



9. ELCCA Work Plan

As our team developed the 1063 Block Replacement design, it was obvious that many elements could enhance the building's performance, but we had to weigh each of these options carefully against the available budget, always working to include what was best for the project. At this point in the design, we have done Energy Life-Cycle Cost Analysis (ELCCA) for the HVAC systems, interior lighting, renewable energy and domestic water heating.

Energy Life-Cycle Cost Analysis Work Plan

In making these decisions, the ELCCA tool provided our team with a rational analysis of the long-term economic value of such components. For the facility at this point of design, we used the State's ELCCA tool to inform the design on four scopes:

- 1. HVAC System Selection:** We compared the Federal Center South HVAC system with our proposed 1063 Block Replacement design. See the table below for more detail on how it checked out.
- 2. Interior Lighting:** We studied LED versus fluorescent lighting options.
- 3. Renewable Energy:** We studied the value of adding geothermal to the project.
- 4. Domestic Water Heating:** We compared electric or gas-fired water heaters for the central core.

The table on the following page lists the ELCCA cost for each item. Following this section, beginning on page 126, are the ELCCA calculations for each of our studied components.

In addition to analyzing the long-term economic value, we also considered the relative effect each option would have on the facility's EUI, future flexibility, maintenance and occupant experience.

As you can see from the table, we found that the 1063 HVAC system, LED lights, adding geothermal and using gas-fired domestic hot water had the lowest ELCCA costs.

Future Studies

In accordance with the requirements in the RFP, after the Sellen | ZGF team has been awarded the project we would like to complete additional ELCCA studies. These would ideally be completed during the scope validation phase and would include

potential betterments and other items that could further improve the value of the project. A more formal ELCCA work plan will be completed after award, once discussions with the DES have been completed that enable us to further vet the list and agree on the appropriate adaptation of State requirements to the design-build delivery process. We expect those discussions to encompass the following:

- Adding solar photovoltaic electricity generation
- Centralizing the break rooms
- Adding thermal storage
- Connection to the campus chilled water plant
- Adding piping to provide a LOTT reclaimed water ready installation
- Adding a rainwater collection cistern for irrigation and serving non-potable building needs
- Adding solar thermal for domestic hot water

Utility Incentives

As we have already mentioned in Section 5, our team has investigated multiple state and federal incentive opportunities, as well as potential utility grants from Puget Sound Energy (PSE), the electricity and natural gas utility, and LOTT, the potable and reclaimed water purveyor. We are aware that PSE often offers grants for whole building custom approach with incentives up to \$1.80/square foot (of conditioned space) for buildings that perform 30% better than the Washington State Energy Code. Additionally, we would also pursue a set of component-based prescriptive grants that would reimburse the cost difference between a conventional product and a high-performing product. For plumbing fixtures, LOTT offers a per fixture rebate that we would look to apply to this project.

1. HVAC SYSTEM OPTIONS		
	FEDERAL CENTER SOUTH DESIGN	1063 BLOCK REPLACEMENT DESIGN
Heat Recovery Chillers	✓	✓
Geothermal	✓	✓
Dedicated Outside Air System	✓	✓
Underfloor Air Distribution	✓	
Overhead Air Distribution		✓
Chilled Sails	✓	
Fan-powered boxes		✓
Thermal Storage	✓	

ELCCA SUMMARY

	FIRST COST	ANNUAL ENERGY COST	ELCCA COST	EUI IMPACT KBTU/SF	FUTURE FLEXIBILITY	USER EXPERIENCE	MAINTAINABILITY	RECOMMEND?
HVAC SYSTEM								
Federal Center South	\$9,120,000	\$53,851	\$12,589,898	0.0				
1063 Block Replacement	\$7,497,500	\$57,803	\$11,287,245	0.93 Higher	Better	Better	Better	Yes
LIGHTING								
Fluorescent	\$1,200,000	\$31,307	\$2,101,694					
LED	\$1,614,710	\$26,611	\$2,009,960	1.1 Lower	Better	Better	Better	Yes
RENEWABLE								
1063 Proposed (with geothermal)	\$7,497,500	\$35,782	\$11,287,245	0	Better	N/A	Equal	Yes
1063 without geothermal	\$7,103,500	\$57,803	\$11,329,618	3.7 Lower		N/A	Equal	
DOMESTIC WATER HEATING								
Electric	\$2,000	\$1,752	\$66,656				Equal	
Gas-fired	\$4,000	\$940	\$55,456	0.05 Lower	Better	N/A	Equal	Yes

