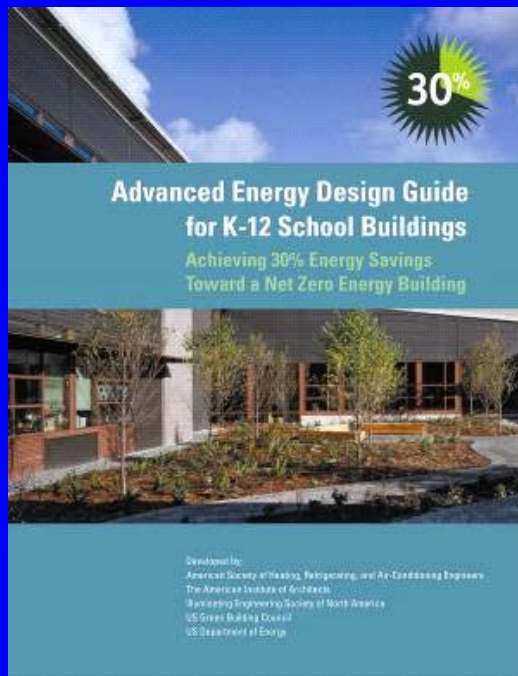


# ASHRAE AEDG K-12 Schools Envelope Criteria



Merle McBride, Ph.D., P.E.  
Senior Research Associate  
Owens Corning

June 25, 2008

# Agenda

Objective  
Background  
Recommendations  
How-To Tips



# Objective



Review the AEDG  
K-12 Schools  
Envelope Criteria

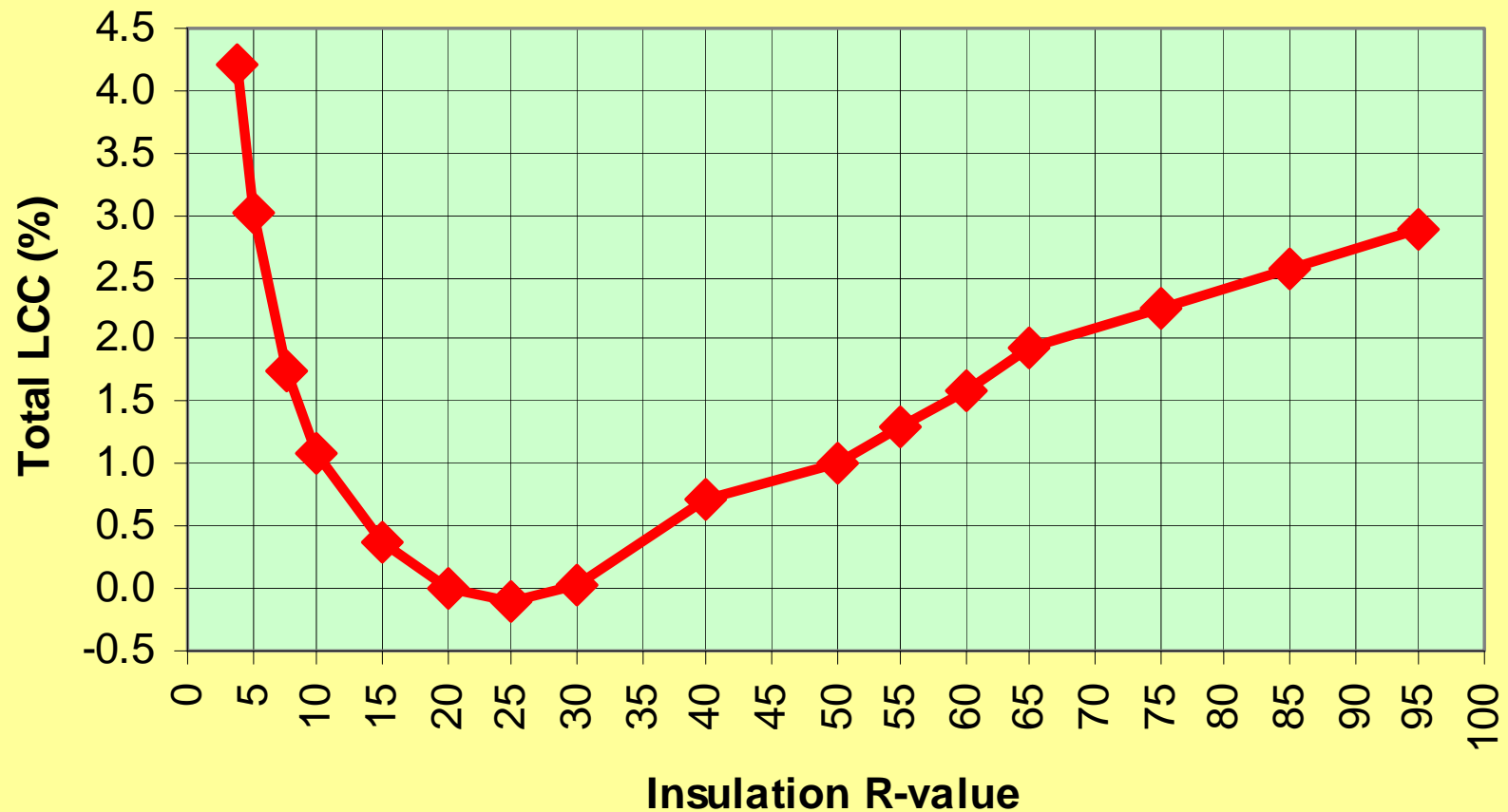


# Envelope Stringency

- LCC Optimization
  - Insulation Entirely Above Deck
  - Mass Walls
- Reference Documents
  - AEDG Small Office
  - Standard 90.1-2007
    - » Addendum as, at and g

# LCC Optimization

## Insulation Above Deck - CZ 5A



# Envelope Recommendations

AEDG K-12 Schools

ASHRAE Std. 90.1-2007

ASHRAE Std. 90.1-1999

# Roof Insulation

(R-values)

Roof	Source	Climate Zone							
		1	2	3	4	5	6	7	8
Above Deck	AEDG-K-12	25	25	25	25	25	25	25	25
	90.1-2007	15	20	20	20	20	20	20	20
	90.1-1999	15	15	15	15	15	15	15	20
Metal Bldg	AEDG-K-12	19	13+13	13+13	13+19	13+19	19+19	13+19	19+19
	90.1-2007	19	19	19	19	19	19	19	13+19
	90.1-1999	19	19	19	19	19	19	19	13+13
