Document No. 8

Integrated Resource Plan

Demand-Side Management Briefing
Appendix 2

PUBLIC VERSION

Corporate Planning Department

December 2005

NP

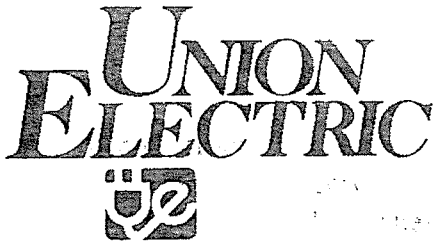
Integrated Resource Plan

Demand-Side Management Briefing

Appendix 2

1. October 1997 Demand-Side Management Briefing-AmerenUE
2. June 1995 Demand-Side Management Analyses-AmerenUE

DEMAND-SIDE MANAGEMENT BRIEFING



DEMAND-SIDE PLANNING

October 1997

Demand-Side Management Briefing

1 Overview

Union Electric has designed, implemented, and evaluated DSM pilots for all customer classes since 1993. Actual out-of-pocket DSM expenditures to date are in the $6.5 million range.

Estimates of potential capacity from DSM resources were as high as 173 MW by the year 2000 in UE's first Missouri resource plan filing in 1993. As the Company gained more experience in more pilot programs, the estimate was adjusted to 133 MW in the 1995 Illinois resource plan filing, In UE's energy resource implementation plan filing in December 1996, the estimate was reduced to 80MW.

Section 6 of this document shows that cost-effective DSM potential is even lower yet. Programs which are not cost effective have either been eliminated or scaled back to target very specialized markets.

Why? Most residential customers assign a low value to energy efficiency. For small commercial customers, their limited time is better invested in tending to their business operations. Larger customers can handle their own energy needs or they can turn to the many energy service companies ready to serve them. Industrial customers value production over energy efficiency.

Recognizing the relatively low market interest in energy conservation and anticipating retail competition in the generation business, we are rethinking how DSM can work in a competitive environment. Our vision is to offer all markets the energy information and education that they need to make energy efficiency decisions. The intent is to provide energy efficiency services at cost to customers.

Specialized market segments that we intend to serve effectively with DSM programs include:

- A small core in every customer class readily adopts conservation measures based on environmental impact. These users can be induced to make changes simply based on information they obtain from reputable sources. We will provide information and education by various means to target these customers.

- Mid-sized commercial and industrial users are under-served by the competitive market and lack the expertise to analyze their own energy situations. In general, lighting and motor upgrades are the primary cost-effective DSM measures available to these users. Unfortunately, the financial

benefits of the upgrades are marginal. These users are willing to invest in upgrades but need guidance and assurances that they are making good decisions. We will provide assessments at reasonable costs for these customers and provide guarantees of energy savings.

- There are specific conservation measures that can be promoted effectively to larger commercial and industrial customers. These measures receive only minimal promotion, or are not provided by the competitive market. They include interruptible loads, demand control and compressed air efficiency. We will continue to promote these using direct contact, educational seminars and informational assessments.

We will continue to explore ways to encourage the installation of cost-effective energy efficiency measures for low-income customers.

2 Discussion of DSM Activities

In preparation for previous filings, about 2000 demand side measures were assessed to determine whether each measure could contribute benefits to a demand-side management program. Measures that had unmanageable qualities or that had no potential economic benefits were removed from the list. The remaining measures were grouped for similarity. As an example, many measures involved upgrading insulation. We analyzed numerous scenarios having different amounts of existing insulation and different types of heat sources. In general, the analysis showed benefits by adding insulation to any building that is not well insulated. All of the insulation measures were then grouped into a single measure.

Programs were then designed to implement these measures. The programs were designed to bring together all of the measures applicable to a particular market segment or to a particular delivery mechanism. In many cases a measure is addressed in more than one program. A few measures were not included because no practical program could be created to accommodate them. In one case, a measure that did not pass measure level screening was included in a program.

We completed a detailed review of the measures identified in the 1995 filing. We also reviewed the current marketing programs to identify the measures they include. The following section of this report contains tables showing programs the measures were placed into. Report sections are also included to show measures that did not pass screening and were included in programs as well as measures that passed screening but were not included in programs.

The status of Union Electric's DSM programs will be discussed during the October, 1997 briefing. Here is a brief description of the past, current and planned programs and the status of each one:

Program Names are in Bold
Program descriptions per 1995 filing are in italics.

In Concert With the Environment
Program R1 - Residential Energy Audit and Financing Program [R1AB, R1C, R1D]
Program R2 - Residential Setback Thermostats for AC homes with Gas Heat [R2]

An energy efficiency and environmental awareness education program targeting residential customers through high schools. Financing was not

included in the program. The program showed little benefit relative to its costs and was terminated in 1996. Replaced by HABI.

Home Audits By Internet (HABI)

Program R1 - Residential Energy Audit and Financing Program [R1AB, R1C, R1D]

Program R2 - Residential Setback Thermostats for AC homes with Gas Heat [R2]

This program provides free, on-line bill dis-aggregation surveys for residential UE customers. Recently launched. Access through UE's Internet home page. Non-traditional financing database to be added around year end.

Energy Savers Plan

Program R3 - Low Income [R3AB, R3C, R3D]

This program provides free energy audits and free installation of selected measures for low-income, residential customers who partake in the UE customer assistance program.

Still in pilot phase. Over-the-phone energy surveys were canceled due to lack of use by customers. Continuing with in-home audits and installations. Looking into expanding the territory covered by the program and working with other assistance agencies.

No Sweat

Program R4 - Electric Appliance Cycling [R4A, R4B]

A residential air conditioner and water heater cycling program. Water heater cycling was not included in program due to high cost for connections. The program was not cost effective and was terminated 8/97.

Cold Cash

Program R5 - Residential Appliance Removal Program [R5A, R5B]

Program provided a cash reimbursement for old refrigerators and freezers. Program terminated in 1995 due to excessive free-ridership

Greenkey

Program R6 - Residential New Construction [R6A, R6B]

A new home energy certification program that provides rebates for specific conservation measures. Continuing with program. Over 100 homes in program and over 50 completed. The process evaluation will begin in 1998. Initial indications are that there is a high degree of free-ridership. Participation by low income builders is virtually non-existent.

Energy Service Partnership (ESP)

Program C1 -Commercial Building Audits [C1A, C1B, C1C, C3, C4]

Full service energy efficiency solutions for large commercial customers. The program costs are very high and the program essentially duplicates services already available to large commercial customers, which are provided by competitive energy service companies. The program will be terminated at the end of 1997. Marketing may continue to fund the audit program to support Marketing goals.

Business Energy Efficiency Program (BEEP)

Program C2 - Small Commercial Energy Services [C2A, C2B]

Low cost or no cost energy audits for smaller commercial customers. Do-it-yourself audits terminated earlier this year due to lack of participation. On-site audit program was recently suspended. Very low level of implementation. Will be modified to provide information and education with full cost audits made available to customers. The program will be tailored to cover only lighting, since it is the main conservation measure that is cost-effective for customers. At the same time, the program will be expanded to cover all size customers. Planning to provide a guarantee of energy savings to entice customers to implement energy efficient lighting upgrades.

Program C3 - New Construction Design Assistance

No program established. The measures associated with this program are included in the Energy Service Partnership program

Program C4 - Thermal Storage, Off Peak Cooling

No program established. On-peak vs. Off-peak rate differential are such that thermal storage is not cost-effective. The measures associated with this program are included in the Energy Service Partnership program

Industrial Process Audits

Program I1 - Customized Industrial Process Audits [I1]

Provides audits for specific industrial processes to identify process and energy use improvements. In general, implementation of measures is low. The main problem is the difficulty of obtaining personnel with process expertise greater than that of the customer. The program is being changed to cover only selected industrial processes where outside guidance is likely to be beneficial (e.g. compressed air).

Demand and Energy Management

Program I2 - Demand and Energy Control Information [I2]

Provides information and education to large commercial and industrial customers regarding fundamentals of energy management and bill reduction. The cost of the program is relatively low and the benefits have been substantial. This program will be continued for the foreseeable future.

Motor Miser

Program I3 - Energy Efficient Motors and Adjustable Speed Drives [I3A, I3B]

Promotion of energy efficient motors and adjustable speed drives for commercial and industrial customers. Program is relatively low cost and piggybacks nicely with the demand and energy management program being offered to larger industrial customers.

Interruptibles and Curtailables

Program I4 - Stand By Generation and Curtailable Power Program [I4]

This program provides special rate incentives for customers to decrease load during system peaks and periods of high electric cost. Total interruptible demand attributable to the pilot decreased from 13 MW in 1995 to 4 MW in 1997. It appears that customers are only willing to participate when production levels are down.

3 Demand-Side Measures Included In Past, Current And Planned Marketing Programs

RESIDENTIAL

Measure Description	DSM Program Name
High Efficiency Central AC	Greenkey HABI
Service Central AC or heat pump	Energy Plus Energy Savers Plan HABI
AC and heat pump cycling	No Sweat
Shading of AC	Energy Plus Greenkey HABI
Conversion to high efficiency heat pump from electric resistance.	HABI
Setback thermostat	Greenkey HABI
Weatherization	Energy Plus Energy Savers Plan Greenkey
Insulation	Energy Plus Energy Savers Plan Greenkey HABI
Multi-pane windows in new construction	Greenkey
Low emissivity windows in new construction	Greenkey
Air sealing and duct leakage control	Energy Plus Energy Savers Plan Greenkey
Compact Fluorescent Lamps	Energy Plus Energy Savers Plan Greenkey HABI
Low flow faucet aerators	Energy Plus Energy Savers Plan Greenkey HABI

Low flow showerheads	Energy Plus Energy Savers Plan Greenkey HABI
Hot water pipe insulation	Energy Plus Energy Savers Plan Greenkey HABI
Water heater tank wrap	Energy Plus Energy Savers Plan HABI
High efficiency water heater (new construction)	Greenkey
Removal of secondary refrigerator or freezer	Cold Cash HABI

COMMERCIAL

Measure Description	DSM Program Name
High efficiency chillers	ESP
Outside air economizers	ESP
Hydronic economizers	ESP
Cooling tower fans, variable or two speed	ESP
Chilled water reset	ESP
Thermal energy storage	ESP
Condenser coil cleaning	ESP BEEP
High efficiency heat pump	ESP BEEP
Adjustable speed drives	Motor Miser ESP
Variable air volume systems	ESP
High efficiency HVAC motors	Motor Miser ESP
HVAC timers	ESP
Ceiling and wall insulation	BEEP ESP
Specular Reflectors	BEEP ESP
Delamping	BEEP ESP
Halogen lamps	BEEP ESP
T8 lamps and electronic ballasts	BEEP ESP
Compact fluorescent lamps	BEEP ESP
Outdoor HPS lamps	BEEP ESP
Occupancy sensors	BEEP ESP
Ellipsoidal lamps	BEEP ESP
LED exit signs	BEEP ESP
Lighting timers	BEEP ESP

Photocells	BEEP ESP
High efficiency water heaters	BEEP ESP
Water heat from HVAC de-superheaters	ESP
High efficiency elevator motors	Motor Miser ESP
Efficient refrigerated case lighting	BEEP ESP
Refrigeration condenser coil cleaning	BEEP

INDUSTRIAL

Measure Description	DSM Program Name
Halogen lamps	D&E Management
Electronic Ballasts	D&E Management
Low wattage T12 lamps	D&E Management
T8 lamps	D&E Management
HID lamps	D&E Management
Delamping	D&E Management
Daylighting controls	D&E Management
Efficient motors	D&E Management Motor Miser Process Audit
Adjustable speed drives	D&E Management Motor Miser Process Audit
High efficiency chillers	Process Audit
Refrigerator strip curtains	Process Audit
High efficiency refrigeration compressors	Process Audit
Parallel refrigerant compressors	Process Audit
Floating head refrigerant pressure controls	Process Audit
Refrigerant screw compressors	Process Audit
Compressed air piping	Process Audit
High efficiency air compressors	Process Audit
Compressed air controls	Process Audit
Time of use rates	Rider G and interruptible rates

4 Items Failing Measure Screening That Were Included In Programs.

Our review only identified one item that failed measure screening that was included in a program. Air conditioner and heat pump maintenance did not pass measure level screening for either residential or commercial customers. The BEEP program and HABI survey recommend periodic maintenance. Also, information brochures and literature distributed to customers by UE promote such maintenance. Our experience is that this maintenance increases the longevity of the equipment considerably. This factor was not considered in the measure level screening and would likely show the maintenance to be beneficial.

5 Items Passing Measure Screening That Were Not Included In Programs.

The following measures were not included into programs. An explanation is provided with each item.

MEASURE DESCRIPTION	REASON FOR EXCLUSION
Add storm window to single pane windows	The shrink-to-fit plastic window covers included in Weatherization are a financially better investment. This is also a largely saturated market since storm windows have been around for decades.
Air to Air heat exchangers	Only marginal benefit. Lack of retail infrastructure. Lack of vendor knowledge. Problems with some suppliers or equipment.
Water heater cycling, residential	Originally explored along with AC cycling. Costs for connecting controls too high.
High efficiency water heater replacement	For existing installations a tank insulation wrap is a more economical alternative. Federal laws now require minimum efficiency standards for new water heaters. Costs for high efficiency water heaters has dropped to where they are now considered standard.
High efficiency pool or spa pump	Market niche is too small to approach effectively. Low potential for significant demand reduction.
Thermal storage heating (multi-family)	Only marginal benefit due to low time-of-day system cost differentials. Lack of retail infrastructure. Lack of vendor knowledge. Problems with some suppliers or equipment.

Glass doors on refrigerated cases	Already highly promoted by the competitive energy service market. Free ridership would be high.
Low emissivity windows or film, new construction, commercial and industrial	Now considered a standard design specification. Free ridership would be near 100%.
Multi pane windows, new construction, commercial and industrial	Now considered a standard design specification. Free ridership would be near 100%.
Energy efficient desktop computers	The Energy Star standard is universally accepted by manufacturers. Turnover and replacement of PCs with energy efficient models will occur naturally and will not be hastened by utility intervention. Free ridership would be near 100%.
Window films for existing restaurants	Already strongly promoted by the competitive energy service market. Free ridership would be high.
Refrigerant desuperheaters for restaurant hot water	Upgrading to a high efficiency water heater is a financially better investment.
High efficiency evaporator fan motors for commercial refrigeration	Already highly promoted by the competitive energy service market. Now a standard maintenance retrofit. Free ridership would be high.
Convection ovens, commercial restaurants	Already included in UE's food service program.
Solid state oven controls, commercial restaurants	Already included in UE's food service program.
High efficiency fryers, commercial restaurants	Already included in UE's food service program.
High efficiency refrigeration compressors, commercial refrigeration	Already highly promoted by the competitive energy services market. Free ridership would be high.
Refrigeration mechanical subcooling, commercial refrigeration	Already highly promoted by the competitive energy services market. Free ridership would be high.
Ambient subcooling of refrigerant	Mechanical subcooling is an even better option.

Space heating with recovered refrigerant heat	Already highly promoted by the competitive energy services market. Market already saturated where this is can be applied.
Anti-sweat controls for refrigerated case doors	Already highly promoted by the competitive energy services market. This promotion just starting, but financial incentive for customers is high. We predict this market will be saturated in 2 few years. These are now standard specification for new doors. Free ridership would be near 100%.
Heat pipes,	Very few practical applications.
Copier timers, commercial	The Energy Star standard is universally accepted by manufacturers. Turnover and replacement of Copiers with energy efficient models will occur naturally and will not be hastened by utility intervention.
Replace desktop computers with laptops	Aspects of functionality and cost are paramount in determining choice of a PC.
Back up generation	Use of backup generation for demand reduction is only sensible in applications where the backup generation already exists or is needed for another reason. Locations with existing generation are covered under the ESP program.
Real time pricing	The rate design case is pending.

6 Demand And Energy Impact Of Current And Planned Demand-Side Programs And Marketing Programs Containing Demand Side Measures

Notes: Actual Impact numbers show the date of impact study. Projection numbers are based on those provided in the 6/95 filing except canceled programs show projection of zero. Projection numbers used are from the base case.

PROGRAM NAME	PROJECTED IMPACT MW IN 2000	PROJECTED IMPACT MWH IN 2000	ACTUAL IMPACT MW	ACTUAL IMPACT MWH
In Concert With the Environment (ICWE) (Replaced by) Home Audits By Internet (HABI) R1AB, R1C, R1D, R2	0.7	2500	ICWE impact was not Measurable. HABI is new.	ICWE impact was not Measurable. HABI is new.
Energy Savers Plan R3AB, R3C, R3D	0.1	1700	New Program	New Program
No Sweat (Canceled) R4A, R4B	0	0	0	0
Cold Cash (Canceled) R5A, R5B	0	0	0.1 (6/93)	400 (6/93)
Greenkey R6A, R6B	0.9	8700	Not evaluated.	Not evaluated
Energy Service Partnership (ESP) (Canceled) C1A, C1B, C1C, C3, C4	0	0	3.1 (9/97)	17000 (9/97)
Business Energy Efficiency Program (BEEP) C2A, C2B	5.1	22800	0.2 (7/97)	1500 (7/97)
Industrial Process Audits I1	3.6	9600	3.0 (9/97)	Not evaluated
Demand and Energy Management I2	5.6	4600	52.7 (9/97), Laclede = 48	Not evaluated
Motor Miser I3A, I3B	0.4	2700	Not evaluated	Not evaluated
Interruptibles and curtailables I4	37.9	2000	3.0 (9/97)	115 (9/97)
Total	54.3	54600	62.1 (confirmed)	19000

Note: Total does not match previous filing because mix of programs has changed.

DEMAND-SIDE MANAGEMENT ANALYSIS - APPENDICES

UNION ELECTRIC

DEMAND SIDE PLANNING

June 1995

LIST OF APPENDICES

APPENDIX A

RESIDENTIAL SECTOR MLSA RESULTS

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback In Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
Prototype Baseline Levels																			
SF Elect Furnace w/ CAC		11,268	2,565																
SF Elect Heat Pump		7,030	3,037																
SF Elect Baseboard w/ RAC		11,089	1,503																
SF Gas w/ CAC (35+ yrs old)		449	2,355																
SF Gas w/ CAC (< 35 yrs old)		508	2,482																
SF Gas w/ RAC		382	1,495																
1. High Efficiency CAC																	0.12	0.09	65.12
SF Elect Resist w/ CAC																			
SEER 10 (Baseline)	Existing	11,268	2,258	-	0.24	-	-	-	-	9	4	170	124	12	$ 1,650		0.79	0.59	9.88
SEER 11.5	SEER 10	11,268	1,963	-	0.23	-	-	-	-	9	4	162	119	12	$ 240	$ 240	0.59	0.44	13.08
SEER 12.5	SEER 11.5	11,268	1,805	-	0.12	-	-	-	-	5	2	87	63	12	$ 170	$ 170			
SF Gas w/ CAC (35+ yrs old)																	0.08	0.06	94.52
SEER 10 (Baseline)	Existing	449	2,143	-	0.17	-	-	-	-	7	3	117	85	12	$ 1,650		0.77	0.58	10.43
SEER 11.5	SEER 10	449	1,864	-	0.23	-	-	-	-	10	3	154	112	12	$ 240	$ 240	0.58	0.44	13.90
SEER 12.5	SEER 11.5	449	1,715	-	0.12	-	-	-	-	5	2	82	60	12	$ 170	$ 170			
SF Gas w/ CAC (< 35 yrs old)																	0.06	0.04	134.58
SEER 10 (Baseline)	Existing	508	2,333	-	0.12	-	-	-	-	4	2	83	59	12	$ 1,650		0.82	0.62	9.54
SEER 11.5	SEER 10	508	2,028	-	0.24	-	-	-	-	10	3	171	121	12	$ 240	$ 240	0.62	0.46	12.74
SEER 12.5	SEER 11.5	508	1,867	-	0.13	-	-	-	-	4	2	91	64	12	$ 170	$ 170			
2. High Efficiency RAC																			
SF Elect Baseboard w/ RAC																	0.30	0.23	26.80
EER 8.5	Existing	11,089	1,289	-	0.19	-	-	-	-	4	3	110	97	11	$ 475		0.73	0.56	10.92
EER 10.0	EER 8.5	11,089	1,097	-	0.18	-	-	-	-	3	2	100	88	11	$ 175	$ 175			
SF Gas w/ RAC																	0.19	0.14	40.77
EER 8.5	Existing	382	1,354	-	0.12	-	-	-	-	2	3	73	62	11	$ 475		0.74	0.56	10.40
EER 10.0	EER 8.5	382	1,151	-	0.17	-	-	-	-	4	3	105	91	11	$ 175	$ 175			
3. Heat Pump Conversion																			
SF Elect Resist w/ CAC																			
SEER 10.0 & Res Furn (2.0 ton baseline)		11,268	2,258	-	0.24	-	-	-	-	9	4	170	124	12					
Std Air Source HP (2.5 ton)	SEER 10.0 & Resist Furn	5,237	2,258	(0.77)	-	2,454	2,676	334	568	-	-	-	-	15	$ 701	$ 701	2.75	1.21	2.87
High Efficiency Air Source HP	Std Air Source HP	3,954	1,805	1.84	0.35	2,918	3,134	507	756	15	6	249	183	15	$ 533	$ 533	6.49	3.86	1.60
Ground Source Heat Pump	High Eff Air Source HP	4,827	1,737	2.39	0.05	238	309	78	64	2	-	38	28	20	$ 2,500	$ 2,500	0.44	0.38	74.55
Water Source Heat Pump	High Eff Air Source HP	4,438	2,053	4.07	(0.19)	369	501	116	90	(8)	(4)	(137)	(99)	20	$ 2,500	$ 2,500	0.61	0.54	107.69
Water Source Heat Pump	Ground Source HP	4,438	2,053	1.67	(0.24)	131	192	40	26	(10)	(4)	(175)	(127)						
4. High Efficiency Heat Pump																			
SF Elect Heat Pump																	0.11	0.06	57.74
Std Air Source Heat Pump	Existing (2.5 ton)	6,727	2,582	(0.41)	0.37	143	174	(25)	12	13	5	258	178	15	$ 2,875		1.65	1.06	5.81
High Efficiency Air Source HP	Std Air Source HP	5,513	2,066	0.21	0.42	461	483	119	150	15	5	293	203	15	$ 533	$ 533	0.52	0.45	67.82
Ground Source Heat Pump	High Eff Air Source HP	5,023	1,986	2.90	0.06	255	335	87	72	2	-	44	32	20	$ 2,500	$ 2,500	0.73	0.66	102.14
Water Source Heat Pump	High Eff Air Source HP	4,591	2,347	4.98	(0.23)	401	546	133	102	(8)	(3)	(160)	(111)	20	$ 2,500	$ 2,500			
Water Source Heat Pump	Ground Source HP	4,591	2,347	2.08	(0.29)	146	211	45	30	(11)	(3)	(204)	(143)						
5. Duel Fuel Heat Pump																			
SF Elect Resist w/ CAC																			
SEER 10.0 & Res Furn (2.0 ton baseline)		11,268	2,258	-	0.24	-	-	-	-	9	4	170	124	12					
Duel Fuel Heat Pump (2.5 ton)	SEER 10.0 & Resist Furn	5,237	2,258	5.88	-	2,454	2,676	334	568	-	-	-	-	15	$ 1,076	$ 1,076	3.53	2.53	4.41

UNION ELECTRIC COMPANY

RESIDENTIAL SECTOR - ECONOMIC SCREENING

SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
6. Exterior Shading for CAC/HP Cooling																			
SF Elect Resist w/ CAC		11,268	2,461	-	0.07	-	-	-	-	10	1	55	37	6	$ 1,006	$ 1,006	0.04	0.03	121.80
SF Elect Heat Pump		7,030	2,928	-	0.04	-	-	-	-	15	2	52	40	6	$ 1,053	$ 1,053	0.03	0.02	125.40
SF Gas w/ CAC (35+ yrs old)		449	2,270	-	0.07	-	-	-	-	7	1	38	39	6	$ 908	$ 908	0.04	0.03	132.99
SF Gas w/ CAC (< 35 yrs old)		508	2,291	-	0.19	-	-	-	-	16	2	121	51	6	$ 968	$ 968	0.09	0.07	63.42
7. Exterior Shading for RAC																			
SF Elect Baseboard w/ RAC		11,089	1,398	-	0.12	-	-	-	-	3	(1)	61	42	6	$ 800	$ 800	0.07	0.05	91.28
SF Gas w/ RAC		382	1,432	-	0.04	-	-	-	-	4	6	27	26	6	$ 972	$ 972	0.02	0.02	201.23
8. Window Treatment for CAC																			
SF Elect Resist w/ CAC		11,973	2,266	0.02	0.10	(398)	(111)	(136)	(61)	25	7	169	98	8	$ 321	$ 321	-0.23	-0.08	-68.03
SF Elect Heat Pump		7,329	2,665	0.09	0.13	(129)	(54)	(88)	(27)	30	8	228	106	8	$ 336	$ 336	0.21	0.19	19.10
SF Gas w/ CAC (35+ yrs old)		470	2,127	0.00	0.10	(12)	(3)	(4)	(1)	21	5	126	75	8	$ 290	$ 290	0.30	0.21	16.85
SF Gas w/ CAC (< 35 yrs old)		537	2,118	0.00	0.22	(17)	(5)	(6)	(2)	26	5	230	103	8	$ 309	$ 309	0.50	0.36	10.98
9. Window Treatment for RAC																			
SF Elect Baseboard w/ RAC		11,627	1,272	0.01	0.13	(290)	(85)	(116)	(48)	6	4	139	82	8	$ 255	$ 255	-0.17	-0.02	-94.31
SF Gas w/ RAC		397	1,296	-	0.06	(9)	(1)	(3)	(1)	10	10	109	69	8	$ 310	$ 310	0.21	0.13	20.31
10. Light Colored Roof for CAC																			
SF Elect Resist w/ CAC		11,441	2,475	(0.01)	0.04	(69)	(51)	(25)	(28)	4	3	44	39	15	$ 1,191	$ 1,191	-0.02	0.00	3846.29
SF Elect Heat Pump		7,124	2,907	(0.02)	0.05	(31)	(23)	(19)	(21)	6	3	66	55	15	$ 1,556	$ 1,556	0.02	0.01	230.71
SF Gas w/ CAC (35+ yrs old)		464	2,214	(0.00)	0.05	(6)	(4)	(3)	(3)	10	8	57	66	15	$ 1,126	$ 1,126	0.06	0.04	107.42
SF Gas w/ CAC (< 35 yrs old)		515	2,394	(0.00)	0.03	(3)	(2)	(2)	(2)	6	1	43	37	15	$ 1,318	$ 1,318	0.03	0.02	194.97
11. Light Colored Roof for RAC																			
SF Elect Resist w/ RAC		11,309	1,413	(0.00)	0.02	(65)	(65)	(35)	(35)	3	3	45	38	15	$ 1,369	$ 1,369	-0.03	-0.01	-852.53
SF Gas w/ RAC		390	1,413	-	0.02	(2)	(2)	(1)	(2)	5	3	33	41	15	$ 1,086	$ 1,086	0.03	0.02	175.34
12. Increased Attic Ventilation																			
SF Elect Resist w/ CAC														30					
Poor Ventilation (existing)		11,268	2,565	-	-	-	-	-	-	-	-	-	-	30	$ 123	$ -	0.52	0.40	21.95
Natural Ventilation	Existing	11,280	2,498	-	0.06	-	-	-	-	2	-	40	25	30	$ 290	$ 290	0.10	0.05	47.46
Power Ventilation	Natural Ventilation	11,312	2,419	-	-	-	-	-	-	7	5	26	40	15					
SF Elect Heat Pump														30					
Poor Ventilation (existing)		7,030	3,037	-	-	-	-	-	-	-	-	-	-	30	$ 161	$ -	0.54	0.41	22.66
Natural Ventilation	Existing	7,038	2,950	-	0.08	-	-	-	-	4	1	56	26	30	$ 290	$ 290	0.14	0.07	30.25
Power Ventilation	Natural Ventilation	7,061	2,830	-	-	-	-	-	-	8	3	46	62	15					
SF Elect Baseboard w/ RAC														30					
Poor Ventilation (existing)		11,089	1,503	-	-	-	-	-	-	-	-	-	-	30	$ 142	$ -	0.27	0.20	37.63
Natural Ventilation	Existing	11,104	1,457	-	0.03	-	-	-	-	1	-	24	20	30	$ 290	$ 290	0.12	0.06	34.56
Power Ventilation	Natural Ventilation	11,144	1,355	-	-	-	-	-	-	3	4	50	46	15					
SF Gas w/ CAC (35+ yrs old)														30					
Poor Ventilation (existing)		449	2,355	-	-	-	-	-	-	-	-	-	-	30	$ 116	$ -	0.58	0.42	17.08
Natural Ventilation	Existing	450	2,272	-	0.05	-	-	-	-	3	2	45	33	30	$ 290	$ 290	0.23	0.13	24.76
Power Ventilation	Natural Ventilation	453	2,123	-	0.03	-	-	-	-	13	6	54	76	15					
SF Gas w/ CAC (< 35 yrs old)														30					
Poor Ventilation (existing)		508	2,482	-	-	-	-	-	-	-	-	-	-	30	$ 136	$ -	0.57	0.44	20.96
Natural Ventilation	Existing	508	2,403	-	0.07	-	-	-	-	4	-	52	22	30	$ 290	$ 290	0.04	0.00	59.61
Power Ventilation	Natural Ventilation	509	2,343	-	(0.02)	-	-	-	-	3	1	16	40	15					
SF Gas w/ RAC														30					
Poor Ventilation (existing)		382	1,495	-	-	-	-	-	-	-	-	-	-	30	$ 112	$ -	0.24	0.17	36.26
Natural Ventilation	Existing	383	1,457	-	0.02	-	-	-	-	2	-	19	17	30	$ 290	$ 290	0.15	0.08	38.68
Power Ventilation	Natural Ventilation	384	1,361	-	0.02	-	-	-	-	5	9	37	46	15					

UNION ELECTRIC COMPANY

RESIDENTIAL SECTOR - ECONOMIC SCREENING

SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
13. Duct Repair																			
SF Elect Resist w/ CAC		10,267	2,472	0.47	(0.03)	396	425	75	106	2	3	15	74	25	$ 300	$ 300	2.03	1.24	6.23
SF Elect Heat Pump		6,682	2,934	0.33	(0.07)	125	121	52	51	2	2	15	84	25	$ 300	$ 300	0.89	0.56	13.28
SF Gas w/ CAC (35+ yrs old)		410	2,283	0.02	(0.02)	15	17	3	4	3	2	7	60	25	$ 300	$ 300	0.14	0.05	40.72
SF Gas w/ CAC (< 35 yrs old)		465	2,391	0.02	(0.06)	17	18	3	5	2	2	15	72	25	$ 300	$ 300	0.09	-0.01	32.54
14. Duct Insulation																			
SF Elect Resist w/ CAC	Duct Repair	9,483	2,403	0.30	(0.00)	292	312	76	104	3	2	24	39	25	$ 350	$ 350	1.34	0.81	9.39
SF Elect Heat Pump	Duct Repair	6,459	2,850	1.34	(0.00)	73	68	44	37	3	1	42	38	25	$ 350	$ 350	1.69	1.49	22.05
SF Gas w/ CAC (35+ yrs old)	Duct Repair	378	2,216	0.01	(0.00)	12	12	3	4	2	3	32	30	25	$ 350	$ 350	0.13	0.07	51.79
SF Gas w/ CAC (< 35 yrs old)	Duct Repair	423	2,334	0.02	(0.03)	15	15	5	6	2	-	16	36	25	$ 350	$ 350	0.08	0.02	55.01
15a. Setback Electronic Thermostat - Existing																			
SF Elect Resist w/ CAC		9,639	2,250	(1.52)	(0.01)	187	1,078	39	325	24	6	256	29	12	$ 85		2.52	-1.24	0.93
SF Elect Heat Pump		5,893	2,642	(1.06)	(0.02)	219	586	74	259	40	5	339	11	12	$ 150		1.41	-0.27	1.94
SF Elect Baseboard w/ RAC		9,349	1,334	(0.28)	(0.00)	287	1,079	56	318	6	2	128	33	12	$ 85		6.11	2.42	1.01
SF Gas w/ CAC (35+ yrs old)		384	2,050	(0.04)	(0.01)	8	41	1	14	33	5	237	29	12	$ 85		1.25	0.55	3.19
SF Gas w/ CAC (< 35 yrs old)		437	2,161	(0.05)	(0.01)	6	48	2	15	30	5	271	15	12	$ 85		1.28	0.54	3.00
15b. Setback Electronic Thermostat - New																			
SF Elect Resist w/ CAC		9,639	2,250	(1.52)	(0.01)	187	1,078	39	325	24	6	256	29	12		$ 47	4.55	-2.25	0.52
SF Elect Heat Pump		5,893	2,642	(1.06)	(0.02)	219	586	74	259	40	5	339	11	12		$ 112	1.89	-0.35	1.45
SF Elect Baseboard w/ RAC		9,349	1,334	(0.28)	(0.00)	287	1,079	56	318	6	2	128	33	12		$ 47	11.05	4.38	0.56
SF Gas w/ CAC (< 35 yrs old)		437	2,161	(0.05)	(0.01)	6	48	2	15	30	5	271	15	12		$ 47	2.31	0.97	1.66
16. Ceiling Insulation																			
SF Elect Resist w/ CAC																			
R-0 Ceiling Insulation (baseline)		20,089	3,129	-	-	-	-	-	-	-	-	-	-	35	$ 576	$ 576	10.14	6.48	1.49
Add R-19 to R-0	R-0 Insulation	11,609	2,590	4.20	0.21	3,186	3,297	824	1,174	32	24	235	248	35	$ 576	$ 576	0.96	0.60	15.26
Add R-19 to R-19 (R-38 total)	R-19 Insulation	10,795	2,531	0.37	0.02	306	324	73	111	2	2	29	26	35	$ 576	$ 576			
SF Elect Heat Pump																			
R-0 Ceiling Insulation (baseline)		9,193	3,887	-	-	-	-	-	-	-	-	-	-	35	$ 753	$ 753	5.79	4.89	5.07
Add R-19 to R-0	R-0 Insulation	7,140	3,079	7.80	0.29	634	571	405	442	38	27	353	391	35	$ 753	$ 753	0.54	0.41	35.97
Add R-19 to R-19 (R-38 total)	R-19 Insulation	6,852	2,964	0.54	0.03	92	90	47	58	6	2	54	53	35	$ 753	$ 753			
SF Elect Baseboard w/ RAC																			
R-0 Ceiling Insulation (baseline)		18,901	1,875	-	-	-	-	-	-	-	-	-	-	35	$ 662	$ 662	5.93	3.16	2.01
Add R-19 to R-0	R-0 Insulation	11,451	1,522	0.71	0.01	2,610	2,754	938	1,148	15	26	132	180	35	$ 662	$ 662	0.75	0.41	16.02
Add R-19 to R-19 (R-38 total)	R-19 Insulation	10,542	1,467	0.12	0.01	333	363	87	127	1	1	27	28	35	$ 662	$ 662			
SF Gas w/ CAC (35+ yrs old)																			
R-0 Ceiling Insulation (baseline)		699	2,780	-	-	-	-	-	-	-	-	-	-	35	$ 545	$ 545	0.97	0.62	10.51
Add R-19 to R-0	R-0 Insulation	409	2,276	0.13	0.19	109	112	29	40	28	26	208	241	35	$ 545	$ 545	0.10	0.06	101.73
Add R-19 to R-19 (R-38 total)	R-19 Insulation	381	2,224	0.01	0.02	11	11	1	4	1	2	20	29	35	$ 545	$ 545			
SF Gas w/ CAC (< 35 yrs old)																			
R-0 Ceiling Insulation (baseline)		928	3,001	-	-	-	-	-	-	-	-	-	-	35	$ 638	$ 638	0.80	0.48	11.83
Add R-19 to R-0	R-0 Insulation	531	2,528	0.15	0.09	147	153	40	57	24	25	184	242	35	$ 638	$ 638	0.11	0.07	82.08
Add R-19 to R-19 (R-38 total)	R-19 Insulation	492	2,453	0.01	0.02	14	15	3	6	3	(1)	36	36	35	$ 638	$ 638			
SF Gas w/ RAC																			
R-0 Ceiling Insulation (baseline)		549	1,722	-	-	-	-	-	-	-	-	-	-	35	$ 525	$ 525	0.38	0.19	20.25
Add R-19 to R-0	R-0 Insulation	373	1,485	0.02	0.00	62	64	22	28	15	13	92	118	35	$ 525	$ 525	0.07	0.04	134.86
Add R-19 to R-19 (R-38 total)	R-19 Insulation	351	1,447	0.00	0.01	8	9	2	3	2	2	14	20	35	$ 525	$ 525			

UNION ELECTRIC COMPANY

RESIDENTIAL SECTOR - ECONOMIC SCREENING

SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
17a. Wall Insulation (2x4) - Existing																			
SF Elect Resist w/ CAC																			
R-0 Wall (2x4) Baseline		15,924	2,709	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	10,846	2,558	3.03	0.09	1,783	2,014	511	770	15	2	89	45	35	$ 885		4.06	2.67	4.07
SF Elect Heat Pump																			
R-0 Wall (2x4) Baseline		8,082	3,232	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	6,934	3,028	3.49	0.10	312	331	227	278	15	-	117	72	35	$ 952		2.08	1.74	15.12
SF Elect Baseboard w/ RAC																			
R-0 Wall (2x4) Baseline		14,633	1,508	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	10,431	1,492	0.51	(0.04)	1,403	1,641	477	681	4	7	5	1	35	$ 893		2.39	1.28	5.23
SF Gas w/ CAC (35+ yrs old)																			
R-0 Wall (2x4) Baseline		557	2,441	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	403	2,319	0.06	0.07	54	61	15	23	13	4	72	33	35	$ 806		0.24	0.16	51.09
SF Gas w/ CAC (< 35 yrs old)																			
R-0 Wall (2x4) Baseline		704	2,548	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	488	2,468	0.08	(0.03)	75	86	21	34	12	3	27	38	35	$ 903		0.17	0.09	60.79
SF Gas w/ RAC																			
R-0 Wall (2x4) Baseline		470	1,527	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	349	1,483	0.01	0.04	41	46	14	20	6	4	37	(2)	35	$ 830		0.13	0.08	100.89
17b. Wall Insulation (2x4) - New																			
SF Elect Resist w/ CAC																			
R-0 Wall (2x4) Baseline		15,924	2,709	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	10,846	2,558	3.03	0.09	1,783	2,014	511	770	15	2	89	45	35		$ 281	12.77	8.42	1.29
SF Elect Heat Pump																			
R-0 Wall (2x4) Baseline		8,082	3,232	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	6,934	3,028	3.49	0.10	312	331	227	278	15	-	117	72	35		$ 303	6.53	5.47	4.81
SF Elect Baseboard w/ RAC																			
R-0 Wall (2x4) Baseline		14,633	1,508	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	10,431	1,492	0.51	(0.04)	1,403	1,641	477	681	4	7	5	1	35		$ 284	7.52	4.02	1.66
SF Gas w/ CAC (35+ yrs old)																			
R-0 Wall (2x4) Baseline		557	2,441	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	403	2,319	0.06	0.07	54	61	15	23	13	4	72	33	35		$ 256	0.77	0.52	16.23
SF Gas w/ CAC (< 35 yrs old)																			
R-0 Wall (2x4) Baseline		704	2,548	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	488	2,468	0.08	(0.03)	75	86	21	34	12	3	27	38	35		$ 287	0.52	0.28	19.32
SF Gas w/ RAC																			
R-0 Wall (2x4) Baseline		470	1,527	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 insulation	349	1,483	0.01	0.04	41	46	14	20	6	4	37	(2)	35		$ 264	0.40	0.25	32.09