ENERGY LIFE CYCLE COST SPREADSHEET								
-----PROJECT DATA-----					ELCCA2005.xls	17-Feb-14		
PROJECT: 1063 Office Block Replacement			WSP					
ALT. No.: Proposed HVAC			T. Marseille					
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----								
Enter 1 or 0 for each fuel type:				Years:		Rate:		
	1 = Yes	Real Discount Rate (i)		2005 - 2,040		2.0%		
	0 = No	Electricity		2005 - 2,015		1.0%		
IOU Electricity Source*	1	(Investor Owned Utility)		2,016 - 2,025		2.0%		
POU Electricity Source*	0			2,026 - 2,040		2.0%		
Natural Gas Fuel?	1	Natural Gas		2005 - 2,015		1.0%		
Propane Fuel?	0	And other fossil fuels		2,016 - 2,025		1.0%		
Oil Fuel?	0			2,026 - 2,040		1.0%		
		Maintenance		2005 - 2,040		2.0%		
		Inflation (Nominal , not used)		2005 - 2,040		3.0%		
* IOU = Investor Owned Utility								
** POU = Publicly Owned Utility					\$11,287,245 =30-year LCC			
-----ANNUAL REAL CASH FLOWS-----								
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat.Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i)^-n	Present Worth of Annual Costs	Present Worth of Cumulative Costs
2,015	\$7,497,500	\$89,574	\$5,940	\$29,842	\$125,356	1.00	\$7,497,500	\$7,497,500
2,016	0	93,193	5,999	30,439	129,631	0.98	127,089	7,624,589
2,017	0	95,057	6,059	31,048	132,164	0.96	127,032	7,751,621
2,018	0	96,958	6,120	31,669	134,746	0.94	126,974	7,878,595
2,019	0	98,897	6,181	32,302	137,380	0.92	126,918	8,005,513
2,020	0	100,875	6,243	32,948	140,066	0.91	126,862	8,132,375
2,021	0	102,893	6,305	33,607	142,805	0.89	126,807	8,259,182
2,022	0	104,950	6,368	34,279	145,598	0.87	126,752	8,385,933
2,023	0	107,049	6,432	34,965	148,446	0.85	126,697	8,512,631
2,024	0	109,190	6,496	35,664	151,351	0.84	126,643	8,639,274
2,025	0	111,374	6,561	36,377	154,313	0.82	126,590	8,765,864
2,026	0	113,602	6,627	37,105	157,333	0.80	126,537	8,892,402
2,027	0	115,874	6,693	37,847	160,414	0.79	126,485	9,018,887
2,028	0	118,191	6,760	38,604	163,555	0.77	126,433	9,145,320
2,029	0	120,555	6,827	39,376	166,759	0.76	126,382	9,271,702
2,030	0	122,966	6,896	40,164	170,025	0.74	126,331	9,398,034
2,031	0	125,426	6,965	40,967	173,357	0.73	126,281	9,524,315
2,032	0	127,934	7,034	41,786	176,755	0.71	126,231	9,650,546
2,033	0	130,493	7,105	42,622	180,219	0.70	126,182	9,776,729
2,034	0	133,103	7,176	43,474	183,753	0.69	126,133	9,902,862
2,035	0	135,765	7,247	44,344	187,356	0.67	126,085	10,028,947
2,036	0	138,480	7,320	45,231	191,031	0.66	126,037	10,154,985
2,037	0	141,249	7,393	46,135	194,778	0.65	125,990	10,280,975
2,038	0	144,074	7,467	47,058	198,600	0.63	125,943	10,406,918
2,039	0	146,956	7,542	47,999	202,497	0.62	125,897	10,532,814
2,040	0	149,895	7,617	48,959	206,471	0.61	125,851	10,658,665
2,041	0	152,893	7,693	49,938	210,525	0.60	125,805	10,784,470
2,042	0	155,951	7,770	50,937	214,658	0.59	125,760	10,910,230
2,043	0	159,070	7,848	51,956	218,874	0.57	125,716	11,035,946
2,044	0	162,251	7,926	52,995	223,173	0.56	125,671	11,161,617
2,045	0	165,496	8,006	54,055	227,557	0.55	125,628	11,287,245
Totals:	\$7,497,500	\$3,780,661	\$208,675	\$1,234,852	\$12,721,687		\$11,287,245	=30-year LCC
	1st+Repl	Maint	Fuel	Elec	Total Annual			