Attic	AEDG-K-12	30	38	38	38	38	38	60	60
	90.1-2007	30	38	38	38	38	38	38	49
	90.1-1999	30	30	30	30	30	38	38	38

# Cool Roofs

Climate Zones 1-3

SRI = 78



# Floor Insulation

(R-values)

Floors	Source	Climate Zone							
		1	2	3	4	5	6	7	8
Mass	AEDG-K-12	4.2	6.3	8.3	8.3	10.4	13.3	12.5	16.7
	90.1-2007	0	6.3	6.3	8.3	10.4	12.5	12.5	14.6
	90.1-1999	0	4.2	6.3	6.3	8.3	8.3	8.3	12.5
Steel Framed	AEDG-K-12	19	19	19	30	30	30	38	38
	90.1-2007	0	19	19	30	30	30	30	38
	90.1-1999	0	19	19	19	19	30	30	30
Wood Framed	AEDG-K-12	19	19	30	30	30	30	30	30
	90.1-2007	0	19	19	30	30	30	30	30
	90.1-1999	0	19	19	19	30	30	30	30

# Slab Insulation

(R-values and Length – inches)

Slab	Source	Climate Zone							
		1	2	3	4	5	6	7	8
Unheated	AEDG-K-12	0	0	0	0	0	10-24	15-24	20-24
	90.1-2007	0	0	0	0	0	10-24	15-24	15-24
	90.1-1999	0	0	0	0	0	0	0	10-24
Heated	AEDG-K-12	7.5-12	7.5-12	10-24	15-24	15-24	15-24	15-Full	15-Full
	90.1-2007	7.5-12	7.5-12	10-24	15-24	15-24	15-24	20-24	20-48
	90.1-1999	7.5-12	7.5-12	7.5-12	7.5-24	10-36	10-36	10-36	10-48