UNION ELECTRIC COMPANY

RESIDENTIAL SECTOR - ECONOMIC SCREENING

SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life (Years)	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback In Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling		Existing	New	w/Envir Cost	Utility	
18a. Wall Insulation (2x6) - Existing																			
SF Elect Resist w/ CAC																			
R-0 Wall (2x6) Baseline		15,924	2,709	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	10,204	2,535	3.39	0.11	2,005	2,275	573	867	17	3	107	47	35	$ 947		4.26	2.81	3.86
SF Elect Heat Pump																			
R-0 Wall (2x6) Baseline		8,082	3,232	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	6,755	2,985	3.89	0.12	362	388	258	318	18	-	141	88	35	$ 1,020		2.19	1.83	13.84
SF Elect Baseboard w/ RAC																			
R-0 Wall (2x6) Baseline		14,633	1,508	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	9,854	1,477	0.53	(0.03)	1,599	1,876	533	769	4	6	14	8	35	$ 956		2.53	1.35	4.89
SF Gas w/ CAC (35+ yrs old)																			
R-0 Wall (2x6) Baseline		557	2,441	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	383	2,303	0.07	0.09	61	69	18	26	15	5	81	37	35	$ 862		0.26	0.18	48.42
SF Gas w/ CAC (< 35 yrs old)																			
R-0 Wall (2x6) Baseline		704	2,548	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	458	2,439	0.09	(0.02)	84	98	25	38	15	3	43	48	35	$ 967		0.19	0.11	52.76
SF Gas w/ RAC																			
R-0 Wall (2x6) Baseline		470	1,527	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	332	1,522	0.01	(0.03)	46	53	17	23	7	4	8	(14)	35	$ 888		0.06	0.02	159.91
18b. Wall Insulation (2x6) - New																			
SF Elect Resist w/ CAC																			
R-0 Wall (2x6) Baseline		15,924	2,709	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	10,204	2,535	3.39	0.11	2,005	2,275	573	867	17	3	107	47	35		$ 354	11.41	7.51	1.44
SF Elect Heat Pump																			
R-0 Wall (2x6) Baseline		8,082	3,232	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	6,755	2,985	3.89	0.12	362	388	258	318	18	-	141	88	35		$ 381	5.87	4.89	5.17
SF Elect Baseboard w/ RAC																			
R-0 Wall (2x6) Baseline		14,633	1,508	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	9,854	1,477	0.53	(0.03)	1,599	1,876	533	769	4	6	14	8	35		$ 357	6.78	3.62	1.83
SF Gas w/ CAC (35+ yrs old)																			
R-0 Wall (2x6) Baseline		557	2,441	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	383	2,303	0.07	0.09	61	69	18	26	15	5	81	37	35		$ 322	0.70	0.47	18.09
SF Gas w/ CAC (< 35 yrs old)																			
R-0 Wall (2x6) Baseline		704	2,548	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	458	2,439	0.09	(0.02)	84	98	25	38	15	3	43	48	35		$ 361	0.52	0.29	19.70
SF Gas w/ RAC																			
R-0 Wall (2x6) Baseline		470	1,527	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	332	1,522	0.01	(0.03)	46	53	17	23	7	4	8	(14)	35		$ 332	0.17	0.06	59.79

UNION ELECTRIC COMPANY

RESIDENTIAL SECTOR - ECONOMIC SCREENING

SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
19. Door Upgrades																			
SF Elect Resist w/ CAC	w/o Storm Door	10,875	2,556	0.28	0.01	144	156	39	54	-	1	5	3	20	$ 810	$ 810	0.32	0.21	48.66
SF Elect Heat Pump	w/o Storm Door	6,924	3,019	0.34	0.01	32	32	21	22	2	-	11	4	20	$ 810	$ 810	0.20	0.17	143.51
SF Elect Baseboard w/ RAC	w/o Storm Door	10,740	1,499	0.10	0.00	123	139	36	50	-	-	3	1	20	$ 810	$ 810	0.22	0.13	56.12
20. Window Upgrades																			
SF Elect Resist w/ CAC														30					
Single Pane (baseline)		13,804	2,600	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	10,648	2,510	2.20	0.06	1,147	1,257	308	445	7	2	54	26	30	$ 1,847		1.24	0.84	13.70
Double Pane	Single Pane	10,648	2,510	2.20	0.06	1,147	1,257	308	445	7	2	54	26	30		$ 233	9.80	6.63	1.73
Triple Pane	Double Pane	9,887	2,502	0.44	0.01	276	300	76	109	1	1	7	(1)	30	NA	$ 389	1.32	0.87	12.39
Double Pane Low-E	Triple Pane	9,767	2,492	0.08	(0.01)	38	52	10	20	-	-	6	4	30	NA	$ 389	0.21	0.13	67.93
SF Elect Heat Pump														30					
Single Pane (baseline)		7,562	3,092	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	6,752	2,944	2.67	0.06	237	248	151	174	8	2	85	54	30	$ 1,933		0.74	0.62	43.11
Double Pane	Single Pane	6,752	2,944	2.67	0.06	237	248	151	174	8	2	85	54	30		$ 244	5.85	4.94	5.44
Triple Pane	Double Pane	6,507	2,920	0.53	0.02	72	80	43	50	2	-	17	5	30	NA	$ 407	0.80	0.65	34.21
Double Pane Low-E	Triple Pane	6,466	2,902	0.09	0.00	10	15	7	9	2	1	8	6	30	NA	$ 407	0.15	0.12	136.85
SF Elect Baseboard w/ RAC														30					
Single Pane (baseline)		12,890	1,466	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	10,514	1,468	0.35	(0.05)	824	940	256	356	1	3	(9)	3	30	$ 1,468		0.80	0.43	15.33
Double Pane	Single Pane	10,514	1,468	0.35	(0.05)	824	940	256	356	1	3	(9)	3	30		$ 185	6.33	3.40	1.93
Triple Pane	Double Pane	9,942	1,416	0.02	0.09	201	228	60	83	1	-	38	13	30	NA	$ 309	1.10	0.64	11.25
Double Pane Low-E	Triple Pane	9,852	1,410	(0.00)	0.00	28	39	8	14	-	-	3	3	30	NA	$ 309	0.14	0.07	75.21
21. Weatherization - Existing																			
SF Elect Resist w/ CAC																			
Poor Weatherization (baseline)		14,262	2,627	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	10,262	2,546	3.08	0.06	1,547	1,546	406	521	(1)	1	37	44	10	$ 328	NA	5.83	4.01	1.94
SF Elect Heat Pump																			
Poor Weatherization (baseline)		7,752	3,139	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	6,740	3,001	3.81	0.08	319	292	208	193	-	1	68	69	10	$ 339	NA	3.65	3.15	6.46
SF Elect Baseboard w/ RAC																			
Poor Weatherization (baseline)		13,508	1,526	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	10,224	1,488	0.48	0.04	1,203	1,242	381	458	-	1	14	22	10	$ 280	NA	3.90	2.17	2.06
SF Gas w/ CAC (35+ yrs old)																			
Poor Weatherization (baseline)		539	2,409	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	420	2,332	0.05	0.06	46	46	12	15	-	1	43	32	10	$ 306	NA	0.29	0.20	27.34
SF Gas w/ CAC (< 35 yrs old)																			
Poor Weatherization (baseline)		638	2,548	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	463	2,451	0.06	0.06	67	66	18	23	(2)	2	38	59	10	$ 334	NA	0.34	0.23	21.86
SF Gas w/ RAC																			
Poor Weatherization (baseline)		449	1,515	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	359	1,484	0.01	0.04	33	33	11	13	(2)	-	10	24	10	$ 320	NA	0.16	0.11	49.88

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SINGLE-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh/yr)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh/yr	Cooling kWh/yr	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
22. Air to Air Heat Exchanger																			
SF Elect Resist w/ CAC																			
Weatherization (baseline)		10,262	2,546	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	7,766	2,449	1.97	0.06	969	971	240	316	1	2	47	47	12	$ 1,050	$ 1,050	1.29	0.89	9.63
SF Elect Heat Pump																			
Weatherization (baseline)		6,740	3,001	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	5,645	2,856	2.83	0.09	368	391	135	137	1	2	64	71	12	$ 1,050	$ 1,050	1.08	0.90	19.75
SF Elect Baseboard w/ RAC																			
Weatherization (baseline)		10,224	1,488	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	7,980	1,431	1.36	0.04	864	867	226	287	1	2	23	31	12	$ 1,050	$ 1,050	1.05	0.69	11.00
SF Gas w/ CAC (35+ yrs old)																			
Weatherization (baseline)		420	2,332	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	345	2,267	0.03	0.05	29	29	7	10	-	1	31	33	12	$ 1,050	$ 1,050	0.07	0.05	123.58
SF Gas w/ CAC (< 35 yrs old)																			
Weatherization (baseline)		463	2,451	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	356	2,294	0.04	0.18	41	41	11	14	2	1	106	48	12	$ 1,050	$ 1,050	0.16	0.12	60.12
SF Gas w/ RAC																			
Weatherization (baseline)		359	1,484	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	292	1,438	0.02	0.04	25	25	8	9	-	-	23	23	12	$ 1,050	$ 1,050	0.05	0.04	160.00
24. Floor Insulation																			
SF Elect Resist w/ CAC	w/o Floor Insulation	10,866	2,623	0.01	(0.03)	216	113	54	19	(11)	(4)	(30)	(12)	35	$ 408	$ 408	0.37	0.18	33.94
SF Elect Heat Pump	w/o Floor Insulation	6,854	3,106	0.04	(0.03)	91	45	34	6	(16)	(2)	(38)	(14)	35	$ 533	$ 533	0.09	0.04	265.24
SF Elect Baseboard w/ RAC	w/o Floor Insulation	10,543	1,574	(0.03)	(0.02)	273	170	71	33	(7)	(11)	(28)	(26)	35	$ 469	$ 469	0.43	0.20	27.82
25. Basement Insulation (R-5)																			
(Unconditioned Basement)																			
SF Elect Resist w/ CAC	w/o Wall Insulation	10,626	2,508	0.20	0.02	259	268	49	67	1	2	23	31	35	$ 532	$ 532	0.77	0.46	17.38
SF Elect Heat Pump	w/o Wall Insulation	6,772	2,963	0.24	0.03	95	105	27	32	2	0	36	36	35	$ 608	$ 608	0.43	0.30	36.59
SF Elect Resist w/ RAC	w/o Wall Insulation	10,432	1,474	0.19	0.02	264	272	52	69	1	1	14	14	35	$ 570	$ 570	0.69	0.41	19.70
(Conditioned Basement)																			
SF Elect Resist w/ CAC														35					
Baseline - No Insulation		12,641	2,785																
Insulated Basement	w/o Wall Insulation	11,323	2,642	0.80	0.17	509	550	105	153	10	4	74	55	35	$ 532	$ 532	2.01	1.37	8.22
SF Elect Heat Pump														35					
Baseline - No Insulation		7,428	3,234																
Insulated Basement	w/o Wall Insulation	6,984	3,062	1.08	0.19	157	182	51	53	6	4	96	65	35	$ 608	$ 608	1.30	1.07	19.03
SF Elect Resist w/ RAC																			
Baseline - No Insulation		12,696	1,715																
Insulated Basement	w/o Wall Insulation	11,245	1,593	0.86	0.02	566	597	122	167	3	3	68	48	35	$ 570	$ 570	1.84	1.20	8.29
26. AC/HP Maintenance																			
SF Elect Resist w/ CAC	Existing	11,268	2,110		0.33					14	6	253	182	2	$ 150		0.48	0.35	4.00
SF Elect Heat Pump	Existing	7,030	2,481		0.45					16	6	314	219	2	$ 150		0.61	0.46	3.27
SF Elect Resist w/ RAC	Existing	11,089	1,234		0.24					4	3	139	122	2	$ 80		0.58	0.44	3.57
SF Gas w/ CAC (35+ yrs old)	Existing	449	1,931		0.35					15	6	236	168	2	$ 150		0.47	0.35	4.30
SF Gas w/ CAC (< 35 yrs old)	Existing	508	2,028		0.33					13	5	254	181	2	$ 150		0.47	0.35	4.00
SF Gas w/ RAC	Existing	382	1,225		0.23					5	5	140	121	2	$ 80		0.57	0.43	3.58

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback In Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
Prototype Baseline Levels																			
SMF Elect Resist w/ CAC		4,775	1,548																
SMF Elect Baseboard w/ RAC		3,320	907																
SMF Gas w/ CAC (35+ yrs old)		156	2,288																
SMF Gas w/ CAC (< 35 yrs old)		216	1,667																
SMF Gas w/ RAC (35+ yrs old)		199	1,497																
SMF Gas w/ RAC (< 35 yrs old)		107	1,342																
1. High Efficiency CAC																			
SMF Elect Resist w/ CAC																			
SEER 10 (Baseline)	Existing	4,775	1,309	-	0.21	-	-	-	-	9	5	124	101	12					
SEER 11.5	SEER 10	4,775	1,139	-	0.15	-	-	-	-	6	4	89	72	12	$ 130	$ 130	0.91	0.70	9.31
SEER 12.5	SEER 11.5	4,775	1,048	-	0.08	-	-	-	-	3	2	47	39	12	$ 92	$ 92	0.69	0.53	12.32
SMF Gas w/ CAC (35+ yrs old)																			
SEER 10 (Baseline)	Existing	156	2,034	-	0.19	-	-	-	-	13	6	132	103	12					
SEER 11.5	SEER 10	156	1,769	-	0.20	-	-	-	-	14	7	137	107	12	$ 180	$ 180	0.93	0.69	8.38
SEER 12.5	SEER 11.5	156	1,627	-	0.10	-	-	-	-	7	4	73	57	12	$ 127	$ 127	0.70	0.52	11.10
SMF Gas w/ CAC (< 35 yrs old)																			
SEER 10 (Baseline)	Existing	216	1,622	-	0.04	-	-	-	-	2	1	24	18	12					
SEER 11.5	SEER 10	216	1,411	-	0.18	-	-	-	-	9	5	111	86	12	$ 180	$ 180	0.80	0.61	10.45
SEER 12.5	SEER 11.5	216	1,298	-	0.10	-	-	-	-	5	2	59	46	12	$ 127	$ 127	0.60	0.46	13.80
2. High Efficiency RAC																			
SMF Elect Resist w/ RAC																			
EER 8.5	Existing	3,320	879	-	0.04	-	-	-	-	1	1	14	12	11					
EER 10.0	SEER 8.5	3,320	747	-	0.17	-	-	-	-	5	4	68	55	11	$ 132	$ 132	0.81	0.65	12.28
SMF Gas w/ RAC (35+ yrs old)																			
EER 8.5	Existing	199	1,444	-	0.04	-	-	-	-	2	1	29	22	11					
EER 10.0	EER 8.5	199	1,227	-	0.18	-	-	-	-	6	4	118	89	11	$ 161	$ 161	0.85	0.65	9.02
SMF Gas w/ RAC (< 35 yrs old)																			
EER 8.5	Existing	107	1,294	-	0.04	-	-	-	-	2	1	24	20	11					
EER 10.0	EER 8.5	107	1,100	-	0.18	-	-	-	-	6	5	100	83	11	$ 161	$ 161	0.80	0.61	10.15
3. Heat Pump Conversion																			
SMF Elect Resist w/ CAC																			
SEER 10.0 & Res Furn (1.08 ton baseline)		4,775	1,309	-	0.21	-	-	-	-	9	5	124	101	12					
Std Air Source HP (1.5 ton)	SEER 10.0 & Resist Furn	4,180	1,310	0.02	-	237	207	80	71	-	-	-	-	15	$ 547	$ 547	0.41	0.21	22.74
High Efficiency Air Source HP	Std Air Source HP	3,886	1,048	0.02	0.26	345	314	118	111	10	5	137	110	15	$ 319	$ 319	1.72	1.06	5.56
Ground Source Heat Pump	High Eff Air Source HP	3,059	1,007	0.01	0.30	678	648	186	204	11	6	158	127	20	$ 1,500	$ 1,500	0.66	0.38	15.92
Water Source Heat Pump	High Eff Air Source HP	2,911	1,191	0.04	0.42	1,422	1,351	387	420	15	9	220	177	20	$ 1,500	$ 1,500	1.25	0.70	8.36
Water Source Heat Pump	Ground Source HP	2,911	1,191	0.03	0.12	744	703	201	216	4	2	62	50						
4. High Efficiency Heat Pump																			
Not Applicable																			
5. Duel Fuel Heat Pump																			
SMF Elect Resist w/ CAC																			
SEER 10.0 & Res Furn (baseline)		4,775	1,309	-	0.21	-	-	-	-	9	5	124	101	12					
Duel Fuel Heat Pump	SEER 10.0 & Resist Furn	2,790	1,309	1.30	-	901	931	43	110	-	-	-	-	15	$ 772	$ 772	1.38	0.92	9.61

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	tf-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
6. Exterior Shading for CAC/HP Cooling																			
SMF Elect Resist w/ CAC		4,841	1,501	0.00	0.03	-	-	-	-	6	1	25	15	6	$ 458	$ 458	0.04	0.03	124.96
SMF Gas w/ CAC (35+ yrs old)		157	2,219	(0.00)	0.02	-	-	-	-	16	3	26	24	6	$ 1,001	$ 1,001	0.02	0.01	201.75
SMF Gas w/ CAC (< 35 yrs old)		219	1,598	-	0.03	-	-	-	-	10	2	34	23	6	$ 733	$ 733	0.03	0.02	138.49
7. Exterior Shading for RAC																			
SMF Elect Resist w/ RAC		3,366	881	0.00	0.01	-	-	-	-	3	1	15	8	6	$ 414	$ 414	0.02	0.01	204.81
SMF Gas w/ RAC (35+ yrs old)		201	1,439	(0.00)	0.01	-	-	-	-	7	2	29	20	6	$ 883	$ 883	0.02	0.01	197.30
SMF Gas w/ RAC (< 35 yrs old)		109	1,316	-	0.01	-	-	-	-	2	1	15	8	6	$ 370	$ 370	0.02	0.02	179.93
8. Window Treatment for CAC																			
SMF Elect Resist w/ CAC		5,141	1,374	(0.00)	0.14	(218)	(50)	(70)	(28)	15	4	106	49	8	$ 146	$ 146	-0.06	0.10	-145.90
SMF Gas w/ CAC (35+ yrs old)		163	2,021	0.00	0.07	(4)	(1)	(2)	(1)	44	12	139	73	8	$ 319	$ 319	0.28	0.17	16.13
SMF Gas w/ CAC (< 35 yrs old)		228	1,442	0.00	0.10	(7)	(1)	(3)	(1)	25	9	122	69	8	$ 234	$ 234	0.38	0.26	13.72
9. Window Treatment for RAC																			
SMF Elect Resist w/ RAC		3,566	800	(0.03)	0.05	(114)	(50)	(48)	(35)	8	4	61	34	8	$ 132	$ 132	-0.21	-0.08	-91.86
SMF Gas w/ RAC (35+ yrs old)		209	1,274	0.00	0.03	(6)	(1)	(3)	(1)	18	8	131	66	8	$ 282	$ 282	0.23	0.13	16.31
SMF Gas w/ RAC (< 35 yrs old)		114	1,210	-	0.12	(4)	(1)	(1)	(1)	8	5	75	43	8	$ 118	$ 118	0.59	0.46	11.49
10. Light Colored Roof for CAC																			
SMF Elect Resist w/ CAC		4,868	1,496	(0.00)	0.05	(38)	(30)	(12)	(12)	4	2	26	20	15	$ 651	$ 651	0.01	0.02	1868.90
SMF Gas w/ CAC (35+ yrs old)		162	2,068	(0.00)	0.07	(2)	(2)	(1)	(1)	28	13	94	85	15	$ 600	$ 600	0.18	0.12	36.26
SMF Gas w/ CAC (< 35 yrs old)		222	1,573	(0.00)	0.07	(2)	(2)	(1)	(1)	9	5	43	37	15	$ 689	$ 689	0.10	0.07	96.84
11. Light Colored Roof for RAC																			
SMF Elect Resist w/ RAC		3,383	873	(0.00)	0.01	(22)	(20)	(8)	(12)	2	1	18	13	15	$ 570	$ 570	-0.01	0.00	3213.94
SMF Gas w/ RAC (35+ yrs old)		206	1,363	(0.00)	0.02	(3)	(2)	(1)	(1)	9	4	64	56	15	$ 702	$ 702	0.08	0.05	67.27
SMF Gas w/ RAC (< 35 yrs old)		111	1,275	(0.00)	0.02	(1)	(1)	(0)	(0)	3	2	36	26	15	$ 645	$ 645	0.05	0.03	123.09
12. Increased Attic Ventilation																			
SMF Elect Resist w/ CAC														30					
Poor Ventilation		4,775	1,595											30	$ 67		0.70	0.54	17.74
Natural Ventilation	Existing	4,775	1,548	-	0.04	-	-	-	-	3	2	24	19	15	$ 290	$ 290	0.10	0.05	43.29
Power Ventilation	Natural Ventilation	4,917	1,464	-	-	-	-	-	-	6	3	42	33						
SMF Elect Resist w/ RAC														30					
Poor Ventilation		3,320	935											30	$ 59		0.56	0.46	26.26
Natural Ventilation	Existing	3,320	907	-	0.03	-	-	-	-	1	1	15	11	15	$ 290	$ 290	0.20	0.16	66.99
Power Ventilation	Natural Ventilation	3,410	854	-	0.08	-	-	-	-	2	2	29	20						
SMF Gas w/ CAC (35+ yrs old)														30					
Poor Ventilation		156	2,358											30	$ 62		0.97	0.71	11.51
Natural Ventilation	Existing	156	2,288	-	0.05	-	-	-	-	8	4	31	27	15	$ 290	$ 290	0.43	0.21	10.82
Power Ventilation	Natural Ventilation	166	1,940	-	-	-	-	-	-	40	18	156	134						
SMF Gas w/ CAC (< 35 yrs old)														30					
Poor Ventilation		216	1,718											30	$ 71		0.69	0.53	17.73
Natural Ventilation	Existing	216	1,667	-	0.04	-	-	-	-	4	2	24	20	15	$ 290	$ 290	0.33	0.24	24.63
Power Ventilation	Natural Ventilation	225	1,517	-	0.09	-	-	-	-	13	7	72	58						
SMF Gas w/ RAC (35+ yrs old)														30					
Poor Ventilation		199	1,543											30	$ 73		0.59	0.45	19.85
Natural Ventilation	Existing	199	1,497	-	0.04	-	-	-	-	3	1	23	19	15	$ 290	$ 290	0.33	0.19	16.74
Power Ventilation	Natural Ventilation	210	1,282	-	0.04	-	-	-	-	14	5	106	89						
SMF Gas w/ RAC (< 35 yrs old)														30					
Poor Ventilation		107	1,383											30	$ 67		0.61	0.47	20.18
Natural Ventilation	Existing	107	1,342	-	0.04	-	-	-	-	2	1	22	16	15	$ 290	$ 290	0.19	0.12	34.55
Power Ventilation	Natural Ventilation	113	1,238	-	0.04	-	-	-	-	5	3	55	40						

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback In Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
13. Duct Repair																			
SMF Elect Resist w/ CAC		4,350	1,462	0.20	0.04	159	175	37	54	4	3	34	46	25	$ 180	$ 180	1.74	1.11	7.44
SMF Gas w/ CAC (35+ yrs old)		142	2,225	0.02	0.00	5	6	1	2	10	7	13	33	25	$ 180	$ 180	0.22	0.13	35.01
SMF Gas w/ CAC (< 35 yrs old)		196	1,598	0.01	0.01	8	8	2	2	4	5	20	40	25	$ 180	$ 180	0.25	0.14	28.98
14. Duct Insulation																			
SMF Elect Resist w/ CAC	Duct Repair	4,006	1,417	0.17	0.03	150	148	34	44	2	1	23	18	25	$ 210	$ 210	1.24	0.81	11.18
SMF Gas w/ CAC (35+ yrs old)	Duct Repair	132	2,184	0.01	(0.01)	4	4	1	2	5	3	13	20	25	$ 210	$ 210	0.10	0.05	59.45
SMF Gas w/ CAC (< 35 yrs old)	Duct Repair	181	1,560	0.00	(0.01)	5	6	2	2	3	1	14	19	25	$ 210	$ 210	0.09	0.04	57.99
15a. Setback Electronic Thermostat - Existing																			
SMF Elect Resist w/ CAC		3,710	1,381	(1.81)	(0.16)	(102)	965	14	187	16	2	137	11	12	$ 85		-1.75	-4.15	1.51
SMF Elect Baseboard w/ RAC		2,368	836	(0.36)	(0.01)	(50)	772	(61)	291	8	4	49	10	12	$ 85		2.44	0.42	1.93
SMF Gas w/ CAC (35+ yrs old)		118	2,035	(0.08)	(0.00)	3	25	0	10	48	9	158	37	12	$ 85		0.89	0.33	4.18
SMF Gas w/ CAC (< 35 yrs old)		165	1,467	(0.06)	(0.01)	(1)	41	(1)	12	27	5	144	23	12	$ 85		0.73	0.25	4.85
15b. Setback Electronic Thermostat - New																			
SMF Elect Resist w/ CAC		3,710	1,381	(1.81)	(0.16)	(102)	965	14	187	16	2	137	11	12		$ 47	-3.16	-7.51	0.83
SMF Elect Baseboard w/ RAC		2,368	836	(0.36)	(0.01)	(50)	772	(61)	291	8	4	49	10	12		$ 47	4.41	0.76	1.07
SMF Gas w/ CAC (< 35 yrs old)		165	1,467	(0.06)	(0.01)	(1)	41	(1)	12	27	5	144	23	12		$ 47	1.32	0.45	2.68
16. Ceiling Insulation																			
SMF Elect Resist w/ CAC																			
Baseline R-0 Ceiling Insulation		10,745	1,884																
Add R-19 to R-0	R-0 Insulation	4,909	1,557	2.24	0.28	2,218	2,249	587	781	15	13	163	135	35	$ 315	$ 315	12.24	7.68	1.20
Add R-19 to R-19 (R-38 total)	R-19 Insulation	4,377	1,519	0.20	0.06	204	214	48	66	2	2	18	18	35	$ 315	$ 315	1.18	0.76	12.81
SMF Elect Resist w/ RAC																			
Baseline R-0 Ceiling Insulation		9,242	1,171																
Add R-19 to R-0	R-0 Insulation	3,597	922	1.93	0.09	1,984	2,201	571	889	11	8	128	102	35	$ 276	$ 276	12.68	7.67	1.11
Add R-19 to R-19 (R-38 total)	R-19 Insulation	3,119	896	0.16	0.01	172	197	41	69	1	1	14	11	35	$ 276	$ 276	1.07	0.65	12.82
SMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Ceiling Insulation		157	2,290																
Add R-19 to R-0	R-0 Insulation	108	2,086	0.06	0.07	18	19	5	7	17	11	87	88	35	$ 290	$ 290	0.63	0.43	16.19
Add R-19 to R-19 (R-38 total)	R-19 Insulation	103	2,063	0.01	0.01	2	2	0	1	1	2	9	12	35	$ 290	$ 290	0.07	0.04	143.04
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline R-0 Ceiling Insulation		328	1,846																
Add R-19 to R-0	R-0 Insulation	185	1,607	0.07	0.16	54	55	15	20	12	12	109	106	35	$ 333	$ 333	0.89	0.62	13.36
Add R-19 to R-19 (R-38 total)	R-19 Insulation	171	1,581	0.01	0.01	5	5	1	2	2	1	12	11	35	$ 333	$ 333	0.08	0.05	126.70
SMF Gas w/ RAC (35+ yrs old)																			
Baseline R-0 Ceiling Insulation		243	1,579																
Add R-19 to R-0	R-0 Insulation	151	1,392	0.07	0.04	34	35	10	13	7	6	85	89	35	$ 340	$ 340	0.53	0.33	17.96
Add R-19 to R-19 (R-38 total)	R-19 Insulation	143	1,369	0.01	0.00	3	3	1	1	2	1	11	10	35	$ 340	$ 340	0.06	0.04	154.78
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline R-0 Ceiling Insulation		302	1,762																
Add R-19 to R-0	R-0 Insulation	110	1,349	0.06	0.11	74	75	19	24	15	13	216	169	35	$ 312	$ 312	1.17	0.72	7.54
Add R-19 to R-19 (R-38 total)	R-19 Insulation	93	1,304	0.01	0.01	6	7	1	2	1	1	24	19	35	$ 321	$ 321	0.11	0.06	72.80

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
17a. Wall Insulation (2x4) - Existing																			
SMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x4)		8,928	1,680																
Add R-11 to R-0	R-0 Insulation	5,295	1,573	1.65	0.12	1,292	1,446	372	525	7	3	69	28	35	$ 748		3.23	2.06	4.81
SMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x4)		6,653	1,006																
Add R-11 to R-0	R-0 Insulation	3,894	929	1.05	0.06	954	1,082	279	444	3	2	45	27	35	$ 616		2.82	1.74	5.23
SMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		171	2,315																
Add R-11 to R-0	R-0 Insulation	129	2,277	0.05	0.02	15	16	5	6	6	2	14	16	35	$ 752		0.09	0.06	164.88
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline R-0 Wall (2x4)		298	1,732																
Add R-11 to R-0	R-0 Insulation	205	1,667	0.05	0.08	32	36	10	15	7	1	39	17	35	$ 784		0.18	0.13	88.46
SMF Gas w/ RAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		247	1,540																
Add R-11 to R-0	R-0 Insulation	180	1,483	0.05	0.03	24	25	8	11	4	2	27	25	35	$ 796		0.12	0.08	108.48
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline R-0 Wall (2x4)		200	1,455																
Add R-11 to R-0	R-0 Insulation	110	1,354	0.03	(0.01)	35	36	9	11	3	2	51	45	35	$ 603		0.15	0.08	50.40
17b. Wall Insulation (2x4) - New																			
SMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x4)		8,928	1,680																
Add R-11 to R-0	R-0 Insulation	5,295	1,573	1.65	0.12	1,292	1,446	372	525	7	3	69	28	35		$ 238	10.15	6.47	1.53
SMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x4)		6,653	1,006																
Add R-11 to R-0	R-0 Insulation	3,894	929	1.05	0.06	954	1,082	279	444	3	2	45	27	35		$ 196	8.86	5.46	1.66
SMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		171	2,315																
Add R-11 to R-0	R-0 Insulation	129	2,277	0.05	0.02	15	16	5	6	6	2	14	16	35		$ 239	0.28	0.20	52.40
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline R-0 Wall (2x4)		298	1,732																
Add R-11 to R-0	R-0 Insulation	205	1,667	0.05	0.08	32	36	10	15	7	1	39	17	35		$ 249	0.56	0.41	28.10
SMF Gas w/ RAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		247	1,540																
Add R-11 to R-0	R-0 Insulation	180	1,483	0.05	0.03	24	25	8	11	4	2	27	25	35		$ 253	0.37	0.26	34.48
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline R-0 Wall (2x4)		200	1,455																
Add R-11 to R-0	R-0 Insulation	110	1,354	0.03	(0.01)	35	36	9	11	3	2	51	45	35		$ 192	0.47	0.24	16.05

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life (Years	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling		Existing	New	w/Envir Cost	Utility	
18a. Wall Insulation (2x6) - Existing																			
SMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x6)		8,928	1,680																
Add R-19 to R-0	R-0 Insulation	4,853	1,556	1.84	0.17	1,449	1,628	413	585	8	3	80	34	35	$ 801		3.41	2.18	4.58
SMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x6)		6,653	1,006																
Add R-19 to R-0	R-0 Insulation	3,581	919	1.17	0.06	1,063	1,209	307	493	4	2	50	30	35	$ 660		2.92	1.80	5.03
SMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		171	2,315																
Add R-19 to R-0	R-0 Insulation	124	2,256	0.05	0.04	17	17	5	7	8	3	26	23	35	$ 805		0.11	0.08	125.14
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline R-0 Wall (2x6)		298	1,732																
Add R-19 to R-0	R-0 Insulation	194	1,658	0.05	0.09	36	41	11	16	8	1	45	19	35	$ 840		0.19	0.14	83.70
SMF Gas w/ RAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		247	1,540																
Add R-19 to R-0	R-0 Insulation	172	1,477	0.06	0.03	27	28	9	12	4	2	29	28	35	$ 852		0.12	0.08	104.80
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline R-0 Wall (2x6)		200	1,455																
Add R-19 to R-0	R-0 Insulation	99	1,343	0.03	(0.01)	39	40	10	12	4	2	56	50	35	$ 646		0.16	0.08	48.48
18b. Wall Insulation (2x6) - New																			
SMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x6)		8,928	1,680																
Add R-19 to R-0	R-0 Insulation	4,853	1,556	1.84	0.17	1,449	1,628	413	585	8	3	80	34	35		$ 299	9.12	5.84	1.71
SMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x6)		6,653	1,006																
Add R-19 to R-0	R-0 Insulation	3,581	919	1.17	0.06	1,063	1,209	307	493	4	2	50	30	35		$ 247	7.81	4.81	1.88
SMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		171	2,315																
Add R-19 to R-0	R-0 Insulation	124	2,256	0.05	0.04	17	17	5	7	8	3	26	23	35		$ 301	0.30	0.22	46.79
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline R-0 Wall (2x6)		298	1,732																
Add R-19 to R-0	R-0 Insulation	194	1,658	0.05	0.09	36	41	11	16	8	1	45	19	35		$ 314	0.51	0.38	31.29
SMF Gas w/ RAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		247	1,540																
Add R-19 to R-0	R-0 Insulation	172	1,477	0.06	0.03	27	28	9	12	4	2	29	28	35		$ 318	0.33	0.23	39.11
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline R-0 Wall (2x6)		200	1,455																
Add R-19 to R-0	R-0 Insulation	99	1,343	0.03	(0.01)	39	40	10	12	4	2	56	50	35		$ 241	0.43	0.22	18.09

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
19. Door Upgrades																			
SMF Elect Resist w/ CAC	w/o Storm Door	4,588	1,540	0.10	0.02	69	76	18	24	0	-	4	3	20	$ 540	$ 540	0.22	0.15	66.04
SMF Elect Resist w/ RAC	w/o Storm Door	3,149	900	0.08	0.00	61	71	15	24	0	0	4	2	20	$ 540	$ 540	0.18	0.12	72.03
SMF Gas w/ CAC (35+ yrs old)	w/o Storm Door	154	2,284	0.00	0.00	1	1	0	0	2	-	1	1	20	$ 540	$ 540	0.01	0.00	1662.81
SMF Gas w/ CAC (< 35 yrs old)	w/o Storm Door	211	1,663	0.00	0.01	2	2	1	1	0	0	2	2	20	$ 540	$ 540	0.02	0.01	1001.13
SMF Gas w/ RAC (35+ yrs old)	w/o Storm Door	196	1,493	0.00	0.00	1	1	0	1	-	-	3	2	20	$ 540	$ 540	0.01	0.01	1138.90
SMF Gas w/ RAC (< 35 yrs old)	w/o Storm Door	102	1,332	0.00	0.00	2	2	0	0	-	-	6	4	20	$ 540	$ 540	0.02	0.01	505.71
20. Window Upgrades																			
SMF Elect Resist w/ CAC																			
Baseline - Single Pane		7,062	1,611	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	5,208	1,571	0.99	0.10	685	737	184	247	1	1	25	13	30	$ 841		1.51	1.00	10.75
Double Pane	Single Pane	5,208	1,571	0.99	0.10	685	737	184	247	1	1	25	13	30		$ 107	11.88	7.85	1.37
Triple Pane	Double Pane	5,002	1,526	0.13	0.07	60	102	13	32	4	1	28	12	30	NA	$ 177	1.11	0.78	14.85
Double Pane Low-E	Triple Pane	4,729	1,522	0.13	0.01	102	109	28	35	(0)	(0)	4	0	30	NA	$ 177	0.99	0.64	15.54
SMF Elect Resist w/ RAC																			
Baseline - Single Pane		5,278	960	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	3,540	922	0.78	0.04	618	694	164	261	1	1	22	15	30	$ 759		1.45	0.92	10.33
Double Pane	Single Pane	3,540	922	0.78	0.04	618	694	164	261	1	1	22	15	30		$ 96	11.47	7.25	1.31
Triple Pane	Double Pane	3,333	893	0.09	0.01	68	93	14	32	2	1	16	9	30	NA	$ 160	0.88	0.54	15.06
Double Pane Low-E	Triple Pane	3,084	889	0.10	0.00	90	102	22	35	(0)	-	3	2	30	NA	$ 160	0.94	0.58	15.30
SMF Gas w/ CAC (35+ yrs old)																			
Baseline - Single Pane		183	2,329	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	154	2,305	0.03	0.02	10	11	3	5	2	(2)	19	5	30	$ 1,838		0.03	0.02	575.59
Double Pane	Single Pane	154	2,305	0.03	0.02	10	11	3	5	2	(2)	19	5	30		$ 232	0.22	0.17	72.65
Triple Pane	Double Pane	150	2,244	0.01	0.02	1	2	0	1	11	2	33	15	30	NA	$ 387	0.11	0.07	81.53
Double Pane Low-E	Triple Pane	144	2,244	0.01	(0.00)	2	2	1	1	1	(1)	1	(2)	30	NA	$ 387	0.01	0.00	2037.25
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline - Single Pane		279	1,698	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	216	1,675	0.03	0.02	22	25	7	9	3	1	13	6	30	$ 1,345		0.05	0.03	310.99
Double Pane	Single Pane	216	1,675	0.03	0.02	22	25	7	9	3	1	13	6	30		$ 170	0.39	0.27	39.31
Triple Pane	Double Pane	208	1,627	0.01	0.05	2	4	1	1	8	1	26	13	30	NA	$ 283	0.20	0.16	71.09
Double Pane Low-E	Triple Pane	198	1,616	0.00	0.02	4	4	1	2	-	(1)	9	3	30	NA	$ 283	0.08	0.06	203.56
SMF Gas w/ RAC (35+ yrs old)																			
Baseline - Single Pane		240	1,529	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	197	1,509	0.04	0.02	15	16	5	7	2	1	13	4	30	$ 1,622		0.03	0.02	494.80
Double Pane	Single Pane	197	1,509	0.04	0.02	15	16	5	7	2	1	13	4	30		$ 205	0.26	0.19	62.54
Triple Pane	Double Pane	191	1,464	0.01	0.01	1	3	0	1	4	2	26	14	30	NA	$ 342	0.09	0.05	89.15
Double Pane Low-E	Triple Pane	184	1,462	0.01	0.00	3	3	1	1	(0)	-	3	(1)	30	NA	$ 342	0.03	0.02	776.10
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline - Single Pane		160	1,413	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	109	1,361	0.02	0.01	19	20	5	6	1	1	30	20	30	$ 679		0.08	0.05	106.99
Double Pane	Single Pane	109	1,361	0.02	0.01	19	20	5	6	1	1	30	20	30		$ 86	0.64	0.37	13.55
Triple Pane	Double Pane	104	1,328	0.00	0.01	2	2	0	0	2	1	19	11	30	NA	$ 143	0.15	0.09	50.71
Double Pane Low-E	Triple Pane	96	1,312	0.00	0.10	3	3	1	1	-	1	10	6	30	NA	$ 143	0.52	0.48	86.25

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
SMALL MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	ff-Pea Cooling	(Years	Existing	New	w/Envir Cost	Utility	
21. Weatherization - Existing																			
SMF Elect Resist w/ CAC																			
Baseline - Poor Weatherization		5,890	1,591	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	4,406	1,534	0.93	0.12	574	584	147	178	0	1	30	25	10	$ 186		3.78	2.58	2.87
SMF Elect Resist w/ RAC																			
Baseline - Poor Weatherization		4,295	944	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	3,007	892	0.69	0.01	465	521	120	183	1	1	27	23	10	$ 176		3.11	2.00	3.12
SMF Gas w/ CAC (35+ yrs old)																			
Baseline - Poor Weatherization		167	2,313	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	153	2,278	0.02	0.02	6	6	2	2	2	0	16	17	10	$ 312		0.08	0.06	90.25
SMF Gas w/ CAC (< 35 yrs old)																			
Baseline - Poor Weatherization		246	1,701	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	206	1,656	0.02	0.05	15	15	4	5	0	1	24	20	10	$ 250		0.19	0.14	46.94
SMF Gas w/ RAC (35+ yrs old)																			
Baseline - Poor Weatherization		218	1,527	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	192	1,486	0.02	0.03	10	10	3	4	0	1	19	21	10	$ 285		0.12	0.09	63.48
SMF Gas w/ RAC (< 35 yrs old)																			
Baseline - Poor Weatherization		140	1,403	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	97	1,319	0.01	0.01	17	17	4	5	1	1	45	36	10	$ 166		0.26	0.15	19.15
22. Air to Air Heat Exchanger																			
SMF Elect Resist w/ CAC																			
Baseline - Weatherization		4,406	1,534	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	3,501	1,495	0.59	0.04	352	366	84	103	1	0	20	19	12	$ 1,050	$ 1,050	0.45	0.30	26.30
SMF Elect Resist w/ RAC																			
Baseline - Weatherization		3,007	892	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	2,264	853	0.43	0.00	267	312	62	101	0	1	21	16	12	$ 1,050	$ 1,050	0.34	0.22	31.57
24. Floor Insulation (R-11 to Flr)																			
SMF Elect Resist w/ CAC	w/o Floor Insulation	4,418	1,586	0.00	(0.05)	166	113	45	33	(6)	(2)	(22)	(7)	35	$ 223	$ 223	0.55	0.22	19.18
SMF Elect Resist w/ RAC	w/o Floor Insulation	3,320	907	-	-	-	-	-	-	-	-	-	-	35	$ 195	$ 195	0.00	0.00	infinity
26. AC Maintenance																			
SMF Elect Resist w/ CAC	Exisiting	4,775	1,272	0.00	0.27	0	0	0	0	10	5	145	116	2	$ 150		0.34	0.26	6.63
SMF Elect Resist w/ RAC	Exisiting	3,320	740	0.00	0.21	0	0	0	0	6	5	86	70	2	$ 80		0.44	0.36	5.88
SMF Gas w/ CAC (35+ yrs old)	Exisiting	156	1,883	0.00	0.30	0	0	0	0	20	10	210	164	2	$ 150		0.43	0.32	4.57
SMF Gas w/ CAC (< 35 yrs old)	Exisiting	216	1,363	0.00	0.27	0	0	0	0	13	7	160	125	2	$ 150		0.35	0.27	6.04
SMF Gas w/ RAC (35+ yrs old)	Exisiting	199	1,228	0.00	0.24	0	0	0	0	8	5	146	111	2	$ 80		0.58	0.44	3.60
SMF Gas w/ RAC (< 35 yrs old)	Exisiting	107	1,100	0.00	0.21	0	0	0	0	8	6	124	104	2	$ 80		0.51	0.39	4.04