ENERGY LIFE CYCLE COST SPREADSHEET									
-----PROJECT DATA-----					ELCCA2005.xls	17-Feb-14			
PROJECT: 1063 Office Block Replacement			WSP						
ALT. No.: FCS HVAC System			T. Marseille						
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----									
Enter 1 or 0 for each fuel type:				Years:		Rate:			
	1 = Yes	Real Discount Rate (i)		2005 - 2,040		2.0%			
	0 = No	Electricity.		2005 - 2,015		1.0%			
IOW Electricity Source*	1	(Investor Owned Utility)		2,016 - 2,025		2.0%			
POU Electricity Source*	0			2,026 - 2,040		2.0%			
Natural Gas Fuel?	1	Natural Gas		2005 - 2,015		1.0%			
Propane Fuel?	0	And other fossil fuels		2,016 - 2,025		1.0%			
Oil Fuel?	0			2,026 - 2,040		1.0%			
		Maintenance		2005 - 2,040		2.0%			
		Inflation (Nominal , not used)		2005 - 2,040		3.0%			
* IOU = Investor Owned Utility									
** POU = Publicly Owned Utility					\$12,589,898 =30-year LCC				
-----ANNUAL REAL CASH FLOWS-----									
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat. Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i)^-n	Present Worth of Annual Costs	Present Worth of Cumulative Costs	
2,014	\$ 9,120,000	\$85,154	\$5,940	\$25,889	\$116,983	1.00	\$9,120,000	\$9,120,000	
2,014	\$9,120,000	--	--	--	\$9,120,000	1.00	\$9,120,000	\$9,120,000	
2,015	0	86,857	5,999	26,148	119,004	0.98	116,671	9,236,671	
2,016	0	88,594	6,059	26,409	121,063	0.96	116,362	9,353,032	
2,017	0	90,366	6,120	26,938	123,423	0.94	116,305	9,469,337	
2,018	0	92,173	6,181	27,476	125,831	0.92	116,248	9,585,585	
2,019	0	94,017	6,243	28,026	128,285	0.91	116,192	9,701,777	
2,020	0	95,897	6,305	28,586	130,789	0.89	116,137	9,817,913	
2,021	0	97,815	6,368	29,158	133,341	0.87	116,082	9,933,995	
2,022	0	99,771	6,432	29,741	135,944	0.85	116,027	10,050,022	
2,023	0	101,767	6,496	30,336	138,599	0.84	115,973	10,165,996	
2,024	0	103,802	6,561	30,943	141,306	0.82	115,920	10,281,916	
2,025	0	105,878	6,627	31,562	144,067	0.80	115,867	10,397,783	
2,026	0	107,996	6,693	32,193	146,882	0.79	115,815	10,513,599	
2,027	0	110,156	6,760	32,837	149,752	0.77	115,763	10,629,362	
2,028	0	112,359	6,827	33,494	152,680	0.76	115,712	10,745,074	
2,029	0	114,606	6,896	34,163	155,665	0.74	115,661	10,860,736	
2,030	0	116,898	6,965	34,847	158,709	0.73	115,611	10,976,347	
2,031	0	119,236	7,034	35,544	161,814	0.71	115,562	11,091,908	
2,032	0	121,621	7,105	36,255	164,980	0.70	115,512	11,207,421	
2,033	0	124,053	7,176	36,980	168,209	0.69	115,464	11,322,884	
2,034	0	126,534	7,247	37,719	171,501	0.67	115,415	11,438,299	
2,035	0	129,065	7,320	38,474	174,858	0.66	115,367	11,553,667	
2,036	0	131,646	7,393	39,243	178,282	0.65	115,320	11,668,987	
2,037	0	134,279	7,467	40,028	181,774	0.63	115,273	11,784,260	
2,038	0	136,965	7,542	40,829	185,335	0.62	115,227	11,899,487	
2,039	0	139,704	7,617	41,645	188,966	0.61	115,181	12,014,668	
2,040	0	142,498	7,693	42,478	192,669	0.60	115,135	12,129,803	
2,041	0	145,348	7,770	43,328	196,446	0.59	115,090	12,244,893	
2,042	0	148,255	7,848	44,194	200,297	0.57	115,046	12,359,939	
2,043	0	151,220	7,926	45,078	204,225	0.56	115,001	12,474,940	
2,044	0	154,245	8,006	45,980	208,230	0.55	114,958	12,589,898	
Totals:	\$9,120,000	\$3,523,622	\$208,675	\$1,050,631	\$13,902,927		\$12,589,898	=30-year LCC	
	1st+Repl	Maint	Fuel	Elec	Total Annual				

