	1,585	1,478	1,516	19,061

Building Energy Consumption = 4,982 MJ/(m2-year)
 Source Energy Consumption = 13,207 MJ/(m2-year)
 Floor Area = 11,158 m2

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (kwh)	Water Cons. (kL)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Primary heating					
Primary heating	9,914.1	1,242,134.0		8.1 %	1,337,254.8
Primary cooling					
Cooling Compressor		1,528,721.5		9.9 %	1,609,180.4
Tower/Cond Fans	122,329.8		19,060.7	0.8 %	367,026.2
Condenser Pump	27,837.3			0.2 %	83,520.2
Other CLG Accessories	14,124.0			0.1 %	42,376.1
Cooling Subtotal....	164,291.1	1,528,721.5	19,060.7	11.0 %	2,102,103.0
Auxiliary					
Supply Fans	8,652,317.0			56.0 %	25,959,544.0
Circ Pumps	3,008,486.0			19.5 %	9,026,360.0
Base Utilities				0.0 %	0.0
Aux Subtotal....	11,660,803.0			75.5 %	34,985,904.0
Lighting					
Lighting	322,887.8			2.1 %	968,760.1
Receptacle					
Receptacles	511,120.0			3.3 %	1,533,513.1
Heating plant load					
Base Utilities				0.0 %	0.0
Cogeneration					
Cogeneration				0.0 %	0.0
Totals					
Totals**	12,669,016.0	2,770,855.5	19,060.7	100.0 %	40,927,536.0

* Note: Resource Utilization factors are included in the Total Source Energy value.

** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

MONTHLY UTILITY COSTS

By ae

Alternative: 1

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Electric													
On-Pk Cons. (\$)	93,883	85,021	104,241	79,606	86,320	89,446	76,887	88,586	76,040	89,152	92,467	86,729	1,048,377
Off-Pk Cons. (\$)	101	101	101	101	101	101	101	101	101	101	101	101	1,207
Total (\$):	93,984	85,121	104,342	79,706	86,421	89,546	76,987	88,687	76,141	89,252	92,567	86,830	1,049,584
Gas													
On-Pk Cons. (\$)	1,047	953	1,073	705	525	512	562	496	473	647	905	901	8,799
Water													
On-Pk Cons. (\$)	2,185	2,126	2,197	2,176	2,228	2,209	2,394	2,305	2,230	2,218	2,172	2,189	26,630
Monthly Total (\$):	97,216	88,200	107,612	82,588	89,174	92,267	79,944	91,488	78,844	92,117	95,644	89,920	1,085,013

ELECTRICAL PEAK CHECKSUMS

By ae

Alternative: 1 Palestra Building
 Yearly Time of Peak: 9(Hr) 1(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
IC Chiller 1	16.83	0.33
IC Chiller 2	0.15	0.00
IC Chiller 3	0.15	0.00
IC Chiller 4	0.15	0.00
IC Chiller 5	0.15	0.00
Sub total	17.43	0.33
Heating Equipment		
Boiler 1	978.23	18.93
Boiler 2	978.23	18.93
Boiler 4	978.23	18.93
Boiler 3	978.23	18.93
Sub total	3,912.92	75.72
Fan Equipment		
SUMMATION OF FAN ELECTRICAL DEMAND	1,225.63	23.72
SUMMATION OF FAN ELECTRICAL DEMAND	1,325.00	25.64
SUMMATION OF FAN ELECTRICAL DEMAND	400.00	7.74
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	1.06
SUMMATION OF FAN ELECTRICAL DEMAND	55.00	1.06
Sub total	3,060.63	59.22
Miscellaneous		
Lights	93.63	1.81
Base Utilities	0.00	0.00
Misc Equipment	140.61	2.72
Sub total	234.24	4.53

ELECTRICAL PEAK CHECKSUMS

By ae

Alternative: 1 Palestra Building
Yearly Time of Peak: 9(Hr) 1(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Total	7,225.22	140