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
LARGE MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
Prototype Baseline Levels																			
LMF Elect Resist w/ CAC		5,053	1,817																
LMF Elect Resist w/ RAC		4,222	1,169																
LMF Gas w/ CAC (35+ yrs old)		147	1,427																
1. High Efficiency CAC																			
LMF Elect Resist w/ CAC																			
SEER 10 (Baseline)	Existing	5,053	1,581	-	0.20	-	-	-	-	10	4	135	86	12					
SEER 11.5	SEER 10	5,053	1,375	-	0.18	-	-	-	-	9	3	118	76	12	$ 150	$ 150	0.93	0.71	8.90
SEER 12.5	SEER 11.5	5,053	1,265	-	0.09	-	-	-	-	5	2	63	40	12	$ 107	$ 107	0.70	0.53	11.90
LMF Gas w/ CAC (35+ yrs old)																			
SEER 10 (Baseline)	Existing	147	1,191	-	0.20	-	-	-	-	6	4	120	105	12					
SEER 11.5	SEER 10	147	1,036	-	0.13	-	-	-	-	4	2	79	69	12	$ 120	$ 120	0.87	0.66	9.36
SEER 12.5	SEER 11.5	147	953	-	0.07	-	-	-	-	2	1	42	37	12	$ 85	$ 85	0.65	0.50	12.44
2. High Efficiency RAC																			
LMF Elect Resist w/ RAC																			
EER 8.5	Existing	4,222	963	-	0.26	-	-	-	-	6	5	101	94	11					
EER 10.0	EER 8.5	4,222	818	-	0.18	-	-	-	-	4	4	71	66	11	$ 87	$ 87	1.35	1.10	7.35
3. Heat Pump Conversion																			
LMF Elect Resist w/ CAC																			
SEER 10.0 & Res Furn (1.25 ton baseline)		5,053	1,581	-	0.19	-	-	-	-	10	4	135	87	12					
Std Air Source HP (1.5 ton)	SEER 10.0 & Resist Furn	4,378	1,581	0.01	-	209	257	84	125	0	0	0	(0)	15	$ 366	$ 366	0.68	0.34	13.40
High Efficiency Air Source HP	Std Air Source HP	4,011	1,264	0.01	0.25	321	383	138	200	14	5	180	117	15	$ 319	$ 319	1.93	1.15	4.69
Ground Source Heat Pump	High Eff Air Source HP	3,201	1,216	0.01	0.29	593	731	208	321	16	6	208	135	20	$ 1,500	$ 1,500	0.71	0.40	14.32
Water Source Heat Pump	High Eff Air Source HP	3,078	1,437	0.02	0.41	1,222	1,516	428	662	22	9	290	188	20	$ 1,500	$ 1,500	1.33	0.73	7.64
Water Source Heat Pump	Ground Source HP	3,078	1,437	0.02	0.12	629	785	220	341	6	3	82	53	20					
4. High Efficiency Heat Pump																			
Not Applicable																			
5. Duel Fuel Heat Pump																			
LMF Elect Resist w/ CAC																			
SEER 10.0 & Resist Furnance		5,053	1,581	-	0.20	-	-	-	-	10	4	135	86	12					
Duel Fuel Heat Pump (1.5 ton)	SEER 10.0 & Resist Furn	3,075	1,581	1.62	-	745	988	67	178	(0)	-	-	0	15	$ 591	$ 591	1.95	1.34	7.39

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
LARGE MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback In Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
6. Exterior Shading for CAC/HP Cooling																			
LMF Elect Resist w/ CAC		5,175	1,655	-	0.11	-	-	-	-	18	4	95	45	6	$ 472	$ 472	0.13	0.10	37.23
SMF Gas w/ CAC (35+ yrs old)		151	1,303	-	0.08	-	-	-	-	11	3	67	43	6	$ 437	$ 437	0.11	0.08	44.39
7. Exterior Shading for RAC																			
LMF Elect Resist w/ RAC		4,343	1,048	-	0.07	-	-	-	-	8	4	70	39	6	$ 524	$ 524	0.08	0.06	54.13
8. Window Treatment for CAC																			
LMF Elect Resist w/ CAC		5,349	1,568	(0.03)	0.16	(156)	(45)	(65)	(30)	24	7	151	68	8	$ 150	$ 150	0.20	0.24	19.50
LMF Gas w/ CAC (35+ yrs old)		156	1,240	(0.00)	0.12	(5)	(1)	(2)	(1)	14	6	106	62	8	$ 139	$ 139	0.60	0.44	9.53
9. Window Treatment for RAC																			
LMF Elect Resist w/ RAC		4,535	987	(0.03)	0.05	(173)	(51)	(63)	(27)	10	7	108	57	8	$ 167	$ 167	-0.17	-0.07	85.59
13. Duct Repair																			
LMF Elect Resist w/ CAC		4,603	1,697	0.20	0.05	151	213	28	57	5	2	65	48	25	$ 180	$ 180	1.91	1.22	6.43
LMF Gas w/ CAC (35+ yrs old)		132	1,327	0.00	0.05	5	7	1	2	5	3	37	55	25	$ 180	$ 180	0.44	0.30	20.81
14. Duct Insulatation																			
LMF Elect Resist w/ CAC	Duct Repair	4,240	1,697	0.01	0.01	122	172	23	46	(0)	0	2	(1)	25	$ 210	$ 210	0.79	0.41	14.23
LMF Gas w/ CAC (35+ yrs old)	Duct Repair	129	1,330	(0.00)	(0.01)	0	1	1	2	(0)	0	(2)	(1)	25	$ 210	$ 210	-0.02	-0.03	-2196.63
15a. Setback Electronic Thermostat - Existing																			
LMF Elect Resist w/ CAC		4,243	1,584	(0.87)	(0.25)	(324)	985	(220)	370	31	7	192	3	12	$ 85		-0.48	-2.57	1.67
LMF Elect Resist w/ RAC		3,399	1,046	(0.77)	(0.03)	(213)	883	(159)	312	4	5	79	34	12	$ 85		0.65	-1.24	1.97
LMF Gas w/ CAC (35+ yrs old)		119	1,262	(0.02)	(0.03)	(10)	32	(6)	12	14	2	144	4	12	$ 85		0.51	0.14	5.96
15b. Setback Electronic Thermostat - New																			
LMF Elect Resist w/ CAC		4,243	1,584	(0.87)	(0.25)	(324)	985	(220)	370	31	7	192	3	12		$ 47	-0.87	-4.65	0.93
LMF Elect Resist w/ RAC		3,399	1,046	(0.77)	(0.03)	(213)	883	(159)	312	4	5	79	34	12		$ 47	1.17	-2.25	1.09
16. Ceiling Insulation																			
LMF Elect Resist w/ CAC																			
Baseline R-0 Ceiling Insulation		9,144	2,101	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	5,142	1,828	1.22	0.17	1,285	1,493	446	778	27	10	157	79	35	$ 547	$ 547	4.66	2.82	2.98
Add R-19 to R-19 (R-38 total)	R-19 Insulation	4,796	1,782	0.15	0.06	114	142	33	58	3	1	31	11	35	$ 547	$ 547	0.50	0.33	30.90
LMF Elect Resist w/ RAC																			
Baseline R-0 Ceiling Insulation		7,246	1,293	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	4,219	1,169	0.74	0.03	983	1,108	343	593	6	4	84	30	35	$ 412	$ 412	4.28	2.48	3.11
Add R-19 to R-19 (R-38 total)	R-19 Insulation	3,953	1,151	0.12	0.03	87	111	24	44	1	0	13	4	35	$ 412	$ 412	0.46	0.30	33.72
LMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Ceiling Insulation		269	1,536	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	144	1,424	0.03	0.00	41	49	13	23	12	4	72	24	35	$ 368	$ 368	0.33	0.18	26.65
Add R-19 to R-19 (R-38 total)	R-19 Insulation	134	1,407	0.00	0.02	3	4	1	2	1	-	13	3	35	$ 368	$ 368	0.07	0.06	208.81

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RESIDENTIAL SECTOR - ECONOMIC SCREENING
LARGE MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback in Years
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	
17a. Wall Insulation (2x4) - Existing																			
LMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x4)		8,079	2,013	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	4,762	1,801	1.58	0.21	1,127	1,316	332	543	14	5	123	71	35	$ 896		2.61	1.69	5.92
LMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x4)		6,690	1,247	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	3,593	1,147	1.25	0.07	1,096	1,240	293	467	4	3	51	41	35	$ 774		2.56	1.59	5.80
LMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		236	1,496	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	127	1,409	0.02	0.07	37	46	9	17	6	2	52	27	35	$ 731		0.20	0.13	64.13
17b. Wall Insulation (2x4) - New																			
LMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x4)		8,079	2,013	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	4,762	1,801	1.58	0.21	1,127	1,316	332	543	14	5	123	71	35		$ 285	8.22	5.31	1.88
LMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x4)		6,690	1,247	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	3,593	1,147	1.25	0.07	1,096	1,240	293	467	4	3	51	41	35		$ 246	8.06	5.01	1.84
LMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x4)		236	1,496	-	-	-	-	-	-	-	-	-	-						
Add R-11 to R-0	R-0 Insulation	127	1,409	0.02	0.07	37	46	9	17	6	2	52	27	35		$ 232	0.62	0.42	20.35
18a. Wall Insulation (2x6) - Existing																			
LMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x6)		8,079	2,013	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	4,406	1,773	1.74	0.23	1,249	1,465	363	596	16	5	139	79	35	$ 959		2.70	1.75	5.71
LMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x6)		6,690	1,247	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	3,301	1,136	1.38	0.07	1,202	1,365	316	507	5	4	57	46	35	$ 829		2.62	1.63	5.67
LMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		236	1,496	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	115	1,398	0.03	0.08	41	51	10	18	7	2	59	30	35	$ 783		0.21	0.14	61.26
18b. Wall Insulation (2x6) - New																			
LMF Elect Resist w/ CAC																			
Baseline R-0 Wall (2x6)		8,079	2,013	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	4,406	1,773	1.74	0.23	1,249	1,465	363	596	16	5	139	79	35		$ 358	7.24	4.68	2.13
LMF Elect Resist w/ RAC																			
Baseline R-0 Wall (2x6)		6,690	1,247	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	3,301	1,136	1.38	0.07	1,202	1,365	316	507	5	4	57	46	35		$ 310	7.00	4.36	2.12
LMF Gas w/ CAC (35+ yrs old)																			
Baseline R-0 Wall (2x6)		236	1,496	-	-	-	-	-	-	-	-	-	-						
Add R-19 to R-0	R-0 Insulation	115	1,398	0.03	0.08	41	51	10	18	7	2	59	30	35		$ 292	0.56	0.38	22.85

UNION ELECTRIC COMPANY
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LARGE MULTI-FAMILY HVAC MEASURES

Measure	Basis of Comparison	Annual Use		Demand Savings		Energy Savings by Costing Period (kWh)								Life	Incremental Cost		Benefit/Cost Ratio		Est Cust Payback
						Winter		Spring/Fall				Summer							
		Heating kWh	Cooling kWh	Winter kW	Summer kW	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Htg elec	Off-Peak Htg elec	On-Peak Cooling	Off-Peak Cooling	On-Peak Cooling	Off-Peak Cooling	(Years)	Existing	New	w/Envir Cost	Utility	in Years
20. Window Upgrades																			
LMF Elect Resist w/ CAC																			
Baseline - Single Pane		6,514	1,878	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	4,577	1,790	1.07	0.07	686	775	190	286	4	1	51	31	30	$ 866		1.54	1.01	10.13
Double Pane	Single Pane	4,577	1,790	1.07	0.07	686	775	190	286	4	1	51	31	30		$ 109	12.27	8.03	1.27
Triple Pane	Double Pane	4,373	1,730	0.12	0.03	61	96	11	34	6	1	36	17	30	NA	$ 182	0.98	0.64	13.98
Double Pane Low-E	Triple Pane	4,124	1,721	0.12	0.02	88	103	21	38	1	0	5	2	30	NA	$ 183	0.92	0.60	17.00
LMF Elect Resist w/ RAC																			
Baseline - Single Pane		5,826	1,196	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	3,835	1,160	0.97	0.02	702	806	187	295	1	0	23	13	30	$ 962		1.32	0.84	11.51
Double Pane	Single Pane	3,835	1,160	0.97	0.02	702	806	187	295	1	0	23	13	30		$ 121	10.51	6.68	1.45
Triple Pane	Double Pane	3,588	1,115	0.13	0.02	75	114	16	43	2	2	27	13	30	NA	$ 203	0.92	0.59	14.93
Double Pane Low-E	Triple Pane	3,301	1,113	0.14	(0.00)	102	121	25	40	(0)	-	2	1	30	NA	$ 202	0.88	0.56	17.09
LMF Gas w/ CAC (35+ yrs old)																			
Baseline - Single Pane		199	1,446	-	-	-	-	-	-	-	-	-	-	30					
Double Pane-Add storm to single	Existing	130	1,418	0.02	0.03	24	29	6	9	1	0	17	9	30	$ 802		0.09	0.06	158.01
Double Pane	Single Pane	130	1,418	0.02	0.03	24	29	6	9	1	0	17	9	30		$ 102	0.68	0.46	20.10
Triple Pane	Double Pane	121	1,374	0.00	0.03	3	4	0	1	3	2	24	15	30	NA	$ 168	0.25	0.18	44.32
Double Pane Low-E	Triple Pane	112	1,371	0.00	0.01	3	4	1	1	0	(0)	3	-	30	NA	$ 169	0.08	0.06	264.72
21. Weatherization																			
LMF Elect Resist w/ CAC																			
Baseline - Poor Weatherization		5,877	1,849	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	4,254	1,771	1.04	0.03	587	649	162	225	1	1	40	37	10	$ 182	NA	4.05	2.69	2.52
LMF Elect Resist w/ RAC																			
Baseline - Poor Weatherization		4,863	1,185	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	3,605	1,147	0.77	(0.01)	451	512	119	174	0	1	17	21	10	$ 194	NA	2.81	1.84	3.59
LMF Gas w/ CAC (35+ yrs old)																			
Baseline - Poor Weatherization		170	1,445	-	-	-	-	-	-	-	-	-	-						
Weatherization Treatment	Existing	125	1,407	0.01	0.03	17	19	4	6	0	0	13	24	10	$ 174	NA	0.20	0.13	35.07
22. Air to Air Heat Exchanger																			
LMF Elect Resist w/ CAC																			
Baseline - Weatherization		4,254	1,771	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	3,132	1,683	0.78	0.07	404	467	98	154	2	1	51	34	12	$ 1,050	$ 1,050	0.58	0.40	19.92
LMF Elect Resist w/ RAC																			
Baseline - Weatherization		3,605	1,147	-	-	-	-	-	-	-	-	-	-						
Air-to-Air Heat Exchanger	Weatherization	2,743	1,102	0.58	0.01	313	365	71	114	0	1	22	22	12	$ 1,050	$ 1,050	0.42	0.28	27.16
26. AC Maintenance																			
LMF Elect Resist w/ CAC	Existing	5,053	1,491	0.00	0.27	0	0	0	0	14	5	186	120	2	$ 150		0.37	0.28	5.63
LMF Elect Resist w/ RAC	Existing	4,222	963	0.00	0.26	0	0	0	0	6	5	101	94	2	$ 80		0.55	0.44	4.73
LMF Gas w/ CAC	Existing	147	1,168	0.00	0.22	0	0	0	0	7	4	132	116	2	$ 150		0.29	0.22	7.02

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
LIGHTING																
Indoor Lighting - Lamps/Ballasts Only - Retail Costs																
Baseline - 60 W incandescent								49				12				
13 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	13	36	0.002	0.003	12	$5.12	2.64	1.49	2.77
15 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$10.62	1.21	0.68	6.01
15 W fluor. w/ 3 W elec ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$16.62	0.78	0.44	9.41
Baseline - 75 W incandescent								62				12				
18 W fluor. w/ 3 W mag ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$8.26	2.00	1.13	3.64
18 W fluor. w/ 3 W elec ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$12.76	1.30	0.73	5.63
Baseline - 100 W incandescent								82				12				
26 W fluor. w/ 3 W mag ballast	Baseline - 100 W incandescent	8	7	15	11	10	8	24	58	0.003	0.004	12	$9.76	2.23	1.26	3.27
27 W fluor. w/ 3 W elec ballast	Baseline - 100 W incandescent	8	6	15	11	10	8	25	57	0.003	0.004	12	$16.26	1.32	0.74	5.53
Indoor Lighting - Lamps/Ballasts & Fixtures - Retail Costs																
Baseline - 60 W incandescent								49				12				
13 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	13	36	0.002	0.003	12	$54.13	0.25	0.14	29.27
15 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$59.63	0.22	0.12	33.77
15 W fluor. w/ 3 W elec ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$65.63	0.20	0.11	37.17
Baseline - 75 W incandescent								62				12				
18 W fluor. w/ 3 W mag ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$76.29	0.22	0.12	33.64
18 W fluor. w/ 3 W elec ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$80.79	0.21	0.12	35.63
Baseline - 100 W incandescent								82				12				
26 W fluor. w/ 3 W mag ballast	Baseline - 100 W incandescent	8	7	15	11	10	8	24	58	0.003	0.004	12	$77.79	0.28	0.16	26.09
27 W fluor. w/ 3 W elec ballast	Baseline - 100 W incandescent	8	6	15	11	10	8	25	57	0.003	0.004	12	$84.29	0.25	0.14	28.67

Notes:
(1) All indoor lamps assume a usage of 2.25 hours per day or 821 hours per year. All outdoor lamps assume a usage of 2.3 hours per day or 840 hours per year.
(2) Calculations of lighting costs assume a discount rate of: 11.3%
(3) Incandescent bulb and standard flood lamp costs are PV lifecycle costs
(4) Baseline costs are a function of hours per bulb, hours per year, $ per bulb and discount rate.

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST PAY BACK YEARS
Indoor Lighting - Lamps/Ballasts Only - Wholesale Costs																
Baseline - 60 W Incandescent								49				12				
13 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	13	36	0.002	0.003	12	$4.54	2.98	1.68	2.45
15 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$5.04	2.56	1.44	2.85
15 W fluor. w/ 3 W elec ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$10.54	1.22	0.69	5.97
Baseline - 75 W Incandescent								62				12				
18 W fluor. w/ 3 W mag ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$6.58	2.52	1.42	2.90
19 W fluor. w/ 3 W elec ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$8.08	2.05	1.16	3.56
Baseline - 100 W Incandescent								82				12				
26 W fluor. w/ 3 W mag ballast	Baseline - 100 W incandescent	8	7	15	11	10	8	24	58	0.003	0.004	12	$7.58	2.87	1.62	2.54
27 W fluor. w/ 3 W elec ballast	Baseline - 100 W incandescent	8	6	15	11	10	8	25	57	0.003	0.004	12	$10.08	2.13	1.20	3.43
Indoor Lighting - Lamps/Ballasts & Fixtures - Wholesale Costs																
Baseline - 60 W Incandescent								49				12				
13 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	13	36	0.002	0.003	12	$29.54	0.46	0.26	15.97
15 W fluor. w/ 3 W mag ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$30.04	0.43	0.24	17.01
15 W fluor. w/ 3 W elec ballast	Baseline - 60 W incandescent	5	4	9	7	6	5	15	35	0.002	0.003	12	$35.54	0.36	0.20	20.13
Baseline - 75 W Incandescent								62				12				
18 W fluor. w/ 3 W mag ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$31.58	0.52	0.30	13.92
18 W fluor. w/ 3 W elec ballast	Baseline - 75 W incandescent	6	5	11	8	7	6	17	44	0.002	0.003	12	$33.08	0.50	0.28	14.59
Baseline - 100 W Incandescent								82				12				
26 W fluor. w/ 3 W mag ballast	Baseline - 100 W incandescent	8	7	15	11	10	8	24	58	0.003	0.004	12	$32.58	0.67	0.38	10.93
27 W fluor. w/ 3 W elec ballast	Baseline - 100 W incandescent	8	6	15	11	10	8	25	57	0.003	0.004	12	$35.08	0.61	0.34	11.93

Notes:
(1) All indoor lamps assume a usage of 2.25 hours per day or 821 hours per year. All outdoor lamps assume a usage of 2.3 hours per day or 840 hours per year.
(2) Calculations of lighting costs assume a discount rate of: 11.3%
(3) Incandescent bulb and standard flood lamp costs are PV lifecycle costs
(4) Baseline costs are a function of hours per bulb, hours per year, $ per bulb and discount rate.

Outdoor Lighting - Lamps Only - Retail Costs																
Baseline- 75 W Std Flood Lamp								63				3				
45 Watt Halogen Flood Lamp	Baseline- 75 W Std Flood Lamp	3	3	7	5	4	3	38	25	0.001	0.002	3	($3.21)	INFINITE	INFINITE	NOW
Baseline- 150 W Std Flood Lamp								126				3				
90 Watt Halogen Flood Lamp	Baseline- 150 W Std Flood Lamp	7	6	13	10	8	7	76	50	0.003	0.004	3	($1.80)	INFINITE	INFINITE	NOW
Outdoor Lighting - Lamps Only - Wholesale Costs																
Baseline- 75 W Std Flood Lamp								63				3				
45 Watt Halogen Flood Lamp	Baseline- 75 W Std Flood Lamp	3	3	7	5	4	3	38	25	0.001	0.002	3	($0.60)	INFINITE	INFINITE	NOW
Baseline- 150 W Std Flood Lamp								126				3				
90 Watt Halogen Flood Lamp	Baseline- 150 W Std Flood Lamp	7	6	13	10	8	7	76	50	0.003	0.004	3	$0.05	129.68	73.07	0.02

Notes:
(1) All indoor lamps assume a usage of 2.25 hours per day or 821 hours per year. All outdoor lamps assume a usage of 2.3 hours per day or 840 hours per year.
(2) Calculations of lighting costs assume a discount rate of: 11.3%
(3) Incandescent bulb and standard flood lamp costs are PV lifecycle costs
(4) Baseline [redacted]

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
WATER HEATING																
								3932								
Water Heater - Existing																
Add low flow faucets (3/house)		16	13	17	15	17	15	3839	93	0.012	0.015	15	$12.00	3.70	2.28	2.38
Add low flow showers (2/house)		42	35	46	41	44	39	3282	249	0.084	0.103	15	$20.00	8.04	5.77	1.49
Add Pipe Insulation		42	35	46	40	44	39	3687	245	0.031	0.039	15	$3.00	39.00	23.98	0.23
Add Bottom Board (1)		5	5	6	5	6	5	3900	32	0.004	0.005	12	$28.77	0.47	0.29	16.62
Add Wrap		34	28	37	33	35	31	3734	198	0.025	0.031	10	$23.00	3.30	2.03	2.15
Add Hot water saver (1)		84	70	93	82	88	79	3437	495	0.064	0.078	20	$195.27	1.36	0.84	7.29
Early Repl. Water Heater (EF = .8814)	Water Heater (EF = .8413)	35	29	39	34	37	33	3800	208	0.027	0.033	13	$462.54	0.20	0.12	41.10
Early Repl. Water Heater (EF = .95)	Water Heater (EF = .8413)	82	68	90	80	86	76	3526	482	0.062	0.076	13	$537.54	0.40	0.25	20.61
Add-on remote HPWH (EF = 1.64)	Water Heater (EF = .8413)	320	267	354	312	336	300	2043	1889	0.243	0.299	13	$1,490	0.56	0.35	14.58
Solar Assist WH	Water Heater (EF = .8413)	333	278	369	325	350	312	1966	1966	0.253	0.311	20	$2,375	0.44	0.27	22.33
Hot Water Storage (w/120 gal tank)	Water Heater (EF = .8413)	0	0	0	0	0	0	3932	0	0.505	0.622	13	$509.00	0.76	0.76	NEVER
Desuperheater DHW System	Water Heater (EF = .8413)	158	132	175	154	166	148	2998	934	0.120	0.000	15	$575.00	0.70	0.40	11.38
Full Condenser DHW System	Water Heater (EF = .8413)	175	146	194	170	184	164	2900	1032	0.133	0.163	15	$800.00	0.62	0.38	14.33
Cycling	Water Heater (EF = .8413)															
Cycling (33%)		0	0	0	0	0	0	3932	0	0.078	0.098	15	$122.54	0.52	0.52	NEVER
Cycling (50%)		0	0	0	0	0	0	3932	0	0.160	0.221	15	$122.54	1.21	1.21	NEVER
Cycling (67%)		0	0	0	0	0	0	3932	0	0.282	0.347	15	$122.54	1.90	1.90	NEVER
Cycling (100%)		0	0	0	0	0	0	3932	0	0.480	0.591	15	$122.54	3.23	3.23	NEVER
								3795								
Water Heater - Replacement																
Add low flow faucets (3/house)		16	13	17	15	17	15	3702	93	0.012	0.015	15	$12.00	3.70	2.28	2.38
Add low flow showers (2/house)		42	35	46	41	44	39	3145	249	0.084	0.103	15	$20.00	8.04	5.77	1.49
Add Pipe Insulation		42	35	46	40	44	39	3550	245	0.031	0.039	15	$3.00	39.00	23.98	0.23
Add Bottom Board (1)		3	2	3	3	3	3	3779	16	0.002	0.003	12	$28.77	0.24	0.15	33.24
Add Wrap		17	14	19	17	18	16	3693	102	0.013	0.016	10	$23.00	1.70	1.04	4.17
Add Hot water saver (1)		84	70	93	82	88	79	3300	495	0.064	0.078	20	$195.27	1.36	0.84	7.29
High-eff. water heater (EF = .95)	Water Heater (EF = .8814)	46	39	51	45	49	43	3521	274	0.035	0.043	13	$75.00	1.63	1.00	5.06
Integral HPWH (EF = 1.64)	Water Heater (EF = .8814)	298	248	329	290	312	278	2039	1756	0.226	0.278	13	$1,490.03	0.52	0.32	15.68
Solar Assist WH	Water Heater (EF = .8814)	333	278	369	325	350	312	1829	1966	0.253	0.311	20	$2,375.00	0.44	0.27	22.33
Hot Water Storage (w/120 gal tank)	Water Heater (EF = .8814)	0	0	0	0	0	0	3795	0	0.468	0.600	13	$963.00	0.39	0.39	NEVER
Desuperheater DHW System	Water Heater (EF = .8814)	153	127	169	149	160	143	2894	901	0.116	0.000	15	$575.00	0.68	0.39	11.80
Full Condenser DHW System	Water Heater (EF = .8814)	169	141	187	165	177	158	2799	996	0.128	0.157	15	$800.00	0.59	0.37	14.65
Cycling	Water Heater (EF = .8814)															
Cycling (33%)		0	0	0	0	0	0	3795	0	0.075	0.093	15	$122.54	0.51	0.51	NEVER
Cycling (50%)		0	0	0	0	0	0	3795	0	0.174	0.214	15	$122.54	1.17	1.17	NEVER
Cycling (67%)		0	0	0	0	0	0	3795	0	0.272	0.335	15	$122.54	1.83	1.83	NEVER
Cycling (100%)		0	0	0	0	0	0	3795	0	0.463	0.570	15	$122.54	3.12	3.12	NEVER

(1) The incremental costs represent installed costs; because the proper installation of a bottom board and hot water saver typically requires a plumber, costs include a labor charge for installation ($18.77 for the first hour).

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
WATER HEATING (continued)																
Water Heating - New								3300								
Add low flow faucets (3/house)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15	NA			
Add low flow showers (2/house)		42	35	47	41	44	39	3052	248	0.032	0.039	15	$20.00	5.92	3.64	1.49
Add Pipe Insulation		42	35	46	40	44	39	3055	245	0.031	0.039	15	$3.00	39.00	23.98	0.23
Add Bottom Board (1)		3	2	3	3	3	3	3284	16	0.002	0.003	12	$28.77	0.24	0.15	33.24
Add Wrap		17	14	19	17	18	16	3198	102	0.013	0.016	10	$23.00	1.70	1.04	4.17
Add Hot water saver (1)		84	70	93	82	88	79	2805	495	0.064	0.078	20	$195.27	1.36	0.84	7.29
													NA			
High-eff. water heater (EF = .95)	Water Heater (EF = .8814)	40	34	45	39	42	38	3062	238	0.031	0.038	13	$75.00	1.41	0.87	5.82
Integral HPWH (EF = 1.64)	Water Heater (EF = .8814)	259	216	286	252	271	242	1774	1526	0.196	0.241	13	$1,490.03	0.46	0.28	18.05
Solar Assist WH	Water Heater (EF = .8814)	333	278	369	325	350	312	1334	1966	0.253	0.311	20	$2,375.00	0.44	0.27	22.33
Hot Water Storage (w/120 gal tank)	Water Heater (EF = .8814)	0	0	0	0	0	0	3300	0	0.424	0.522	13	$963.00	0.34	0.34	NEVER
Desuperheater DHW System	Water Heater (EF = .8814)	133	111	147	130	139	124	2516	784	0.101	0.000	15	$575.00	0.59	0.34	13.56
Full Condenser DHW System	Water Heater (EF = .8814)	147	122	162	143	154	137	2434	866	0.111	0.137	15	$800.00	0.52	0.32	17.07
Cycling	Water Heater (EF = .8814)															
Cycling (33%)		0	0	0	0	0	0	3300	0	0.065	0.081	15	$122.54	0.44	0.44	NEVER
Cycling (50%)		0	0	0	0	0	0	3300	0	0.151	0.186	15	$122.54	1.02	1.02	NEVER
Cycling (67%)		0	0	0	0	0	0	3300	0	0.237	0.291	15	$122.54	1.59	1.59	NEVER
Cycling (100%)		0	0	0	0	0	0	3300	0	0.403	0.498	15	$122.54	2.71	2.71	NEVER

(1) The incremental costs represent installed costs; because the proper installation of a bottom board and hot water saver typically requires a plumber, costs include a labor charge for installation ($18.77 for the first hour).

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
APPLIANCES																
Refrigerator																
Existing Stock (1-20 yrs old) Servicing	Existing Stock (1-20 yrs old)	12	12	9	9	10	10	1265 1202	63	0.010	0.006	1	$50.00	0.07	0.04	13.63
Existing Stock (16-20 years old) Remove 2nd refrigerator	Existing Stock (16-20 years old)	325	325	256	255	275	275	1710 0	1710	0.274	0.170	5	$125.00	3.17	1.94	1.28
Existing Stock (11-20 years old) Early Repl. Ref. - 1993 Std	Existing Stock (11-20 years old)	158	158	125	124	134	134	1558 724	834	0.134	0.083	8	$646.00	0.42	0.26	13.55
High-Eff (10% above '93 std)	1993 Standard New Refrigerator	14	14	11	11	12	12	652	72	0.012	0.007	20	$132.00	0.29	0.18	31.90
High-Eff (15% above '93 std)	1993 Standard New Refrigerator	21	21	16	16	17	17	615	109	0.017	0.011	20	$182.00	0.32	0.19	29.33
High-Eff (20% above '93 std)	1993 Standard New Refrigerator	28	28	22	22	23	23	579	145	0.023	0.014	20	$484.00	0.16	0.10	58.49
Freezer																
Existing Stock (1-20 yrs old) Servicing	Existing Stock (1-20 yrs old)	9	9	6	7	7	7	918 872	46	0.008	0.004	1	$50.00	0.05	0.03	18.84
Existing Stock (16-20 years old) Remove 2nd freezer	Existing Stock (16-20 years old)	250	258	180	193	194	210	1286 0	0 1286	0.210	0.117	5	$125.00	2.37	1.44	1.68
Existing Stock (11-20 years old) Early Repl. Frz. - 1993 Std	Existing Stock (11-20 years old)	116	120	84	90	90	98	1152 554	598	0.098	0.054	8	$451.00	0.43	0.26	13.05
High-Eff (10% above '93 std)	1993 Standard New Freezer	11	11	8	8	8	9	499	55	0.009	0.005	20	$92.15	0.32	0.19	28.78
High-Eff (15% above '93 std)	1993 Standard New Freezer	16	17	12	12	13	14	471	83	0.014	0.008	20	$127.06	0.35	0.21	26.45
High-Eff (20% above '93 std)	1993 Standard New Freezer	22	22	16	17	17	18	443	111	0.018	0.010	20	$337.90	0.17	0.11	52.76
Clothes Washer																
1992 New Horizontal-axis clothes washer	1992 New	63	29	67	31	66	31	840 653	287	0.034	0.110	15	$259.00	0.61	0.40	16.54
Clothes Dryer																
1992 New High-eff clothes dryer	1992 New	18	11	22	13	22	13	822 723	99	0.009	0.014	17	$82.00	0.59	0.36	15.62
Range/Oven																
1992 New High-eff range/oven	1992 New	32	17	37	21	36	20	601 439	162	0.057	0.016	18	$1,610.00	0.06	0.04	185.05
Pool/Spa Pump																
1992 New High-eff pool/spa pump	1992 New	21	18	42	31	27	22	1100 938	162	0.009	0.012	15	$35.00	1.94	1.09	4.22

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kW/h/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
SPACE CONDITIONING (Single Family - Existing)																
Central AC Only																
Shading AC with trellis	Existing Stock	188	0	0	0	25	0	2926	214	0.327	0.000	15	$210.00	1.13	0.94	4.14
Cycling (33%)	Existing Stock	0	0	0	0	0	0	3139	0	0.505	0.000	15	$126.96	1.90	1.90	NEVER
Cycling (50%)	Existing Stock	0	0	0	0	0	0	3139	0	1.165	0.000	15	$126.96	4.39	4.39	NEVER
Cycling (67%)	Existing Stock	0	0	0	0	0	0	3139	0	1.825	0.000	15	$126.96	6.87	6.87	NEVER
Cycling (100%)	Existing Stock	0	0	0	0	0	0	3139	0	3.107	0.000	15	$126.96	11.70	11.70	NEVER
Resistance Heating Only																
								24024	0							
Electric Thermal Storage-Heating	Existing Stock	0	0	8135	-8135	0	0	24024	0	0.000	11.390	18	$5,051.64	0.75	0.77	NEVER
Heat Pump Cooling/Heating																
								16043	0							
Electric Thermal Storage-Heating	1992--Std ASHP (SEER = 10.0)	0	0	3710	-3710	0	0	13332	0	0.000	7.146	18	$3,030.14	0.76	0.78	NEVER
Shading ASHP with trellis	Existing Stock	191	0	0	0	17	0	12857	208	0.343	0.000	15	$210.00	1.15	0.97	4.17
Cycling (33%)	Existing Stock	0	0	0	0	0	0	16043	0	0.530	1.244	15	$126.96	4.76	4.76	NEVER
Cycling (50%)	Existing Stock	0	0	0	0	0	0	16043	0	1.222	2.871	15	$126.96	10.97	10.97	NEVER
Cycling (67%)	Existing Stock	0	0	0	0	0	0	16043	0	1.914	4.498	15	$126.96	17.19	17.19	NEVER
Cycling (100%)	Existing Stock	0	0	0	0	0	0	16043	0	3.259	7.657	15	$126.96	29.26	29.26	NEVER
Central AC/Gas Furnace																
Shading AC with trellis	Existing Stock	188	0	0	0	25	0	2926	214	0.327	0.000	15	$210.00	1.13	0.94	4.14
Central AC/Resistance Heating																
								27163	0							
Electric Thermal Storage-Heating	CAC (SEER = 10.0)/Resist. Heat	0	0	8135	-8135	0	0	26853	0	0.000	11.390	18	$5,051.64	0.75	0.77	NEVER
Shading AC with trellis	Existing Stock	188	0	0	0	25	0	20976	214	0.327	0.000	15	$210.00	1.13	0.94	4.14

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVISION COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
SPACE CONDITIONING (Single Family - New)																
Central AC Only																
								3066	0							
Shading AC with trellis	1992 Standard (SEER = 10.0)	173	0	0	0	31	0	2862	204	0.283	0.000	15	$210.00	1.01	0.84	4.41
Cycling (33%)	1992 Standard (SEER = 10.0)	0	0	0	0	0	0	3066	0	0.437	0.000	15	$126.96	1.65	1.65	NEVER
Cycling (50%)	1993 Standard (SEER = 10.0)	0	0	0	0	0	0	3066	0	1.009	0.000	15	$126.96	3.80	3.80	NEVER
Cycling (67%)	1992 Standard (SEER = 10.0)	0	0	0	0	0	0	3066	0	1.581	0.000	15	$126.96	5.95	5.95	NEVER
Cycling (100%)	1992 Standard (SEER = 10.0)	0	0	0	0	0	0	3066	0	2.692	0.000	15	$126.96	10.14	10.14	NEVER
Resistance Heating Only																
								16846	0							
Electric Thermal Storage-Heating	New Resistance Heating	0	0	5759	-5759	0	0	16847	0	0.000	8.528	18	$5,106.19	0.55	0.56	NEVER
Heat Pump Cooling/Heating																
								10976	0							
Electric Thermal Storage-Heating	1992 Std ASHP (SEER = 10.0)	0	0	2705	-2705	0	0	10977	0	0.000	5.332	18	$3,084.69	0.56	0.57	NEVER
Shading ASHP with trellis	1992 Std ASHP (SEER = 10.0)	180	0	0	0	22	0	9118	203	0.301	0.000	15	$210.00	1.05	0.88	4.34
Cycling (33%)	1992 Std ASHP (SEER = 10.0)	0	0	0	0	0	0	10976	0	0.465	0.823	15	$126.96	3.58	3.58	NEVER
Cycling (50%)	1993 Std ASHP (SEER = 10.0)	0	0	0	0	0	0	10976	0	1.073	1.900	15	$126.96	8.26	8.26	NEVER
Cycling (67%)	1992 Std ASHP (SEER = 10.0)	0	0	0	0	0	0	10976	0	1.682	2.976	15	$126.96	12.94	12.94	NEVER
Cycling (100%)	1992 Std ASHP (SEER = 10.0)	0	0	0	0	0	0	10976	0	2.862	5.065	15	$126.96	22.01	22.01	NEVER
Central AC/Gas Furnace																
								3066	0							
Shading AC with trellis	CAC (SEER = 10.0)/Gas Furnace	173	0	0	0	31	0	2862	204	0.283	0.000	15	$210.00	1.01	0.84	4.41
Central AC/Resistance Heating																
								19912	0							
Electric Thermal Storage-Heating	CAC (SEER = 10.0)/Resist. Heat	0	0	5759	-5759	0	0	19912	0	0.000	8.528	18	$5,106.19	0.55	0.56	NEVER
Shading AC with trellis	CAC (SEER = 10.0)/Resist. Heat	173	0	0	0	31	0	15849	204	0.283	0.000	15	$210.00	1.01	0.84	4.41

UNION ELECTRIC COMPANY
RESIDENTIAL SECTOR - ECONOMIC SCREENING
APPLIANCE MEASURES

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
SPACE CONDITIONING (Multi-Family - Existing)																
Resistance Heating Only																
								101097	0							
Elect.Thermal Storage-Heating	Existing Stock	0	0	38037	-38037	0	0	101097	0	0.000	63.156	18	$14,876	1.39	1.42	NEVER
Heat Pump Cooling/Heating (1)																
								95410								
Elect. Thermal Storage-Heating	Std ASHP (EER=8.2)	0	0	19897	-19897	0	0	95410	0	0.000	41.946	18	$14,876	0.91	0.92	NEVER
Central AC/Resistance Heating																
								150988	0							
Elect. Thermal Storage-Heating	CAC (EER = 8.2)/Resist. Heat	0	0	38037	-38037	0	0	146670	0	0.000	63.156	18	$14,876	1.39	1.42	NEVER
SPACE CONDITIONING (Multi- Family - New)																
Resistance Heating Only																
								38553	0							
Elect. Thermal Storage-Heating	New Resistance Heating	0	0	14202	-14202	0	0	38553	0	0.000	26.939	18	$9,852	0.89	0.90	NEVER
Heat Pump Cooling/Heating																
								48763	0			18				
Elect. Thermal Storage-Heating	Std ASHP (EER = 8.2)	0	0	8227	-8227	0	0	48763	0	0.000	16.916	18	$9,852	0.55	0.56	NEVER
Central AC/Resistance Heating																
								65043	0							
Elect. Thermal Storage-Heating	CAC (EER = 8.2)/Resist. Heat	0	0	14202	-14202	0	0	65043	0	0.000	26.939	18	$9,852	0.89	0.90	NEVER