ENERGY LIFE CYCLE COST SPREADSHEET									
-----PROJECT DATA-----						ELCCA2005.xls	17-Feb-14		
PROJECT: 1063 Office Block Replacement		WSP							
ALT. No.: Proposed HVAC_Less Ground Loop HTX		T. Marseille							
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----									
Enter 1 or 0 for each fuel type:				Years:			Rate:		
1 = Yes		Real Discount Rate (i)		2005 - 2,040			2.0%		
0 = No		Electricity		2005 - 2,015			1.0%		
IOU Electricity Source*		1		(Investor Owned Utility)			2.0%		
POU Electricity Source*		0		2,016 - 2,025			2.0%		
Natural Gas Fuel?		1		2,026 - 2,040			2.0%		
Propane Fuel?		0		Natural Gas			2005 - 2,015		
Oil Fuel?		0		And other fossil fuels			2005 - 2,015		
				2,016 - 2,025			1.0%		
				2,026 - 2,040			1.0%		
				Maintenance			2005 - 2,040		
				Inflation (Nominal , not used)			2005 - 2,040		
							3.0%		
* IOU = Investor Owned Utility									
** POU = Publicly Owned Utility									
						\$11,329,618 =30-year LCC			
-----ANNUAL REAL CASH FLOWS-----									
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat. Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i)^-n	Present Worth of Annual Costs	Present Worth of Cumulative Costs	
2,014	\$7,103,500	\$88,614	\$37,191	\$20,612	\$146,417	1.00	\$7,103,500	\$7,103,500	
2,014	\$7,103,500	--	--	--	\$7,103,500	0.98	145,850	7,249,350	
2,015	0	90,386	37,563	20,818	148,767	0.96	145,289	7,394,639	
2,016	0	92,194	37,939	21,026	151,159	0.94	144,932	7,539,571	
2,017	0	94,038	38,318	21,447	153,803	0.92	144,578	7,684,149	
2,018	0	95,919	38,701	21,876	156,495	0.91	144,227	7,828,376	
2,019	0	97,837	39,088	22,313	159,238	0.89	143,880	7,972,256	
2,020	0	99,794	39,479	22,759	162,032	0.87	143,536	8,115,792	
2,021	0	101,790	39,874	23,215	164,878	0.85	143,196	8,258,988	
2,022	0	103,825	40,273	23,679	167,777	0.84	142,859	8,401,847	
2,023	0	105,902	40,675	24,152	170,730	0.82	142,525	8,544,372	
2,024	0	108,020	41,082	24,636	173,738	0.80	142,195	8,686,567	
2,025	0	110,180	41,493	25,128	176,802	0.79	141,868	8,828,435	
2,026	0	112,384	41,908	25,631	179,923	0.77	141,544	8,969,979	
2,027	0	114,632	42,327	26,143	183,102	0.76	141,223	9,111,202	
2,028	0	116,924	42,750	26,666	186,341	0.74	140,905	9,252,107	
2,029	0	119,263	43,178	27,200	189,640	0.73	140,591	9,392,698	
2,030	0	121,648	43,609	27,744	193,001	0.71	140,279	9,532,978	
2,031	0	124,081	44,046	28,298	196,425	0.70	139,971	9,672,949	
2,032	0	126,563	44,486	28,864	199,913	0.69	139,666	9,812,614	
2,033	0	129,094	44,931	29,442	203,466	0.67	139,363	9,951,978	
2,034	0	131,676	45,380	30,031	207,087	0.66	139,064	10,091,041	
2,035	0	134,309	45,834	30,631	210,774	0.65	138,767	10,229,809	
2,036	0	136,995	46,292	31,244	214,532	0.63	138,474	10,368,283	
2,037	0	139,735	46,755	31,869	218,359	0.62	138,183	10,506,466	
2,038	0	142,530	47,223	32,506	222,259	0.61	137,895	10,644,361	
2,039	0	145,381	47,695	33,156	226,232	0.60	137,610	10,781,971	
2,040	0	148,288	48,172	33,819	230,280	0.59	137,328	10,919,299	
2,041	0	151,254	48,654	34,496	234,403	0.57	137,049	11,056,348	
2,042	0	154,279	49,140	35,186	238,605	0.56	136,772	11,193,120	
2,043	0	157,365	49,632	35,889	242,886	0.55	136,498	11,329,618	
2,044	0	160,512	50,128	36,607	247,247				
Totals:	\$7,103,500	\$3,666,798	\$1,306,625	\$836,471	\$12,913,393		\$11,329,618	=30-year LCC	
	1st+Repl	Maint	Fuel	Elec	Total Annual				