YEARLY CASH FLOW

By ae

Alternative: 1
Life Cycle Cost: 28,716,638.12

Year	Utility Cost (\$)	Maint. Cost (\$)	Interest Cost (\$)	Principal Cost (\$)	Property Taxes (\$)	Insurance Cost (\$)	Revenue Penalty (\$)	Replace. Expenses (\$)	Deprec. Tax (\$)	Cash Flow Effect (\$)	Present Value (\$)
0	0	0	0	17,826,732	0	0	0	0	0	17,826,732	17,826,732
1	1,085,013	306,000	0	0	0	0	0	0	891,337	934,543	812,646
2	1,085,013	367,200	0	0	0	0	0	0	891,337	983,503	743,669
3	1,085,013	440,640	0	0	0	0	0	0	891,337	1,042,255	685,300
4	1,085,013	528,768	0	0	0	0	0	0	891,337	1,112,757	636,223
5	1,085,013	634,522	0	0	0	0	0	0	891,337	1,197,360	595,300
6	1,085,013	761,426	0	0	0	0	0	0	891,337	1,298,884	561,543
7	1,085,013	913,711	0	0	0	0	0	0	891,337	1,420,712	534,098
8	1,085,013	1,096,453	0	0	0	0	0	0	891,337	1,566,905	512,224
9	1,085,013	1,315,744	0	0	0	0	0	0	891,337	1,742,338	495,281
10	1,085,013	1,578,893	0	0	0	0	0	0	891,337	1,952,857	482,716
11	1,085,013	1,894,671	0	0	0	0	0	0	891,337	2,205,480	474,053
12	1,085,013	2,273,605	0	0	0	0	0	0	891,337	2,508,627	468,880
13	1,085,013	2,728,326	0	0	0	0	0	0	891,337	2,872,404	466,846
14	1,085,013	3,273,992	0	0	0	0	0	0	891,337	3,308,936	467,648
15	1,085,013	3,928,790	0	0	0	0	0	0	891,337	3,832,775	471,027
16	1,085,013	4,714,548	0	0	0	0	0	0	891,337	4,461,381	476,765
17	1,085,013	5,657,457	0	0	0	0	0	0	891,337	5,215,709	484,674
18	1,085,013	6,788,949	0	0	0	0	0	0	891,337	6,120,902	494,600
19	1,085,013	8,146,739	0	0	0	0	0	0	891,337	7,207,134	506,412
20	1,085,013	9,776,086	0	0	0	0	0	0	891,337	8,510,612	520,001

TRACE® 700 Economic Summary

By ae

Project Information

Weather file Heathrow, England
 Project Name
 Location London, England
 Building Owner Balckfriars Investment
 User
 Company Penn State University
 Comments

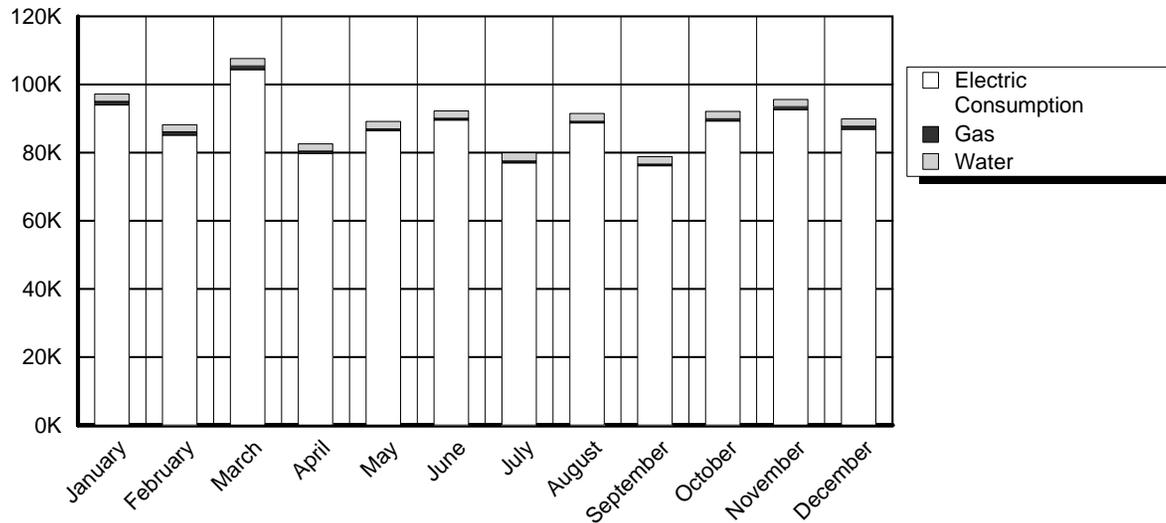
Alternative 1 - - Palestra Building

Economic Summary

Alternative Number	Installed Cost	First Year Util. Cost	Final Year Util. Cost	First Year Maint. Cost	Final Year Maint. Cost	Life Cycle Cost
1	17,722,422.00	1,085,012.70	1,085,012.70	306,000.00	9,776,086.14	28,618,857.23

Monthly Utility Costs per Utility

(1 alternative)



Equipment Energy Consumption by Alternative

	Elect Cons. (kWh)	Gas Cons. (kwh)	Water Cons. (liters)	Percent of Total Energy	Total Source Energy* (kWh/yr)
Alternative: 1 - Palestra Building					
Primary heating	9,914.1	1,242,134.0		8.1%	1,337,254.8
Cooling Compressor		1,528,721.5		9.9%	1,609,180.4
Tower/Cond Fans	122,329.8		19,060.7	0.8%	367,026.2
Condenser Pump	27,837.3			0.2%	83,520.2
Other CLG Accessories	14,124.0			0.1%	42,376.1
Supply Fans	8,652,317.0			56.0%	25,959,544.0
Circ Pumps	3,008,486.0			19.5%	9,026,360.0
Lighting	322,887.8			2.1%	968,760.1
Totals	12,669,016.0	2,770,855.5	19,060.7	100.0%	40,927,536.0

* Note: Resource Utilization factors are included in the Total Source Energy value.