APPENDIX B

COMMERCIAL SECTOR MLSA RESULTS

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
EXISTING SMALL OFFICE BUILDING BASELINE								16.72								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 3.52 (0)	COP = 3.52 (existing stock)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000			0.00000	0.00000	20.0	NA			
COP = 4.0	COP = 3.52 (standard equip.)	0.02783	0.00515	0.01149	0.00528	0.01538	0.00510	16.65	0.07	0.00003	0.00000	20.0	0.02714	1.76	1.24	6.74
COP = 4.6	COP = 3.52 (standard equip.)	0.05568	0.01030	0.02297	0.01058	0.03074	0.01018	16.58	0.14	0.00007	0.00001	20.0	0.06106	1.57	1.10	7.59
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2 (0)	EER = 7.5	0.14392	0.01800	0.00077	0.00006	0.02799	0.00198	16.53	0.19	0.00020	0.00000	18.0	1.29695	0.14	0.11	90.59
EER = 9.5	EER = 8.2	0.19875	0.02489	0.00107	0.00009	0.03865	0.00275	16.26	0.27	0.00028	0.00000	18.0	0.14391	1.71	1.35	7.28
EER = 10.5	EER = 8.2	0.33592	0.04205	0.00181	0.00015	0.06531	0.00464	16.08	0.45	0.00047	0.00000	18.0	0.26461	1.63	1.29	7.62
Evaporative Condenser	Unitary System Air-Cooled	0.20560	0.02574	0.00110	0.00009	0.03999	0.00284	16.44	0.28	0.00029	0.00000	16.0	0.26040	0.90	0.71	12.73
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Central Chiller Air-Cooled	0.00192	0.00094	0.00319	0.00087	0.00978	0.00355	16.70	0.02	0.00000	0.00000	20.0	0.00544	1.53	0.75	6.36
Enthalpy Economizer	Central Chiller Air-Cooled	0.00222	0.00159	0.00319	0.00087	0.00983	0.00339	16.70	0.02	0.00000	0.00000	20.0	0.00544	1.59	0.78	5.86
Dry-Bulb Economizer	Unitary System Air-Cooled	0.00416	0.00200	0.00210	0.00027	0.00648	0.00126	16.70	0.02	0.00000	0.00000	18.0	0.10601	0.06	0.03	122.61
Enthalpy Economizer	Unitary System Air-Cooled	0.00440	0.00171	0.00214	0.00020	0.00659	0.00125	16.70	0.02	0.00000	0.00000	18.0	0.10601	0.06	0.03	122.78
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.01079	0.00210	0.10787	0.04845	0.06765	0.03652	16.45	0.27	0.00000	0.00000	20.0	0.02474	4.41	2.17	2.38
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.00811	0.00153	0.00553	0.00122	0.00841	0.00196	16.69	0.03	0.00000	0.00000	15.0	0.02306	0.41	0.21	16.47
Variable Speed Fans	Single-Speed Fans	0.00942	0.00182	0.00579	0.00129	0.00889	0.00209	16.69	0.03	0.00000	0.00000	15.0	0.02756	0.38	0.19	17.63
Condenser Coil Cleaning	Unitary System Air-Cooled	0.10281	0.01286	0.00055	0.00004	0.02000	0.00142	16.58	0.14	0.00014	0.00000	1.0	0.00928	1.48	1.17	0.91
Time Clock		-0.04379	0.12607	-0.20261	0.38584	-0.06852	0.13307	16.39	0.33	-0.00002	-0.00023	10.0	0.02650	0.78	-1.17	1.70
Setback Thermostat		-0.00591	0.00226	-0.34544	0.48680	-0.03072	0.12447	16.49	0.23	-0.00001	-0.00083	10.0	0.05300	-2.57	-3.29	6.53

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Cooling/Heating																
Unitary System & Elec. Heating EER = 8.2	Unitary System & Elec. Heating EER = 7.5	0.08452	0.01186	0.00001	0.00000	0.01439	0.00086	16.61	0.11	0.00012	0.00000	18.0	NA			
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	0.00018	-0.00020	1.14025	0.46687	0.35341	0.12589	14.52	2.09	0.00000	-0.00010	18.0	0.07420	10.37	6.01	0.99
EER = 9.6, COP = 3.1	EER = 8.2	0.12112	0.01688	1.26399	0.51275	0.41629	0.14062	14.15	2.46	0.00017	-0.00010	18.0	0.30300	3.30	1.75	3.21
Ground-Coupled Heat Pump EER = , COP =	Unitary System & Elec. Heating EER = 8.2	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Unitary System & Gas Furnace EER = 8.2	Unitary System & Gas Furnace EER = 7.5	0.03994	0.00319	0.00001	0.00000	0.00674	0.00025	16.67	0.05	0.00006	0.00000	18.0	NA			
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	-0.00052	-0.00021	-0.05928	-0.01248	-0.07924	-0.01329	16.83	0.17	0.00000	0.00000	18.0	0.02002	-3.21	-1.60	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.05662	0.00439	-0.05121	-0.01102	-0.05804	-0.01118	16.74	0.07	0.00008	0.00000	18.0	0.12900	0.11	0.22	471.18
Bypass/Delay Timer		-0.01819	0.03457	0.01556	0.04576	0.00295	0.02844	16.61	0.11	-0.00001	0.00000	15.0	0.01237	2.54	0.86	2.55
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	-0.08108	-0.01974	0.31879	0.26133	0.10435	0.07292	16.06	0.66	-0.00004	0.00031	20.0	0.57000	0.58	0.35	30.19
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Double-Pane Windows	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Triple-Pane Windows	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
"Triple Pane" Low E	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Tinted Window Films	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Tinted Window Films	Double-Pane Windows	0.05524	0.00630	0.01717	0.00953	0.00744	-0.00024	16.62	0.10	0.00008	-0.00012	20.0	0.09167	0.43	0.22	14.70
Low E Films	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Low E Films	Double-Pane Windows	0.12241	0.01479	0.08772	0.07552	0.03152	0.01244	16.38	0.34	0.00014	0.00015	20.0	0.45883	0.57	0.42	24.65

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH DIVISION COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.50557	0.06158	0.12532	0.02726	0.24107	0.01255	15.76	0.97	0.00050	0.00010	10.0	1.73800	0.28	0.20	28.58
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.41642	0.10081	0.18707	0.05933	0.24678	0.05711	15.65	1.07	0.00043	0.00019	10.0	0.00389	130.84	91.44	0.06
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.41642	0.10081	0.18707	0.05933	0.24678	0.05711	15.65	1.07	0.00043	0.00019	10.0	0.02449	20.77	14.51	0.40
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.41642	0.10081	0.18707	0.05933	0.24678	0.05711	15.65	1.07	0.00043	0.00019	10.0	0.26265	2.01	1.41	4.09
Halogen Lamps	Incandescent Lamps	0.01191	0.00295	0.00847	0.00176	0.00857	0.00182	16.68	0.04	0.00001	0.00000	0.6	0.00023	6.18	4.20	0.12
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.11883	0.02875	0.06311	0.02696	0.07411	0.01965	16.39	0.33	0.00012	0.00006	20.0	0.07809	2.76	1.90	4.19
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.48643	0.11814	0.21226	0.05879	0.29122	0.06635	15.49	1.23	0.00051	0.00022	20.0	0.50530	1.64	1.15	7.03
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.18344	0.04442	0.08838	0.03114	0.11484	0.02788	16.23	0.49	0.00019	0.00009	3.5	0.00848	12.45	8.66	0.30
Electronic Ballasts	T12 Fluorescent Lamps	0.31782	0.07671	0.14063	0.04375	0.19206	0.04426	15.90	0.82	0.00033	0.00014	20.0	0.31926	1.71	1.20	6.76
Compact Fluorescent Lamps	Incandescent Lamps	0.12013	0.02907	0.06358	0.02710	0.07490	0.01986	16.39	0.33	0.00012	0.00006	2.9	-0.00330	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.01907	0.03891	0.01883	0.03864	0.01929	0.03874	16.55	0.17	0.00000	0.00000	20.0	0.02827	2.46	1.18	3.19
Metal Halide - Outdoor	Mercury Vapor Lamps	0.01017	0.02075	0.01005	0.02062	0.01030	0.02066	16.63	0.09	0.00000	0.00000	20.0	0.02827	1.31	0.63	5.98
Occupancy Sensors		0.20558	0.04741	0.11570	0.03435	0.13431	0.02166	16.16	0.56	0.00004	-0.00003	10.0	0.20353	0.83	0.44	6.44
Ellipsoidal Lamps	Incandescent Lamps	0.01586	0.00394	0.00973	0.00201	0.01102	0.00245	16.67	0.05	0.00002	0.00001	0.6	0.00023	7.74	5.30	0.09
LED Exit Lighting	Incandescent Exit Lighting	0.01567	0.01847	0.01549	0.01839	0.01586	0.01829	16.62	0.10	0.00001	0.00001	15.0	0.06007	0.73	0.42	11.50
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.01330	0.01568	0.01314	0.01560	0.01346	0.01552	16.63	0.09	0.00001	0.00001	15.0	0.05118	0.73	0.42	11.55
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.01852	0.02184	0.01830	0.02172	0.01874	0.02162	16.60	0.12	0.00001	0.00001	15.0	0.09156	0.57	0.33	14.84
Exterior Time Clock		0.00831	0.03368	0.00822	0.03341	0.00841	0.03367	16.59	0.13	0.00001	0.00001	10.0	0.00777	5.16	2.75	1.21
Photocell - Outdoor Lighting		0.03384	0.02762	0.01116	0.00002	0.01976	0.01158	16.62	0.10	0.00001	0.00001	10.0	0.00777	4.51	2.56	1.19
Delay Timer		0.00197	0.02371	0.00799	0.01271	-0.00045	0.01528	16.66	0.06	0.00000	0.00000	10.0	0.00247	6.78	3.12	0.73

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.00237	0.00278	0.00233	0.00276	0.00240	0.00276	16.70	0.02	0.00000	0.00000	10.0	0.00148	3.59	2.07	1.89
Water Heater Blanket Blanket R = 11	Water Heater	0.00237	0.00278	0.00233	0.00276	0.00240	0.00276	16.70	0.02	0.00000	0.00000	10.0	0.00269	1.98	1.14	3.41
Storage Water Heater	Water Heater	0.03524	-0.03466	0.03482	-0.03425	0.03566	-0.03508	16.72	0.00	0.00003	0.00003	10.0	0.09717	0.23	0.24	1104.83

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.00734	0.01142	0.00323	0.00748	0.00208	0.00940	16.68	0.04	0.00000	0.00000	6.0	0.03675	0.21	0.10	15.81
Energy Efficient Desktops	Desktops	0.09459	0.01227	0.04382	0.00578	0.06136	0.00672	16.50	0.22	0.00009	0.00005	6.0	1.83748	0.04	0.03	142.09
Energy Efficient Laptops	Desktops	0.12699	0.01437	0.06040	0.00594	0.08197	0.00634	16.42	0.30	0.00012	0.00007	6.0	3.30263	0.03	0.02	193.48
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.00893	0.01175	0.00385	0.00780	0.00299	0.00956	16.68	0.04	0.00000	0.00000	6.0	0.02261	0.38	0.17	8.88
Energy Efficient Printers	Dedicated Printers	0.12699	0.01437	0.06040	0.00594	0.08197	0.00634	16.42	0.30	0.00012	0.00007	6.0	0.93852	0.11	0.08	64.98
Copiers																
Timer (off at night/weekends)	Copiers	0.00312	0.00369	0.00419	0.00291	0.00077	0.00298	16.70	0.02	0.00000	0.00000	6.0	0.00585	0.59	0.27	5.99
Energy Efficient Copiers	Copiers	0.05143	0.00594	0.02477	0.00238	0.03464	0.00286	16.60	0.12	0.00005	0.00003	6.0	0.71576	0.06	0.04	102.31

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE (YRS)	INCR COST ($)	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
NEW SMALL OFFICE BUILDING BASELINE								15.81								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.52	0.02748	0.00527	0.00952	0.00574	0.01288	0.00479	15.75	0.07	0.00000	0.00000	20.0	0.02375	1.10	0.54	6.17
COP = 4.6	COP = 3.52	0.05493	0.01054	0.01900	0.01146	0.02572	0.00958	15.68	0.13	0.00000	0.00000	20.0	0.05343	0.98	0.48	6.94
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.17747	0.02270	0.00073	0.00006	0.03416	0.00248	15.58	0.24	0.00000	0.00000	18.0	0.12936	0.71	0.35	7.32
EER = 10.5	EER = 8.2	0.31944	0.04086	0.00131	0.00011	0.06148	0.00447	15.39	0.43	0.00000	0.00000	18.0	0.22886	0.72	0.36	7.19
Evaporative Condenser	Unitary System Air-Cooled	0.19876	0.02543	0.00083	0.00007	0.03826	0.00279	15.55	0.27	0.00000	0.00000	15.0	0.23406	0.40	0.20	11.82
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (1)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	0.00000			
Enthalpy Economizer	Central Chiller Air-Cooled	0.00020	0.00030	0.00000	0.00000	0.00006	-0.00004	15.77	0.00	0.00000	0.00000	20.0	0.02102	0.01	0.00	509.02
Dry-Bulb Economizer (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	0.00000			
Enthalpy Economizer	Unitary System Air-Cooled	0.00012	0.00020	0.00004	0.00000	0.00006	-0.00004	15.81	0.00	0.00000	0.00000	18.0	0.09011	0.00	0.00	3200.46
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.02132	0.00565	0.09487	0.05700	0.06524	0.03840	15.54	0.27	0.00000	0.00000	20.0	0.09657	1.13	0.55	8.70
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.00894	0.00173	0.00117	0.00006	0.00496	0.00054	15.80	0.02	0.00000	0.00000	15.0	0.02306	0.27	0.13	20.74
Variable Speed Fans	Single-Speed Fans	0.01035	0.00204	0.00122	0.00006	0.00531	0.00060	15.79	0.02	0.00000	0.00000	15.0	0.01837	0.38	0.19	14.49
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		-0.02502	0.12251	-0.24874	0.35033	-0.04983	0.13287	15.53	0.28	-0.00001	0.00003	10.0	0.02650	2.61	0.90	1.82
Setback Thermostat		-0.00589	0.00412	-0.36488	0.42994	-0.02658	0.12180	15.66	0.16	-0.00004	0.00002	10.0	0.05300	0.42	-0.11	9.48
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	0.00023	-0.00037	1.12732	0.41591	0.35912	0.11503	13.80	2.02	0.00060	0.00039	18.0	0.07420	16.15	10.97	1.03
EER = 9.6, COP = 3.1	EER = 8.2	0.10881	0.01541	1.37616	0.51741	0.44717	0.14057	13.21	2.61	0.00073	0.00047	18.0	0.30276	5.01	3.37	3.06
Ground-Coupled Heat Pump	Unitary System & Elec. Heating	0.22976	0.03290	1.69380	0.68668	0.46683	0.15691	12.55	3.27	0.00092	0.00049	18.0	0.89046	2.10	1.40	6.91
EER = 11.6 COP = 3.5																
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	-0.00049	-0.00018	-0.06281	-0.01131	-0.08091	-0.01221	15.88	0.17	-0.00002	-0.00005	18.0	0.02002	-4.67	-3.04	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.05119	0.00414	-0.04891	-0.00866	-0.05491	-0.00917	15.88	0.07	-0.00002	-0.00004	18.0	0.12886	-0.37	-0.27	798.52
Bypass/Delay Timer		-0.01339	0.03395	-0.02626	0.01484	0.00139	0.02848	15.77	0.04	-0.00004	0.00002	15.0	0.01237	-0.31	-0.98	5.21

TABLE
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ECONOMIC SCREENING
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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R= 38	Ceiling Insulation	-0.03537	-0.00753	0.12546	0.12853	0.06576	0.04006	15.50	0.32	0.00007	0.00008	20.0	0.56000	0.34	0.22	59.73
Wall Insulation R= 19	Wall Insulation	-0.00474	0.00551	0.49183	0.35906	0.20374	0.10544	14.85	1.16	0.00030	0.00022	20.0	0.34240	2.01	1.33	8.23
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.22303	0.03092	0.00566	0.04587	-0.00566	-0.01256	15.53	0.29	0.00001	-0.00001	20.0	2.06869	0.06	0.03	94.39
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	-0.07028	-0.01281	0.21719	0.16140	0.09391	0.05779	15.37	0.45	0.00011	0.00010	20.0	0.11536	2.32	1.54	9.46
"Triple Pane" Low E	Double-Pane Windows	0.09659	0.01252	0.17771	0.15906	0.09037	0.04604	15.23	0.58	0.00011	0.00008	20.0	2.29548	0.14	0.09	89.12
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.05265	0.00680	-0.07365	-0.04000	-0.01729	-0.01313	15.90	0.08	-0.00006	-0.00002	12.0	0.09167	-0.60	-0.46	NEVER
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.11017	0.01472	0.05113	0.06245	3.55785	0.01135	16.53	3.81	0.00003	0.00002	12.0	0.45883	2.74	1.36	3.23

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Lighting																
Daylighting Controls		0.41960	0.05375	0.01269	-0.04031	0.18886	0.00806	15.17	0.64	-0.00004	0.00001	10.0	0.78996	0.22	0.10	17.68
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Halogen Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.6	NA			
T8 Fluorescent Lamps Electronic Ballast (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
T8 Fluorescent Lamps Electronic Ballast	T8 Fluorescent Lamps	0.40120	0.10092	0.10665	0.00770	0.23661	0.06139	14.90	0.91	0.00002	0.00008	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	3.5	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Compact Fluorescent Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.9	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.01905	0.03892	0.01883	0.03866	0.01929	0.03874	15.64	0.17	0.00002	0.00002	20.0	-0.00254	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.01017	0.02076	0.01003	0.02062	0.01029	0.02066	15.72	0.09	0.00001	0.00001	20.0	-0.00254	INFINITE	INFINITE	NOW
Occupancy Sensors		0.17177	0.04035	0.03476	-0.02155	0.11151	0.01854	15.46	0.38	-0.00001	0.00003	10.0	0.20353	0.60	0.25	9.07
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.6	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.01600	0.01800	0.01500	0.01800	0.01600	0.01800	15.71	0.10	0.00000	0.00000	15.0	0.02066	1.69	0.80	4.00
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.01330	0.01568	0.01315	0.01558	0.01346	0.01552	15.73	0.09	0.00000	0.00001	15.0	0.01178	2.78	1.43	2.66
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.01900	0.02200	0.01800	0.02200	0.01900	0.02200	15.69	0.12	0.00000	0.00000	15.0	0.06215	0.81	0.38	8.35
Exterior Time Clock		0.00831	0.03368	0.00820	0.03341	0.00841	0.03368	15.69	0.13	0.00001	0.00001	10.0	0.00777	5.49	3.08	1.21
Photocell - Outdoor Lighting		0.03384	0.02762	0.01116	-0.00001	0.01975	0.01158	15.71	0.10	0.00000	0.00000	10.0	0.00777	3.56	1.61	1.19
Delay Timer		0.00167	0.02011	-0.02715	-0.01008	0.00025	0.01324	15.82	0.00	-0.00005	0.00001	10.0	0.00247	-7.16	-7.25	2.67

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Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.00237	0.00279	0.00232	0.00278	0.00239	0.00276	15.80	0.02	0.00000	0.00000	10.0	0.00148	2.88	1.36	1.88
Water Heater Blanket (1) Blanket R= 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.03524	-0.03466	0.03481	-0.03424	0.03565	-0.03507	15.81	0.00	0.00000	0.00000	10.0	0.09717	0.03	0.04	1097.66
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.00709	0.01118	-0.01307	-0.00069	0.00153	0.00879	15.80	0.01	-0.00003	0.00000	6.0	0.03675	-0.10	-0.15	26.88
Energy Efficient Desktops	Desktops	0.09199	0.01199	0.00293	-0.02021	0.05937	0.00563	15.66	0.15	-0.00005	0.00001	6.0	-1.37717	INFINITE	INFINITE	NOW
Energy Efficient Laptops	Desktops	0.12344	0.01423	0.03049	-0.01498	0.08030	0.00601	15.57	0.24	-0.00003	0.00002	6.0	0.08800	0.49	0.21	5.91
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.00865	0.01151	-0.01245	-0.00052	0.00236	0.00895	15.80	0.02	-0.00003	0.00000	6.0	0.02261	-0.13	-0.22	14.27
Energy Efficient Printers	Dedicated Printers	0.12344	0.01423	0.03049	-0.01498	0.08030	0.00601	15.57	0.24	-0.00003	0.00002	6.0	0.05088	0.86	0.37	3.42
Copiers																
Timer (off at night/weekends)	Copiers	0.00301	0.00363	-0.00028	0.00228	0.00179	0.00358	15.80	0.01	0.00000	0.00000	6.0	0.00565	0.61	0.35	7.01
Energy Efficient Copiers	Copiers	0.05011	0.00594	0.02295	0.00359	0.03291	0.00313	15.70	0.12	0.00001	0.00001	6.0	0.06134	0.47	0.28	9.00

Note:

(1) Not Applicable to New Buildings

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TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
EXISTING FAST FOOD RESTAURANT BASELINE								83.59								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2	EER = 7.6	0.42817	0.28026	0.03475	0.02481	0.17547	0.10178	82.54	1.06	0.00049	0.00000	18.0	2.37603	0.27	0.19	33.62
EER = 9.5	EER = 8.2	0.75094	0.50913	0.06099	0.04351	0.30777	0.17856	80.69	1.85	0.00086	0.00000	18.0	0.25627	4.43	3.01	2.07
EER = 10.5	EER = 8.2	1.20151	0.81469	0.09754	0.06960	0.49242	0.28567	79.57	2.98	0.00138	0.00000	18.0	0.45341	4.01	2.73	2.29
Evaporative Condenser	Unitary System Air-Cooled	0.82605	0.56002	0.06704	0.04787	0.33853	0.19640	81.56	2.04	0.00095	0.00000	18.0	0.46371	2.69	1.83	3.40
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Unitary System Air-Cooled	0.18674	0.20323	0.39204	0.26261	0.76045	0.49912	81.29	2.30	0.00000	0.00000	18.0	0.65242	1.35	0.84	6.50
Enthalpy Economizer	Unitary System Air-Cooled	0.19226	0.20323	0.39204	0.26261	0.76261	0.49912	81.28	2.31	0.00000	0.00000	18.0	0.65242	1.35	0.84	6.47
Condenser Coil Cleaning	Unitary System Air-Cooled	0.38602	0.26173	0.03136	0.02238	0.15816	0.09175	82.64	0.95	0.00044	0.00000	1.0	0.00941	6.70	4.55	0.15
Time Clock		0.03430	0.24510	0.06373	0.20631	0.02301	0.14065	82.88	0.71	-0.00009	-0.00014	10.0	0.02688	4.76	0.84	0.70
Setback Thermostat		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	83.59		0.00000	0.00000	10.0	0.05376	0.00	0.00	NEVER
Heating																
Heat Recovery from Refrigeration System	Unitary System	0.00000	0.00000	0.00544	0.00815	0.00000	0.00063	83.58	0.01	0.00000	0.00005	18.0	0.23899	0.08	0.07	469.61
Cooling/Heating																
Unitary System & Elec. Heating EER = 8.2	Unitary System & Elec. Heating EER = 7.5	0.06159	0.04115	0.00557	0.00396	0.02574	0.01480	83.44	0.15	0.00007	0.00000	18.0	NA			
High Eff. Air Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7		-0.00002	0.00008	0.16428	0.13782	0.02436	0.03563	83.08	0.36	0.00000	0.00000	18.0	0.17921	0.76	0.37	13.82
EER = 9.6, COP = 3.1		0.11508	0.07697	0.22675	0.19003	0.08169	0.07464	82.67	0.77	0.00013	0.00000	18.0	0.73118	0.49	0.28	20.21
Unitary System & Gas Furnace EER = 8.2	Unitary System & Gas Furnace	0.36857	0.24914	0.02920	0.02095	0.14976	0.08696	82.69	0.90	0.00042	0.00000	18.0	NA			
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7		-0.00032	-0.00065	-0.03838	-0.02855	-0.05515	-0.03162	82.84	0.15	0.00000	-0.00001	18.0	0.02539	-2.42	-1.21	NEVER
EER = 9.6, COP = 3.1		0.68438	0.46477	0.02326	0.01618	0.23488	0.13701	81.13	1.56	0.00079	-0.00001	18.0	0.16338	6.03	4.16	1.51

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	-0.02050	-0.00973	0.00590	0.01806	-0.06824	-0.03297	83.70	0.11	0.00002	0.00015	20.0	0.57000	0.02	0.06	
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.01686	0.00801	0.02175	0.01917	0.00527	0.00359	83.62	0.07	0.00003	0.00004	20.0	0.26216	0.23	0.17	68.79
Triple-Pane Windows	Single-Pane Windows	0.03241	0.01681	0.02782	0.02436	0.01109	0.00712	83.47	0.12	0.00006	0.00005	20.0	0.72595	0.13	0.09	111.07
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.02120	0.00934	0.03048	0.02672	0.00426	0.00446	83.50	0.10	0.00005	0.00006	20.0	0.28803	0.28	0.21	59.37
"Triple Pane" Low E	Single-Pane Windows	0.06884	0.03919	0.03134	0.02905	0.03053	0.01450	83.38	0.21	0.00010	0.00008	20.0	0.77680	0.20	0.14	61.71
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.07737	0.04619	0.00928	0.01122	0.04135	0.01864	83.39	0.20	0.00009	0.00002	12.0	0.06760	1.55	1.07	5.21
Tinted Window Films	Double-Pane Windows	0.06029	0.03476	0.02424	0.02261	0.02797	0.01272	83.41	0.18	0.00008	0.00004	12.0	0.41631	0.24	0.17	38.23
Low E Films	Single-Pane Windows	0.06975	0.04080	0.02017	0.01947	0.03422	0.01523	83.39	0.20	0.00009	0.00003	12.0	0.10287	1.05	0.74	8.42
Low E Films	Double-Pane Windows	0.06957	0.04010	0.02664	0.02511	0.03224	0.01493	83.38	0.21	0.00009	0.00005	12.0	0.63361	0.18	0.13	50.72
Lighting																
Halogen Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	0.00087			
Compact Fluorescent Lamps	Incandescent Lamps	0.98811	0.74247	0.88864	0.53952	0.86991	0.62981	79.14	4.46	0.00071	0.00045	2.1	-0.01540	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.05434	0.15277	0.05369	0.15171	0.05499	0.15206	82.97	0.62	0.00001	0.00001	20.0	NA			
Metal Halide - Outdoor	Mercury Vapor Lamps	0.02208	0.06205	0.02183	0.06164	0.02235	0.06177	83.34	0.25	0.00000	0.00000	20.0	NA			
Exterior Time Clock		0.00000	0.18459	0.00000	0.18307	0.00000	0.18450	83.04	0.55	0.00000	0.00000	10.0	0.01971	7.47	3.25	0.70
Photocell - Outdoor Lighting		0.08397	0.11446	0.01458	0.00868	0.04313	0.05587	83.27	0.32	0.00003	0.00002	10.0	0.01971	5.33	2.94	0.86

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
Heat Pump Water Heater COP = 3.0	Water Heater	0.30262	0.24114	0.30413	0.24723	0.31145	0.24183	81.84	1.65	0.00024	0.00029	18.0	0.36925	2.26	1.38	4.40
Desuperheater - HVAC	Water Heater	1.15279	0.89629	-0.07115	-0.05775	0.82345	0.58360	80.26	3.33	0.00093	-0.00011	18.0	0.16800	10.11	6.16	0.79
Desuperheater - Refrigeration	Water Heater	1.21060	0.96443	1.21652	0.98891	1.24585	0.96746	77.00	6.59	0.00098	0.00116	18.0	0.16800	19.85	12.13	0.50
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.05128	0.06044	0.05070	0.06016	0.05191	0.05984	83.26	0.33	0.00004	0.00004	10.0	0.00376	30.75	17.73	0.22
Water Heater Blanket Blanket R = 11	Water Heater	0.05128	0.06044	0.05070	0.06016	0.05191	0.05984	83.26	0.33	0.00004	0.00004	10.0	0.00681	16.99	9.80	0.40
Solar Assisted Water Heater	Water Heater	0.70367	0.54948	0.27806	0.22610	0.54649	0.40549	80.88	2.71	0.00059	0.00019	20.0	2.97303	0.48	0.30	19.26

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ECONOMIC SCREENING
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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH DIVERSN. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Refrigeration																
High Eff. Evaporator Fan Motor 3% Increase in Efficiency	Evaporator Fan Motor	0.00916	0.01087	0.00702	0.00815	0.00788	0.00891	83.54	0.05	0.00001	0.00001	15.0	0.00038	61.69	38.48	0.14
High Efficiency Compressor 10% Increase in EER	Reciprocating Compressor	0.02878	0.03410	0.02203	0.02554	0.02484	0.02805	83.43	0.16	0.00002	0.00002	15.0	0.02100	3.47	2.05	2.41
Variable Speed Compressor (1)	Constant Speed Compressors	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Condenser Coil Cleaning		0.02223	0.02632	0.01701	0.01974	0.01919	0.02163	83.47	0.13	0.00002	0.00002	1.0	0.00898	0.73	0.43	1.33
Appliances																
High Efficiency Fryers	Fryers	0.43301	0.36224	0.47029	0.35827	0.48911	0.36427	81.12	2.48	0.00036	0.00027	11.0	0.12545	7.50	4.46	1.00

Note:

(1) Not Applicable to Existing Buildings

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TABLE
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ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
NEW FAST FOOD RESTAURANT																
BASELINE								78.97								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.63255	0.41881	0.00517	0.00577	0.17268	0.09400	77.64	1.33	0.00077	0.00000	18.0	0.25627	3.48	2.47	2.68
EER = 10.5	EER = 8.2	1.07150	0.70862	0.00878	0.00981	0.29258	0.15918	76.72	2.25	0.00131	0.00000	18.0	0.45341	3.34	2.36	2.80
Evaporative Condenser	Unitary System Air-Cooled	0.72289	0.47875	0.00594	0.00662	0.19740	0.10743	77.45	1.52	0.00088	0.00000	18.0	0.46371	2.20	1.58	4.24
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	0.65242			
Enthalpy Economizer	Unitary System Air-Cooled	0.00532	0.00000	0.00000	0.00000	0.00193	0.00000	78.96	0.01	0.00000	0.00000	18.0	0.65242	0.00	0.00	1286.49
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		0.01269	0.18678	0.08307	0.22258	0.03239	0.13370	78.30	0.67	-0.00009	-0.00011	10.0	0.02688	4.53	0.86	0.81
Setback Thermostat		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	78.97		0.00000	0.00000	10.0	0.05376	0.00	0.00	NEVER
Heating																
Heat Recovery from Refrigeration System	Unitary System	0.00000	0.00000	0.00370	0.00562	0.00000	0.00041	78.88	0.01	0.00000	0.00000	18.0	0.23899	0.02	0.01	686.31
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7		0.00000	0.00000	0.23982	0.19865	0.04521	0.05712	78.43	0.54	0.00000	0.00000	18.0	0.04480	4.53	2.21	2.32
EER = 9.6, COP = 3.1		0.09647	0.06287	0.27342	0.22359	0.07875	0.07970	78.15	0.82	0.00012	0.00000	18.0	0.18280	2.01	1.14	5.01
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7		-0.00088	-0.00211	-0.05675	-0.04228	-0.10184	-0.06445	79.23	0.26	0.00000	-0.00001	18.0	0.10154	-1.00	-0.48	NEVER
EER = 9.6, COP = 3.1		0.57409	0.37992	-0.04870	-0.03417	0.06370	0.03492	78.00	0.97	0.00070	-0.00002	18.0	0.66361	1.10	0.81	8.33

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ECONOMIC SCREENING
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IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 38	Ceiling Insulation	-0.01046	-0.00264	0.05587	0.04318	-0.00520	0.00584	78.88	0.09	0.00001	0.00011	20.0	0.56000	0.13	0.10	223.39
Wall Insulation R = 19	Wall Insulation	0.54378	0.31296	0.08738	0.06746	0.09443	0.07022	77.79	1.18	0.00136	0.00021	20.0	0.94161	1.33	1.08	11.57
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.11977	0.06892	0.03565	0.03196	0.04684	0.02692	78.64	0.33	0.00016	0.00007	20.0	3.32285	0.07	0.05	162.42
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	0.11067	0.06483	0.00298	0.00727	0.03768	0.01776	78.73	0.24	0.00013	0.00002	20.0	0.18530	0.93	0.66	11.11
"Triple Pane" Low E	Double-Pane Windows	0.36510	0.20984	-0.00389	0.01074	0.12175	0.05394	78.21	0.76	0.00040	0.00006	20.0	3.68714	0.14	0.10	68.98
Tinted Window Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Window Films	Double-Pane Windows	0.28815	0.16639	-0.02203	-0.00645	0.09343	0.03943	78.41	0.56	0.00030	0.00002	12.0	0.48432	0.63	0.44	11.86
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.30102	0.16920	-0.00595	0.00911	0.10816	0.04608	78.34	0.63	0.00031	0.00008	12.0	0.73701	0.46	0.32	16.76
Lighting																
Halogen Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
Compact Fluorescent Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.1	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.02379	0.06681	0.02348	0.06638	0.02403	0.06651	78.70	0.27	0.00000	0.00000	20.0	NA			
Metal Halide - Outdoor	Mercury Vapor Lamps	0.01018	0.02862	0.01006	0.02847	0.01028	0.02852	78.95	0.12	0.00000	0.00000	20.0	NA			
Exterior Time Clock		0.00000	0.18453	0.00000	0.18307	0.00000	0.18452	78.42	0.55	0.00000	0.00000	10.0	0.01971	7.46	3.26	0.70
Photocell - Outdoor Lighting		0.08400	0.11445	0.01455	0.00863	0.04307	0.05592	78.66	0.32	0.00003	0.00002	10.0	0.01971	5.33	2.94	0.86

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. COST PAY BACK YEARS
Water Heating																
Heat Pump Water Heater COP = 3.0	Water Heater	0.30265	0.24110	0.30413	0.24720	0.31143	0.24185	77.32	1.65	0.00024	0.00029	18.0	0.36925	2.26	1.38	4.40
Desuperheater - HVAC	Water Heater	1.15279	0.89825	-0.07116	-0.05776	0.82345	0.58357	75.64	3.33	0.00093	-0.00011	18.0	0.16800	10.11	6.16	0.79
Desuperheater - Refrigeration	Water Heater	1.21062	0.96442	1.21654	0.98891	1.24579	0.98745	72.38	6.59	0.00098	0.00116	18.0	0.16800	19.85	12.13	0.50
High Efficiency Water Heater Tank Wall R = 24.0	Water Heater	0.05131	0.06046	0.05070	0.06014	0.05188	0.05983	78.64	0.33	0.00004	0.00004	10.0	0.00376	30.75	17.73	0.22
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	0.00691			
Solar Assisted Water Heater	Water Heater	0.70367	0.54950	0.27603	0.22610	0.54844	0.40551	76.26	2.71	0.00059	0.00019	20.0	2.97303	0.48	0.30	19.26

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Refrigeration																
High Eff. Evaporator Fan Motor 3% Increase in Efficiency	Evaporator Fan Motor	0.07630	0.08964	0.07005	0.08304	0.07351	0.08439	78.49	0.48	0.00006	0.00006	15.0	0.00038	553.16	321.69	0.02
High Efficiency Compressor 10% Increase in EER	Reciprocating Compressor	0.02875	0.03407	0.02157	0.02529	0.02433	0.02772	78.81	0.16	0.00002	0.00002	15.0	0.02100	3.45	2.04	2.42
Variable Speed Compressor	Constant Speed Compressors	0.03018	0.02691	0.05236	0.06531	0.04212	0.04807	78.71	0.26	0.00002	0.00006	15.0	0.26882	0.45	0.27	22.37
Condenser Coil Cleaning (1)		NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Appliances																
High Efficiency Fryers	Fryers	0.44877	0.36740	0.44297	0.34397	0.46515	0.34703	76.56	2.42	0.00041	0.00028	11.0	0.12545	7.52	4.56	1.01

Note:

(1) Not Applicable to New Buildings

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TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	ENERGY COST WITH ENVIRON. COSTS	ENERGY COST UTILITY	EST. CUST. PAY BACK YEARS
EXISTING FULL SERVICE RESTAURANT																
BASELINE								58.44								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2	EER = 7.5	0.34388	0.24884	0.01422	0.00869	0.12880	0.07378	57.62	0.82	0.00037	0.00000	18.0	1.80087	0.27	0.19	31.90
EER = 9.5	EER = 8.2	0.46667	0.33787	0.01929	0.01184	0.17477	0.10013	56.51	1.11	0.00050	0.00000	18.0	0.19883	3.36	2.27	2.61
EER = 10.5	EER = 8.2	0.74506	0.53945	0.03081	0.01895	0.27901	0.15988	55.85	1.77	0.00080	0.00000	18.0	0.35364	3.03	2.05	2.89
Evaporative Condenser	Unitary System Air-Cooled	0.52398	0.37933	0.02166	0.01328	0.19624	0.11245	57.19	1.25	0.00056	0.00000	18.0	0.36157	2.09	1.41	4.20
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Unitary System Air-Cooled	0.07465	0.12928	0.13202	0.07676	0.34663	0.22581	57.45	0.99	0.00000	0.00000	18.0	0.52402	0.71	0.34	11.75
Enthalpy Economizer	Unitary System Air-Cooled	0.07962	0.13538	0.13205	0.07661	0.34656	0.22924	57.44	1.00	0.00000	0.00000	18.0	0.52402	0.73	0.34	11.47
Condenser Coil Cleaning	Unitary System Air-Cooled	0.24662	0.17782	0.01016	0.00620	0.09198	0.05269	57.86	0.58	0.00026	0.00000	1.0	0.01146	3.33	2.25	0.28
Time Clock		-0.05332	0.38347	0.00111	0.07003	-0.01787	0.26111	57.78	0.66	-0.00002	0.00000	10.0	0.03275	5.01	1.97	0.84
Setback Thermostat		-0.07859	0.17857	0.01468	0.02738	0.02075	0.04088	58.23	0.21	-0.00003	0.00000	10.0	0.06550	0.62	0.14	5.44
Heating																
Heat Recovery from Refrigeration System	Unitary System	0.00000	0.00007	0.00230	0.00701	0.00051	0.00391	58.45	0.01	0.00000	0.00000	18.0	0.27216	0.02	0.01	546.82
Cooling/Heating																
Unitary System & Elec. Heating EER = 8.2	Unitary System & Elec. Heating EER = 7.5	0.09621	0.09340	0.00788	0.00574	0.04496	0.03627	58.15	0.28	0.00010	0.00000	18.0	NA			
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.6	EER = 8.2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	58.15		0.00000	0.00000	18.0	0.04367	0.00	0.00	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.13974	0.13667	0.01143	0.00843	0.06523	0.05272	57.74	0.41	0.00014	0.00000	18.0	0.17817	1.28	0.82	6.50
Unitary System & Gas Furnace EER = 8.2	Unitary System & Gas Furnace EER = 7.5	0.24603	0.16431	0.00627	0.00286	0.08326	0.03713	57.91	0.53	0.00027	0.00000	18.0	NA			
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.6	EER = 8.2	0.00000	-0.00209	-0.00098	-0.02044	0.00039	-0.05032	57.98	0.07	0.00000	0.00000	18.0	0.07423	-0.36	-0.16	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.35731	0.22242	0.00836	-0.01292	0.12124	0.01138	57.20	0.71	0.00039	0.00000	18.0	0.47772	0.97	0.69	9.21