ENERGY LIFE CYCLE COST SPREADSHEET										
-----PROJECT DATA-----					ELCCA2005.xls	17-Feb-14				
PROJECT: 1063 Office Block Replacement			WSP							
ALT. No.: Electric DHW for Core			T. Marseille							
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----										
Enter 1 or 0 for each fuel type:				Years:			Rate:			
1 = Yes				Real Discount Rate (i)			2005 - 2,040			2.0%
0 = No				Electricity			2005 - 2,015			1.0%
IOU Electricity Source*				(Investor Owned Utility)			2,016 - 2,025			2.0%
POU Electricity Source*							2,026 - 2,040			2.0%
Natural Gas Fuel?				Natural Gas			2005 - 2,015			1.0%
Propane Fuel?				And other fossil fuels			2,016 - 2,025			1.0%
Oil Fuel?							2,026 - 2,040			1.0%
				Maintenance			2005 - 2,040			2.0%
				Inflation (Nominal , not used)			2005 - 2,040			3.0%
* IOU = Investor Owned Utility										
** POU = Publicly Owned Utility										
				\$66,656 =30-year LCC						
-----ANNUAL REAL CASH FLOWS-----										
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat.Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i) ⁻ⁿ	Present Worth of Annual Costs	Present Worth of Cumulative Costs		
2,014	\$2,000	\$300	\$0	\$1,752	\$2,052	1.00	\$2,000	\$2,000		
2,014	\$2,000	--	--	--	\$2,000	0.98	2,035	4,035		
2,015	0	306	0	1,770	2,076	0.96	2,018	6,054		
2,016	0	312	0	1,788	2,100	0.94	2,018	8,072		
2,017	0	318	0	1,823	2,142	0.92	2,018	10,090		
2,018	0	325	0	1,860	2,185	0.91	2,018	12,108		
2,019	0	331	0	1,897	2,228	0.89	2,018	14,127		
2,020	0	338	0	1,935	2,273	0.87	2,018	16,145		
2,021	0	345	0	2,013	2,365	0.85	2,018	18,163		
2,022	0	351	0	2,054	2,412	0.82	2,018	20,182		
2,023	0	359	0	2,095	4,460	0.80	2,018	23,841		
2,024	2,000	366	0	2,136	2,509	0.79	2,018	25,859		
2,025	0	373	0	2,179	2,560	0.77	2,018	27,877		
2,026	0	380	0	2,223	2,611	0.76	2,018	29,895		
2,027	0	388	0	2,267	2,663	0.74	2,018	31,914		
2,028	0	396	0	2,313	2,716	0.73	2,018	33,932		
2,029	0	404	0	2,359	2,771	0.71	2,018	35,950		
2,030	0	412	0	2,406	2,826	0.70	2,018	37,968		
2,031	0	420	0	2,454	2,883	0.69	2,018	39,987		
2,032	0	428	0	2,503	2,940	0.67	2,018	42,005		
2,033	0	437	0	2,553	4,999	0.66	2,018	45,369		
2,034	2,000	446	0	2,604	3,059	0.65	2,018	47,388		
2,035	0	455	0	2,656	3,120	0.63	2,018	49,406		
2,036	0	464	0	2,710	3,183	0.62	2,018	51,424		
2,037	0	473	0	2,764	3,246	0.61	2,018	53,442		
2,038	0	483	0	2,819	3,311	0.60	2,018	55,461		
2,039	0	492	0	2,875	3,377	0.59	2,018	57,479		
2,040	0	502	0	2,933	3,445	0.57	2,018	59,497		
2,041	0	512	0	2,992	3,514	0.56	2,018	61,516		
2,042	0	522	0	3,051	3,584	0.55	2,018	63,534		
2,043	0	533	0	3,112	5,656		3,122	66,656		
2,044	2,000	543	0							
Totals:	\$8,000	\$12,414	\$0	\$71,119	\$91,533					
	1st+Repl	Maint	Fuel	Elec	Total Annual					
								\$66,656 =30-year LCC		

