

# C E E R E

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**Building Energy Efficiency Program**



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**Report:**

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**Listing of Assumptions for Energy Analysis of  
Typical Commercial Buildings for ASHRAE 90.1**

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## Office Building

Parameters	Value	Reference
Set point temperature	Heating: 21C (70F), night setback 12C (54F) Cooling: 24 C (75F), night setup 37 C(98F)	ASHRAE 90.1 C5.1 (C5-modeling assumptions)
HVAC system type	VAV with economizer	Huang, and Franconi [1999]
Lighting power density	12 W/m <sup>2</sup> (1.12 W/ft <sup>2</sup> )	ASHRAE 90.1 C5.4 (C5-modeling assumptions)
Plug load	0.75 W/ft <sup>2</sup>	Huang, and Franconi [1999]
Perimeter and interior zone systems	VAV HVAC system with individual thermostats for different zones	
Windows	See Table 2.	
WWR	50	Approximation to the average based on Huang, and Franconi [1999]
Orientation	Longer axis N-S	
Building area	110,000	Approximation to the average based on Huang, and Franconi [1999]
Footprint (aspect ratio)	153 x 102	Assuming the ratio in LBNL [1991]
No of Floors	7	Approximation to the average based on Huang, and Franconi [1999]
Occupancy	390	Huang, and Franconi [1999]
Schedules	<b>Operations:</b> 7am– 6pm weekdays 7 am–1pm weekend and holidays <b>Occupancy:</b> 9am-5pm weekdays <b>Lighting:</b> 7am-5 pm (90%), 20% for the rest of the hours and weekend	Huang et al [1991]
Locations	Zone 1: Miami, FL Zone 2: Phoenix, AZ Zone 3: San Francisco, CA Zone 4: Baltimore, MD Zone 5: Chicago, IL Zone 6: Burlington, VT Zone 7: Duluth, MN Zone 8: Fairbanks, AK	Briggs et al [2002]

Wall Insulation level	<b>Variable</b> Zone 1: R13 Zone 2: R13 Zone 3: R13 Zone 4: R13 Zone 5: R13 Zone 6: R13 Zone 7: R13 + R13 Zone 8: R13 + R13	ASHRAE 90.1 (Table B1-B26) For metal building
Roof Insulation level	<b>Variable</b> Zone 1: R19 Zone 2: R19 Zone 3: R19 Zone 4: R19 Zone 5: R19 Zone 6: R19 Zone 7: R13 + R13 Zone 8: R16 + R13	ASHRAE 90.1 (Table B1-B26) For metal building
Floor Insulation level	<b>Variable</b> Zone 1: NR Zone 2: NR Zone 3: R13 Zone 4: R13 Zone 5: R13 Zone 6: R13 Zone 7: R13 Zone 8: R15	ASHRAE 90.1 (Table B1-B26) Mass floor
Electric/gas rate	National average	LBNL[2003 ]
HVAC sizing	Autosize	
HVAC downsizing cost (to be included in LCC)	To be discussed	
Infiltration	Perimeter zones – 0.038 cfm/ft <sup>2</sup> (ext wall area) Core zones 0.001 cfm/ft <sup>2</sup> (floor area)	DOE2.2 default
Wall construction	Metal frame	
Roof construction	Metal frame	
Floor construction	Mass	
Daylighting	Will be considered for one of the locations	
Daylight dimming	Continuous dimming over 500 lux (applicable only for daylighting calculations)	
Surface reflectance for daylight calculation	80% for ceiling, 50% for walls and 20% for floors (applicable only for daylighting calcs)	ASHRAE 90.1 C5.1 (C5-modeling assumptions)
Software used	EQuest (based on DOE2.2 simulation engine)	

References:

1. Huang, J., H. Akbari, L. Raines and R. Ritschard, 481 Prototypical commercial buildings for 20 urban market areas , LBL-29798, April 1991.
2. Huang, J. and E. Franconi, Commercial Heating and Cooling Loads Component Analysis, Table 10, pp31, LBL-37028, November 1999.
3. Briggs, R., R.G. Lucas and Z.T. Tylor, Climate classification for building energy codes and standards, Technical paper final review draft, PNNL, March 26, 2002
4. LBNL 2003, Commercial unitary air conditioner & heat pump – Life-Cycle Cost Analysis, Power Point Presentation distributed by ASHRAE 90.1 Envelope subcommittee, July 2003

**Table 2a. List of Typical Windows**

						Overall U-factor and SHGC for a window at NFRC Standard Size (47" x 59")					
						Alum w/o brk.		Alum w/ brk		Renf'd vinyl	
ID	Glazing	Fill Gas	Centre of glazing			U	SHGC	U	SHGC	U	SHGC
			U <sub>c</sub>	SHGC <sub>c</sub>	VT <sub>c</sub>						
1	Double clear (103-air-103)	Air	0.47	0.70	0.79	0.72	0.66	0.57	0.63	0.52	0.61
2	Double Green (9984-air-103)	Air	0.47	0.40	0.59	0.72	0.41	0.57	0.37	0.52	0.36
3	Double lowE Pye (e2=0.2) (9924-arg-103)	Arg	0.29	0.62	0.73	0.58	0.59	0.44	0.56	0.39	0.55
4	Double lowE Spe (e2=0.04) (963-arg-103)	Arg	0.25	0.39	0.68	0.55	0.40	0.40	0.36	0.36	0.35
5	Triple lowe (film) (963-arg-1510-arg-103)	Arg	0.20	0.29	0.52	0.52	0.32	0.37	0.28	0.32	0.27

**Notes:** 6 mm glass panes with 12.7 mm gap are used in all the glazing except for triple glazing. For triple glazing unit the gap is 6.3mm in each cavity. The glass IDs in the bracket correspond to WINDO5 glass IDs.

Frames are of generic design

All spacers are metal

Units for U-factor: [Btu/hr·ft<sup>2</sup>·°F]

**Table 2b. Cost associated with the typical Windows**

ID	Glazing	Initial cost (1997)* \$/sf		
		Alum w/o brk.	Alum w/ brk	Renf'd vinyl
1	Double clear	3.93	5.88	9.13
2	Double Green	4.43	6.38	9.63
3	Double lowE Pye (e2=0.2)	5.23	7.18	10.43
4	Double lowE Spe (e2=0.04)	5.88	7.83	11.08
5	Triple lowe (film)			\$15.17

\* - Fenestration product cost assumptions for 1999 version (from 25 Feb 1997)