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R= 30	Ceiling Insulation	0.01532	0.03274	0.14403	0.19550	0.00814	0.09276	57.96	0.48	0.00005	0.00019	20.0	0.57000	0.47	0.30	29.49
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.00968	0.00860	0.02464	0.03190	0.00941	0.01465	58.34	0.10	0.00001	0.00003	20.0	0.36641	0.15	0.10	81.45
Triple-Pane Windows	Single-Pane Windows	0.02844	0.02262	0.03134	0.03917	0.01957	0.02260	58.28	0.16	0.00003	0.00003	20.0	0.98892	0.09	0.06	120.36
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.02359	0.01979	0.04023	0.05161	0.01835	0.02623	58.26	0.18	0.00003	0.00004	20.0	0.39157	0.26	0.16	46.49
"Triple Pane" Low E	Single-Pane Windows	0.04926	0.04090	0.04016	0.04981	0.03163	0.03125	58.20	0.24	0.00005	0.00004	20.0	1.06605	0.13	0.08	82.33
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.04801	0.03893	0.00430	0.00423	0.02637	0.01163	58.31	0.13	0.00005	0.00000	12.0	0.09190	0.67	0.44	10.49
Tinted Window Films	Double-Pane Windows	0.04162	0.03422	0.02822	0.03461	0.02579	0.02323	58.26	0.19	0.00004	0.00003	12.0	0.36860	0.23	0.14	36.17
Low E Films	Single-Pane Windows	0.04633	0.03792	0.02164	0.02625	0.02855	0.02174	58.26	0.19	0.00005	0.00002	12.0	0.13985	0.69	0.38	13.46
Low E Films	Double-Pane Windows	0.04792	0.03953	0.03233	0.03980	0.03045	0.02755	58.22	0.22	0.00005	0.00003	12.0	0.56092	0.17	0.11	47.56
Lighting																
Halogen Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
Compact Fluorescent Lamps	Incandescent Lamps	0.51010	0.43171	0.38588	0.31285	0.46686	0.35252	56.98	2.46	0.00043	0.00033	2.1	-0.01759	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.07001	0.19536	0.06917	0.19401	0.07087	0.19454	57.64	0.79	0.00001	0.00001	20.0	0.61135	0.61	0.24	15.07
Metal Halide - Outdoor	Mercury Vapor Lamps	0.02760	0.07695	0.02726	0.07642	0.02793	0.07662	58.13	0.31	0.00001	0.00000	20.0	0.37118	0.33	0.16	23.22
LED Exit Lighting	Incandescent Exit Lighting	0.00096	0.00108	0.00091	0.00106	0.00093	0.00106	58.43	0.01	0.00000	0.00000	15.0	0.14847	0.02	0.01	481.83
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.00079	0.00089	0.00077	0.00094	0.00084	0.00091	58.43	0.01	0.00000	0.00000	15.0	0.12651	0.02	0.01	485.34
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.00111	0.00127	0.00106	0.00125	0.00110	0.00125	58.43	0.01	0.00000	0.00000	15.0	0.22630	0.01	0.01	627.02
Exterior Time Clock		0.00000	0.23013	0.00000	0.22828	0.00000	0.23013	57.75	0.69	0.00000	0.00000	10.0	0.02402	7.64	3.32	0.68
Photocell - Outdoor Lighting		0.10433	0.13603	0.01705	0.00305	0.05293	0.06266	58.06	0.38	0.00004	0.00002	10.0	0.02402	5.17	2.87	0.98

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
Heat Pump Water Heater COP = 3.0	Water Heater	0.30163	0.23316	0.29805	0.23196	0.30620	0.23085	56.84	1.60	0.00027	0.00013	18.0	1.30109	0.60	0.36	15.91
Desuperheater - HVAC	Water Heater	1.16291	0.88124	0.11442	0.08850	0.87083	0.62149	54.70	3.74	0.00104	0.00003	18.0	0.30867	6.32	3.91	1.36
Desuperheater - Refrigeration	Water Heater	0.32097	0.24810	0.31710	0.24680	0.32478	0.24565	56.74	1.70	0.00028	0.00014	18.0	0.30867	2.69	1.60	3.55
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.04530	0.05337	0.04472	0.05308	0.04584	0.05284	58.14	0.30	0.00003	0.00003	10.0	0.00459	22.28	12.85	0.30
Water Heater Blanket Blanket R = 11	Water Heater	0.04530	0.05337	0.04472	0.05308	0.04584	0.05284	58.14	0.30	0.00003	0.00003	10.0	0.00830	12.31	7.10	0.55
Solar Assisted Water Heater	Water Heater	0.77765	0.59245	0.40702	0.31575	0.63693	0.46881	56.24	3.20	0.00071	0.00015	20.0	11.78428	0.14	0.09	66.48

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Refrigeration																
High Eff. Evaporator Fan Motor 3% Increase in Efficiency	Evaporator Fan Motor	0.00557	0.00663	0.00492	0.00593	0.00485	0.00591	58.41	0.03	0.00000	0.00000	15.0	0.00055	26.97	15.75	0.31
High Efficiency Compressor 10% Increase in EER	Reciprocating Compressor	0.01583	0.01893	0.01403	0.01696	0.01388	0.01686	58.34	0.10	0.00001	0.00001	15.0	0.03199	1.32	0.77	6.34
Variable Speed Compressor (1)	Constant Speed Compressors	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Condenser Coil Cleaning		0.01223	0.01458	0.01081	0.01304	0.01066	0.01302	58.36	0.07	0.00001	0.00001	1.0	0.01092	0.35	0.20	2.81
Appliances																
Convection Ovens	Radiant Ovens	0.10373	0.05517	0.08553	0.05020	0.09842	0.05142	57.99	0.44	0.00006	0.00008	15.0	0.58769	0.36	0.22	24.48
Solid-State Temperature Controls	Radiant Ovens	0.07044	0.03744	0.05719	0.03362	0.06638	0.03456	58.14	0.30	0.00004	0.00005	15.0	0.06550	2.13	1.30	4.18
High Efficiency Fryers	Fryers	0.04511	0.02392	0.03751	0.02200	0.04306	0.02258	58.24	0.19	0.00003	0.00003	11.0	0.07642	1.00	0.61	7.56

Note:

(1) Not Applicable to Existing Buildings

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
NEW FULL SERVICE RESTAURANT																
BASELINE								54.33								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.39386	0.24911	0.00480	0.00387	0.11399	0.06124	53.50	0.83	0.00042	0.00000	18.0	0.21731	2.42	1.68	3.68
EER = 10.5	EER = 8.2	0.66715	0.42196	0.00809	0.00653	0.19305	0.10375	52.93	1.40	0.00072	0.00000	18.0	0.38447	2.32	1.61	3.84
Evaporative Condenser	Unitary System Air-Cooled	0.45011	0.28470	0.00545	0.00440	0.13027	0.06999	53.38	0.94	0.00048	0.00000	18.0	0.39321	1.53	1.06	5.83
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	0.56987			
Enthalpy Economizer	Unitary System Air-Cooled	0.00411	0.00699	0.00005	0.00000	0.00163	0.00331	54.31	0.02	0.00000	0.00000	18.0	0.56987	0.01	0.01	525.50
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		-0.09945	0.95110	-0.00502	0.45424	-0.04496	0.72421	52.35	1.98	-0.00004	0.00000	10.0	0.03275	15.46	6.30	0.30
Setback Thermostat		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	54.33		0.00000	0.00000	10.0	0.06650	0.00	0.00	NEVER
Heating																
Heat Recovery from Refrigeration System	Unitary System	0.00000	0.00000	0.00322	0.00382	0.00084	0.00099	54.34	0.01	0.00000	0.00000	18.0	0.27216	0.01	0.01	868.03
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	54.33		0.00000	0.00000	18.0	0.04694	0.00	0.00	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.11754	0.11319	0.00403	0.00336	0.04613	0.03439	54.01	0.32	0.00012	0.00000	18.0	0.19163	0.94	0.62	8.73
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	0.00000	0.00000	-0.00553	-0.00795	-0.00452	-0.00122	54.36	0.02	0.00000	0.00000	18.0	0.08103	-0.09	-0.04	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.30447	0.15369	-0.00363	-0.00596	0.07311	0.03017	53.78	0.55	0.00033	0.00000	18.0	0.62161	0.72	0.52	12.80

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COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 38	Ceiling Insulation	0.00709	0.01549	0.09093	0.11116	0.02421	0.05285	54.03	0.30	0.00002	0.00000	20.0	0.56000	0.23	0.12	47.36
Wall Insulation R = 19	Wall Insulation	0.11925	0.10332	0.17605	0.20938	0.07563	0.12093	53.52	0.80	0.00018	0.00000	20.0	0.99616	0.41	0.25	25.55
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.07287	0.05147	0.04388	0.05721	0.03845	0.03514	54.03	0.30	0.00008	0.00000	20.0	3.15945	0.05	0.03	192.67
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	0.05606	0.04249	0.07656	0.09416	0.04179	0.05104	53.97	0.36	0.00007	0.00000	20.0	0.17619	1.01	0.59	10.10
"Triple Pane" Low E	Double-Pane Windows	0.16901	0.11612	0.05802	0.08072	0.07659	0.05642	53.77	0.56	0.00019	0.00000	20.0	3.50582	0.09	0.06	108.26
Tinted Window Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Window Films	Double-Pane Windows	0.13017	0.08440	-0.01520	-0.00934	0.04095	0.00927	54.09	0.24	0.00013	0.00000	12.0	0.46050	0.28	0.20	24.99
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.16137	0.10738	0.00804	0.02082	0.05898	0.02671	53.94	0.38	0.00017	0.00000	12.0	0.70076	0.27	0.18	26.92
Lighting																
Halogen Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
Compact Fluorescent Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.1	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.07003	0.19538	0.06919	0.19406	0.07087	0.19456	53.53	0.79	0.00001	0.00000	20.0	-0.05602	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.02760	0.07695	0.02726	0.07645	0.02793	0.07661	54.01	0.31	0.00001	0.00000	20.0	-0.03341	INFINITE	INFINITE	NOW
LED Exit Lighting	Incandescent Exit Lighting	0.00094	0.00110	0.00094	0.00108	0.00094	0.00108	54.32	0.01	0.00000	0.00000	15.0	0.05107	0.05	0.03	165.03
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.00082	0.00096	0.00079	0.00094	0.00082	0.00091	54.32	0.01	0.00000	0.00000	15.0	0.02911	0.07	0.04	108.18
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.00111	0.00130	0.00108	0.00125	0.00113	0.00125	54.32	0.01	0.00000	0.00000	15.0	0.12890	0.02	0.01	353.19
Exterior Time Clock		0.00000	0.23016	0.00000	0.22826	0.00000	0.23013	53.64	0.69	0.00000	0.00000	10.0	0.02402	7.64	3.32	0.68
Photocell - Outdoor Lighting		0.10433	0.13606	0.01705	0.00310	0.05293	0.06264	53.95	0.38	0.00004	0.00002	10.0	0.02402	5.17	2.87	0.98

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
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IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
Heat Pump Water Heater COP = 3.0	Water Heater	0.30166	0.23316	0.29805	0.23196	0.30521	0.23085	52.73	1.60	0.00027	0.00010	18.0	1.30109	0.59	0.35	15.91
Desuperheater - HVAC	Water Heater	1.16293	0.88126	0.11446	0.08853	0.87084	0.62149	50.59	3.74	0.00104	0.00000	18.0	0.30867	6.29	3.88	1.36
Desuperheater - Refrigeration	Water Heater	0.32094	0.24810	0.31712	0.24678	0.32478	0.24565	52.62	1.70	0.00028	0.00010	18.0	0.30867	2.65	1.67	3.65
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.04530	0.05337	0.04474	0.05308	0.04585	0.05281	54.03	0.30	0.00003	0.00000	10.0	0.00459	20.84	11.21	0.30
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Solar Assisted Water Heater	Water Heater	0.77770	0.59250	0.40702	0.31575	0.63691	0.46881	51.13	3.20	0.00071	0.00010	20.0	11.78428	0.14	0.09	66.48
Refrigeration																
High Eff. Evaporator Fan Motor 3% Increase in Efficiency	Evaporator Fan Motor	0.00555	0.00687	0.00497	0.00543	0.00486	0.00574	54.29	0.03	0.00000	0.00000	15.0	0.00046	29.79	16.49	0.26
High Efficiency Compressor 10% Increase in EER	Reciprocating Compressor	0.01578	0.01965	0.01417	0.01556	0.01383	0.01650	54.23	0.10	0.00001	0.00000	15.0	0.03199	1.22	0.68	6.35
Variable Speed Compressor	Constant Speed Compressors	0.01256	0.00384	0.03629	0.05233	0.02284	0.03497	54.16	0.16	0.00001	0.00010	15.0	0.40939	0.22	0.14	62.23
Condenser Coil Cleaning (1)		NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Appliances																
Convection Ovens	Radiant Ovens	0.10897	0.05947	0.08766	0.05452	0.09811	0.05498	53.86	0.46	0.00007	0.00010	15.0	0.56769	0.39	0.24	23.35
Solid-State Temperature Controls	Radiant Ovens	0.07268	0.04001	0.05884	0.03675	0.06571	0.03706	54.02	0.31	0.00004	0.00010	15.0	0.06550	2.41	1.55	4.02
High Efficiency Fryers	Fryers	0.04784	0.02635	0.03871	0.02426	0.04323	0.02445	54.12	0.20	0.00003	0.00000	11.0	0.07642	0.95	0.54	7.12

Note:

(1) Not Applicable to New Buildings

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON PEAK INCR IMPACT (kWh/yr)	SUMMER OFF PEAK INCR IMPACT (kWh/yr)	WINTER ON PEAK INCR IMPACT (kWh/yr)	WINTER OFF PEAK INCR IMPACT (kWh/yr)	TRANSITIONAL ON PEAK INCR IMPACT (kWh/yr)	TRANSITIONAL OFF PEAK INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST PAY BACK YEARS
EXISTING SMALL RETAIL BUILDING																
BASELINE								14.87								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Air-Cooled	Recip. Chiller Air-Cooled															
COP = 2.46	COP = 2.46 (existing)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	14.87		0.00000	0.00000	20.0	NA			
COP = 4.0	COP = 2.46 (standard)	0.07217	0.04011	0.00002	0.00002	0.01764	0.00889	14.73	0.14	0.00010	0.00000	20.0	0.02929	3.59	2.62	2.90
COP = 4.6	COP = 2.46 (standard)	0.08789	0.04886	0.00002	0.00002	0.02149	0.01082	14.70	0.17	0.00012	0.00000	20.0	0.04070	3.14	2.30	3.30
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2 (0)	EER = 7.5 (existing)	0.09774	0.05116	0.00000	0.00000	0.00929	0.00493	14.71	0.16	0.00016	0.00000	18.0	1.55072	0.09	0.07	122.50
EER = 9.5	EER = 8.2 (standard)	0.13266	0.06941	0.00000	0.00000	0.01260	0.00667	14.49	0.22	0.00021	0.00000	18.0	0.16726	1.15	0.89	9.74
EER = 10.5	EER = 8.2 (standard)	0.21179	0.11081	0.00000	0.00000	0.02010	0.01066	14.36	0.35	0.00034	0.00000	18.0	0.28592	1.04	0.80	10.79
Evaporative Condenser	Unitary System Air-Cooled	0.14893	0.07793	0.00000	0.00000	0.01414	0.00760	14.62	0.25	0.00024	0.00000	15.0	0.30264	0.66	0.51	15.69
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer (2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Dry-Bulb Economizer	Unitary System Air-Cooled	0.00003	0.00007	0.00000	0.00000	0.00002	0.00000	14.87	0.00	0.00000	0.00000	18.0	0.11830	0.00	0.00	######
Enthalpy Economizer	Unitary System Air-Cooled	0.00003	0.00000	0.00000	0.00000	0.00002	0.00000	14.87	0.00	0.00000	0.00000	18.0	0.11830	0.00	0.00	37153
Hydronic Economizer Cycle(2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Condenser Coil Cleaning	Unitary System Air-Cooled	0.06981	0.03653	0.00000	0.00000	0.00664	0.00352	14.76	0.12	0.00011	0.00000	1.0	0.00636	1.71	1.33	0.70
Time Clock		-0.01724	0.07542	-0.04000	0.08922	-0.00767	0.04174	14.73	0.14	-0.00001	-0.00008	10.0	0.01817	0.69	-0.30	2.35
Setback Thermostat		0.00000	0.00000	-0.00085	0.01507	0.00001	0.00010	14.86	0.01	0.00000	-0.00001	10.0	0.03635	0.01	-0.05	70.88
Cooling/Heating																
Unitary System & Elec. Heating	Unitary System & Elec. Heating	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
EER = 8.2	EER = 7.5															
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	0.00009	0.00008	0.27872	0.17731	0.09011	0.06089	20.84	0.61	0.00000	0.00000	18.0	0.01616	14.27	7.04	0.74
EER = 9.6, COP = 3.1	EER = 8.2	0.01954	0.01011	0.31051	0.19728	0.10521	0.06994	20.73	0.71	0.00003	0.00000	18.0	0.06591	4.35	2.26	2.45
Ground-Coupled Heat Pump	Unitary System & Elec. Heating	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
EER = 11.6, COP = 3.5	EER = 8.2															
Unitary System & Gas Furnace	Unitary System & Gas Furnace	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
EER = 8.2	EER = 7.5															
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	-0.00808	-0.00518	-2.56979	-1.81401	-0.70447	-0.46855	20.28	5.57	0.00000	-0.00712	18.0	0.08284	-61.36	-38.45	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.13563	0.06996	-2.33474	-1.66637	-0.59209	-0.40165	19.50	4.79	0.00023	-0.00712	18.0	0.53315	-7.21	-5.48	NEVER

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	-0.31448	-0.18465	0.14960	0.11955	-0.09370	-0.02909	15.23	0.35	-0.00021	0.00024	20.0	0.57000	-0.31	-0.18	NEVER
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.00000	0.00230	0.05608	0.04552	0.01053	0.01024	14.75	0.12	0.00002	0.00008	20.0	0.55840	0.16	0.11	122.26
Triple-Pane Windows	Single-Pane Windows	0.03021	0.01393	0.06817	0.05502	0.02011	0.01577	14.67	0.20	0.00008	0.00011	20.0	1.54624	0.10	0.07	166.36
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.01870	0.00762	0.07688	0.06118	0.01877	0.01611	14.67	0.20	0.00006	0.00012	20.0	0.61349	0.24	0.18	73.58
"Triple Pane" Low E	Single-Pane Windows	0.06524	0.04157	0.07108	0.05892	0.03447	0.02186	14.56	0.31	0.00014	0.00012	20.0	1.66454	0.14	0.10	97.23
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.11107	0.05635	0.01613	0.01632	0.02837	0.01305	14.63	0.24	0.00013	0.00004	12.0	0.13711	1.00	0.72	8.41
Tinted Window Films	Double-Pane Windows	0.00603	0.00409	-0.00038	-0.00008	0.00183	-0.00006	14.86	0.01	0.00000	0.00000	12.0	0.01876	0.16	0.06	21.49
Low E Films	Single-Pane Windows	0.09457	0.04733	0.04201	0.03730	0.03024	0.01709	14.60	0.27	0.00013	0.00008	12.0	0.21910	0.71	0.52	13.60
Low E Films	Double-Pane Windows	0.01449	0.00842	0.00002	0.00048	0.00488	0.00119	14.84	0.03	0.00000	0.00000	12.0	0.06559	0.18	0.11	31.15
Lighting																
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.01586	0.00843	0.00971	0.00502	0.01186	0.00582	14.82	0.06	0.00001	0.00001	10.0	0.00008	289.36	187.67	0.03
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.01586	0.00843	0.00971	0.00502	0.01186	0.00582	14.82	0.06	0.00001	0.00001	10.0	0.00051	45.93	29.79	0.16
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.01586	0.00843	0.00971	0.00502	0.01186	0.00582	14.82	0.06	0.00001	0.00001	10.0	0.00525	4.45	2.89	1.67
Halogen Lamps	Incandescent Lamps	0.03947	0.02099	0.02419	0.01263	0.02968	0.01474	14.73	0.14	0.00004	0.00002	0.4	0.00078	4.48	2.90	0.10

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting (Cont.)																
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.09165	0.04869	0.06594	0.02935	0.06898	0.03402	14.54	0.33	0.00008	0.00005	20.0	0.05250	3.62	2.35	2.89
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.42324	0.22424	0.25838	0.13456	0.31404	0.15543	13.36	1.51	0.00039	0.00023	20.0	0.35703	2.45	1.59	4.27
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.07887	0.04190	0.04829	0.02532	0.05940	0.02933	14.59	0.28	0.00007	0.00004	2.6	0.00210	19.60	12.72	0.13
Electronic Ballasts	T12 Fluorescent Lamps	0.43892	0.23261	0.26804	0.13966	0.32543	0.16120	13.31	1.57	0.00041	0.00024	20.0	0.30452	2.88	1.94	3.51
Compact Fluorescent Lamps	Incandescent Lamps	0.13611	0.07211	0.08295	0.04337	0.10181	0.05029	14.39	0.49	0.00013	0.00007	2.1	-0.00333	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.01504	0.03129	0.01486	0.03107	0.01523	0.03114	14.73	0.14	0.00000	0.00000	20.0	0.02423	2.29	1.10	3.42
Metal Halide - Outdoor	Mercury Vapor Lamps	0.00922	0.01920	0.00913	0.01906	0.00935	0.01910	14.79	0.09	0.00000	0.00000	20.0	0.02423	1.40	0.68	5.58
Ellipsoidal Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.00071	0.00086	0.00071	0.00084	0.00074	0.00085	14.87	0.00	0.00000	0.00000	15.0	0.02746	0.07	0.04	114.41
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.00060	0.00073	0.00060	0.00071	0.00062	0.00071	14.87	0.00	0.00000	0.00000	15.0	0.02340	0.07	0.04	115.46
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.00083	0.00101	0.00085	0.00099	0.00086	0.00100	14.87	0.01	0.00000	0.00000	15.0	0.04186	0.06	0.03	148.07
Exterior Time Clock		0.00000	0.11175	0.00000	0.11082	0.00000	0.11179	14.64	0.33	0.00000	0.00000	10.0	0.00889	10.03	4.36	0.52
Photocell - Outdoor Lighting		0.05893	0.04362	0.01471	-0.01070	0.03133	0.01219	14.72	0.16	0.00002	0.00002	10.0	0.00889	6.05	3.61	0.88
Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.00787	0.00930	0.00779	0.00923	0.00798	0.00918	14.82	0.05	0.00001	0.00001	10.0	0.00170	10.48	6.04	0.65
Water Heater Blanket Blanket R= 11	Water Heater	0.00787	0.00930	0.00779	0.00923	0.00798	0.00918	14.82	0.05	0.00001	0.00001	10.0	0.00307	5.78	3.34	1.17
Storage Water Heater	Water Heater	0.10301	-0.12229	0.10177	-0.12091	0.10424	-0.12350	14.93	0.06	0.00011	0.00011	10.0	0.07361	0.78	0.94	

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Not Applicable to Air Distribution System and/or Chiller System

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST WITH UTILITY	EST. CUST. PAY BACK YEARS
NEW SMALL RETAIL BUILDING																
BASELINE								14.04								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Air-Cooled	Recip. Chiller Air-Cooled															
COP = 4.0	COP = 2.46	0.07085	0.03876	0.00001	0.00003	0.01765	0.00878	13.90	0.14	0.00010	0.00000	20.0	NA			
COP = 4.6	COP = 2.46	0.08605	0.04720	0.00001	0.00004	0.02149	0.01069	13.88	0.17	0.00012	0.00000	20.0	0.00992	12.91	9.52	0.82
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.13927	0.07393	0.00000	0.00000	0.01783	0.00881	13.80	0.24	0.00022	0.00000	18.0	0.15709	1.29	0.99	8.56
EER = 10.5	EER = 8.2	0.23591	0.12522	0.00000	0.00000	0.03019	0.01493	13.63	0.41	0.00037	0.00000	18.0	0.27793	1.23	0.94	8.94
Evaporative Condenser	Unitary System Air-Cooled	0.15916	0.08448	0.00000	0.00000	0.02039	0.01007	13.77	0.27	0.00025	0.00000	15.0	0.28425	0.76	0.58	13.55
Outside Air Economizer Cycle:																
Dry-Bulb Economizer(2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer(2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Dry-Bulb Economizer(1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.00018	0.00000	0.00000	0.00000	0.00006	0.00001	14.04	0.00	0.00000	0.00000	18.0	0.12884	0.00	0.00	7698.71
Hydronic Economizer Cycle(2)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		-0.02761	0.08636	-0.02435	0.07855	-0.00305	0.03976	13.89	0.16	0.00000	-0.00005	10.0	0.01817	1.35	0.10	2.26
Setback Thermostat		0.00000	0.00000	0.00008	0.00264	0.00000	0.00000	14.04	0.00	0.00000	0.00000	10.0	0.03635	0.04	0.03	373.13
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 9.2, COP = 2.7	EER = 8.2	0.00001	0.00015	0.25498	0.15481	0.06820	0.04510	13.52	0.52	0.00000	0.00000	18.0	0.01616	12.30	6.09	0.86
EER = 9.6, COP = 3.1	EER = 8.2	0.02367	0.01245	0.28530	0.17266	0.08158	0.05284	13.41	0.63	0.00004	0.00000	18.0	0.06591	3.90	2.07	2.73
Ground-Coupled Heat Pump	Unitary System & Elec. Heating															
EER = 11.0, COP = 3.5	EER = 8.2	0.04577	0.02421	0.39278	0.24887	0.09171	0.06170	13.18	0.87	0.00007	0.00006	18.0	0.19388	3.37	2.51	5.67
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 9.2, COP = 2.7	EER = 8.2	-0.00191	-0.00220	-2.37111	-1.54447	-0.54515	-0.35477	18.86	4.82	0.00000	-0.00703	18.0	0.07780	-50.70	-38.85	NEVER
EER = 9.6, COP = 3.1	EER = 8.2	0.17161	0.09019	-2.14879	-1.41353	-0.44452	-0.29817	18.08	4.04	0.00027	-0.00703	18.0	0.50074	-7.01	-5.47	NEVER

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH DIVERSION COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R= 38	Ceiling Insulation	-0.13570	-0.08144	0.07878	0.05712	-0.05120	-0.01767	14.19	0.15	-0.00009	0.00012	20.0	0.56000	-0.12	-0.08	NEVER
Wall Insulation R= 19	Wall Insulation	0.01298	0.01711	0.09939	0.07103	0.00201	0.01078	13.83	0.21	0.00006	0.00017	20.0	0.20966	0.81	0.61	23.27
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.05153	0.02579	0.01244	0.01131	0.01472	0.00775	13.92	0.12	0.00008	0.00003	20.0	1.29376	0.09	0.08	162.45
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	0.00540	0.00236	0.02754	0.02078	0.00413	0.00393	13.98	0.06	0.00001	0.00005	20.0	0.07215	0.65	0.47	27.21
"Triple Pane" Low E	Double-Pane Windows	0.09798	0.04954	0.02051	0.01848	0.02718	0.01463	13.81	0.23	0.00013	0.00005	20.0	1.43659	0.12	0.09	96.15
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.08120	0.04264	-0.00439	-0.00032	0.02165	0.00989	13.89	0.15	0.00007	0.00001	12.0	0.18857	0.42	0.29	17.04
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.10481	0.05397	0.00351	0.00628	0.02800	0.01322	13.83	0.21	0.00012	0.00003	12.0	0.28695	0.43	0.31	19.41
Lighting																
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Halogen Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
T8 Fluorescent Lamps Electronic Ballast (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			

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Lighting (Cont.)																
T8 Fluorescent Lamps (1) Electronic Ballast	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.6	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Compact Fluorescent Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.1	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.01505	0.03128	0.01487	0.03105	0.01523	0.03112	13.90	0.14	0.00000	0.00000	20.0	-0.00218	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.00924	0.01919	0.00914	0.01906	0.00935	0.01909	13.98	0.09	0.00000	0.00000	20.0	-0.00218	INFINITE	INFINITE	NOW
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.00073	0.00084	0.00072	0.00083	0.00072	0.00083	14.04	0.00	0.00000	0.00000	15.0	0.00945	0.21	0.12	39.55
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.00061	0.00071	0.00061	0.00070	0.00061	0.00070	14.04	0.00	0.00000	0.00000	15.0	0.00538	0.32	0.18	26.69
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.00086	0.00100	0.00085	0.00099	0.00086	0.00099	14.04	0.01	0.00000	0.00000	15.0	0.02384	0.10	0.06	84.12
Exterior Time Clock		0.00000	0.11175	0.00000	0.11082	0.00000	0.11177	13.71	0.33	0.00000	0.00000	10.0	0.00889	10.03	4.36	0.52
Photocell - Outdoor Lighting		0.05895	0.04352	0.01472	-0.01071	0.03133	0.01216	13.89	0.15	0.00002	0.00002	10.0	0.00889	6.05	3.61	0.88
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.00789	0.00928	0.00779	0.00923	0.00788	0.00918	13.99	0.05	0.00001	0.00001	10.0	0.00170	10.48	6.04	0.65
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.10301	-0.10301	0.10178	-0.10178	0.10423	-0.10423	14.10		0.00011	-0.00011	10.0	0.07361	0.33	0.37	

Note:

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EXISTING LARGE OFFICE BUILDING																
BASELINE								18.72								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 3.52	COP = 3.14	0.0336	0.0096	0.0107	0.0061	0.0174	0.0065	18.64	0.08	0.0000	0.0000	20.0	0.198	0.27	0.19	39.83
COP = 4.0	COP = 3.52	0.0224	0.0064	0.0072	0.0041	0.0116	0.0044	18.58	0.06	0.0000	0.0000	20.0	0.018	1.88	1.36	5.51
COP = 4.6	COP = 3.52	0.0620	0.0170	0.0190	0.0102	0.0303	0.0112	18.49	0.15	0.0001	0.0000	20.0	0.041	2.41	1.67	4.59
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 4.04	COP = 3.91	0.0336	0.0096	0.0107	0.0061	0.0174	0.0065	18.64	0.08	0.0000	0.0000	20.0	0.430	0.13	0.09	88.45
COP = 5.6	COP = 4.04	0.2186	0.0615	0.0688	0.0386	0.1111	0.0417	18.10	0.54	0.0002	0.0000	20.0	0.072	4.92	3.40	2.23
COP = 6.0	COP = 4.04	0.2521	0.0711	0.0795	0.0447	0.1286	0.0482	18.01	0.62	0.0003	0.0000	20.0	0.136	2.99	2.06	3.66
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 3.91	0.1706	0.0477	0.0641	0.0399	0.1054	0.0356	18.17	0.46	0.0002	0.0000	20.0	0.072	3.98	2.67	2.69
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2	EER = 7.5	0.0507	0.0086	0.0002	0.0000	0.0157	0.0018	18.64	0.08	0.0001	(0.0000)	18.0	0.341	0.17	0.13	62.16
EER = 9.5	EER = 8.2	0.0507	0.0086	0.0002	0.0000	0.0157	0.0018	18.57	0.08	0.0001	0.0000	18.0	0.097	0.60	0.45	17.78
EER = 10.5	EER = 8.2	0.0913	0.0155	0.0004	0.0000	0.0283	0.0032	18.51	0.14	0.0001	0.0000	18.0	0.172	0.62	0.46	17.47
Evaporative Condenser	Unitary System Air-Cooled	0.0849	0.0110	0.0003	0.0000	0.0201	0.0023	18.62	0.10	0.0001	0.0000	15.0	0.070	0.99	0.74	10.05
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Central Chiller Water-Cooled	0.0010	0.0000	0.0026	0.0000	0.0084	0.0018	18.71	0.01	(0.0000)	(0.0000)	20.0	0.013	0.44	0.21	23.46
Enthalpy Economizer	Central Chiller Water-Cooled	0.0049	0.0038	0.0026	0.0000	0.0102	0.0027	18.70	0.02	0.0000	0.0000	20.0	0.064	0.15	0.07	50.68
Dry-Bulb Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18.72		0.0000	0.0000	15.0	0.016	0.00	0.00	NEVER
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18.72		0.0000	0.0000	15.0	0.078	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0712	0.0192	0.2980	0.1463	0.2525	0.0994	17.84	0.89	0.0000	0.0001	20.0	0.207	1.93	1.06	5.78
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0180	0.0039	0.0047	0.0004	0.0162	0.0020	18.68	0.05	0.0000	0.0000	15.0	0.004	4.58	2.27	1.34
Variable Speed Fans	Single-Speed Fans	0.0217	0.0047	0.0060	0.0004	0.0175	0.0022	18.67	0.05	0.0000	0.0000	15.0	0.035	0.52	0.26	11.61
Chilled Water Reset	Central Chiller Constant Temp.	0.0276	0.0133	0.0196	0.0130	0.0260	0.0124	18.61	0.11	0.0000	0.0000	20.0	0.026	2.21	1.33	4.42
Thermal Energy Storage	Central Chiller Water-Cooled	0.9161	(0.9226)	0.2767	(0.2850)	0.4792	(0.4665)	18.72	0.00	0.0013	0.0001	20.0	1.090	0.73	0.74	
Full Storage																
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0304	0.0052	0.0001	0.0000	0.0094	0.0011	18.68	0.05	0.0000	0.0000	1.0	0.001	6.40	4.78	0.18
Time Clock		(0.0871)	0.1812	0.0139	0.1215	0.0109	0.1172	18.36	0.36	0.0000	(0.0000)	10.0	0.003	28.31	12.39	0.20
Setback Thermostat		(0.0090)	(0.0020)	(0.0111)	0.2893	(0.0152)	0.0973	18.37	0.35	(0.0000)	(0.0000)	10.0	0.102	0.78	0.27	8.51

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Heating																
Heat Pipe	Central Chiller System	0.0255	0.0024	0.1216	0.0359	0.0881	(0.0014)	18.45	0.27	0.0000	0.0001	20.0	0.304	0.43	0.25	27.60
Exhaust Air Heat Recovery	Central Chiller System	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18.72	0.00	0.0000	0.0000	20.0	0.259	0.00	0.00	116767
Cooling/Heating																
Closed Water Loop Heat Pump (1) EER = 11.0, COP = 4.0	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Double-Bundled Chiller (1) COP = 5.6	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Bypass/Delay Timer		(0.0143)	0.0452	0.0022	0.0369	(0.0004)	0.0404	18.61	0.11	(0.0000)	0.0000	15.0	0.017	1.94	0.72	3.18
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.0842	0.0182	0.0824	0.0156	0.0885	0.0178	18.42	0.30	0.0001	0.0000	15.0	0.239	0.65	0.42	15.30
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.1164	0.1919	0.1438	0.1779	0.1404	0.1886	17.76	0.96	0.0001	0.0001	15.0	0.099	3.92	2.14	2.03
Variable Air Volume Systems	Central Chiller CAV System	0.3093	0.0764	0.4817	0.2388	0.4196	0.1441	17.05	1.67	0.0003	0.0003	20.0	0.276	3.26	2.04	3.57
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0209	0.0043	0.0167	0.0073	0.0195	0.0052	18.65	0.07	0.0000	0.0000	15.0	0.008	5.07	3.34	2.01
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.0080	0.0077	0.0075	0.0081	0.0079	0.0077	18.67	0.05	0.0000	0.0000	15.0	0.003	8.11	4.82	1.08
Reduction in Fan Flowrate 10 % Reduction in Fan cfm	Original Fan Flowrate	0.0553	0.0180	0.1423	0.0492	0.1251	0.0349	18.30	0.42	0.0000	0.0001	15.0	0.182	1.03	0.61	9.83
Fan Motor Downsizing HP Reduced to 1/3 of the Original	Original Fan Size	0.1639	0.0336	0.1316	0.0583	0.1459	0.0408	18.16	0.57	0.0001	0.0001	15.0	0.228	1.32	0.87	7.69

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Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	0.0043	0.0002	0.0572	0.0214	0.0093	0.0076	18.62	0.10	0.0000	0.0001	20.0	0.670	0.12	0.09	150.52
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Window Films	Double-Pane Windows	0.0629	0.0098	(0.0360)	(0.0103)	0.0016	(0.0084)	18.70	0.02	0.0001	(0.0000)	12.0	0.064	0.40	0.36	15.89
Low E Films(2)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.0893	0.0131	0.0089	0.0052	0.0167	0.0028	18.59	0.14	0.0001	0.0000	12.0	0.341	0.28	0.22	35.83
Lighting																
Daylighting Controls		0.3321	0.0478	0.0789	0.0110	0.1906	0.0181	18.04	0.68	0.0003	0.0001	10.0	0.561	0.61	0.44	13.21
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2405	0.0700	0.1059	0.0400	0.1698	0.0505	18.04	0.68	0.0002	0.0001	10.0	0.002	145.26	97.14	0.05
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2405	0.0700	0.1059	0.0400	0.1698	0.0505	18.04	0.68	0.0002	0.0001	10.0	0.013	23.06	15.42	0.33
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2405	0.0700	0.1059	0.0400	0.1698	0.0505	18.04	0.68	0.0002	0.0001	10.0	0.132	2.23	1.49	3.43
Halogen Lamps	Incandescent Lamps	0.0144	0.0042	0.0059	0.0029	0.0103	0.0036	18.68	0.04	0.0000	0.0000	0.6	0.000	17.99	11.93	0.04
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.0714	0.0207	0.0309	0.0142	0.0504	0.0148	18.52	0.20	0.0001	0.0000	20.0	0.046	2.65	1.77	4.04

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting (cont.)																
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.1702	0.0492	0.0746	0.0287	0.1204	0.0350	18.24	0.48	0.0002	0.0001	20.0	0.172	1.70	1.13	6.33
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.1702	0.0492	0.0746	0.0287	0.1204	0.0350	18.24	0.48	0.0002	0.0001	3.5	0.008	12.58	8.41	0.28
Electronic Ballasts	T12 Fluorescent Lamps	0.1137	0.0331	0.0493	0.0196	0.0802	0.0238	18.40	0.32	0.0001	0.0000	20.0	0.112	1.74	1.16	6.16
Compact Fluorescent Lamps	Incandescent Lamps	0.0855	0.0249	0.0372	0.0159	0.0606	0.0180	18.48	0.24	0.0001	0.0000	2.9	(0.002)	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0081	0.0165	0.0080	0.0164	0.0082	0.0164	18.65	0.07	0.0000	0.0000	20.0	0.117	0.25	0.12	31.16
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0039	0.0080	0.0038	0.0079	0.0039	0.0079	18.69	0.04	0.0000	0.0000	20.0	0.107	0.13	0.08	59.08
Occupancy Sensors		0.2557	0.0089	0.1382	(0.0076)	0.1847	(0.0020)	18.13	0.59	0.0000	(0.0000)	10.0	0.170	1.04	0.64	5.13
Ellipsoidal Lamps	Incandescent Lamps	0.0144	0.0042	0.0059	0.0029	0.0103	0.0036	18.68	0.04	0.0000	0.0000	0.6	0.000	11.02	7.31	0.06
LED Exit Lighting	Incandescent Exit Lighting	0.0044	0.0052	0.0044	0.0052	0.0045	0.0051	18.69	0.03	0.0000	0.0000	15.0	0.017	0.73	0.42	11.56
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0038	0.0044	0.0037	0.0044	0.0038	0.0044	18.70	0.02	0.0000	0.0000	15.0	0.014	0.73	0.42	11.56
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0052	0.0062	0.0052	0.0061	0.0053	0.0061	18.69	0.03	0.0000	0.0000	15.0	0.026	0.57	0.33	14.84
Exterior Time Clock		0.0018	0.0200	0.0017	0.0198	0.0018	0.0202	18.66	0.07	0.0000	0.0000	10.0	0.000	35.09	16.60	0.15
Photocell - Outdoor Lighting		0.0148	0.0097	0.0051	0.0007	0.0087	0.0022	18.68	0.04	0.0000	0.0000	10.0	0.000	28.37	16.48	0.19
Delay Timer		0.0018	0.0161	(0.0017)	0.0090	(0.0002)	0.0118	18.68	0.04	0.0000	(0.0000)	10.0	0.000	62.19	27.32	0.07
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.0047	0.0055	0.0046	0.0055	0.0047	0.0054	18.69	0.03	0.0000	0.0000	10.0	0.000	201.30	116.07	0.03
Water Heater Blanket Blanket R = 11	Water Heater	0.0047	0.0055	0.0046	0.0055	0.0047	0.0054	18.69	0.03	0.0000	0.0000	10.0	0.000	111.32	64.18	0.06
Storage Water Heater	Water Heater	0.0786	(0.0792)	0.0777	(0.0782)	0.0796	(0.0801)	18.72	0.00	0.0001	0.0001	10.0	0.029	1.49	1.57	

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Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0172	0.0228	(0.0001)	0.0194	0.0083	0.0205	18.63	0.09	0.0000	(0.0000)	6.0	0.049	0.34	0.16	9.83
Energy Efficient Desktops	Desktops	0.1248	0.0205	0.0608	0.0098	0.0917	0.0137	18.40	0.32	0.0001	0.0001	6.0	2.452	0.04	0.03	135.02
Energy Efficient Laptops	Desktops	0.1713	0.0258	0.0844	0.0106	0.1264	0.0159	18.29	0.43	0.0002	0.0001	6.0	4.407	0.03	0.02	179.31
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0248	0.0306	0.0012	0.0243	0.0123	0.0271	18.60	0.12	0.0000	(0.0000)	6.0	0.028	0.82	0.37	4.14
Energy Efficient Printers	Dedicated Printers	0.1663	0.0258	0.0817	0.0107	0.1227	0.0166	18.30	0.42	0.0002	0.0001	6.0	1.176	0.12	0.09	49.05
Copiers																
Timer (off at night/weekends)	Copiers	0.0054	0.0076	(0.0004)	0.0067	0.0027	0.0072	18.69	0.03	0.0000	(0.0000)	6.0	0.005	1.10	0.50	3.10
Energy Efficient Copiers	Copiers	0.0408	0.0054	0.0203	0.0029	0.0303	0.0041	18.62	0.10	0.0000	0.0000	6.0	0.644	0.08	0.04	110.37
Miscellaneous																
High Efficiency Elevator Motors	Elevator Motors	0.0201	0.0002	0.0199	0.0002	0.0204	0.0001	18.66	0.06	0.0000	0.0000	15.0	0.003	11.03	8.95	0.85
3% Increase in Efficiency																

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Most of the Buildings do not have Single-Pane Windows

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NEW LARGE OFFICE BUILDING																
BASELINE								17.18								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.52	0.03257	0.00892	0.00581	0.00443	0.01410	0.00643	17.11	0.07	0.00004	0.00000	20.0	0.01852	2.67	1.89	4.16
COP = 4.6	COP = 3.52	0.07076	0.01887	0.01163	0.00887	0.02882	0.01094	17.03	0.15	0.00009	0.00001	20.0	0.04168	2.56	1.82	4.41
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.17904	0.04830	0.03100	0.02363	0.07577	0.02901	16.79	0.39	0.00021	0.00001	20.0	0.07253	3.73	2.65	2.99
COP = 6.0	COP = 4.04	0.21153	0.05720	0.03681	0.02806	0.08985	0.03444	16.72	0.46	0.00025	0.00002	20.0	0.13762	2.33	1.65	4.80
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.13365	0.03488	0.03604	0.01726	0.06813	0.02179	16.87	0.31	0.00013	0.00001	20.0	0.07253	2.68	1.82	3.86
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.05027	0.00847	0.00015	0.00001	0.01459	0.00161	17.10	0.08	0.00006	0.00000	18.0	0.09739	0.61	0.46	18.11
EER = 10.5	EER = 8.2	0.08344	0.01406	0.00025	0.00001	0.02422	0.00267	17.06	0.12	0.00010	0.00000	18.0	0.17230	0.57	0.43	19.30
Evaporative Condenser	Unitary System Air-Cooled	0.05630	0.00949	0.00017	0.00001	0.01634	0.00180	17.09	0.08	0.00007	0.00000	15.0	0.07049	0.87	0.66	11.70
Outside Air Economizer Cycle:																
Dry-Bulb Economizer(1)	Central Chiller Water-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	0.00227	0.00121	0.00003	-0.00005	0.00137	0.00045	17.17	0.01	0.00000	0.00000	15.0	0.06436	0.03	0.01	184.56
Dry-Bulb Economizer(1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	17.18		0.00000	0.00000	15.0	0.07832	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.04892	0.01361	0.12247	0.08323	0.12546	0.05862	16.73	0.45	0.00002	0.00005	20.0	0.20981	0.99	0.55	11.02
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.01743	0.00384	0.00016	0.00004	0.00864	0.00097	17.15	0.03	0.00000	0.00000	15.0	0.00352	3.13	1.54	1.69
Variable Speed Fans	Single-Speed Fans	0.02142	0.00458	0.00017	0.00004	0.00955	0.00108	17.14	0.04	0.00000	0.00000	15.0	0.03541	0.37	0.18	14.11
Chilled Water Reset	Central Chiller Constant Temp.	0.02179	0.01367	0.02531	-0.00516	0.03047	0.00234	17.09	0.09	0.00001	0.00001	20.0	0.02600	1.56	0.88	5.43
Thermal Energy Storage	Central Chiller Water-Cooled	0.82506	-0.82794	0.13847	-0.13645	0.36258	-0.35325	17.17	0.01	0.00123	0.00009	20.0	1.10329	0.66	0.67	
Full Storage																
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		-0.06709	0.14899	0.00803	0.10204	0.00910	0.08893	16.89	0.29	-0.00005	-0.00001	10.0	0.00341	16.09	3.20	0.24
Setback Thermostat		-0.01059	-0.00236	-0.02484	0.21439	-0.01659	0.05489	16.96	0.21	-0.00002	-0.00005	10.0	0.10218	0.38	0.08	14.41
Heating																
Heat Pipe	Central Chiller System	0.00278	0.00193	0.01510	-0.01163	0.01102	-0.00691	17.17	0.01	0.00000	0.00000	20.0	0.41211	0.02	0.01	828.89
Exhaust Air Heat Recovery	Central Chiller System	0.00000	0.00000	0.00123	0.00229	0.00006	0.00060	17.17	0.00	0.00000	0.00000	20.0	0.35118	0.01	0.00	2349.80

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Cooling/Heating																
Closed Water Loop Heat Pump EER = 11.0, COP = 4.0	Central Chiller System	-0.87343	0.13296	0.18741	0.55782	0.04221	0.38655	16.75	0.43	-0.00093	-0.00039	18.0	0.00000			
Double-Bundled Chiller COP = 5.6	Central Chiller System	0.13689	0.06283	0.20245	0.03488	0.16398	0.01241	16.56	0.61	0.00014	0.00004	20.0	0.18161	1.84	1.16	5.84
Bypass/Delay Timer		-0.01098	0.04157	0.00380	0.03142	0.00124	0.03292	17.08	0.10	-0.00001	0.00000	15.0	0.01703	1.81	0.71	3.42
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.07527	0.01637	0.06414	0.01257	0.07489	0.01470	16.82	0.26	0.00006	0.00004	15.0	0.20894	0.64	0.42	15.56
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.11784	0.19011	0.13919	0.19107	0.14020	0.18935	16.21	0.97	0.00006	0.00012	15.0	0.10134	3.90	2.15	2.08
Variable Air Volume Systems	Central Chiller CAV System	0.24770	0.04720	0.22358	0.10621	0.26285	0.06537	16.23	0.95	0.00020	0.00015	20.0	0.06853	8.03	5.14	1.40
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.01967	0.00409	0.01413	0.00564	0.01784	0.00440	17.11	0.07	0.00002	0.00001	15.0	0.00696	4.80	3.21	2.02
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.00806	0.00776	0.00748	0.00821	0.00778	0.00780	17.13	0.05	0.00001	0.00001	15.0	0.00227	9.33	6.55	0.94
Reduction in Fan Flowrate(1) 10 % Reduction in Fan cfm	Original Fan Flowrate	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Fan Motor Downsizing (1) HP Reduced to 1/3 of the Original	Original Fan Size	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			

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Building Shell																
Ceiling Insulation R= 38	Ceiling Insulation R=	0.00200	-0.00009	0.02868	0.01256	0.00551	0.00267	17.13	0.05	0.00001	0.00004	20.0	0.56000	0.06	0.04	285.68
Wall Insulation R= 19	Wall Insulation R=	0.01974	0.00400	0.37311	0.16829	0.07913	0.05285	16.48	0.70	0.00004	0.00053	20.0	0.15473	3.00	2.11	5.94
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.16901	0.02306	-0.00233	0.01097	0.02113	0.00390	16.95	0.23	0.00018	0.00007	20.0	1.53609	0.14	0.11	91.01
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	-0.02467	-0.00511	0.15397	0.07122	0.03252	0.02444	16.93	0.25	-0.00002	0.00018	20.0	0.08566	1.69	1.10	11.17
"Triple Pane" Low E	Double-Pane Windows	0.08413	0.01181	0.11353	0.06063	0.04529	0.02295	16.84	0.34	0.00009	0.00017	20.0	1.70449	0.14	0.10	103.28
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.03316	0.00511	0.00446	0.00325	0.00742	0.00082	17.12	0.05	0.00003	0.00002	12.0	0.06353	0.57	0.43	17.20
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.08098	0.01197	0.01322	0.01157	0.01716	0.00433	17.04	0.14	0.00008	0.00005	12.0	0.34070	0.26	0.20	36.86

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.29173	0.04195	0.06836	0.00888	0.16748	0.01856	16.58	0.60	0.00029	0.00008	10.0	0.55060	0.54	0.38	15.02
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Halogen Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.6	NA			
T8 Fluorescent Lamps Electronic Ballast (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	3.5	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Compact Fluorescent Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.9	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.00808	0.01650	0.00798	0.01639	0.00818	0.01643	17.10	0.07	0.00000	0.00000	20.0	-0.01064	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.00390	0.00797	0.00385	0.00791	0.00394	0.00793	17.14	0.04	0.00000	0.00000	20.0	-0.00964	INFINITE	INFINITE	NOW
Occupancy Sensors		0.22204	0.00750	0.12526	-0.00514	0.17311	-0.00057	16.66	0.52	0.00003	-0.00003	10.0	0.16999	0.92	0.48	5.82
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.6	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.00441	0.00520	0.00436	0.00517	0.00446	0.00515	17.16	0.03	0.00000	0.00000	15.0	0.00584	2.12	1.22	3.97
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.00376	0.00443	0.00371	0.00441	0.00380	0.00439	17.16	0.02	0.00000	0.00000	15.0	0.00333	3.18	1.83	2.66
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.00524	0.00617	0.00517	0.00614	0.00530	0.00611	17.14	0.03	0.00000	0.00000	15.0	0.01474	1.00	0.58	8.45
Exterior Time Clock		0.00177	0.01999	0.00175	0.01975	0.00179	0.02023	17.11	0.07	0.00000	0.00000	10.0	0.00050	35.10	15.50	0.15
Photocell - Outdoor Lighting		0.01484	0.00967	0.00513	0.00068	0.00866	0.00216	17.14	0.04	0.00000	0.00000	10.0	0.00050	28.37	16.48	0.19
Delay Timer		0.00114	0.01405	-0.00141	0.00910	-0.00030	0.01092	17.14	0.03	0.00000	0.00000	10.0	0.00016	56.80	25.01	0.08

TABLE
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IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.00467	0.00550	0.00461	0.00547	0.00472	0.00546	17.15	0.03	0.00000	0.00000	10.0	0.00005	201.32	116.07	0.03
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.07862	-0.07918	0.07768	-0.07824	0.07955	-0.08012	17.18	0.00	0.00006	0.00006	10.0	0.02940	1.49	1.57	
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.01583	0.02287	0.00049	0.01770	0.00815	0.02002	17.09	0.09	0.00001	-0.00001	6.0	0.04904	0.33	0.15	10.18
Energy Efficient Desktops	Desktops	0.11936	0.02020	0.08143	0.01109	0.09081	0.01407	16.86	0.32	0.00013	0.00006	6.0	-1.83759	INFINITE	INFINITE	NOW
Energy Efficient Laptops	Desktops	0.16427	0.02559	0.08527	0.01214	0.12443	0.01749	16.76	0.43	0.00018	0.00008	6.0	0.11768	1.25	0.88	4.89
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.02282	0.03056	0.00131	0.02347	0.01206	0.02660	17.06	0.12	0.00001	-0.00001	6.0	0.02833	0.79	0.36	4.28
Energy Efficient Printers	Dedicated Printers	0.15841	0.02554	0.08260	0.01264	0.12069	0.01753	16.76	0.42	0.00017	0.00008	6.0	0.06376	2.24	1.57	2.72
Copiers																
Timer (off at night/weekends)	Copiers	0.00481	0.00760	0.00007	0.00572	0.00248	0.00707	17.15	0.03	0.00000	0.00000	6.0	0.00509	1.05	0.47	3.26
Energy Efficient Copiers	Copiers	0.03918	0.00536	0.02072	0.00201	0.03036	0.00306	17.08	0.10	0.00004	0.00002	6.0	0.05517	0.63	0.45	9.77
Miscellaneous																
High Efficiency Elevator Motors 3% Increase in Efficiency	Elevator Motors	0.02182	0.00022	0.01654	-0.00034	0.01848	-0.00007	17.12	0.06	0.00001	0.00000	15.0	0.00264	10.57	6.71	0.86

Note:

(1) Not Applicable to New Buildings

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EXISTING LARGE RETAIL BUILDING																
BASELINE								19.66								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 3.52 (0)	COP = 3.24 (existing)	0.0152	0.0087	0.0042	0.0020	0.0082	0.0040	19.61	0.04	0.0000	0.0000	20.0	0.158	0.16	0.10	60.69
COP = 4.0	COP = 3.52 (standard)	0.0186	0.0106	0.0051	0.0024	0.0100	0.0048	19.56	0.05	0.0000	0.0000	20.0	0.015	2.08	1.36	4.58
COP = 4.6	COP = 3.52 (standard)	0.0355	0.0203	0.0097	0.0046	0.0192	0.0093	19.51	0.10	0.0000	0.0000	20.0	0.033	1.77	1.16	5.40
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled											20.0	0.149			
COP = 4.04 (0)	COP = 4.04 (existing)											20.0	0.025	4.18	2.74	2.28
COP = 5.6	COP = 4.04 (standard)	0.0634	0.0362	0.0174	0.0083	0.0342	0.0166	19.48	0.18	0.0001	0.0000	20.0	0.047	2.50	1.63	3.82
COP = 6.0	COP = 4.04 (standard)	0.0718	0.0411	0.0197	0.0094	0.0388	0.0188	19.46	0.20	0.0001	0.0000	20.0	0.025	4.18	2.74	2.28
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled	0.0634	0.0362	0.0174	0.0083	0.0342	0.0166	19.48	0.18	0.0001	0.0000	20.0	0.025			
COP = 5.6	COP = 4.04 (standard)															
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2	EER = 7.6 (existing)	0.1145	0.0596	0.0009	0.0006	0.0246	0.0118	19.44	0.21	0.0001	0.0000	18.0	1.273	0.12	0.09	81.82
EER = 9.5	EER = 8.2 (standard)	0.1554	0.0809	0.0012	0.0008	0.0333	0.0160	19.16	0.29	0.0002	0.0000	18.0	0.364	0.56	0.40	17.24
EER = 10.5	EER = 8.2 (standard)	0.2481	0.1291	0.0019	0.0013	0.0532	0.0256	18.98	0.46	0.0003	0.0000	18.0	0.644	0.50	0.37	19.11
Evaporative Condenser	Unitary System Air-Cooled	0.1745	0.0908	0.0013	0.0009	0.0374	0.0180	19.33	0.32	0.0002	0.0000	16.0	0.264	0.80	0.58	11.11
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Central Chiller Water-Cooled	0.0041	0.0024	0.0041	0.0028	0.0148	0.0075	19.62	0.04	0.0000	0.0000	20.0	0.008	1.84	0.89	4.97
Enthalpy Economizer	Central Chiller Water-Cooled	0.0049	0.0036	0.0040	0.0028	0.0147	0.0074	19.62	0.04	(0.0000)	0.0000	20.0	0.032	0.46	0.22	18.27
Dry-Bulb Economizer	Unitary System Air-Cooled	0.0015	0.0010	0.0026	0.0016	0.0069	0.0035	19.64	0.02	0.0000	0.0000	16.0	0.082	0.07	0.04	111.96
Enthalpy Economizer	Unitary System Air-Cooled	0.0019	0.0006	0.0026	0.0016	0.0070	0.0036	19.64	0.02	0.0000	0.0000	16.0	0.293	0.02	0.01	395.11
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0390	0.0176	0.1336	0.0652	0.1660	0.0761	19.16	0.50	0.0000	0.0000	20.0	0.124	1.67	0.86	6.09
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0090	0.0043	0.0060	0.0027	0.0127	0.0052	19.62	0.04	0.0000	0.0000	16.0	0.004	3.67	1.73	1.93
Variable Speed Fans	Single-Speed Fans	0.0108	0.0053	0.0063	0.0028	0.0135	0.0056	19.61	0.04	0.0000	0.0000	16.0	0.011	1.48	0.72	4.65
Chilled Water Reset	Central Chiller Constant Temp.	0.0183	0.0092	0.0086	0.0041	0.0136	0.0064	19.60	0.06	0.0000	0.0000	20.0	0.026	1.19	0.72	7.62
Thermal Energy Storage	Central Chiller Water-Cooled	0.3359	(0.2888)	0.0979	(0.1097)	0.1859	(0.1683)	19.63	0.05	0.0006	0.0000	20.0	0.434	0.68	0.67	107.31
Full Storage																
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0954	0.0497	0.0007	0.0005	0.0205	0.0098	19.48	0.18	0.0001	0.0000	1.0	0.003	4.60	3.33	0.23
Time Clock		(0.0323)	0.1334	0.0234	0.0859	0.0373	0.0757	19.35	0.30	(0.0000)	(0.0000)	10.0	0.008	7.82	2.39	0.64
Setback Thermostat(2)		NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			

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Heating																
Heat Pipe	Central Chiller System	0.1038	0.0346	0.1496	0.0748	0.2017	0.0807	19.01	0.65	0.0000	0.0000	20.0	0.877	0.30	0.15	29.78
Exhaust Air Heat Recovery	Central Chiller System	0.0000	0.0000	0.0015	0.0080	(0.0000)	0.0008	19.65	0.01	0.0000	0.0000	20.0	0.685	0.01	0.00	1888.26
Cooling/Heating																
Closed Water Loop Heat Pump (1) EER = 11.0, COP = 4.0	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Double-Bundled Chiller (1) COP = 5.6	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Bypass/Delay Timer		0.0034	0.0600	0.0210	0.0311	0.0399	0.0690	19.43	0.22	(0.0000)	0.0000	15.0	0.003	26.24	11.20	0.26
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.0105	0.0057	0.0082	0.0045	0.0097	0.0050	19.61	0.04	0.0000	0.0000	15.0	0.030	0.68	0.43	13.17
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0176	0.0090	0.0246	0.0123	0.0218	0.0111	19.56	0.10	0.0000	0.0000	15.0	0.009	4.70	2.86	2.02
Variable Air Volume Systems	Central Chiller CAV System	0.3039	0.1652	0.5002	0.2440	0.5744	0.2717	17.60	2.06	0.0002	0.0001	20.0	0.276	3.37	1.85	2.90
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0147	0.0083	0.0126	0.0070	0.0134	0.0072	19.59	0.06	0.0000	0.0000	15.0	0.006	4.91	3.03	1.83
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.0014	0.0008	0.0014	0.0007	0.0014	0.0007	19.65	0.01	0.0000	0.0000	15.0	0.001	4.27	2.66	2.18
Reduction in Fan Flowrate 10 % Reduction in Fan cfm	Original Fan Flowrate	0.0611	0.0313	0.1177	0.0581	0.1157	0.0650	19.22	0.44	0.0000	0.0000	15.0	0.179	0.95	0.51	8.97
Fan Motor Downsizing HP Reduced to 1/3 of the Original	Original Fan Size	0.1174	0.0660	0.1010	0.0552	0.1071	0.0579	19.15	0.50	0.0001	0.0000	15.0	0.191	1.25	0.77	7.21

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Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	(0.2434)	(0.1409)	0.0800	0.0368	(0.1904)	(0.0903)	20.20	0.55	(0.0001)	0.0003	20.0	0.570	-0.36	-0.16	NEVER
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.0001	(0.0005)	0.0136	0.0075	0.0012	0.0012	19.63	0.02	0.0000	0.0000	20.0	0.070	0.30	0.23	87.21
Triple-Pane Windows	Single-Pane Windows	0.0080	0.0033	0.0151	0.0086	0.0028	0.0018	19.62	0.04	0.0000	0.0000	20.0	0.194	0.18	0.14	100.52
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	(0.0008)	(0.0013)	0.0195	0.0110	0.0016	0.0012	19.62	0.03	0.0000	0.0000	20.0	0.077	0.40	0.32	74.19
"Triple Pane" Low E	Single-Pane Windows	0.0069	0.0027	0.0186	0.0105	0.0030	0.0019	19.61	0.04	0.0000	0.0000	20.0	0.208	0.19	0.14	103.96
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.0064	0.0028	0.0069	0.0040	0.0016	0.0009	19.63	0.02	0.0000	0.0000	12.0	0.018	1.02	0.83	14.66
Tinted Window Films	Double-Pane Windows	0.0017	0.0007	0.0001	0.0000	0.0003	0.0002	19.65	0.00	0.0000	0.0000	12.0	0.014	0.21	0.18	65.49
Low E Films	Single-Pane Windows	0.0080	0.0036	0.0121	0.0066	0.0026	0.0015	19.62	0.03	0.0000	0.0000	12.0	0.028	0.97	0.77	15.76
Low E Films	Double-Pane Windows	0.0040	0.0017	0.0003	0.0002	0.0006	0.0003	19.65	0.01	0.0000	0.0000	12.0	0.022	0.40	0.35	41.99
Lighting																
Daylighting Controls		0.0173	0.0085	0.0042	0.0023	0.0092	0.0041	19.61	0.05	0.0000	0.0000	10.0	2.970	0.01	0.01	1055.11
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0054	0.0036	0.0029	0.0022	0.0041	0.0027	19.63	0.02	0.0000	0.0000	10.0	0.000	264.81	164.95	0.03
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0054	0.0036	0.0029	0.0022	0.0041	0.0027	19.63	0.02	0.0000	0.0000	10.0	0.000	42.03	26.18	0.17
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0054	0.0036	0.0029	0.0022	0.0041	0.0027	19.63	0.02	0.0000	0.0000	10.0	0.002	4.07	2.54	1.71
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.3001	0.1957	0.1583	0.1222	0.2194	0.1475	18.51	1.14	0.0002	0.0001	20.0	0.181	3.40	2.12	2.85
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.0598	0.0390	0.0313	0.0242	0.0439	0.0296	19.43	0.23	0.0001	0.0000	2.6	0.006	5.56	3.46	0.44
Electronic Ballasts	T12 Fluorescent Lamps	0.3416	0.2227	0.1802	0.1392	0.2497	0.1676	18.35	1.30	0.0003	0.0001	20.0	0.201	3.49	2.17	2.78
Compact Fluorescent Lamps	Incandescent Lamps	0.2857	0.1863	0.1506	0.1163	0.2290	0.1424	18.55	1.11	0.0004	0.0001	2.1	(0.007)	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0059	0.0121	0.0058	0.0121	0.0060	0.0121	19.60	0.05	0.0000	0.0000	20.0	0.087	0.25	0.12	31.60
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0035	0.0073	0.0035	0.0072	0.0036	0.0073	19.62	0.03	0.0000	0.0000	20.0	0.093	0.14	0.07	56.35
Ellipsoidal Lamps	Incandescent Lamps	0.0598	0.0390	0.0312	0.0443	0.0439	0.0296	19.41	0.25	0.0000	(0.0000)	0.4	0.002	1.89	0.85	0.15

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COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting (Cont'd)																
LED Exit Lighting	Incandescent Exit Lighting	0.0011	0.0013	0.0010	0.0012	0.0011	0.0012	19.65	0.01	0.0000	0.0000	15.0	0.041	0.07	0.04	117.33
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0009	0.0011	0.0009	0.0011	0.0009	0.0010	19.65	0.01	0.0000	0.0000	15.0	0.035	0.07	0.04	117.98
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0012	0.0015	0.0012	0.0015	0.0013	0.0015	19.65	0.01	0.0000	0.0000	15.0	0.063	0.08	0.03	151.35
Exterior Time Clock		0.0000	0.0543	0.0000	0.0539	0.0000	0.0543	19.49	0.16	0.0000	0.0000	10.0	0.004	9.70	4.22	0.54
Photocell - Outdoor Lighting		0.0365	0.0668	0.0213	0.0533	0.0260	0.0579	19.39	0.26	0.0000	0.0000	10.0	0.004	17.31	8.65	0.32
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.0089	0.0105	0.0088	0.0104	0.0090	0.0104	19.60	0.06	0.0000	0.0000	10.0	0.000	216.30	124.71	0.03
Water Heater Blanket Blanket R = 11	Water Heater	0.0089	0.0105	0.0088	0.0104	0.0090	0.0104	19.60	0.06	0.0000	0.0000	10.0	0.000	119.61	68.96	0.06
Storage Water Heater	Water Heater	0.1961	(0.1961)	0.1938	(0.1938)	0.1985	(0.1985)	19.66		0.0002	0.0001	10.0	0.014	7.48	7.82	

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Most Existing Buildings Already Use Thermostat Setback

8/17/93

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
NEW LARGE RETAIL BUILDING																
BASELINE								17.19								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.52	0.0152	0.0080	0.0004	0.0002	0.0044	0.0019	17.16	0.03	0.0000	0.0000	20.0	0.015	1.49	1.08	7.05
COP = 4.6	COP = 3.52	0.0274	0.0144	0.0007	0.0003	0.0079	0.0035	17.14	0.05	0.0000	0.0000	20.0	0.034	1.19	0.86	8.81
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.05	0.0457	0.0240	0.0011	0.0005	0.0132	0.0058	17.10	0.09	0.0001	0.0000	20.0	0.026	2.60	1.89	4.02
COP = 6.0	COP = 4.05	0.0548	0.0288	0.0014	0.0006	0.0158	0.0069	17.08	0.11	0.0001	0.0000	20.0	0.049	1.65	1.20	6.36
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled	0.0457	0.0240	0.0011	0.0005	0.0132	0.0058	17.10	0.09	0.0001	0.0000	20.0	0.026			
COP = 5.6	COP = 4.05															
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.1498	0.0777	0.0007	0.0005	0.0309	0.0148	16.92	0.27	0.0002	0.0000	18.0	0.395	0.51	0.38	19.49
EER = 10.6	EER = 8.2	0.2638	0.1316	0.0012	0.0009	0.0524	0.0251	16.73	0.46	0.0003	0.0000	18.0	0.698	0.49	0.36	20.36
Evaporative Condenser	Unitary System Air-Cooled	0.1712	0.0888	0.0008	0.0006	0.0354	0.0169	16.88	0.31	0.0002	0.0000	15.0	0.286	0.75	0.55	12.34
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (1)	Central Chiller Water-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	(0.0000)	0.0000	0.0000	0.0000	0.0000	0.0000	17.19	0.00	(0.0000)	0.0000	20.0	0.029	0.00	0.00	
Dry-Bulb Economizer (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.0003	0.0000	.0.0000	0.0000	0.0000	0.0001	17.19	0.00	0.0000	0.0000	15.0	0.317	0.00	0.00	
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0017	0.0001	0.0083	0.0028	0.0067	0.0074	17.17	0.03	0.0000	0.0000	20.0	0.116	0.18	0.13	108.53
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0051	0.0027	0.0000	0.0000	0.0038	0.0013	17.18	0.01	0.0000	0.0000	15.0	0.004	1.16	0.56	4.78
Variable Speed Fans	Single-Speed Fans	0.0066	0.0034	0.0000	0.0000	0.0041	0.0014	17.18	0.02	0.0000	0.0000	15.0	0.011	0.52	0.25	10.34
Chilled Water Reset	Central Chiller Constant Temp.	0.0097	0.0054	0.0006	0.0003	0.0042	0.0017	17.17	0.02	(0.0000)	0.0000	20.0	0.026	0.34	0.17	17.68
Thermal Energy Storage Full Storage	Central Chiller Water-Cooled	0.2304	(0.2229)	(0.0069)	(0.0517)	0.0645	(0.0980)	17.28	0.09	0.0004	0.0000	20.0	0.263	0.74	0.82	
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		(0.0377)	0.0951	0.0196	0.0627	(0.0024)	0.0506	17.01	0.19	(0.0000)	0.0000	10.0	0.009	4.75	1.67	0.98
Setback Thermostat(2)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.19		0.0000	0.0000	10.0	NA			
Heating																
Heat Pipe	Central Chiller System	0.0000	0.0004	0.0154	0.0194	0.0062	0.0092	17.14	0.05	0.0000	0.0000	20.0	0.877	0.02	0.01	479.73
Exhaust Air Heat Recovery	Central Chiller System	0.0000	0.0004	0.0154	0.0194	0.0062	0.0092	17.14	0.05	0.0000	0.0000	20.0	0.685	0.03	0.01	374.72

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ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Cooling/Heating																
Closed Water Loop Heat Pump EER = 11.0, COP = 4.0	Central Chiller System	(0.6775)	(0.3888)	(0.6250)	(0.3276)	(0.3645)	(0.2016)	19.78	2.58	(0.0004)	(0.0008)	18.0	0.000			
Double-Bundled Chiller COP = 5.6	Central Chiller System	0.0758	0.0068	(0.0260)	(0.0476)	0.0763	(0.0074)	17.12	0.08	0.0001	(0.0000)	20.0	0.105	0.68	0.53	16.03
Bypass/Delay Timer		0.0473	(0.0254)	0.0734	0.0397	0.0301	0.0196	17.01	0.18	(0.0000)	(0.0000)	15.0	0.003	15.96	5.20	0.40
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.0106	0.0057	0.0080	0.0044	0.0093	0.0048	17.15	0.04	0.0000	0.0000	15.0	0.070	0.29	0.18	30.70
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0098	0.0052	0.0074	0.0031	0.0079	0.0033	17.16	0.04	0.0000	0.0000	15.0	0.007	2.69	1.73	3.46
Variable Air Volume Systems	Central Chiller CAV System	0.1612	0.0831	0.1116	0.0762	0.1560	0.0824	16.52	0.67	0.0001	0.0003	20.0	0.066	6.24	4.18	1.88
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0173	0.0093	0.0074	0.0047	0.0134	0.0071	17.13	0.06	0.0000	0.0000	15.0	0.006	4.71	2.94	1.81
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.0009	0.0005	0.0005	0.0002	0.0006	0.0003	17.19	0.00	0.0000	0.0000	15.0	0.001	2.28	1.52	4.19
Reduction in Fan Flowrate(1) 10 % Reduction in Fan cfm	Original Fan Flowrate	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Fan Motor Downsizing(1) HP Reduced to 1/3 of the Original	Original Fan Size	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Building Shell																
Ceiling Insulation R = 38	Ceiling Insulation R =	(0.1517)	(0.0878)	0.1747	0.0855	(0.1193)	(0.0468)	17.34	0.16	(0.0001)	0.0003	20.0	0.560	-0.03	0.03	NEVER
Wall Insulation R = 19	Wall Insulation R =	0.0080	0.0074	0.0167	0.0161	0.0003	0.0018	17.14	0.05	0.0000	0.0002	20.0	0.085	0.99	0.87	34.04
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.0318	0.0168	0.0036	0.0020	0.0092	0.0043	17.13	0.07	0.0001	0.0000	20.0	0.221	0.26	0.20	48.59
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	0.0008	0.0001	0.0096	0.0051	0.0000	0.0001	17.18	0.02	0.0000	0.0000	20.0	0.012	1.28	1.04	20.54
"Triple Pane" Low E	Double-Pane Windows	0.0171	0.0081	0.0088	0.0047	0.0030	0.0023	17.15	0.04	0.0000	0.0000	20.0	0.246	0.16	0.12	90.24
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.0151	0.0076	0.0016	0.0008	0.0048	0.0022	17.16	0.03	0.0000	0.0000	12.0	0.032	0.63	0.47	14.75
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			

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Low E Films	Double-Pane Windows	0.0210	0.0105	0.0045	0.0023	0.0062	0.0029	17.15	0.05	0.0000	0.0000	12.0	0.049	0.83	0.47	15.63

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH DIVERSN. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.0227	0.0119	0.0047	0.0025	0.0113	0.0055	17.13	0.06	0.0000	0.0000	10.0	1.350	0.02	0.01	367.00
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	T8 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.6	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Compact Fluorescent Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	2.1	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0059	0.0121	0.0058	0.0121	0.0060	0.0121	17.14	0.06	0.0000	0.0000	20.0	(0.008)	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0035	0.0073	0.0035	0.0072	0.0036	0.0073	17.16	0.03	0.0000	0.0000	20.0	(0.008)	INFINITE	INFINITE	NOW
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	0.4	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0011	0.0012	0.0010	0.0012	0.0011	0.0012	17.19	0.01	0.0000	0.0000	15.0	0.014	0.21	0.12	40.45
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0009	0.0011	0.0009	0.0011	0.0009	0.0010	17.19	0.01	0.0000	0.0000	15.0	0.008	0.31	0.18	27.12
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0013	0.0016	0.0012	0.0015	0.0013	0.0015	17.18	0.01	0.0000	0.0000	15.0	0.036	0.10	0.06	86.26
Exterior Time Clock		0.0000	0.0543	0.0000	0.0539	0.0000	0.0543	17.03	0.16	0.0000	0.0000	10.0	0.004	9.70	4.22	0.54
Photocell - Outdoor Lighting		0.0365	0.0868	0.0213	0.0533	0.0260	0.0579	16.93	0.26	0.0000	0.0000	10.0	0.004	17.31	8.65	0.32

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Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.0089	0.0105	0.0088	0.0104	0.0090	0.0103	17.14	0.06	0.0000	0.0000	10.0	0.000	216.27	124.70	0.03
Water Heater Blanket (1) Blanket R= 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.1961	(0.1961)	0.1938	(0.1938)	0.1985	(0.1985)	17.19		0.0002	0.0001	10.0	0.014	7.46	7.82	

Note:

(1) Not Applicable to New Buildings
(2) Most New Buildings Already Use Thermostat Setback

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EXISTING HIGH SCHOOL BUILDING																
BASELINE								7.24								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled									0.0000	0.0000	20.0	NA			
COP = 3.52 (0)	COP = 3.52 (existing)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.24		0.0000	0.0000	20.0	0.029	0.40	0.20	17.02
COP = 4.0	COP = 3.52 (standard)	0.0139	0.0008	0.0000	0.0000	0.0130	0.0005	7.21	0.03	0.0000	0.0000	20.0	0.065	0.27	0.13	25.29
COP = 4.6	COP = 3.52 (standard)	0.0210	0.0013	0.0000	0.0000	0.0198	0.0007	7.20	0.04	0.0000	0.0000	20.0				
Unitary System Air-Cooled	Unitary System Air-Cooled									0.0000	0.0000	18.0	NA			
EER = 8.2 (0)	EER = 8.2 (existing)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000	0.0000	18.0	0.064	0.18	0.09	36.11
EER = 9.5	EER = 8.2 (standard)	0.0161	0.0000	0.0000	0.0000	0.0129	0.0001	7.21	0.03	0.0000	0.0000	18.0	0.113	0.17	0.08	37.72
EER = 10.5	EER = 8.2 (standard)	0.0272	0.0000	0.0000	0.0000	0.0218	0.0001	7.19	0.05	0.0000	0.0000	18.0	0.116	0.10	0.05	57.16
Evaporative Condenser	Unitary System Air-Cooled	0.0184	0.0000	0.0000	0.0000	0.0147	0.0001	7.21	0.03	0.0000	0.0000	15.0				
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (2)	Central Chiller Water-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	(0.0000)	0.0000	0.0000	0.0000	0.0001	0.0000	7.24	0.00	0.0000	0.0000	20.0	0.030	0.00	0.00	NEVER
Dry-Bulb Economizer (2)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.24		0.0000	0.0000	18.0	0.168	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0105	0.0001	0.0015	0.0001	0.0085	(0.0007)	7.22	0.02	0.0000	0.0000	20.0	0.095	0.08	0.04	84.35
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0003	0.0000	0.0000	0.0000	0.0004	0.0000	7.24	0.00	0.0000	0.0000	15.0	0.004	0.07	0.03	95.85
Variable Speed Fans	Single-Speed Fans	0.0003	0.0000	0.0000	0.0000	0.0004	0.0000	7.24	0.00	0.0000	0.0000	15.0	0.008	0.03	0.02	190.33
Chilled Water Reset	Central Chiller Constant Temp.	0.0046	0.0001	0.0000	0.0000	0.0054	0.0001	7.23	0.01	0.0000	0.0000	20.0	0.026	0.16	0.08	44.61
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0085	0.0000	0.0000	0.0000	0.0068	0.0000	7.23	0.02	0.0000	0.0000	1.0	0.006	0.11	0.05	6.37
Time Clock		0.0741	0.0980	(0.1075)	0.2216	(0.0154)	0.0623	6.91	0.33	0.0001	(0.0002)	10.0	0.033	3.31	1.78	1.65
Setback Thermostat		0.0824	0.0814	(0.0508)	0.1064	(0.0029)	0.0098	7.02	0.23	0.0001	(0.0001)	10.0	0.065	1.59	1.08	4.18
Heating																
Heat Pipe	Central Chiller System	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	7.24	0.00	0.0000	(0.0000)	20.0	0.700	0.00	0.00	NEVER
Exhaust Air Heat Recovery	Central Chiller System	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	7.24	0.00	0.0000	(0.0000)	20.0	0.678	0.00	0.00	NEVER

TABLE
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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2 (existing = standard)	(0.0000)	(0.0000)	0.1538	0.0681	0.0169	0.0068	7.00	0.25	0.0000	0.0000	18.0	0.020	4.80	2.44	2.23
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0068	(0.0000)	0.1761	0.0776	0.0257	0.0080	6.95	0.29	0.0000	0.0000	18.0	0.080	1.41	0.72	7.37
Closed Water Loop Heat Pump (1)	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
EER = 11.0, COP = 4.0																
Ground-Coupled Heat Pump (1)	Unitary System & Elec. Heating	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
EER = 11.6, COP = 3.5	EER = 8.2 (standard)															
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2 (existing = standard)	(0.0000)	(0.0013)	(0.0489)	(0.0032)	(0.0310)	(0.0049)	7.33	0.09	0.0000	0.0000	18.0	0.020	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0102	(0.0011)	(0.0422)	(0.0028)	(0.0181)	(0.0042)	7.30	0.06	0.0000	0.0000	18.0	0.131	NA	NA	NA
Double-Bundled Chiller (3)	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
COP = 5.6																
Bypass/Delay Timer		0.0688	0.0257	0.0055	0.0964	0.0100	0.0089	7.03	0.22	0.0001	(0.0000)	15.0	0.011	11.59	8.03	0.90
Ventilation																
Adjustable Speed Drives - Fans (2)	Fans - Constant Speed	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0034	0.0004	0.0087	0.0020	0.0130	0.0011	7.21	0.03	0.0000	0.0000	15.0	0.008	1.54	0.93	7.01
Variable Air Volume Systems	Central Chiller CAV System	0.0583	0.0061	0.1339	0.0133	0.1556	0.0138	6.86	0.38	0.0000	0.0001	20.0	0.200	1.00	0.62	12.06
High Efficiency Fan Motors	Fan Motors	0.0078	0.0042	0.0103	0.0014	0.0123	0.0014	7.20	0.04	0.0000	0.0000	15.0	0.006	3.73	2.40	2.66
3% Increase in Efficiency																
High Efficiency Pump Motors	Pump Motors	0.0002	0.0000	0.0008	0.0002	0.0009	0.0001	7.24	0.00	0.0000	0.0000	15.0	0.001	1.15	0.71	10.15
3% Increase in Efficiency																
Reduction in Fan Flowrate	Original Fan Flowrate	0.0242	0.0123	0.0345	0.0027	0.0383	0.0044	7.13	0.12	0.0000	0.0000	15.0	0.146	0.40	0.26	25.00
10 % Reduction in Fan cfm																
Fan Motor Downsizing		0.0626	0.0319	0.0821	0.0108	0.0971	0.0107	6.95	0.30	0.0000	0.0001	15.0	0.463	0.32	0.21	31.12
HP Reduced to 1/3 of the Original	Original Fan Size															

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Building Shell																
Ceiling Insulation R= 30	Ceiling Insulation	(0.0244)	(0.0258)	0.0796	0.0704	0.0131	0.0038	7.13	0.12	0.0000	0.0001	20.0	0.570	0.15	0.11	304.72
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	(0.0338)	(0.0390)	0.0840	0.0679	0.0127	0.0027	7.15	0.09	0.0000	0.0001	20.0	0.645	0.15	0.11	
Triple-Pane Windows	Single-Pane Windows	(0.0209)	(0.0295)	0.0986	0.0785	0.0220	0.0037	7.09	0.15	0.0000	0.0002	20.0	1.609	0.08	0.06	479.16
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	(0.0383)	(0.0479)	0.1183	0.0906	0.0202	0.0034	7.10	0.15	0.0000	0.0002	20.0	0.601	0.20	0.16	466.32
"Triple Pane" Low E	Single-Pane Windows	0.0171	0.0030	0.1024	0.0823	0.0345	0.0071	7.00	0.25	0.0000	0.0002	20.0	1.620	0.10	0.07	166.42
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.1075	0.0792	(0.0436)	(0.0351)	0.0220	(0.0032)	7.12	0.13	0.0001	(0.0000)	12.0	0.131	0.70	0.54	10.03
Tinted Window Films	Double-Pane Windows	0.0020	0.0018	(0.0011)	(0.0007)	0.0002	0.0002	7.24	0.00	0.0000	(0.0000)	12.0	0.005	0.08	0.00	17.87
Low E Films	Single-Pane Windows	0.1067	0.0790	(0.0429)	(0.0341)	0.0217	(0.0031)	7.11	0.13	0.0001	(0.0000)	12.0	0.214	0.43	0.34	16.37
Low E Films	Double-Pane Windows	0.0008	0.0003	(0.0004)	(0.0005)	(0.0000)	(0.0000)	7.24	0.00	0.0000	(0.0000)	12.0	0.021	-0.01	-0.01	362.37