ENERGY LIFE CYCLE COST SPREADSHEET									
-----PROJECT DATA-----					ELCCA2005.xls	17-Feb-14			
PROJECT: 1063 Office Block Replacement		WSP							
ALT. No.: Gas Domestic Hot Water for Core		T. Marseille							
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----									
Enter 1 or 0 for each fuel type:					Years:	Rate:			
1 = Yes		Real Discount Rate (i)			2005 - 2,040	2.0%			
0 = No		Electricity			2005 - 2,015	1.0%			
IOU Electricity Source*	1	(Investor Owned Utility)			2,016 - 2,025	2.0%			
POU Electricity Source*	0				2,026 - 2,040	2.0%			
Natural Gas Fuel?	1	Natural Gas			2005 - 2,015	1.0%			
Propane Fuel?	0	And other fossil fuels			2,016 - 2,025	1.0%			
Oil Fuel?	0				2,026 - 2,040	1.0%			
					Maintenance	2005 - 2,040	2.0%		
					Inflation (Nominal , not used)	2005 - 2,040	3.0%		
* IOU = Investor Owned Utility									
** POU = Publicly Owned Utility									
					\$55,456 =30-year LCC				
-----ANNUAL REAL CASH FLOWS-----									
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat. Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i)^-n	Present Worth of Annual Costs	Present Worth of Cumulative Costs	
2,014	\$4,000	\$633	\$940		\$1,573				
2,014	\$4,000	--	--	--	\$4,000	1.00	\$4,000	\$4,000	
2,015	0	646	949	0	1,595	0.98	1,563	5,563	
2,016	0	659	958	0	1,617	0.96	1,554	7,118	
2,017	0	672	968	0	1,640	0.94	1,545	8,663	
2,018	0	685	978	0	1,663	0.92	1,536	10,199	
2,019	0	699	988	0	1,686	0.91	1,527	11,727	
2,020	0	713	997	0	1,710	0.89	1,519	13,245	
2,021	0	727	1,007	0	1,735	0.87	1,510	14,755	
2,022	0	742	1,017	0	1,759	0.85	1,501	16,257	
2,023	0	756	1,028	0	1,784	0.84	1,493	17,750	
2,024	4,000	772	1,038	0	5,810	0.82	4,766	22,515	
2,025	0	787	1,048	0	1,835	0.80	1,476	23,991	
2,026	0	803	1,059	0	1,862	0.79	1,468	25,459	
2,027	0	819	1,069	0	1,888	0.77	1,460	26,919	
2,028	0	835	1,080	0	1,915	0.76	1,452	28,371	
2,029	0	852	1,091	0	1,943	0.74	1,444	29,814	
2,030	0	869	1,102	0	1,971	0.73	1,436	31,250	
2,031	0	886	1,113	0	1,999	0.71	1,428	32,677	
2,032	0	904	1,124	0	2,028	0.70	1,420	34,097	
2,033	0	922	1,135	0	2,057	0.69	1,412	35,509	
2,034	4,000	941	1,146	0	6,087	0.67	4,096	39,606	
2,035	0	959	1,158	0	2,117	0.66	1,397	41,003	
2,036	0	979	1,170	0	2,148	0.65	1,390	42,392	
2,037	0	998	1,181	0	2,179	0.63	1,382	43,774	
2,038	0	1,018	1,193	0	2,211	0.62	1,375	45,149	
2,039	0	1,039	1,205	0	2,243	0.61	1,367	46,517	
2,040	0	1,059	1,217	0	2,276	0.60	1,360	47,877	
2,041	0	1,080	1,229	0	2,310	0.59	1,353	49,230	
2,042	0	1,102	1,241	0	2,344	0.57	1,346	50,576	
2,043	0	1,124	1,254	0	2,378	0.56	1,339	51,915	
2,044	4,000	1,147	1,266	0	6,413	0.55	3,540	55,456	
Totals:	\$16,000	\$26,193	\$33,011	\$0	\$75,204		\$55,456 =30-year LCC		
	1st+Repl	Maint	Fuel	Elec	Total Annual				

ENERGY LIFE CYCLE COST SPREADSHEET									
-----PROJECT DATA-----					ELCCA2005.xls		17-Feb-14		
PROJECT: 1063 Office Block Replacement				WSP					
ALT. No.: Fluorescent Lighting				T. Marseille					
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----									
Enter 1 or 0 for each fuel type:					Years:		Rate:		
	1 = Yes	Real Discount Rate (i)			2005 - 2,040		2.0%		
	0 = No	Electricity			2005 - 2,015		1.0%		
IOU Electricity Source*	1	(Investor Owned Utility)			2,016 - 2,025		2.0%		
POU Electricity Source*	0				2,026 - 2,040		2.0%		
Natural Gas Fuel?	1	Natural Gas			2005 - 2,015		1.0%		
Propane Fuel?	0	And other fossil fuels			2,016 - 2,025		1.0%		
Oil Fuel?	0				2,026 - 2,040		1.0%		
		Maintenance			2005 - 2,040		2.0%		
		Inflation (Nominal , not used)			2005 - 2,040		3.0%		
* IOU = Investor Owned Utility									
** POU = Publicly Owned Utility									
							\$2,101,694 =15-year LCC		
-----ANNUAL REAL CASH FLOWS-----									
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat. Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i) ⁻ⁿ	Present Worth of Annual Costs	Present Worth of Cumulative Costs	
2,015	\$1,200,000	\$0	\$0	\$31,307	\$31,307	1.00	\$1,200,000	\$1,200,000	
2,015	\$1,200,000	--	--	--	\$1,200,000	1.00	\$1,200,000	\$1,200,000	
2,016	0	0	0	31,933	31,933	0.98	31,307	1,231,307	
2,017	0	0	0	32,572	32,572	0.96	31,307	1,262,614	
2,018	0	0	0	33,223	33,223	0.94	31,307	1,293,921	
2,019	0	0	0	33,888	33,888	0.92	31,307	1,325,227	
2,020	175,000	0	0	34,565	209,565	0.91	189,810	1,515,037	
2,021	0	0	0	35,257	35,257	0.89	31,307	1,546,344	
2,022	0	0	0	35,962	35,962	0.87	31,307	1,577,651	
2,023	0	0	0	36,681	36,681	0.85	31,307	1,608,958	
2,024	0	0	0	37,415	37,415	0.84	31,307	1,640,265	
2,025	175,000	0	0	38,163	213,163	0.82	174,868	1,815,132	
2,026	0	0	0	38,926	38,926	0.80	31,307	1,846,439	
2,027	0	0	0	39,705	39,705	0.79	31,307	1,877,746	
2,028	0	0	0	40,499	40,499	0.77	31,307	1,909,053	
2,029	0	0	0	41,309	41,309	0.76	31,307	1,940,360	
2,030	175,000	0	0	42,135	217,135	0.74	161,334	2,101,694	
LCC = 15 Years because Lighting Replacement Assumed After 15 Years and then Equivalent Technologies/\$									
Annual Hours Operation				3,000 Hours					
Fluorescent Lamp Life				14,000 Hours					
Lamp Replacement Cycle				5 Years					
Group re-lamping and replacement of failed ballasts assumed every 5 years									
Totals:	\$1,725,000	\$0	\$0	\$552,231	\$2,277,231		\$2,101,694 =15-year LCC		
	1st+Repl	Maint	Fuel	Elec	Total Annual				