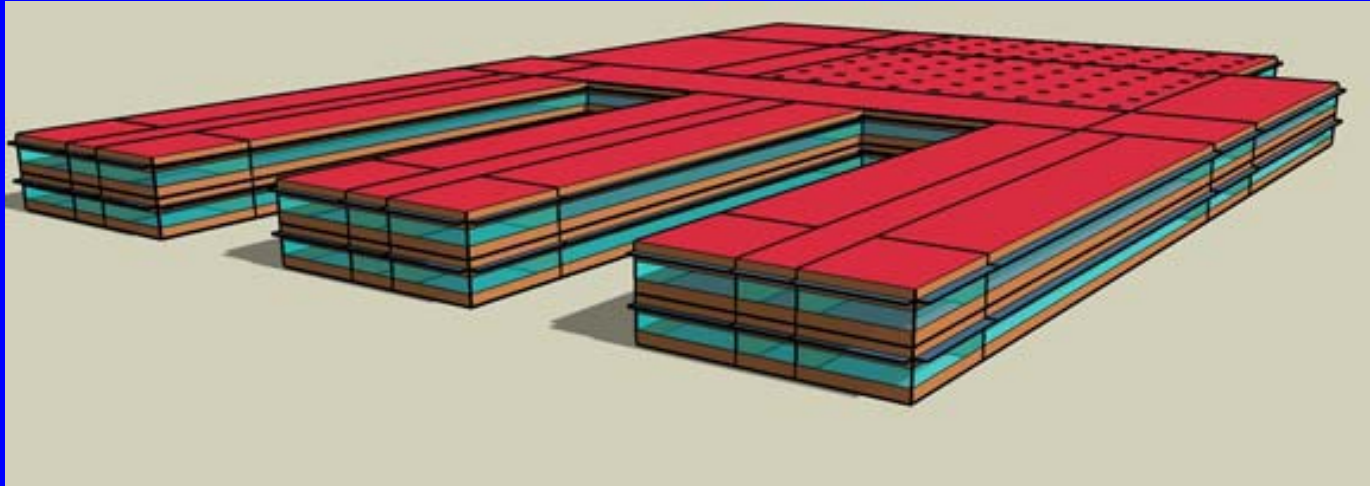
# Doors

(U-factors)

Doors	Source	Climate Zone							
		1	2	3	4	5	6	7	8
Swinging	AEDG-K-12	0.7	0.7	0.7	0.7	0.7	0.7	0.5	0.5
	90.1-2007	0.7	0.7	0.7	0.7	0.7	0.7	0.5	0.5
	90.1-1999	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Nonswinging	AEDG-K-12	1.45	1.45	1.45	0.5	0.5	0.5	0.5	0.5
	90.1-2007	1.45	1.45	1.45	1.5	0.5	0.5	0.5	0.5
	90.1-1999	1.45	1.45	1.45	1.45	1.45	0.5	0.5	0.5



# How-To Tips



Building axis is east-west with most vertical fenestration facing north or south.

Fenestration to gross wall area should not exceed 35%.

# How-To Tips

- Air Infiltration
  - Continuous Air Barrier
  - 0.004 cfm/ft<sup>2</sup> @ 0.3 in H<sub>2</sub>O
- Windows
  - Operable versus Fixed
  - Shading
  - Orientation
  - Passive Solar



## Table A1. Envelope Thermal Performance Factors

Opaque Construction Options					
<b>Roof Assemblies</b>		<b>Walls, Above Grade</b>		<b>Floors</b>	
<b>Insulation Above Deck</b>		<b>Mass Walls</b>		<b>Mass</b>	
<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>
25	0.039	5.7 c.i.	0.151	4.2 c.i.	0.137
		7.6 c.i.	0.123	6.3 c.i.	0.107
		9.5 c.i.	0.104	8.3 c.i.	0.087
		11.4 c.i.	0.090	10.4 c.i.	0.074
		13.3 c.i.	0.080	12.5 c.i.	0.064
		15.2 c.i.	0.071	16.7 c.i.	0.051
<b>Metal Building</b>		<b>Metal Building</b>		<b>Steel Framed</b>	
<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>
19	0.065	16	0.093	19	0.052
13 + 13	0.055	19	0.084	30	0.036
13 + 19	0.049	19+5.6 c.i.	0.057	38	0.032
19 + 19	0.046	19+11.2 c.i.	0.043		
<b>Attic and Other</b>		<b>Steel Framed</b>		<b>Wood Framed and Other</b>	
<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>	<b>R</b>	<b>U</b>
30	0.032	13	0.124	19	0.051
38	0.027	13+3.8 c.i.	0.084	30	0.033
60	0.017	13+7.5 c.i.	0.064		
		13+10 c.i.	0.034		
		<b>Wood Framed and Other</b>		<b>Slabs</b>	
		<b>R</b>	<b>U</b>	<b>Unheated</b>	
		13	0.089	<b>R-in</b>	<b>F</b>
		13+3.8 c.i.	0.064	7.5-12	0.54
		13+7.5 c.i.	0.051	15-24	0.52
		13+10 c.i.	0.045	20-24	0.51
		<b>Walls, Below Grade</b>		<b>Heated</b>	
		<b>Below Grade Walls</b>		<b>R-in</b>	<b>F</b>
		<b>R</b>	<b>C</b>	7.5-12	1.02
		7.5 c.i.	0.119	7.5-24	0.95
		15 c.i.	0.063	10-24	0.90
				15-24	0.86
				15-Full	0.44

A green sunburst graphic with the text "30%" in white, indicating energy savings.

30%

# Advanced Energy Design Guide for K-12 School Buildings

Achieving 30% Energy Savings  
Toward a Net Zero Energy Building



Developed by:  
American Society of Heating, Refrigerating, and Air-Conditioning Engineers  
The American Institute of Architects  
Mechanical Engineering Society of North America  
US Green Building Council  
US Department of Energy

[www.ashrae.org/freeaedg/](http://www.ashrae.org/freeaedg/)