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.2545	(0.0256)	0.4977	0.0375	0.5222	0.0470	5.91	1.33	0.0002	0.0007	10.0	1.188	0.53	0.37	20.41
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0171	0.0076	0.0206	0.0043	0.0255	0.0064	7.16	0.08	0.0000	0.0000	10.0	0.000	87.45	55.62	0.09
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0171	0.0076	0.0206	0.0043	0.0255	0.0064	7.16	0.08	0.0000	0.0000	10.0	0.002	13.88	8.83	0.58
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0171	0.0076	0.0206	0.0043	0.0255	0.0064	7.16	0.08	0.0000	0.0000	10.0	0.024	1.35	0.86	5.94
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.1417	0.0840	0.1669	0.0370	0.2092	0.0502	6.57	0.67	0.0001	0.0002	20.0	0.255	1.45	0.92	7.64
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.1040	0.0463	0.1223	0.0284	0.1542	0.0371	6.76	0.49	0.0001	0.0001	20.0	0.221	1.23	0.78	9.02
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.0693	0.0311	0.0823	0.0188	0.1032	0.0251	6.91	0.33	0.0000	0.0001	6.7	0.005	19.51	12.36	0.31
Electronic Ballasts	T12 Fluorescent Lamps	0.0400	0.0178	0.0473	0.0103	0.0593	0.0144	7.05	0.19	0.0000	0.0001	20.0	0.090	1.16	0.73	9.55
Metal Halide - Indoor	Mercury Vapor Lamps	0.0654	0.0294	0.0776	0.0175	0.0974	0.0236	6.93	0.31	0.0000	0.0001	20.0	0.084	2.06	1.30	5.41
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0041	0.0078	0.0041	0.0078	0.0042	0.0078	7.21	0.04	0.0000	0.0000	20.0	0.008	1.82	0.84	4.15
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0026	0.0050	0.0026	0.0049	0.0026	0.0049	7.22	0.02	0.0000	0.0000	20.0	0.008	1.15	0.53	6.58
Occupancy Sensors		0.0771	0.0199	0.1112	0.0043	0.1346	0.0098	6.89	0.36	0.0000	(0.0000)	10.0	0.059	1.68	0.81	3.41
Ellipsoidal Lamps	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	1.1	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0065	0.0077	0.0064	0.0076	0.0066	0.0076	7.20	0.04	0.0000	0.0000	15.0	0.026	0.71	0.41	11.95
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0055	0.0065	0.0055	0.0065	0.0056	0.0064	7.21	0.04	0.0000	0.0000	15.0	0.022	0.70	0.41	11.98
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0077	0.0091	0.0076	0.0090	0.0078	0.0090	7.19	0.05	0.0000	0.0000	15.0	0.039	0.55	0.32	15.41
Exterior Time Clock		0.0000	0.0120	0.0000	0.0119	0.0000	0.0120	7.21	0.04	0.0000	0.0000	10.0	0.002	4.00	1.74	1.30
Photocell - Outdoor Lighting		0.0086	0.0076	0.0025	0.0012	0.0045	0.0036	7.21	0.03	0.0000	0.0000	10.0	0.002	3.27	1.55	1.37
Delay Timer		0.0302	0.0044	0.0591	0.0050	0.0734	0.0055	7.06	0.18	0.0000	(0.0000)	10.0	0.023	2.17	1.06	2.87

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.0021	0.0025	0.0021	0.0025	0.0021	0.0025	7.23	0.01	(0.0000)	(0.0000)	10.0	0.000	-57.99	-67.60	
Water Heater Blanket Blanket R = 11	Water Heater	0.0323	0.0069	0.0612	0.0075	0.0755	0.0080	7.05	0.19	0.0000	(0.0000)	10.0	0.000	143.98	71.16	0.04
Storage Water Heater	Water Heater	0.0104	(0.0093)	0.0284	(0.0253)	0.0271	(0.0259)	7.24	0.00	0.0000	0.0000	10.0	0.025	0.53	0.53	145.06
Solar Assisted Water Heater	Water Heater	0.0019	0.0004	0.0141	0.0008	0.0083	0.0006	7.22	0.03	0.0000	0.0000	10.0	0.350	0.04	0.03	334.98
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0039	0.0068	0.0020	0.0048	0.0028	0.0052	7.22	0.03	0.0000	(0.0000)	6.0	0.012	0.41	0.18	8.37
Energy Efficient Desktops	Desktops	0.0235	0.0100	0.0276	0.0062	0.0346	0.0088	7.13	0.11	0.0000	0.0000	6.0	0.587	0.05	0.03	106.95
Standard Laptops	Desktops	0.0289	0.0123	0.0336	0.0074	0.0424	0.0102	7.11	0.13	0.0000	0.0000	6.0	1.055	0.04	0.02	166.97
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0071	0.0132	0.0033	0.0094	0.0050	0.0104	7.19	0.06	0.0000	(0.0000)	6.0	0.007	1.23	0.55	2.78
Energy Efficient Printers	Dedicated Printers	0.0307	0.0132	0.0357	0.0079	0.0460	0.0110	7.10	0.14	0.0000	0.0000	6.0	0.307	0.13	0.08	42.94
Copiers																
Timer (off at night/weekends)	Copiers	0.0002	0.0000	0.0003	0.0000	0.0003	(0.0000)	7.24	0.00	0.0000	(0.0000)	6.0	0.001	0.24	0.12	16.58
Energy Efficient Copiers	Copiers	0.0043	0.0017	0.0049	0.0009	0.0059	0.0014	7.22	0.02	0.0000	0.0000	6.0	0.083	0.06	0.04	86.11

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Not Applicable to Air Distribution System
(3) Not Applicable to Chiller System

Barakat & Chamberlin 8/17/93

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NEW HIGH SCHOOL BUILDING																
BASELINE								5.94								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.66	0.0152	0.0009	0.0000	0.0000	0.0118	0.0006	5.91	0.03	0.0000	0.0000	20.0	0.045	0.25	0.13	25.81
COP = 4.6	COP = 3.66	0.0276	0.0016	0.0000	0.0000	0.0214	0.0011	5.89	0.05	0.0000	0.0000	20.0	0.102	0.20	0.10	32.07
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.0053	0.0000	0.0000	0.0000	0.0038	0.0000	5.93	0.01	0.0000	0.0000	18.0	0.087	0.04	0.02	153.43
EER = 10.5	EER = 8.2	0.0089	0.0000	0.0000	0.0000	0.0065	0.0000	5.93	0.02	0.0000	0.0000	18.0	0.154	0.04	0.02	160.25
Evaporative Condenser	Unitary System Air-Cooled	0.0060	0.0000	0.0000	0.0000	0.0044	0.0000	5.93	0.01	0.0000	0.0000	15.0	0.158	0.02	0.01	242.94
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Central Chiller Water-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	(0.0000)	0.0000	0.0000	0.0000	0.0000	(0.0000)	5.94	0.00	0.0000	0.0000	20.0	0.047	0.00	0.00	NEVER
Dry-Bulb Economizer	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.94		0.0000	0.0000	18.0	0.228	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Water-Cooled	(0.0004)	(0.0007)	0.0000	0.0000	(0.0043)	(0.0007)	5.95	0.01	0.0000	0.0000	20.0	0.150	-0.02	-0.01	NEVER
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0005	0.0000	0.0000	0.0000	0.0007	0.0001	5.94	0.00	0.0000	0.0000	15.0	0.004	0.13	0.06	51.96
Variable Speed Fans	Single-Speed Fans	0.0006	0.0000	0.0000	0.0000	0.0008	0.0001	5.94	0.00	0.0000	0.0000	15.0	0.014	0.04	0.02	178.53
Chilled Water Reset	Central Chiller Constant Temp.	0.0091	0.0004	0.0000	0.0000	0.0070	0.0003	5.93	0.02	0.0000	0.0000	20.0	0.026	0.26	0.13	25.14
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		0.0177	0.0196	(0.0623)	0.1303	(0.0177)	0.0468	5.81	0.13	0.0000	(0.0001)	10.0	0.033	0.77	0.14	5.00
Setback Thermostat		0.0294	0.0000	(0.0209)	0.0402	(0.0021)	(0.0002)	5.90	0.05	0.0000	(0.0000)	10.0	0.065	0.29	0.18	21.64
Heating																
Heat Pipe	Central Chiller System	0.0037	0.0002	0.0000	0.0000	0.0063	0.0004	5.93	0.01	0.0000	0.0000	20.0	0.040	0.11	0.05	70.83
Exhaust Air Heat Recovery	Central Chiller System	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.94		0.0000	0.0000	20.0	0.033	0.00	0.00	NEVER

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Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7		0.0000	0.0000	0.1059	0.0377	0.0099	0.0031	5.79	0.16	0.0000	0.0000	18.0	0.017	3.45	1.76	3.10
EER = 9.6, COP = 3.1		0.0056	0.0000	0.1231	0.0431	0.0167	0.0039	5.75	0.19	0.0000	0.0000	18.0	0.071	1.04	0.53	9.94
Closed Water Loop Heat Pump	Central Chiller System	(0.0300)	(0.0109)	(0.1685)	0.0134	0.0074	(0.0014)	6.13	0.19	0.0000	(0.0003)	18.0	0.000			
EER = 11.0, COP = 4.0																
Ground-Coupled Heat Pump	Unitary System & Elec. Heating	0.0117	(0.0005)	0.1353	0.0435	0.0203	0.0041	5.73	0.21	0.0000	0.0006	18.0	0.191	1.32	1.11	23.37
EER = 11.0, COP = 3.5																
EXC SPGS MID SCH-GEOTH	Wat Src w/ boiler & cool twr	67591	0	60	0	13548	0		81199	31	0	18.0	92000	0.51	0.35	15.33
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7		0.0000	(0.0005)	(0.1507)	(0.0441)	(0.0191)	(0.0058)	6.16	0.22	0.0000	(0.0005)	18.0	0.010	NA	NA	NA
EER = 9.6, COP = 3.1		0.0056	(0.0004)	(0.1335)	(0.0388)	(0.0122)	(0.0050)	6.13	0.18	0.0000	(0.0005)	18.0	0.063	NA	NA	NA
Double-Bundled Chiller (3)	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
COP = 5.6																
Bypass/Delay Timer		0.0139	0.0177	(0.0029)	0.0049	(0.0021)	0.0418	5.87	0.07	0.0000	(0.0000)	15.0	0.011	2.18	0.88	2.67
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0104	0.0009	0.0094	0.0015	0.0156	0.0015	5.90	0.04	0.0000	0.0000	15.0	0.013	1.27	0.75	8.98
Variable Air Volume Systems	Central Chiller CAV System	0.0687	0.0061	0.1307	0.0125	0.1374	0.0130	5.57	0.37	0.0000	0.0002	20.0	0.000	INFINITE	INFINITE	NOW
High Efficiency Fan Motors	Fan Motors	0.0052	0.0004	0.0096	0.0009	0.0116	0.0007	5.91	0.03	0.0000	0.0000	15.0	0.005	2.70	1.69	3.95
3% Increase in Efficiency																
High Efficiency Pump Motors	Pump Motors	0.0004	0.0000	0.0008	0.0001	0.0007	0.0001	5.94	0.00	0.0000	0.0000	15.0	0.001	0.89	0.56	11.76
3% Increase in Efficiency																
Reduction in Fan Flowrate (1)	Original Fan Flowrate	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
10 % Reduction in Fan cfm																
Fan Motor Downsizing (1)		NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
HP Reduced to 1/3 of the Original	Original Fan Size															

TABLE
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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 38	Ceiling Insulation	(0.0121)	(0.0012)	0.0769	0.0430	0.0066	0.0027	5.83	0.12	0.0000	0.0001	20.0	0.560	0.15	0.11	158.32
Wall Insulation R = 19	Wall Insulation	(0.0331)	(0.0056)	0.0886	0.0472	0.0023	0.0026	5.84	0.10	0.0000	0.0001	20.0	0.134	0.63	0.49	71.44
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.0486	0.0010	(0.0004)	0.0032	0.0251	0.0007	5.86	0.08	0.0000	0.0000	20.0	1.059	0.04	0.02	208.90
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	(0.0182)	(0.0028)	0.0470	0.0267	0.0019	0.0011	5.89	0.06	(0.0000)	0.0000	20.0	0.059	0.17	-0.01	57.26
"Triple Pane" Low E	Double-Pane Windows	0.0317	0.0007	0.0073	0.0072	0.0172	0.0007	5.88	0.06	0.0000	0.0000	20.0	1.176	0.03	0.02	309.19
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.0582	0.0012	(0.0293)	(0.0151)	0.0257	(0.0011)	5.90	0.04	0.0000	(0.0000)	12.0	0.069	0.11	0.02	16.76
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.0424	0.0009	(0.0207)	(0.0102)	0.0170	(0.0008)	5.91	0.03	0.0000	(0.0000)	12.0	0.235	0.02	0.00	78.23

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.1384	0.0223	0.1435	0.0138	0.1818	0.0183	5.42	0.52	0.0001	0.0003	10.0	0.540	0.47	0.33	20.84
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	6.7	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Metal Halide - Indoor	Mercury Vapor Lamps	0.0510	0.0158	0.0803	0.0156	0.0771	0.0169	5.71	0.24	0.0000	0.0001	20.0	(0.006)	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0041	0.0079	0.0041	0.0078	0.0042	0.0078	5.91	0.04	0.0000	0.0000	20.0	(0.001)	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0026	0.0050	0.0026	0.0049	0.0026	0.0049	5.92	0.02	0.0000	0.0000	20.0	(0.001)	INFINITE	INFINITE	NOW
Occupancy Sensors		0.0603	0.0088	0.0866	0.0052	0.1071	0.0064	5.67	0.27	0.0000	(0.0000)	10.0	0.059	1.31	0.84	4.52
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	1.1	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0065	0.0077	0.0064	0.0076	0.0066	0.0076	5.90	0.04	0.0000	0.0000	15.0	0.009	2.05	1.18	4.11
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0055	0.0065	0.0055	0.0065	0.0056	0.0064	5.91	0.04	0.0000	0.0000	15.0	0.005	3.06	1.77	2.76
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0077	0.0091	0.0076	0.0090	0.0078	0.0090	5.89	0.05	0.0000	0.0000	15.0	0.022	0.96	0.55	8.78
Exterior Time Clock		0.0000	0.0120	0.0000	0.0119	0.0000	0.0120	5.91	0.04	0.0000	0.0000	10.0	0.002	4.00	1.74	1.30
Photocell - Outdoor Lighting		0.0086	0.0076	0.0025	0.0012	0.0045	0.0036	5.91	0.03	0.0000	0.0000	10.0	0.002	3.27	1.55	1.37
Delay Timer		0.0240	0.0014	0.0460	0.0049	0.0587	0.0035	5.80	0.14	0.0000	(0.0000)	10.0	0.023	1.70	0.83	3.74

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY. BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.0021	0.0025	0.0021	0.0025	0.0021	0.0025	5.93	0.01	0.0000	0.0000	10.0	0.000	22.74	13.11	0.30
Water Heater Blanket (1) Blanket R= 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.0104	(0.0093)	0.0264	(0.0253)	0.0271	(0.0259)	5.94	0.00	0.0000	0.0000	10.0	0.025	0.53	0.53	145.12
Solar Assisted Water Heater	Water Heater	0.0019	0.0004	0.0141	0.0008	0.0083	0.0008	5.92	0.03	0.0000	0.0000	10.0	0.350	0.04	0.03	335.05
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0039	0.0056	0.0019	0.0048	0.0036	0.0052	5.92	0.02	0.0000	(0.0000)	6.0	0.012	0.40	0.18	6.88
Energy Efficient Desktops	Desktops	0.0237	0.0073	0.0276	0.0074	0.0368	0.0082	5.83	0.11	0.0000	0.0000	6.0	(0.440)	INFINITE	INFINITE	NOW
Standard Laptops	Desktops	0.0287	0.0089	0.0337	0.0091	0.0438	0.0100	5.81	0.13	0.0000	0.0000	6.0	0.028	1.34	0.86	4.31
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0074	0.0111	0.0032	0.0099	0.0052	0.0103	5.90	0.05	0.0000	(0.0000)	6.0	0.007	1.20	0.54	2.92
Energy Efficient Printers	Dedicated Printers	0.0304	0.0094	0.0357	0.0093	0.0462	0.0101	5.80	0.14	0.0000	0.0000	6.0	0.017	2.39	1.53	2.42
Copiers																
Timer (off at night/weekends)	Copiers	0.0001	0.0000	0.0003	(0.0000)	0.0002	0.0001	5.94	0.00	0.0000	(0.0000)	6.0	0.001	0.17	0.08	26.45
Energy Efficient Copiers	Copiers	0.0042	0.0012	0.0049	0.0010	0.0057	0.0013	5.92	0.02	0.0000	0.0000	6.0	0.009	0.66	0.35	10.38

Notes:

(1) Not Applicable to New Buildings
(2) Not Applicable to Air Distribution System
(3) Not Applicable to Chiller System

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EXISTING NON-REFRIGERATED WAREHOUSE																
BASELINE								10.18								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2 (0)	EER = 7.5 (existing)	0.0607	0.0310	0.0074	0.0036	0.0201	0.0094	10.05	0.13	0.0001	0.0000	18.0	0.433	0.20	0.15	48.45
EER = 9.5	EER = 8.2 (standard)	0.0828	0.0423	0.0101	0.0049	0.0274	0.0128	9.87	0.18	0.0001	0.0000	18.0	0.047	2.59	1.84	3.83
EER = 10.5	EER = 8.2 (standard)	0.1325	0.0676	0.0162	0.0078	0.0439	0.0205	9.76	0.29	0.0002	0.0000	18.0	0.083	2.34	1.66	4.24
Evaporative Condenser	Unitary System Air-Cooled	0.0215	0.0125	0.0114	0.0054	0.0133	0.0064	10.11	0.07	0.0000	0.0000	18.0	0.085	0.47	0.30	20.70
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	0.094			
Enthalpy Economizer	Unitary System Air-Cooled	0.0022	0.0016	0.0000	0.0000	0.0016	0.0010	10.18	0.01	0.0000	0.0000	18.0	0.094	0.03	0.01	233.86
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0101	0.0058	0.0053	0.0026	0.0063	0.0030	10.15	0.03	0.0000	0.0000	1.0	0.002	0.93	0.61	1.12
Time Clock		0.1009	0.0453	0.0955	0.0386	0.1016	0.0432	9.76	0.43	(0.0000)	(0.0000)	10.0	0.006	18.28	8.24	0.28
Setback Thermostat (2)		NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Cooling/Heating																
Unitary System & Elec. Heating	Unitary System & Elec. Heating	0.0141	0.0082	0.0076	0.0036	0.0088	0.0042	10.14	0.05	0.0000	0.0000	18.0	NA			
EER = 8.2	EER = 7.5 (existing)															
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2 COP = 2.7	EER = 8.2 (standard)	0.0065	0.0032	0.0013	0.0004	0.0034	0.0014	10.12	0.02	0.0000	0.0000	18.0	0.041	0.15	0.07	40.10
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0202	0.0117	0.0107	0.0051	0.0125	0.0060	10.07	0.07	0.0000	0.0000	18.0	0.167	0.22	0.14	43.52
Ground-Coupled Heat Pump	Unitary System & Elec. Heating	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
EER = 11.6, COP = 3.5	EER = 8.2 (standard)															
Unitary System & Gas Furnace	Unitary System & Gas Furnace	0.0469	0.0230	0.0000	0.0000	0.0115	0.0052	10.10	0.09	0.0001	0.0000	18.0	NA			
EER = 8.2	EER = 7.5 (existing)															
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2 COP = 2.7	EER = 8.2 (standard)	(0.0132)	(0.0196)	(0.0411)	(0.0249)	(0.0824)	(0.0318)	10.29	0.19	0.0000	(0.0000)	18.0	0.501	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0560	0.0165	(0.0351)	(0.0209)	(0.0353)	(0.0184)	10.13	0.04	0.0001	(0.0000)	18.0	0.627	NA	NA	NA
Bypass/Delay Timer		0.0454	0.0214	0.0381	0.0148	0.0420	0.0186	10.00	0.18	(0.0000)	(0.0000)	15.0	0.002	30.03	14.09	0.21

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Ventilation																
Adjustable Speed Drives - Fans (3)	Fans - Constant Speed	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0149	0.0087	0.0135	0.0072	0.0136	0.0078	10.12	0.07	0.0000	0.0000	15.0	0.002	15.53	9.77	0.60
Reduction in Fan Flowrate 10 % Reduction in Fan cfm	Original Fan Flowrate	0.0756	0.0407	0.0795	0.0416	0.0953	0.0459	9.80	0.38	0.0000	0.0001	15.0	0.084	2.07	1.25	4.44
Fan Motor Downsizing HP Reduced to 1/3 of the Original	Original Fan Size	0.1422	0.0785	0.1243	0.0676	0.1333	0.0694	9.57	0.62	0.0001	0.0001	15.0	0.190	1.58	0.99	5.91
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	0.0821	0.0441	0.0881	0.0609	0.0173	0.0194	9.87	0.31	0.0002	0.0002	20.0	0.570	0.45	0.35	33.65
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.0019	0.0022	0.0043	0.0030	0.0004	0.0006	10.17	0.01	0.0000	0.0000	20.0	0.080	0.12	0.09	125.25
Triple-Pane Windows	Single-Pane Windows	0.0053	0.0034	0.0053	0.0036	0.0016	0.0010	10.16	0.02	0.0000	0.0000	20.0	0.221	0.07	0.05	196.41
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.0056	0.0037	0.0061	0.0042	0.0013	0.0018	10.16	0.02	0.0000	0.0000	20.0	0.088	0.20	0.15	70.81
"Triple Pane" Low E	Single-Pane Windows	0.0135	0.0077	0.0054	0.0038	0.0033	0.0025	10.15	0.04	0.0000	0.0000	20.0	0.236	0.12	0.09	104.26
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.0151	0.0084	(0.0006)	(0.0003)	0.0037	0.0015	10.15	0.03	0.0000	0.0000	12.0	0.021	0.83	0.61	9.93
Tinted Window Films	Double-Pane Windows	0.0013	0.0014	(0.0008)	(0.0006)	(0.0012)	(0.0000)	10.18	0.00	0.0000	(0.0000)	12.0	0.007	0.04	0.04	51.17
Low E Films	Single-Pane Windows	0.0135	0.0081	0.0022	0.0016	0.0031	0.0020	10.15	0.03	0.0000	0.0000	12.0	0.031	0.60	0.44	15.08
Low E Films	Double-Pane Windows	0.0021	0.0015	(0.0007)	(0.0005)	(0.0003)	0.0001	10.18	0.00	0.0000	(0.0000)	12.0	0.010	0.16	0.12	40.46

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COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.6623	0.3112	0.3258	0.1592	0.5190	0.2204	7.98	2.20	0.0005	0.0002	10.0	1.628	0.53	0.34	13.21
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0031	0.0028	0.0026	0.0013	0.0028	0.0016	10.17	0.01	0.0000	0.0000	10.0	0.000	126.24	79.91	0.06
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0031	0.0028	0.0026	0.0013	0.0028	0.0016	10.17	0.01	0.0000	0.0000	10.0	0.000	20.04	12.68	0.36
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0031	0.0028	0.0026	0.0013	0.0028	0.0016	10.17	0.01	0.0000	0.0000	10.0	0.003	1.94	1.23	3.73
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.1113	0.0614	0.0852	0.0476	0.0971	0.0512	9.73	0.45	0.0001	0.0001	20.0	0.103	2.49	1.59	4.25
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.0641	0.0355	0.0498	0.0274	0.0556	0.0299	9.92	0.26	0.0001	0.0001	20.0	0.070	2.12	1.36	5.01
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.0434	0.0241	0.0334	0.0185	0.0370	0.0200	10.01	0.18	0.0000	0.0000	3.0	0.006	4.39	2.81	0.69
Electronic Ballasts	T12 Fluorescent Lamps	0.1113	0.0614	0.0852	0.0476	0.0971	0.0512	9.73	0.45	0.0001	0.0001	20.0	0.127	2.02	1.29	6.25
High Pressure Sodium - Indoor	Mercury Vapor Lamps	0.1419	0.0782	0.1086	0.0610	0.1239	0.0667	9.60	0.58	0.0001	0.0001	20.0	0.067	4.90	3.14	2.17
Metal Halide - Indoor	Mercury Vapor Lamps	0.0599	0.0332	0.0461	0.0255	0.0515	0.0280	9.94	0.24	0.0000	0.0001	20.0	0.070	1.98	1.27	5.37
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0026	0.0060	0.0026	0.0060	0.0026	0.0060	10.16	0.03	0.0000	0.0000	20.0	0.004	2.66	1.22	2.84
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0014	0.0033	0.0014	0.0033	0.0014	0.0033	10.17	0.01	0.0000	0.0000	20.0	0.004	1.46	0.67	5.14
Occupancy Sensors		0.0882	0.0413	0.0686	0.0307	0.0781	0.0340	9.84	0.34	0.0001	0.0001	10.0	0.025	5.84	3.84	1.36
LED Exit Lighting	Incandescent Exit Lighting	0.0055	0.0065	0.0055	0.0065	0.0056	0.0065	10.15	0.04	0.0000	0.0000	15.0	0.093	0.17	0.10	50.52
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0047	0.0055	0.0047	0.0055	0.0048	0.0055	10.15	0.03	0.0000	0.0000	15.0	0.080	0.17	0.10	50.74
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0066	0.0077	0.0066	0.0077	0.0068	0.0076	10.14	0.04	0.0000	0.0000	15.0	0.142	0.13	0.07	65.17
Exterior Time Clock		0.0005	0.0010	0.0005	0.0010	0.0005	0.0010	10.18	0.00	0.0000	0.0000	10.0	0.001	1.50	0.69	3.59
Photocell - Outdoor Lighting		0.0065	0.0032	0.0013	0.0064	0.0034	0.0011	10.16	0.02	0.0000	0.0000	10.0	0.001	7.40	3.53	0.67
Delay Timer		0.0806	0.0370	0.0647	0.0292	0.0734	0.0318	9.87	0.32	0.0001	(0.0000)	10.0	0.000	556.74	380.41	0.02

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	10.18	0.00	0.0000	0.0000	10.0	0.000	123.82	71.40	0.05
Water Heater Blanket Blanket R= 11	Water Heater	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	10.18	0.00	0.0000	0.0000	10.0	0.000	68.47	39.48	0.10
Storage Water Heater	Water Heater	0.0036	(0.0036)	0.0036	(0.0036)	0.0037	(0.0037)	10.18	0.00	0.0000	0.0000	10.0	0.010	0.20	0.21	NEVER
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0013	0.0061	0.0008	0.0046	0.0003	0.0054	10.16	0.02	0.0000	(0.0000)	6.0	0.004	0.79	0.36	4.49
Energy Efficient Desktops	Desktops	0.0415	0.0241	0.0319	0.0188	0.0354	0.0201	10.01	0.17	0.0000	0.0000	6.0	0.223	0.21	0.14	24.32
Energy Efficient Laptops	Desktops	0.0580	0.0319	0.0448	0.0245	0.0496	0.0264	9.95	0.24	0.0001	0.0000	6.0	0.400	0.17	0.11	31.94
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0031	0.0144	0.0014	0.0118	0.0018	0.0126	10.14	0.05	0.0000	(0.0000)	6.0	0.001	7.36	3.36	0.49
Energy Efficient Printers	Dedicated Printers	0.0827	0.0449	0.0628	0.0350	0.0714	0.0373	9.85	0.33	0.0001	0.0001	6.0	0.049	1.90	1.21	2.77
Copiers																
Timer (off at night/weekends)	Copiers	0.0006	0.0034	0.0005	0.0022	0.0002	0.0027	10.17	0.01	0.0000	(0.0000)	6.0	0.001	1.56	0.71	2.26
Energy Efficient Copiers	Copiers	0.0277	0.0154	0.0204	0.0117	0.0234	0.0126	10.07	0.11	0.0000	0.0000	6.0	0.150	0.21	0.13	26.22

Note:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Most Existing Buildings Already Use Thermostat Setback
(3) Not Applicable to Air Distribution System

Barakat & Chamberlin 8/17/93

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
NEW NON-REFRIGERATED WAREHOUSE																
BASELINE								8.76								
Cooling																
High Efficiency Equipment:																
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2 (standard)	0.0598	0.0305	0.0081	0.0038	0.0208	0.0096	8.63	0.13	0.0001	0.0000	18.0	0.047	1.87	1.32	5.26
EER = 10.5	EER = 8.2 (standard)	0.1018	0.0519	0.0138	0.0065	0.0354	0.0164	8.53	0.23	0.0001	0.0000	18.0	0.083	1.80	1.26	5.47
Evaporative Condenser	Unitary System Air-Cooled	0.0164	0.0095	0.0093	0.0044	0.0105	0.0051	8.70	0.06	0.0000	0.0000	18.0	0.085	0.36	0.23	26.75
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (2)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	0.094			
Enthalpy Economizer	Unitary System Air-Cooled	0.0019	0.0013	0.0000	0.0000	0.0014	0.0009	8.75	0.01	0.0000	0.0000	18.0	0.094	0.02	0.01	273.13
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	1.0	NA			
Time Clock		0.0851	0.0374	0.0840	0.0343	0.0891	0.0378	8.39	0.37	(0.0000)	(0.0000)	10.0	0.008	18.05	7.37	0.33
Setback Thermostat (2)		NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2 (standard)	0.0066	0.0037	0.0016	0.0009	0.0036	0.0015	8.74	0.02	0.0000	0.0000	18.0	0.041	0.17	0.08	36.78
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0086	0.0051	0.0071	0.0032	0.0061	0.0032	8.71	0.03	0.0000	0.0000	18.0	0.167	0.13	0.09	91.32
Ground-Coupled Heat Pump	Unitary System & Elec. Heating	0.1349	0.0687	0.0182	0.0087	0.0469	0.0217	8.46	0.30	0.0002	0.0000	18.0	0.490	0.40	0.28	24.45
EER = 11.6, COP = 3.5	EER = 8.2 (standard)															
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2 (standard)	(0.0044)	(0.0071)	(0.0150)	(0.0087)	(0.0161)	(0.0087)	8.82	0.06	0.0000	(0.0000)	18.0	0.023	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0492	0.0247	0.0021	0.0021	0.0158	0.0067	8.72	0.10	0.0001	(0.0000)	18.0	0.149	NA	NA	NA
Bypass/Delay Timer		0.0022	0.0561	(0.0019)	0.0576	0.0035	0.0491	8.59	0.17	0.0000	(0.0000)	15.0				
Ventilation																
Adjustable Speed Drives - Fans (3)	Fans - Constant Speed	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0134	0.0079	0.0113	0.0068	0.0122	0.0071	8.70	0.06	0.0000	0.0000	15.0	0.002	13.75	8.59	0.67
Reduction in Fan Flowrate (1) 10 % Reduction in Fan cfm	Original Fan Flowrate	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			
Fan Motor Downsizing (1) HP Reduced to 1/3 of the Original	Original Fan Size	NA	NA	NA	NA	NA	NA			NA	NA	15.0	NA			

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Building Shell																
Ceiling Insulation R= 38	Ceiling Insulation	0.0472	0.0251	0.0887	0.0427	0.0047	0.0086	8.56	0.20	0.0001	0.0001	20.0	0.560	0.28	0.21	54.02
Wall Insulation R= 19	Wall Insulation	0.0057	0.0045	0.0391	0.0238	0.0022	0.0050	8.68	0.08	0.0000	0.0001	20.0	0.079	0.73	0.53	23.50
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Triple-Pane Windows	Double-Pane Windows	0.0029	0.0018	0.0002	0.0003	0.0014	0.0009	8.75	0.01	0.0000	0.0000	20.0	0.186	0.03	0.02	379.46
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double Pane Low E	Double-Pane Windows	0.0032	0.0015	0.0011	0.0015	0.0027	0.0006	8.75	0.01	0.0000	0.0000	20.0	0.010	0.69	0.48	17.30
"Triple Pane" Low E	Double-Pane Windows	0.0119	0.0059	(0.0002)	0.0002	0.0021	0.0010	8.74	0.02	0.0000	0.0000	20.0	0.206	0.08	0.06	132.09
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Tinted Windows	Double-Pane Windows	0.0097	0.0045	(0.0023)	(0.0015)	0.0009	0.0009	8.75	0.01	0.0000	(0.0000)	12.0	0.027	0.29	0.22	26.01
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	NA			
Low E Films	Double-Pane Windows	0.0123	0.0061	(0.0022)	(0.0017)	0.0029	0.0008	8.74	0.02	0.0000	(0.0000)	12.0	0.041	0.28	0.21	27.55

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Daylighting Controls		0.5282	0.2462	0.2577	0.1285	0.4202	0.1796	7.00	1.76	0.0004	0.0002	10.0	0.740	0.94	0.59	7.51
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	3.0	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
High Pressure Sodium - Indoor	Mercury Vapor Lamps	0.1148	0.0632	0.0881	0.0508	0.1028	0.0545	8.28	0.47	0.0001	0.0001	20.0	(0.005)	INFINITE	INFINITE	NOW
Metal Halide - Indoor	Mercury Vapor Lamps	0.0489	0.0268	0.0383	0.0208	0.0443	0.0223	8.56	0.20	0.0000	0.0000	20.0	(0.005)	INFINITE	INFINITE	NOW
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0026	0.0060	0.0025	0.0060	0.0026	0.0060	8.73	0.03	0.0000	0.0000	20.0	(0.000)	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0014	0.0033	0.0014	0.0033	0.0014	0.0033	8.74	0.01	0.0000	0.0000	20.0	(0.000)	INFINITE	INFINITE	NOW
Occupancy Sensors		0.0724	0.0331	0.0560	0.0251	0.0664	0.0278	8.48	0.28	0.0001	0.0001	10.0	0.003	36.50	23.33	0.22
LED Exit Lighting	Incandescent Exit Lighting	0.0055	0.0065	0.0055	0.0065	0.0056	0.0065	8.72	0.04	0.0000	0.0000	15.0	0.032	0.49	0.28	17.38
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0047	0.0056	0.0047	0.0055	0.0048	0.0055	8.73	0.03	0.0000	0.0000	15.0	0.018	0.72	0.42	11.67
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0066	0.0077	0.0065	0.0077	0.0066	0.0077	8.72	0.04	0.0000	0.0000	15.0	0.081	0.23	0.13	37.11
Exterior Time Clock		0.0005	0.0010	0.0005	0.0010	0.0005	0.0010	8.75	0.00	0.0000	0.0000	10.0	0.001	1.50	0.89	3.59
Photocell - Outdoor Lighting		0.0066	0.0037	0.0018	0.0001	0.0038	0.0005	8.74	0.02	0.0000	0.0000	10.0	0.001	5.53	2.70	0.78
Delay Timer		0.0653	0.0301	0.0528	0.0231	0.0629	0.0265	8.50	0.26	0.0001	(0.0000)	10.0	0.000	455.90	310.55	0.02

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	8.76	0.00	0.0000	0.0000	10.0	0.000	127.26	73.23	0.05
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Storage Water Heater	Water Heater	0.0035	(0.0035)	0.0035	(0.0035)	0.0036	(0.0036)	8.76	0.00	0.0000	0.0000	10.0	0.010	0.20	0.21	2188.69
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0008	0.0056	0.0011	0.0049	0.0012	0.0056	8.74	0.02	0.0000	(0.0000)	6.0	0.004	0.84	0.38	4.52
Energy Efficient Desktops	Desktops	0.0405	0.0235	0.0306	0.0187	0.0362	0.0199	8.59	0.17	0.0000	0.0000	6.0	(0.167)	INFINITE	INFINITE	NOW
Energy Efficient Laptops	Desktops	0.0571	0.0302	0.0446	0.0239	0.0504	0.0263	8.53	0.23	0.0000	0.0000	6.0	0.011	6.10	3.88	0.87
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0037	0.0141	0.0016	0.0125	0.0018	0.0131	8.71	0.05	0.0000	(0.0000)	6.0	0.001	7.83	3.50	0.48
Energy Efficient Printers	Dedicated Printers	0.0806	0.0439	0.0625	0.0346	0.0726	0.0368	8.43	0.33	0.0001	0.0001	6.0	0.003	34.65	22.00	0.15
Copiers																
Timer (off at night/weekends)	Copiers	0.0009	0.0029	0.0007	0.0025	(0.0001)	0.0026	8.75	0.01	0.0000	0.0000	6.0	0.001	1.58	0.75	2.32
Energy Efficient Copiers	Copiers	0.0260	0.0147	0.0214	0.0119	0.0228	0.0122	8.65	0.11	0.0000	0.0000	6.0	0.013	2.37	1.51	2.24

Note:

(1) Not Applicable to New Buildings
(2) Most New Buildings Already Use Thermostat Setback
(3) Not Applicable to Air Distribution System

Barakat & Chamberlin 8/17/93

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
EXISTING ASSEMBLY BUILDING																
BASELINE								17.44								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 3.52	COP = 3.20	0.0482	0.0260	0.0033	0.0020	0.0190	0.0094	17.33	0.11	0.0001	0.0000	20.0	NA			
COP = 4.0	COP = 3.52	0.0552	0.0298	0.0037	0.0023	0.0218	0.0108	17.21	0.12	0.0001	0.0000	20.0	0.044	1.91	1.33	5.23
COP = 4.6	COP = 3.52	0.1011	0.0546	0.0069	0.0042	0.0400	0.0198	17.11	0.23	0.0001	0.0000	20.0	0.098	1.55	1.08	6.43
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 4.04	COP = 3.7	0.0770	0.0415	0.0053	0.0032	0.0304	0.0150	17.27	0.17	0.0001	0.0000	20.0	0.465	0.25	0.17	40.10
COP = 5.6	COP = 4.04	0.1642	0.0887	0.0111	0.0068	0.0650	0.0321	16.90	0.37	0.0002	0.0000	20.0	0.077	3.19	2.22	3.13
COP = 6.0	COP = 4.04	0.1872	0.1010	0.0126	0.0078	0.0740	0.0366	16.85	0.42	0.0002	0.0000	20.0	0.147	1.92	1.34	5.21
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.2412	0.1302	0.0164	0.0101	0.0954	0.0471	16.90	0.54	0.0003	0.0000	20.0	0.077	4.69	3.26	2.13
Unitary System Air-Cooled	Unitary System Air-Cooled							17.44		0.0000	0.0000	18.0	0.673			
EER = 8.2 (0)	EER = 8.2 (existing)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.35	0.10	0.0001	0.0000	18.0	0.192	0.46	0.36	25.88
EER = 9.5	EER = 8.2 (standard)	0.0583	0.0294	0.0000	0.0000	0.0052	0.0027	17.29	0.15	0.0002	0.0000	18.0	0.340	0.41	0.33	28.67
EER = 10.5	EER = 8.2 (standard)	0.0931	0.0469	0.0000	0.0000	0.0084	0.0042	17.34	0.10	0.0001	0.0000	15.0	0.139	0.59	0.47	18.40
Evaporative Condenser	Unitary System Air-Cooled	0.0593	0.0299	0.0000	0.0000	0.0053	0.0027									
Outside Air Economizer Cycle:																
Dry-Bulb Economizer	Central Chiller Water-Cooled	(0.0015)	(0.0005)	0.0063	0.0037	0.0115	0.0057	17.42	0.03	0.0000	0.0000	20.0	0.024	0.42	0.20	29.96
Enthalpy Economizer	Central Chiller Water-Cooled	0.0025	0.0017	0.0063	0.0037	0.0133	0.0071	17.41	0.03	0.0000	0.0000	20.0	0.024	0.57	0.27	16.89
Dry-Bulb Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.44	0.00	0.0000	0.0000	18.0	0.044	0.00	0.00	
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.44	0.00	0.0000	0.0000	18.0	0.044	0.00	0.00	
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0714	0.0403	0.0731	0.0479	0.1829	0.0932	16.93	0.51	0.0000	0.0000	20.0	0.391	0.59	0.32	16.76
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0165	0.0087	0.0016	0.0013	0.0186	0.0078	17.39	0.05	0.0000	0.0000	15.0	0.006	3.38	1.62	1.83
Variable Speed Fans	Single-Speed Fans	0.0202	0.0105	0.0017	0.0013	0.0200	0.0085	17.38	0.06	0.0000	0.0000	15.0	0.023	0.96	0.46	6.28
Chilled Water Reset	Central Chiller Constant Temp.	0.0294	0.0171	0.0061	0.0038	0.0260	0.0122	17.35	0.09	(0.0000)	0.0000	20.0	0.026	1.33	0.59	4.72
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0276	0.0139	0.0000	0.0000	0.0025	0.0013	17.40	0.05	0.0000	0.0000	1.0	0.001	3.90	3.08	0.33
Time Clock		0.1504	0.0804	0.1852	0.0954	0.1724	0.0782	16.70	0.74	(0.0001)	0.0002	10.0	0.003	62.77	30.20	0.09
Setback Thermostat (2)		NA	NA	NA	NA	NA	NA			NA	NA	10.0	NA			
Heating																
Heat Pipe	Central Chiller System	0.0988	0.0537	0.2946	0.1728	0.1790	0.1008	16.54	0.90	0.0000	0.0003	20.0	2.390	0.19	0.11	60.99
Exhaust Air Heat Recovery	Central Chiller System	0.0133	0.0073	0.2657	0.1560	0.0672	0.0433	16.90	0.54	0.0000	0.0003	20.0	1.860	0.17	0.11	91.32

TABLE
UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	0.0000	0.0000	0.4190	0.2381	0.0995	0.0668	16.62	0.82	0.0000	(0.0000)	18.0	0.067	4.65	2.31	2.28
EER = 9.6, COP = 3.1	EER = 8.2	0.0477	0.0240	0.4756	0.2705	0.1273	0.0825	16.41	1.03	0.0001	(0.0000)	18.0	0.275	1.58	0.86	6.85
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	(0.0024)	(0.0012)	(1.0380)	(0.5631)	(0.2619)	(0.1604)	19.46	2.02	0.0000	(0.0030)	18.0	0.038	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2	0.0918	0.0459	(0.9277)	(0.4899)	(0.2091)	(0.1295)	19.06	1.62	0.0002	(0.0030)	18.0	0.245	NA	NA	NA
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.0420	0.0231	0.0284	0.0166	0.0378	0.0196	17.27	0.17	0.0000	0.0000	15.0	0.133	0.61	0.38	14.84
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0304	0.0171	0.0389	0.0208	0.0498	0.0262	17.26	0.18	0.0000	0.0000	15.0	0.023	3.85	2.18	2.60
Variable Air Volume Systems	Central Chiller CAV System	0.2550	0.1384	0.2636	0.1505	0.3668	0.1945	16.07	1.37	0.0001	0.0003	20.0	0.228	2.93	1.70	3.40
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0082	0.0044	0.0069	0.0037	0.0075	0.0040	17.41	0.03	0.0000	0.0000	15.0	0.007	2.33	1.48	4.06
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.0039	0.0021	0.0031	0.0017	0.0040	0.0021	17.42	0.02	0.0000	0.0000	15.0	0.002	4.66	2.88	1.95
Reduction in Fan Flowrate 10 % Reduction in Fan cfm	Original Fan Flowrate	0.0930	0.0553	0.1055	0.0611	0.1693	0.0908	16.87	0.57	0.0000	0.0001	15.0	0.175	1.34	0.74	6.40
Fan Motor Downsizing HP Reduced to 1/3 of the Original	Original Fan Size	0.0998	0.0542	0.0844	0.0472	0.0912	0.0476	17.02	0.42	0.0001	0.0001	15.0	0.478	0.44	0.28	21.50
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	(0.0650)	(0.0407)	0.2960	0.1591	0.1074	0.0592	16.93	0.52	(0.0001)	0.0004	20.0	0.570	0.51	0.33	41.85
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Double-Pane Windows	Single-Pane Windows	0.0045	0.0025	0.0370	0.0212	0.0255	0.0136	17.34	0.10	0.0000	0.0000	20.0	0.128	0.41	0.24	31.51
Triple-Pane Windows	Single-Pane Windows	0.0068	0.0041	0.0455	0.0252	0.0293	0.0159	17.31	0.13	0.0000	0.0000	20.0	0.363	0.19	0.11	70.20
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.0068	0.0042	0.0454	0.0253	0.0293	0.0158	17.31	0.13	0.0000	0.0000	20.0	0.140	0.47	0.29	27.80
"Triple Pane" Low E	Single-Pane Windows	0.0122	0.0061	0.0429	0.0238	0.0209	0.0119	17.32	0.12	0.0000	0.0000	20.0	0.378	0.19	0.12	74.86
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Tinted Window Films	Single-Pane Windows	0.0109	0.0049	(0.0134)	(0.0067)	(0.0214)	(0.0107)	17.48	0.04	0.0000	(0.0000)	12.0	0.033	-0.08	0.12	NEVER
Tinted Window Films	Double-Pane Windows	0.0026	0.0012	(0.0030)	(0.0017)	(0.0038)	(0.0027)	17.45	0.01	0.0000	(0.0000)	12.0	0.011	-0.04	0.07	NEVER

TABLE
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ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Low E Films	Single-Pane Windows	0.0117	0.0056	0.0229	0.0136	0.0088	0.0040	17.38	0.06	0.0000	0.0000	12.0	0.050	0.72	0.51	16.15
Low E Films	Double-Pane Windows	0.0049	0.0026	0.0325	0.0188	0.0212	0.0112	17.35	0.09	0.0000	0.0000	12.0	0.017	2.08	1.23	4.70

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Lighting																
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2437	0.1275	0.1869	0.1021	0.1471	0.0771	16.56	0.88	0.0003	0.0002	10.0	0.003	136.27	93.58	0.06
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2437	0.1275	0.1869	0.1021	0.1471	0.0771	16.56	0.88	0.0003	0.0002	10.0	0.019	21.63	14.85	0.39
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.2437	0.1275	0.1869	0.1021	0.1471	0.0771	16.56	0.88	0.0003	0.0002	10.0	0.194	2.10	1.44	3.99
Halogen Lamps	Incandescent Lamps	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.44		0.0000	0.0000	0.5	NA			
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.1144	0.0600	0.0847	0.0463	0.0687	0.0354	17.03	0.41	0.0001	0.0001	20.0	0.116	2.27	1.56	5.12
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.1298	0.0683	0.0963	0.0527	0.0777	0.0403	16.98	0.47	0.0002	0.0001	20.0	0.311	0.96	0.66	12.09
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.0847	0.0446	0.0623	0.0340	0.0511	0.0263	17.14	0.30	0.0001	0.0001	3.0	0.014	4.09	2.81	0.81
Electronic Ballasts	T12 Fluorescent Lamps	0.1616	0.0848	0.1207	0.0661	0.0965	0.0502	16.86	0.58	0.0002	0.0001	20.0	0.160	2.33	1.60	5.00
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0058	0.0121	0.0058	0.0121	0.0059	0.0121	17.39	0.05	0.0000	0.0000	20.0	0.009	2.45	1.18	3.19
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0036	0.0074	0.0035	0.0073	0.0036	0.0074	17.41	0.03	0.0000	0.0000	20.0	0.010	1.28	0.62	6.12
Occupancy Sensors		0.0000	0.0035	0.0000	0.0029	0.0000	0.0030	17.43	0.01	0.0000	(0.0000)	10.0	0.045	0.06	0.03	90.06
Ellipsoidal Lamps	Incandescent Lamps	0.0011	0.0008	0.0008	0.0004	0.0007	0.0003	17.44	0.00	0.0000	0.0000	0.5	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0004	0.0005	0.0004	0.0005	0.0004	0.0005	17.44	0.00	0.0000	0.0000	15.0	0.015	0.07	0.04	114.62
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0003	0.0004	0.0003	0.0004	0.0003	0.0004	17.44	0.00	0.0000	0.0000	15.0	0.013	0.07	0.04	116.21
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	17.44	0.00	0.0000	0.0000	15.0	0.023	0.06	0.03	147.85
Exterior Time Clock		0.0000	0.0243	0.0000	0.0241	0.0000	0.0243	17.37	0.07	0.0000	0.0000	10.0	0.002	12.03	5.23	0.43
Photocell - Outdoor Lighting		0.0185	0.0400	0.0140	0.0372	0.0153	0.0378	17.28	0.16	0.0000	0.0000	10.0	0.002	29.22	14.25	0.19
Delay Timer		0.0001	0.0012	(0.0000)	0.0009	0.0000	0.0008	17.44	0.00	0.0000	(0.0000)	10.0	0.001	1.64	0.77	3.09

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ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.0095	0.0112	0.0094	0.0111	0.0096	0.0111	17.38	0.06	0.0000	0.0000	10.0	0.000	221.62	127.78	0.03
Water Heater Blanket Blanket R= 11	Water Heater	0.0095	0.0112	0.0094	0.0111	0.0096	0.0111	17.38	0.06	0.0000	0.0000	10.0	0.000	122.55	70.66	0.06

Note:

(1) Not Applicable to Existing Buildings
(2) Most Existing Buildings Already Use Thermostat Setback

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST WITH UTILITY	EST. CUST. PAY BACK YEARS
NEW ASSEMBLY BUILDING																
BASELINE								15.46								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.52	0.0494	0.0267	0.0019	0.0013	0.0170	0.0084	15.35	0.10	(0.0000)	0.0000	20.0	0.044	0.78	0.29	6.02
COP = 4.6	COP = 3.52	0.0890	0.0480	0.0034	0.0023	0.0306	0.0152	15.27	0.19	0.0000	0.0000	20.0	0.098	0.95	0.55	7.52
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.1483	0.0800	0.0056	0.0038	0.0509	0.0252	15.14	0.31	0.0001	0.0000	20.0	0.077	2.36	1.53	3.53
COP = 6.0	COP = 4.04	0.1780	0.0961	0.0067	0.0046	0.0610	0.0303	15.08	0.38	0.0001	0.0000	20.0	0.146	1.55	1.02	5.59
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.1483	0.0800	0.0056	0.0038	0.0509	0.0252	15.14	0.31	0.0001	0.0000	20.0	0.077	2.36	1.53	3.53
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.0578	0.0281	0.0000	0.0000	0.0054	0.0027	15.36	0.10	0.0001	0.0000	18.0	0.192	0.45	0.36	26.06
EER = 10.5	EER = 8.2	0.0923	0.0465	0.0000	0.0000	0.0086	0.0044	15.30	0.16	0.0002	0.0000	18.0	0.340	0.41	0.32	28.88
Evaporative Condenser	Unitary System Air-Cooled	0.0588	0.0296	0.0000	0.0000	0.0056	0.0028	15.36	0.10	0.0000	0.0000	15.0	0.139	0.37	0.26	18.63
Outside Air Economizer Cycle:																
Dry-Bulb Economizer(1)	Central Chiller Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	NA	0.000			
Enthalpy Economizer	Central Chiller Air-Cooled	0.0012	0.0006	0.0000	0.0000	0.0005	0.0005	15.45	0.00	0.0000	0.0000	20.0	0.086	0.01	0.01	467.82
Dry-Bulb Economizer(1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	NA	0.000			
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	15.46		0.0000	0.0000	18.0	0.155	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Air-Cooled	0.0418	0.0230	0.0150	0.0125	0.0635	0.0309	15.27	0.19	(0.0000)	(0.0000)	20.0	0.389	0.13	0.03	40.27
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0158	0.0083	0.0012	0.0009	0.0155	0.0065	15.41	0.05	0.0000	0.0000	15.0	0.006	2.98	1.43	2.01
Variable Speed Fans	Single-Speed Fans	0.0189	0.0104	0.0012	0.0010	0.0166	0.0071	15.40	0.06	0.0000	0.0000	15.0	0.023	0.85	0.41	6.87
Chilled Water Reset	Central Chiller Constant Temp.	0.0276	0.0160	0.0028	0.0019	0.0182	0.0086	15.38	0.08	(0.0000)	0.0000	20.0	0.026	1.05	0.46	5.55
Condenser Coil Cleaning (1)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	NA	0.000			
Time Clock		0.0881	0.0401	0.1759	0.0896	0.1169	0.0537	14.89	0.56	0.0000	0.0001	10.0	0.003	53.89	29.23	0.13
Setback Thermostat(2)		0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	15.46	0.00	0.0000	0.0000	10.0	NA			
Heating																
Heat Pipe	Central Chiller System	0.0048	0.0022	0.2434	0.1415	0.0448	0.0335	14.99	0.47	0.0000	0.0003	20.0	2.390	0.12	0.08	139.36
Exhaust Air Heat Recovery	Central Chiller System	0.0048	0.0022	0.2434	0.1415	0.0448	0.0335	14.99	0.47	0.0000	0.0003	20.0	1.880	0.15	0.10	108.49

TABLE
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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kW/h/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 8.2, COP = 2.7	EER = 8.2	(0.0000)	0.0000	0.4181	0.2374	0.0993	0.0668	14.63	0.82	0.0000	(0.0000)	18.0	0.067	4.64	2.30	2.29
EER = 9.6, COP = 3.1	EER = 8.2	0.0474	0.0238	0.4747	0.2695	0.1269	0.0823	14.43	1.02	0.0001	(0.0000)	18.0	0.276	1.57	0.86	6.88
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	(0.0023)	(0.0007)	(1.0327)	(0.5466)	(0.2619)	(0.1598)	17.46	2.00	0.0000	(0.0030)	18.0	0.038	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2	0.0906	0.0457	(0.9216)	(0.4836)	(0.2057)	(0.1300)	17.06	1.60	0.0002	(0.0030)	18.0	0.245	NA	NA	NA
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.0435	0.0240	0.0282	0.0165	0.0377	0.0197	15.29	0.17	(0.0000)	0.0000	15.0	0.133	0.36	0.13	14.52
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0307	0.0171	0.0207	0.0115	0.0384	0.0203	15.32	0.14	0.0000	0.0000	15.0	0.023	2.15	1.04	3.17
Variable Air Volume Systems	Central Chiller CAV System	0.1096	0.0596	0.1119	0.0652	0.0921	0.0461	14.97	0.48	(0.0000)	0.0001	20.0	0.000			
High Efficiency Fan Motors 3% Increase in Efficiency	Fan Motors	0.0151	0.0083	0.0084	0.0050	0.0113	0.0055	15.40	0.05	0.0000	0.0000	15.0	0.007	2.83	1.52	2.47
High Efficiency Pump Motors 3% Increase in Efficiency	Pump Motors	0.0032	0.0017	0.0021	0.0012	0.0033	0.0017	15.44	0.01	0.0000	0.0000	15.0	0.002	2.83	1.44	2.47
Reduction in Fan Flowrate(1) 10 % Reduction in Fan cfm	Original Fan Flowrate	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Fan Motor Downsizing(1) HP Reduced to 1/3 of the Original	Original Fan Size	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Building Shell																
Ceiling Insulation R = 38	Ceiling Insulation R =	(0.0684)	(0.0405)	0.2573	0.1378	0.0955	0.0538	15.01	0.45	0.0000	0.0002	20.0	0.560	0.43	0.27	49.06
Wall Insulation R = 19	Wall Insulation R =	0.0104	0.0038	0.1099	0.0599	0.0595	0.0342	15.18	0.28	0.0000	(0.0000)	20.0	0.097	1.11	0.54	9.15
Double-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Triple-Pane Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Triple-Pane Windows	Double-Pane Windows	0.0036	0.0011	0.0100	0.0048	0.0005	0.0016	15.43	0.02	0.0000	0.0000	20.0	0.302	0.04	0.03	306.63
Low-Emissivity Windows:																
Double Pane Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
"Triple Pane" Low E (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Double Pane Low E	Double-Pane Windows	(0.0027)	(0.0022)	0.0101	0.0046	0.0007	0.0022	15.44	0.01	0.0000	0.0000	20.0	0.017	0.48	0.33	75.85
"Triple Pane" Low E	Double-Pane Windows	0.0035	0.0013	0.0181	0.0072	0.0078	0.0058	15.41	0.04	0.0000	0.0000	20.0	0.336	0.06	0.04	195.41
Tinted Windows (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Tinted Windows	Double-Pane Windows	0.0084	0.0028	(0.0126)	(0.0064)	(0.0139)	(0.0068)	15.48	0.03	0.0000	(0.0000)	12.0	0.044	-0.22	-0.11	NEVER
Low E Films (1)	Single-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Low E Films	Double-Pane Windows	0.0121	0.0042	0.0162	0.0074	0.0008	0.0023	15.41	0.04	0.0000	0.0000	12.0	0.067	0.46	0.36	29.30

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH UTILITY ENVIRON. COSTS	EST. COST PAY BACK YEARS
Lighting															
Simple Delamping (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA		
Delamping w/Dummy Replacem. (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA		
Delamping with Reflector (1) 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA		
Halogen Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA		

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T8 Fluorescent Lamps Electronic Ballast (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
T8 Fluorescent Lamps (1) Electronic Ballast	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Low Wattage Fluorescent Lamps (1) 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
Electronic Ballasts (1)	T12 Fluorescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0058	0.0121	0.0058	0.0121	0.0059	0.0121	15.40	0.05	0.0000	0.0000	20.0	(0.001)	INFINITE	INFINITE	NOW
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0036	0.0074	0.0035	0.0073	0.0038	0.0074	15.42	0.03	0.0000	0.0000	20.0	(0.001)	INFINITE	INFINITE	NOW
Occupancy Sensors		0.0005	0.0032	0.0000	0.0026	0.0000	0.0026	15.45	0.01	0.0000	(0.0000)	10.0	0.046	0.05	0.02	92.25
Ellipsoidal Lamps (1)	Incandescent Lamps	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0004	0.0005	0.0004	0.0005	0.0004	0.0005	15.45	0.00	0.0000	0.0000	15.0	0.005	0.19	0.10	39.68
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0003	0.0004	0.0003	0.0004	0.0003	0.0004	15.45	0.00	0.0000	0.0000	15.0	0.003	0.28	0.14	26.75
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	15.45	0.00	0.0000	0.0000	15.0	0.013	0.09	0.05	84.39
Exterior Time Clock		0.0000	0.0243	0.0000	0.0241	0.0000	0.0243	15.38	0.07	0.0000	0.0000	10.0	0.002	12.02	5.23	0.43
Photocell - Outdoor Lighting		0.0185	0.0399	0.0140	0.0372	0.0153	0.0379	15.29	0.16	0.0000	0.0000	10.0	0.002	28.23	13.26	0.19
Delay Timer		0.0001	0.0010	(0.0000)	0.0008	(0.0000)	0.0007	15.46	0.00	0.0000	(0.0000)	10.0	0.001	1.33	0.58	3.63
Water Heating																
High Efficiency Water Heater Tank Wall R = 24.9	Water Heater	0.0095	0.0112	0.0094	0.0111	0.0096	0.0111	15.39	0.06	0.0000	0.0000	10.0	0.000	193.87	100.06	0.03
Water Heater Blanket (1) Blanket R = 11	Water Heater	NA	NA	NA	NA	NA	NA			NA	NA	NA	NA			

Note:

(1) Not Applicable to New Buildings
(2) Most New Buildings Already Use Thermostat Setback

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EXISTING COLLEGE BUILDING																
BASELINE								12.92								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 3.52 (0)	COP = 3.2 (existing)	0.0103	0.0050	0.0001	0.0001	0.0041	0.0017	12.90	0.02	0.0000	0.0000	20.0	NA			
COP = 4.0	COP = 3.52 (standard)	0.0262	0.0129	0.0004	0.0003	0.0105	0.0043	12.86	0.05	0.0000	0.0000	20.0	$0.006	6.75	4.83	1.54
COP = 4.6	COP = 3.52 (standard)	0.0275	0.0135	0.0004	0.0003	0.0110	0.0045	12.84	0.08	0.0000	0.0000	20.0	$0.013	3.15	2.26	3.30
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 4.04 (0)	COP = 3.7 (existing)	0.0410	0.0201	0.0006	0.0004	0.0164	0.0067	12.83	0.09	0.0001	0.0000	20.0	$0.194	0.31	0.22	33.24
COP = 5.6	COP = 4.04 (standard)	0.1127	0.0553	0.0016	0.0011	0.0451	0.0186	12.60	0.23	0.0001	0.0000	20.0	$0.032	5.18	3.70	2.01
COP = 6.0	COP = 4.04 (standard)	0.1358	0.0667	0.0019	0.0014	0.0544	0.0224	12.55	0.28	0.0002	0.0000	20.0	$0.061	3.29	2.35	3.16
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04 (standard)	0.1951	0.1027	0.0030	0.0021	0.0919	0.0400	12.48	0.43	0.0002	0.0000	20.0	$0.032	8.15	5.41	1.11
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 8.2 (0)	EER = 8.2 (existing)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	12.92		0.0000	0.0000	18.0	$0.282	0.00	0.00	NEVER
EER = 9.5	EER = 8.2 (standard)	0.0277	0.0130	0.0000	0.0000	0.0084	0.0038	12.87	0.05	0.0000	0.0000	18.0	$0.081	0.51	0.38	21.53
EER = 10.5	EER = 8.2 (standard)	0.0469	0.0219	0.0000	0.0000	0.0142	0.0060	12.83	0.09	0.0001	0.0000	18.0	$0.143	0.48	0.36	22.49
Evaporative Condenser	Unitary System Air-Cooled	0.0317	0.0148	0.0000	0.0000	0.0096	0.0041	12.86	0.06	0.0000	0.0000	18.0	$0.058	0.80	0.60	13.63
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (2)	Central Chiller Water-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	12.92	0.00	0.0000	0.0000	20.0	$0.027	0.00	0.00	2028.07
Dry-Bulb Economizer (2)	Unitary System Air-Cooled	NA	NA	NA	NA	NA	NA			NA	NA	18.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	12.92	0.00	0.0000	0.0000	18.0	$0.065	0.00	0.00	4893.63
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0345	0.0150	(0.0357)	(0.0234)	(0.0182)	(0.0183)	12.97	0.05	0.0000	(0.0000)	20.0	$0.106	-0.04	0.05	171.86
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0109	0.0061	0.0002	0.0001	0.0066	0.0033	12.89	0.03	0.0000	0.0000	15.0	$0.003	4.01	2.19	1.56
Variable Speed Fans	Single-Speed Fans	0.0141	0.0075	0.0002	0.0001	0.0079	0.0036	12.89	0.03	0.0000	0.0000	15.0	$0.016	0.87	0.48	7.15
Chilled Water Reset	Central Chiller Constant Temp.	0.0097	0.0070	0.0007	0.0005	0.0089	0.0049	12.89	0.03	(0.0000)	0.0000	20.0	$0.026	0.41	0.16	13.71
Thermal Energy Storage Full Storage	Central Chiller Water-Cooled	0.5965	(0.6127)	0.0091	(0.0176)	0.2413	(0.2164)	12.92	0.00	0.0008	0.0000	20.0	$0.769	0.56	0.57	
Condenser Coil Cleaning	Unitary System Air-Cooled	0.0045	0.0021	0.0000	0.0000	0.0014	0.0006	12.91	0.01	0.0000	0.0000	1.0	$0.001	0.91	0.68	1.29
Time Clock		0.0914	0.1100	(0.0025)	0.1333	(0.0144)	0.1434	12.46	0.46	(0.0001)	(0.0000)	10.0	$0.005	22.02	8.76	0.17
Setback Thermostat		0.0229	0.0275	(0.0006)	0.0333	(0.0036)	0.0358	12.80	0.12	(0.0000)	(0.0000)	10.0	$0.036	0.89	0.21	5.60

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END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Heating																
Heat Pipe	Central Chiller System	0.0166	0.0080	0.0062	0.0048	0.0162	0.0059	12.86	0.06	0.0000	0.0000	20.0	$2.396	0.01	0.01	750.60
Exhaust Air Heat Recovery	Central Chiller System	0.0005	0.0004	0.0034	0.0028	0.0019	0.0015	12.91	0.01	0.0000	0.0000	20.0	$2.013	0.00	0.00	4746.16
Cooling/Heating																
High Eff. Air-Source Heat Pump	Unitary System & Elec. Heating															
EER = 9.2, COP = 2.7	EER = 8.2 (existing = standard)	(0.0000)	(0.0000)	0.0037	0.0126	0.0003	0.0001	12.90	0.02	0.0000	0.0000	18.0	$0.012	0.52	0.25	19.86
EER = 9.6, COP = 3.1	EER = 8.2 (standard)	0.0058	0.0027	0.0064	0.0166	0.0007	0.0008	12.89	0.03	0.0000	0.0000	18.0	$0.048	0.35	0.22	30.42
Closed Water Loop Heat Pump (1)	Central Chiller System												NA			
EER = 11.0, COP = 4.0		NA	NA	NA	NA	NA	NA			NA	NA	18.0				
Ground-Coupled Heat Pump (1)	Unitary System & Elec. Heating												NA			
EER = 11.6, COP = 3.5	EER = 8.2 (standard)	NA	NA	NA	NA	NA	NA			NA	NA	18.0				
Dual Fuel (Add-On) Heat Pump	Unitary System & Gas Furnace															
EER = 8.2, COP = 2.7	EER = 8.2	(0.0023)	(0.0039)	(0.0727)	(0.1007)	(0.0080)	(0.0190)	13.13	0.21	0.0000	(0.0003)	18.0	$0.007	NA	NA	NA
EER = 9.6, COP = 3.1	EER = 8.2	0.0167	0.0054	(0.0655)	(0.0893)	(0.0012)	(0.0139)	13.07	0.15	0.0000	(0.0003)	18.0	$0.043	NA	NA	NA
Double-Bundled Chiller (1)	Central Chiller System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
COP = 6.6																
Bypass/Delay Timer		0.0823	0.0990	(0.0023)	0.1200	(0.0130)	0.1290	12.50	0.42	(0.0001)	(0.0000)	15.0	$0.006	18.53	5.68	0.26
Ventilation																
Adjustable Speed Drives - Fans	Fans - Constant Speed	0.1233	0.0744	0.1418	0.1037	0.1343	0.1009	12.24	0.68	0.0001	0.0001	15.0	$0.125	2.62	1.63	3.74
Adjustable Speed Drives - Pumps	Pumps - Constant Speed	0.0091	0.0064	0.0020	0.0016	0.0110	0.0071	12.88	0.04	0.0000	0.0000	15.0	$0.016	0.90	0.47	7.75
Variable Air Volume Systems (3)	Central Chiller CAV System	NA	NA	NA	NA	NA	NA			NA	NA	20.0	$0.000			
High Efficiency Fan Motors	Fan Motors	0.0217	0.0122	0.0201	0.0141	0.0246	0.0166	12.81	0.11	0.0000	0.0000	15.0	$0.010	5.39	3.32	1.76
3% Increase in Efficiency																
High Efficiency Pump Motors	Pump Motors	0.0013	0.0008	0.0006	0.0004	0.0012	0.0008	12.91	0.01	0.0000	0.0000	15.0	$0.001	2.56	1.59	3.44
3% Increase in Efficiency																
Reduction in Fan Flowrate	Original Fan Flowrate	0.0677	0.0351	0.0592	0.0428	0.0747	0.0467	12.59	0.33	0.0001	0.0000	15.0	$0.146	1.07	0.66	8.90
10 % Reduction in Fan cfm																
Fan Motor Downsizing		0.1716	0.0966	0.1584	0.1111	0.1944	0.1299	12.06	0.86	0.0002	0.0001	15.0	$0.302	1.35	0.83	7.01
HP Reduced to 1/3 of the Original	Original Fan Size															

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UNION ELECTRIC
ECONOMIC SCREENING
COMMERCIAL SECTOR
IMPACT AND COST PER SQUARE FOOT

END USE/MEASURE	BASIS OF COMPARISON	SUMMER ON INCR IMPACT (kWh/yr)	SUMMER OFF INCR IMPACT (kWh/yr)	WINTER ON INCR IMPACT (kWh/yr)	WINTER OFF INCR IMPACT (kWh/yr)	TRANSITIONAL ON INCR IMPACT (kWh/yr)	TRANSITIONAL OFF INCR IMPACT (kWh/yr)	ANNUAL ENERGY TOTAL USAGE (kWh/yr)	ANNUAL ENERGY INCR IMPACT (kWh/yr)	PEAK DEMAND SUMMER INCR IMPACT (kW)	PEAK DEMAND WINTER INCR IMPACT (kW)	LIFE YRS.	INCR COST $	BENEFIT/COST WITH ENVIRON. COSTS	BENEFIT/COST UTILITY	EST. CUST. PAY BACK YEARS
Building Shell																
Ceiling Insulation R = 30	Ceiling Insulation	0.0359	0.0187	0.0318	0.0413	0.0042	0.0090	12.78	0.14	0.0001	0.0001	20.0	$0.570	0.21	0.16	75.55
Wall Insulation (1)	Wall Insulation	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Double-Pane Windows	Single-Pane Windows	0.0054	0.0033	0.0116	0.0126	0.0014	0.0030	12.88	0.04	0.0000	0.0000	20.0	$0.185	0.15	0.11	106.19
Triple-Pane Windows	Single-Pane Windows	0.0122	0.0072	0.0157	0.0173	0.0036	0.0048	12.86	0.06	0.0000	0.0000	20.0	$0.511	0.09	0.07	166.57
Triple-Pane Windows (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Low-Emissivity Windows:																
Double Pane Low E	Single-Pane Windows	0.0124	0.0073	0.0176	0.0198	0.0035	0.0051	12.85	0.07	0.0000	0.0000	20.0	$0.203	0.25	0.18	62.22
"Triple Pane" Low E	Single-Pane Windows	0.0289	0.0163	0.0172	0.0189	0.0085	0.0087	12.82	0.10	0.0000	0.0000	20.0	$0.547	0.13	0.09	97.09
Double Pane Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
"Triple Pane" Low E (1)	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	20.0	NA			
Tinted Window Films	Single-Pane Windows	0.0321	0.0179	0.0061	0.0061	0.0117	0.0075	12.84	0.08	0.0000	0.0000	12.0	$0.048	0.89	0.61	9.16
Tinted Window Films	Double-Pane Windows	NA	NA	NA	NA	NA	NA			NA	NA	12.0	$0.000			
Low E Films	Single-Pane Windows	0.0290	0.0162	0.0117	0.0124	0.0100	0.0077	12.83	0.09	0.0000	0.0000	12.0	$0.072	0.64	0.45	13.97
Low E Films	Double-Pane Windows	0.0148	0.0084	0.0008	0.0004	0.0053	0.0032	12.89	0.03	0.0000	0.0000	12.0	$0.118	0.15	0.11	52.92

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Lighting																
Daylighting Controls		0.2144	0.0721	0.2312	0.0550	0.2989	0.0641	11.98	0.94	0.0002	0.0004	10.0	$0.921	0.46	0.31	19.75
Simple Delamping 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0090	0.0046	0.0107	0.0041	0.0124	0.0048	12.87	0.05	0.0000	0.0000	10.0	$0.000	135.26	86.26	0.06
Delamping w/Dummy Replacement 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0090	0.0046	0.0107	0.0041	0.0124	0.0048	12.87	0.05	0.0000	0.0000	10.0	$0.001	21.47	13.53	0.37
Delamping with Reflector 4-ft Fixtures, 4 lamps to 2 lamps	4-foot Fixtures, 4 Lamps	0.0090	0.0046	0.0107	0.0041	0.0124	0.0048	12.87	0.05	0.0000	0.0000	10.0	$0.009	2.08	1.31	3.81
T8 Fluorescent Lamps Electronic Ballast	Incandescent Lamps	0.0572	0.0292	0.0670	0.0255	0.0775	0.0299	12.83	0.29	0.0000	0.0001	20.0	$0.071	2.22	1.40	5.00
T8 Fluorescent Lamps Electronic Ballast	T12 Fluorescent Lamps	0.0231	0.0117	0.0272	0.0104	0.0314	0.0122	12.80	0.12	0.0000	0.0000	20.0	$0.037	1.72	1.08	6.46
Low Wattage Fluorescent Lamps 4-Foot Fixtures, 34 Watts	T12 Fluorescent Lamps	0.0995	0.0506	0.1164	0.0444	0.1351	0.0515	12.42	0.50	0.0001	0.0001	3.4	$0.020	4.36	2.75	0.81
Electronic Ballasts	T12 Fluorescent Lamps	0.0040	0.0021	0.0049	0.0018	0.0056	0.0023	12.90	0.02	0.0000	0.0000	20.0	$0.007	1.63	1.02	6.85
Metal Halide - Indoor	Mercury Vapor Lamps	0.0040	0.0021	0.0049	0.0018	0.0056	0.0023	12.90	0.02	0.0000	0.0000	20.0	$0.006	1.90	1.20	5.85
High Pressure Sodium - Outdoor	Mercury Vapor Lamps	0.0035	0.0067	0.0035	0.0067	0.0036	0.0067	12.89	0.03	0.0000	0.0000	20.0	$0.005	2.19	1.01	3.44
Metal Halide - Outdoor	Mercury Vapor Lamps	0.0018	0.0034	0.0017	0.0033	0.0018	0.0033	12.90	0.02	0.0000	0.0000	20.0	$0.005	1.10	0.51	6.88
Occupancy Sensors		0.1608	0.0927	0.1789	0.1197	0.2080	0.1368	12.02	0.90	0.0001	(0.0000)	10.0	$0.032	9.45	5.41	0.74
Ellipsoidal Lamps	Incandescent Lamps	0.0016	0.0008	0.0019	0.0007	0.0022	0.0010	12.91	0.01	0.0000	0.0000	0.6	NA			
LED Exit Lighting	Incandescent Exit Lighting	0.0043	0.0050	0.0042	0.0050	0.0043	0.0050	12.89	0.03	0.0000	0.0000	15.0	$0.018	0.73	0.42	11.51
Fluorescent Exit Lighting	Incandescent Exit Lighting	0.0036	0.0043	0.0036	0.0042	0.0037	0.0042	12.90	0.02	0.0000	0.0000	15.0	$0.014	0.73	0.42	11.56
Electroluminescent Exit Lighting	Incandescent Exit Lighting	0.0050	0.0059	0.0050	0.0059	0.0051	0.0059	12.89	0.03	0.0000	0.0000	15.0	$0.025	0.57	0.33	14.84
Exterior Time Clock		0.0024	0.0127	0.0023	0.0126	0.0024	0.0127	12.87	0.05	0.0000	0.0000	10.0	$0.001	9.21	4.13	0.57
Photocell - Outdoor Lighting		0.0059	0.0052	0.0017	0.0008	0.0031	0.0025	12.90	0.02	0.0000	0.0000	10.0	$0.001	4.05	1.92	1.10
Delay Timer		0.0997	0.0566	0.1321	0.0812	0.1532	0.0933	12.30	0.62	0.0001	(0.0000)	10.0	$0.013	15.91	8.78	0.43

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Water Heating																
High Efficiency Water Heater Tank Wall R= 24.9	Water Heater	0.0011	0.0013	0.0011	0.0012	0.0011	0.0012	12.91	0.01	0.0000	0.0000	10.0	$0.000	222.28	128.17	0.03
Water Heater Blanket Blanket R= 11	Water Heater	0.0011	0.0013	0.0011	0.0012	0.0011	0.0012	12.91	0.01	0.0000	0.0000	10.0	$0.000	122.92	70.87	0.06
Storage Water Heater	Water Heater	0.0178	(0.0185)	0.0199	(0.0206)	0.0197	(0.0204)	12.92	0.00	0.0000	(0.0000)	10.0	$0.008	0.95	1.06	
Solar Assisted Water Heater	Water Heater	0.0160	0.0034	0.0098	0.0005	0.0146	0.0019	12.87	0.05	0.0000	0.0000	20.0	$0.294	0.09	0.06	115.47
Office Equipment																
Personal Computers																
Timer (off at night/weekends)	Desktops	0.0050	0.0111	0.0058	0.0144	0.0070	0.0160	12.86	0.06	0.0000	(0.0000)	6.0	$0.013	0.91	0.42	4.46
Energy Efficient Desktops	Desktops	0.0700	0.0357	0.0820	0.0312	0.0949	0.0365	12.57	0.35	0.0001	0.0001	6.0	$0.838	0.15	0.10	36.60
Standard Laptops	Desktops	0.0911	0.0464	0.1067	0.0406	0.1238	0.0473	12.46	0.46	0.0001	0.0001	6.0	$1.143	0.11	0.07	50.55
Computer Printers																
Timer (off at night/weekends)	Dedicated Printers	0.0037	0.0078	0.0052	0.0123	0.0063	0.0137	12.87	0.05	0.0000	(0.0000)	6.0	$0.003	3.32	1.64	1.26
Energy Efficient Printers	Dedicated Printers	0.0385	0.0198	0.0452	0.0172	0.0522	0.0202	12.73	0.19	0.0000	0.0000	6.0	$0.120	0.45	0.28	12.48
Copiers																
Timer (off at night/weekends)	Copiers	0.0014	0.0033	0.0014	0.0059	0.0018	0.0062	12.90	0.02	0.0000	(0.0000)	6.0	$0	5.41	2.48	0.77
Energy Efficient Copiers	Copiers	0.0132	0.0067	0.0156	0.0059	0.0180	0.0070	12.95	0.07	0.0000	0.0000	6.0	0.091156	0.20	0.13	27.76

Notes:

(0) Early Replacement Scenario
(1) Not Applicable to Existing Buildings
(2) Most Existing Buildings Already Have Dry Bulb Economizers
(3) Not Applicable to Air Distribution System

Barakat & Chamberlin 8/17/93

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NEW COLLEGE BUILDING																
BASELINE								11.96								
Cooling																
High Efficiency Equipment:																
Recip. Chiller Water-Cooled	Recip. Chiller Water-Cooled															
COP = 4.0	COP = 3.52	0.0186	0.0094	0.0005	0.0004	0.0085	0.0042	11.92	0.04	0.0000	0.0000	20.0	0.006	5.69	4.22	2.08
COP = 4.6	COP = 3.52	0.0311	0.0158	0.0008	0.0006	0.0142	0.0070	11.89	0.07	0.0000	0.0000	20.0	0.013	4.00	2.91	2.80
Centrif. Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.1256	0.0635	0.0033	0.0024	0.0571	0.0280	11.68	0.28	0.0002	0.0000	20.0	0.034	5.63	3.84	1.81
COP = 6.0	COP = 4.04	0.1445	0.0731	0.0038	0.0028	0.0658	0.0322	11.64	0.32	0.0002	0.0000	20.0	0.064	3.41	2.39	2.99
Screw Chiller Water-Cooled	Centrif. Chiller Water-Cooled															
COP = 5.6	COP = 4.04	0.1774	0.0969	0.0051	0.0038	0.0970	0.0490	11.53	0.43	0.0001	0.0000	20.0	0.034	7.24	4.84	1.21
Unitary System Air-Cooled	Unitary System Air-Cooled															
EER = 9.5	EER = 8.2	0.0172	0.0080	0.0000	0.0000	0.0055	0.0024	11.93	0.03	0.0000	0.0000	18.0	0.053	0.47	0.35	22.76
EER = 10.5	EER = 8.2	0.0291	0.0136	0.0000	0.0000	0.0093	0.0040	11.91	0.06	0.0000	0.0000	18.0	0.094	0.45	0.34	23.77
Evaporative Condenser	Unitary System Air-Cooled	0.0196	0.0091	0.0000	0.0000	0.0063	0.0027	11.92	0.04	0.0000	0.0000	18.0	0.039	0.75	0.56	14.41
Outside Air Economizer Cycle:																
Dry-Bulb Economizer (1)	Central Chiller Water-Cooled											20.0	NA			
Enthalpy Economizer	Central Chiller Water-Cooled	0.0016	0.0014	0.0000	(0.0000)	0.0016	0.0016	11.95	0.01	(0.0000)	0.0000	20.0	0.028	0.09	0.04	76.64
Dry-Bulb Economizer (1)	Unitary System Air-Cooled											18.0	NA			
Enthalpy Economizer	Unitary System Air-Cooled	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	11.96		0.0000	0.0000	18.0	0.043	0.00	0.00	NEVER
Hydronic Economizer Cycle	Central Chiller Water-Cooled	0.0288	0.0140	(0.0317)	(0.0218)	(0.0282)	(0.0125)	12.01	0.05	0.0000	(0.0000)	20.0	0.110	-0.07	0.02	861.80
Cooling Towers:																
Two-Speed Fans	Single-Speed Fans	0.0120	0.0069	0.0001	0.0001	0.0079	0.0044	11.93	0.03	0.0000	0.0000	15.0	0.003	4.58	2.47	1.37
Variable Speed Fans	Single-Speed Fans	0.0154	0.0083	0.0002	0.0001	0.0093	0.0047	11.92	0.04	0.0000	0.0000	15.0	0.016	0.98	0.54	6.37
Chilled Water Reset	Central Chiller Constant Temp.	0.0114	0.0082	0.0014	0.0010	0.0125	0.0077	11.92	0.04	(0.0000)	0.0000	20.0	0.026	0.58	0.26	10.75
Thermal Energy Storage Full Storage	Central Chiller Water-Cooled	0.5944	(0.6081)	0.0171	(0.0260)	0.2756	(0.2476)	11.96	0.01	0.0007	0.0000	20.0	0.263	1.58	1.61	
Condenser Coil Cleaning (1)	Unitary System Air-Cooled											1.0	0.000			
Time Clock		0.0837	0.1102	0.0002	0.1349	(0.0159)	0.1488	11.50	0.46	(0.0001)	0.0000	10.0	0.005	22.58	7.26	0.18
Setback Thermostat		0.0209	0.0275	0.0001	0.0337	(0.0040)	0.0372	11.85	0.12	(0.0000)	0.0000	10.0	0.036	0.71	0.23	5.67
Heating																
Heat Pipe	Central Chiller System	0.0224	0.0135	0.0127	0.0090	0.0281	0.0197	11.85	0.11	0.0000	0.0000	20.0	2.660	0.02	0.01	485.80
Exhaust Air Heat Recovery	Central Chiller System	0.0000	0.0000	0.0050	0.0039	0.0006	0.0010	11.95	0.01	0.0000	0.0000	20.0	2.227	0.00	0.00	5962.07