ENERGY LIFE CYCLE COST SPREADSHEET									
-----PROJECT DATA-----					ELCCA2005.xls	17-Feb-14			
PROJECT: 1063 Office Block Replacement			WSP						
ALT. No.: LED Lighting			T. Marseille						
-----DISCOUNT & ESCALATION Real Rates as of November 2004-----									
Enter 1 or 0 for each fuel type:					Years:	Rate:			
	1 = Yes				Real Discount Rate (i)	2005 - 2,040	2.0%		
	0 = No				Electricity	2005 - 2,015	1.0%		
IOU Electricity Source*	1				(Investor Owned Utility)	2,016 - 2,025	2.0%		
POU Electricity Source*	0					2,026 - 2,040	2.0%		
Natural Gas Fuel?	1				Natural Gas	2005 - 2,015	1.0%		
Propane Fuel?	0				And other fossil fuels	2,016 - 2,025	1.0%		
Oil Fuel?	0					2,026 - 2,040	1.0%		
					Maintenance	2005 - 2,040	2.0%		
					Inflation (Nominal , not used)	2005 - 2,040	3.0%		
* IOU = Investor Owned Utility									
** POU = Publicly Owned Utility									
					\$2,009,960 =15-year LCC				
-----ANNUAL REAL CASH FLOWS-----									
(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat.Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor (1+i)^-n	Present Worth of Annual Costs	Present Worth of Cumulative Costs	
2,015	\$ 1,614,710	\$0	\$0	\$26,611	\$26,611				
2,015	\$1,614,710	--	--	--	\$1,614,710	1.00	\$1,614,710	\$1,614,710	
2,016	0	0	0	26,877	26,877	0.98	26,350	1,641,060	
2,017	0	0	0	27,415	27,415	0.96	26,350	1,667,410	
2,018	0	0	0	27,963	27,963	0.94	26,350	1,693,760	
2,019	0	0	0	28,522	28,522	0.92	26,350	1,720,110	
2,020	0	0	0	29,093	29,093	0.91	26,350	1,746,460	
2,021	0	0	0	29,674	29,674	0.89	26,350	1,772,810	
2,022	0	0	0	30,268	30,268	0.87	26,350	1,799,160	
2,023	0	0	0	30,873	30,873	0.85	26,350	1,825,510	
2,024	0	0	0	31,491	31,491	0.84	26,350	1,851,860	
2,025	0	0	0	32,121	32,121	0.82	26,350	1,878,210	
2,026	0	0	0	32,763	32,763	0.80	26,350	1,904,560	
2,027	0	0	0	33,418	33,418	0.79	26,350	1,930,910	
2,028	0	0	0	34,087	34,087	0.77	26,350	1,957,260	
2,029	0	0	0	34,768	34,768	0.76	26,350	1,983,610	
2,030	0	0	0	35,464	35,464	0.74	26,350	2,009,960	
LCC = 15 Years because Lighting Replacement Assumed After 15 Years and then Equivalent Technologies/\$									
Annual Hours Operation 3,000 Hours									
LED Lamp Life (to 70%) 50,000 Hours (LED lamp range is 50,000 - 100,000 Hours)									
Lamp Replacement Cycle 17 Years									
Assumes LED Failures in first 15 years all within warranty period (Year 1)									
Totals:	\$1,614,710	\$0	\$0	\$464,795	\$2,079,505		\$2,009,960	=15-year LCC	
	1st+Repl	Maint	Fuel	Elec	Total Annual				