Engineering and Economic Assumptions

As of: Version: June 5, 2009

GENERAL DECISION RULES

If savings by fuel not available, we use nominal reported total cost savings (if available), inflation adjusted per the energy price deflator. This tends to lead to an under-estimate of savings compared to that if the standardized national-average energy prices were used.
No demand charge used; assume captured in US average electricity price reported by EIA
Negative payback times logged as zero years
Rules re: building or commissioning project vintages
Lacking other data, building age set to 1 year prior to date of publication of new-construction commissioning source documents
Lacking year of energy data, we set it to the date of completion of commissioning project
Commissioned floor area is sought, but total floor area is used when more detail is not available

1. New Building Construction Cost 170 $2009/ft2 Used to estimate construction cost where only floor area is available (per RS Means data - national average)
http://www.reedconstructiondata.com/news/2009/04/rsmeans-dollars-per-square-foot-construction-costs-office-buildings-and-pub/

2. Conversion Factors

Electricity heat rate	10,405	BTU/kWh	U.S. Department of Energy, Buildings Energy Data Book
MBTU/1000 lbs steam	1.079		http://www.energystar.gov/ia/business/tools_resources/target_finder/help/Energy_Units_Conversion_Table.htm
Emissions factors			Table 6.2. http://buildingsdatabook.eere.energy.gov/TableView.aspx?table=6.2.4
Electricity	2.0331	pounds CO2-eq/kWh	DOE/EIA Domestic Electricity Emission Factors, 1999-2002 (Spreadsheet, published Oct 2007)
Natural Gas	112.49	pounds CO2-eq/MBTU	"Fuel Emissions Factors" (From Appendix H of the instructions to Form EIA-
Measure life	5	years	For levelizing costs

3. Standardized energy price assumptions (commercial customers, $2009)

Electricity	0.1043	$/kWH	http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html
Gas	12.32	$/MBTU	http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm
Hot/Chilled water; Stear	16.20	$/million BTU (derived, see note 4 below)	
Hot water	15.26	$/million BTU (derived, see note 4 below)	
Chilled water	16.21	$/million BTU (derived, see note 4 below)	
Steam	17.12	$/million BTU (derived, see note 4 below)	
Peak electrical demand	120	$/kW-year	

Where only total energy costs are given, we apply a blend of indices for gas and electricity

2003 CBECS - weights by expenditures

Elect	69,032	75%	
Nat Gas	14,525	16%	
Oil	1,776	2%	
District Heat	7,245	8%	25% < - all fuel
Total	92,578	100%	

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003html/c2.html

Original source for gas and electric: DOE/EIA http://www.eia.doe.gov/emeu/states/_states.html; and Monthly Energy Review

4. Estimating range of prices for delivered hot water, chilled water, or steam: Examples using preceding energy feedstock prices

Hot Water (gas fuel)
85% generation efficiency
95% distribution efficiency
15.26 $/MMBTU

Chilled Water (gas-absorption cycle - electricity)
80% production efficiency
1.00 COP -- Range: about 0.7 for single effect; 1.1 for double effect (most common)
95% distribution efficiency
16.21 $/MMBTU

Steam: (steam boiler - natural gas)
80% generator efficiency
90% distribution efficiency
17.12 $/MMBTU

Cogeneration as source (natural gas fuelstock)
0.3 input to electricity
0.67 .67 avail waste heat (so, 2/3 of fuel price allocated to heat production, balance to power)
80% heat recovered
90% distribution efficiency
11.47 $/MBTU

5. Deflators

Year	Energy prices [a]	Cx Labor prices [b]	Construction Costs [c]	GDP [d]	Skilled Labor costs [b] 100=June	Constructio n Costs [c]	US Com'l Elect Price (c/kWh) [e]	Elect Index	US Com'l Gas Price ($/1000cf) [f]	Gas INDEX	GDP
1969			6.04	14.49	1913	790			0.74	16.44	984.6
1970			5.71	13.74		836			0.77	15.80	1,038.5
1971			5.03	12.66		948			0.82	14.84	1,127.1
1972			4.55	11.52		1048			0.88	13.82	1,238.3
1973			4.19	10.32		1138			0.94	12.94	1,382.7
1974			3.96	9.51	June	1205			1.07	11.37	1,500.0
1975		4.12	3.65	8.71	1985	1306			1.35	9.01	1,638.3
1976		3.81	3.35	7.81	2145	1425			1.64	7.42	1,825.3
1977		3.57	3.09	7.02	2286	1545			2.04	5.96	2,030.9
1978		3.40	2.89	6.22	2405	1654			2.23	5.46	2,294.7
1979		3.16	2.49	5.56	2585	1919			2.73	4.46	2,563.3
1980	*2.32*	2.95	2.46	5.11	2773	1941	*5.5*	*1.89*	3.39	3.59	2,789.5
1981	*2.13*	2.70	2.28	4.56	3030	2097	*5.7*	*1.82*	4.00	3.04	3,128.4
1982	*1.95*	2.44	2.14	4.38	3344	2234	*5.9*	*1.76*	4.82	2.52	3,255.0
1983	*1.82*	2.28	2.00	4.03	3576	2384	*6.1*	*1.70*	5.59	2.18	3,536.7
1984	*1.79*	2.20	1.97	3.63	3711	2417	*6.3*	*1.65*	5.55	2.19	3,933.2
1985	*1.75*	2.16	1.97	3.38	3785	2428	*6.5*	*1.60*	5.50	2.21	4,220.3
1986	*1.76*	2.12	1.92	3.20	3863	2483	*6.7*	*1.55*	5.08	2.39	4,462.8
1987	*1.77*	2.06	1.88	3.01	3966	2541	*6.9*	*1.50*	4.77	2.55	4,739.5
1988	*1.76*	2.01	1.84	2.79	4060	2598	*7.1*	*1.46*	4.63	2.63	5,103.8
1989	1.72	1.96	1.81	2.60	4166	2634	7.25	1.43	4.74	2.57	5,484.4
1990	1.70	1.90	1.77	2.46	4308	2702	7.34	1.41	4.83	2.52	5,803.1
1991	1.67	1.84	1.74	2.38	4440	2751	7.53	1.38	4.81	2.53	5,995.9
1992	1.64	1.79	1.68	2.25	4558	2834	7.66	1.36	4.88	2.49	6,337.7
1993	1.59	1.75	1.59	2.14	4662	2996	7.74	1.34	5.22	2.33	6,657.4
1994	1.57	1.70	1.53	2.02	4806	3111	7.73	1.34	5.44	2.24	7,072.2
1995	1.62	1.66	1.53	1.93	4909	3112	7.69	1.35	5.05	2.41	7,397.7
1996	1.59	1.61	1.49	1.82	5060	3203	7.64	1.36	5.40	2.25	7,816.9
1997	1.55	1.57	1.42	1.72	5203	3364	7.59	1.37	5.80	2.10	8,304.3

1998	1.61	1.53	1.41	1.63	5345	3391	7.41	1.40	5.48	2.22	8,747.0
1999	1.65	1.48	1.38	1.54	5521	3456	7.26	1.43	5.33	2.28	9,268.4
2000	1.51	1.42	1.35	1.45	5735	3539	7.43	1.40	6.59	1.85	9,817.0
2001	1.34	1.37	1.34	1.41	5948	3574	7.92	1.31	8.43	1.44	10,128.0
2002	1.45	1.33	1.32	1.36	6166	3623	7.89	1.32	6.63	1.83	10,469.6
2003	1.33	1.26	1.29	1.30	6487	3693	8.03	1.29	8.40	1.45	10,960.8
2004	1.28	1.22	1.20	1.22	6698	3984	8.17	1.27	9.43	1.29	11,685.9
2005	1.17	1.17	1.14	1.15	6981	4205	8.67	1.20	11.34	1.07	12,421.9
2006	1.08	1.13	1.09	1.08	7213	4369	9.46	1.10	12.00	1.01	13,178.4
2007	1.08	1.08	1.06	1.03	7579	4486	9.65	1.08	11.32	1.07	13,807.5
2008	1.01	1.05	1.02	1.00	7818	4691	10.28	1.01	*12.17*	1.00	14,264.6
2009	1.00	1.00	1.00	1.00	8171	4773	10.43	1.00	*12.17*	1.00	*14,264.6*
					(May 2009)	(May 2009)	rolling 12-mo		Average 2008	(May 2009)	2008 value

[a] Weighted by overall expenditures in sector of electricity versus fuels. Elect: U.S. Department of Energy, Energy Information Administration, electricity prices
http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html (Rolling 12mo average for elect as of Feb 09)
For 1990-1992: http://www.eia.doe.gov/cneaf/electricity/epa/average_price_state.xls
[b] June 2007 values. Source: Engineering News Record (McGraw-Hill), Skilled Labor, and total Construction Cost:
http://data.bls.gov/PDQ/servlet/SurveyOutputServlet;jsessionid=f03046eaf077$11k$3F3
http://enr.construction.com/features/conEco/default.asp Skilled labor index 1975-1993: ENR, March 28, 1994, page 40.
[c] McGraw Hill - Engineering News Record, Building Cost Index (year's average) - http://enr.construction.com/features/conEco/costIndexes/constIndexHist.asp
[d] Current GDP (for normalizing rebate amounts) - http://www.bea.gov/national/xls/gdplev.xls
[e] Electricity prices per USDOE/EIA - 2009 value is rolling average 12-mo price as of January 2009
[f] Gas prices per USDOE/EIA - December 2008 value used for 2009
Gas - annual http://tonto.eia.doe.gov/dnav/ng/hist/n3020us3A.htm
Gas - monthly http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm