

ENERGY CODES 2007

Tough Topics: Metal Buildings

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Metal Building Manufacturers Association

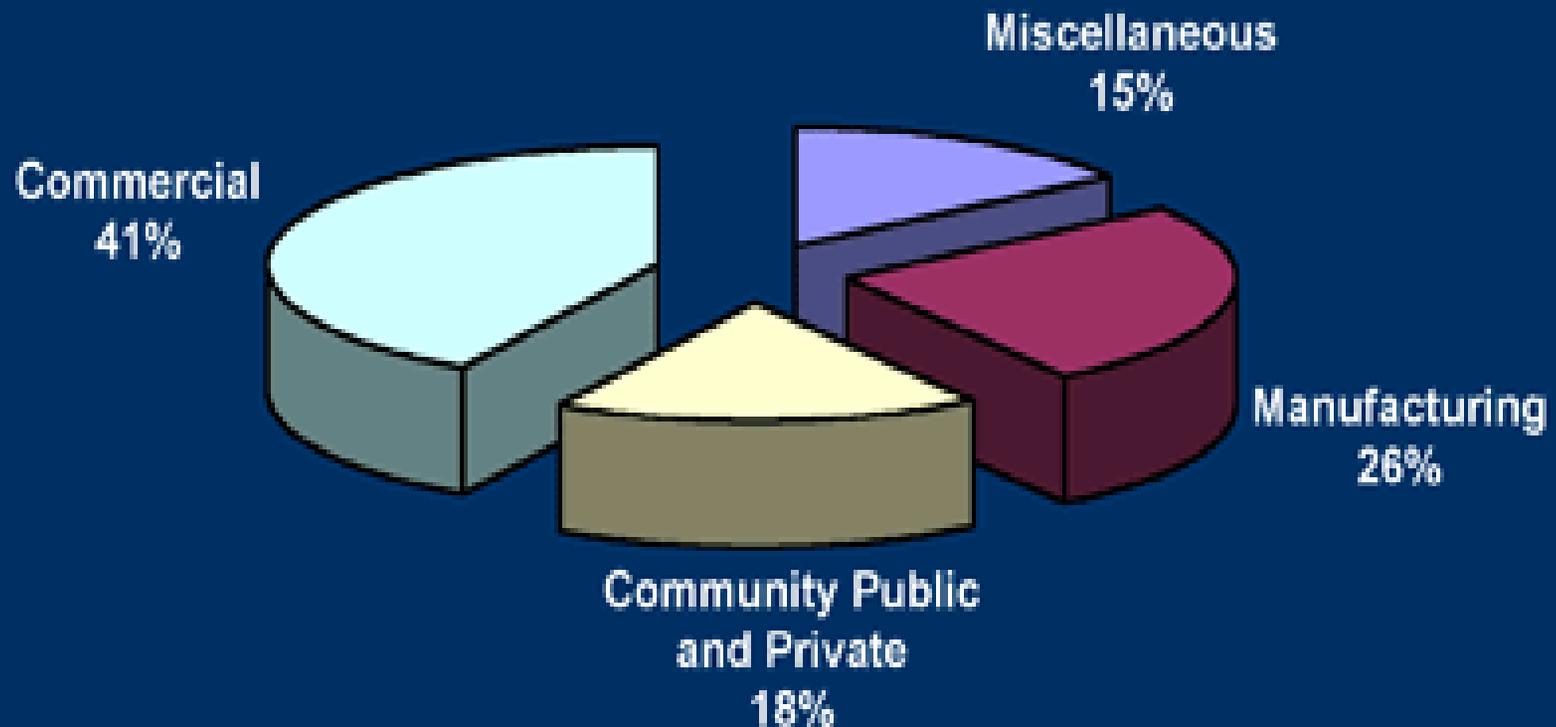
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Pittsburgh, PA

Metal Building Systems

- What is a metal building system?
 - A complete integrated set of mutually dependent components and assemblies that form a building including primary and secondary framing, covering and accessories, and are manufactured to permit inspection on site prior to assembly or erection.
- What about Pre-engineered / Prefabricated buildings?
- Who is MBMA?
 - 36 Building Systems members
 - 53 Associate member suppliers

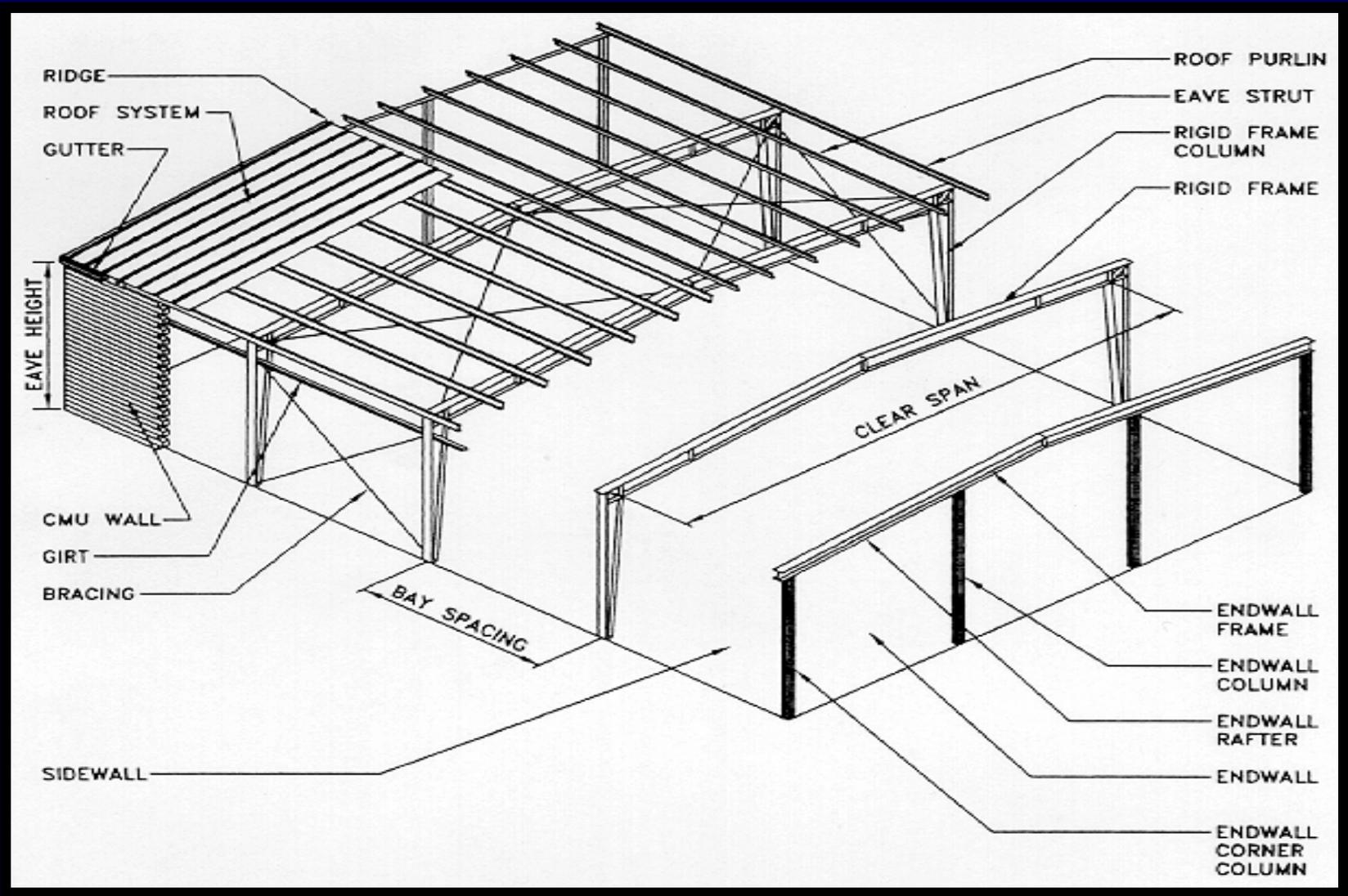
MBMA Market Share by Building Type



MBMA Building Systems

Alliance Steel	Garco Buildings	Metallic Building Company	Star Building Systems
American Steel Building Co.	Ludwig Buildings	Mid-West Steel Building Company	Ruffin Building Systems
BC Steel Buildings	American Buildings	Nucor Buildings	Schulte Building Systems
Behlen Buildings	Kirby Buildings	Oakland Metal Buildings	Spirco Manufacturing
Inland Buildings	Gulf States	Package Industries	Steel Built Corp.
Bigbee Steel Buildings	CBC Steel Buildings	Pinnacle Structures	Tyler Building Systems
Butler Manufacturing Company	Metco/Regal	Ceco Building Systems	United Structures of America
Chief Buildings	A & S Buildings	Robertson Building Systems	VP Buildings
Elite Structures	Mesco Buildings	Star Building Systems	Vulcan Steel
			Whirlwind

Anatomy of a Metal Building



Why is MBMA Involved in Energy Codes?

- Insulation not supplied by MB manufacturer
- MBMA doesn't promote any particular kind or method of insulation
 - Still, insulation impacts structural performance
 - MBMA supports efforts by ASHRAE, IECC to further building energy performance
 - It's good for the environment, the country, and the industry

Energy Code Compliance for Metal Building Systems

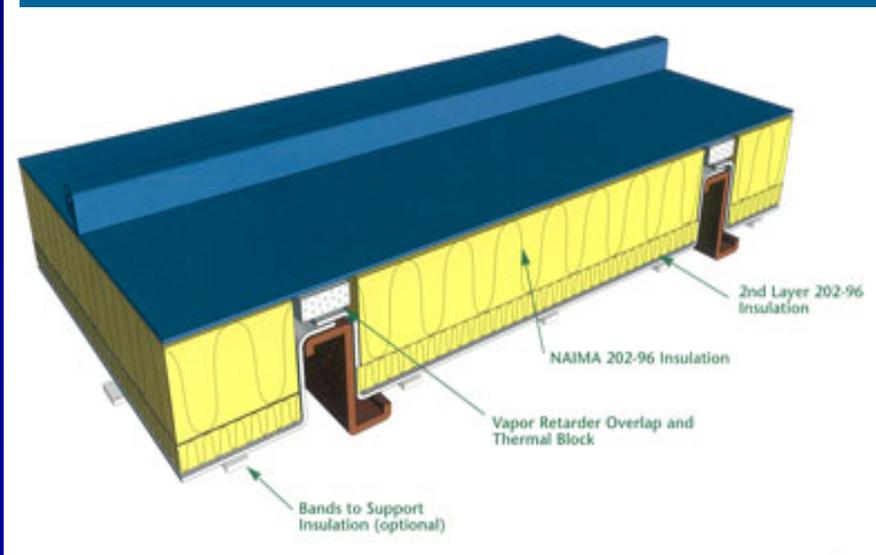
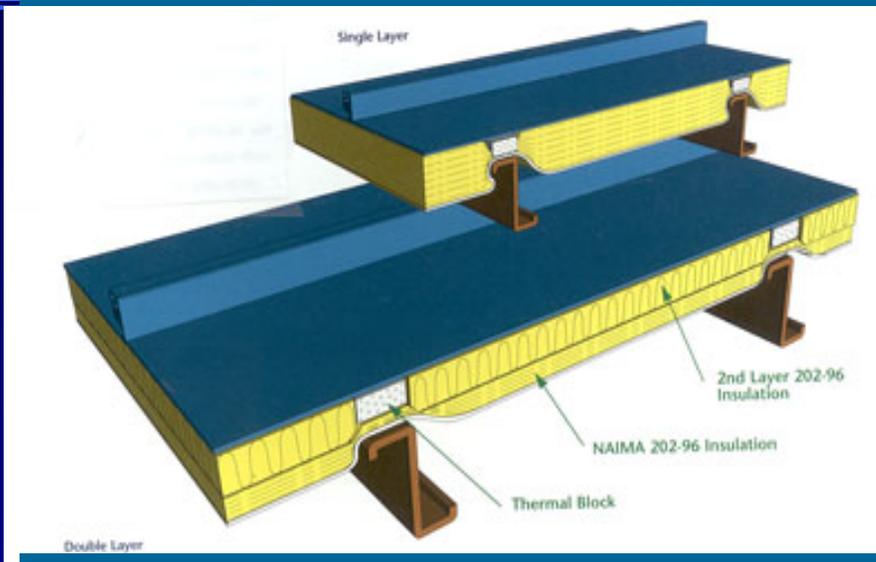
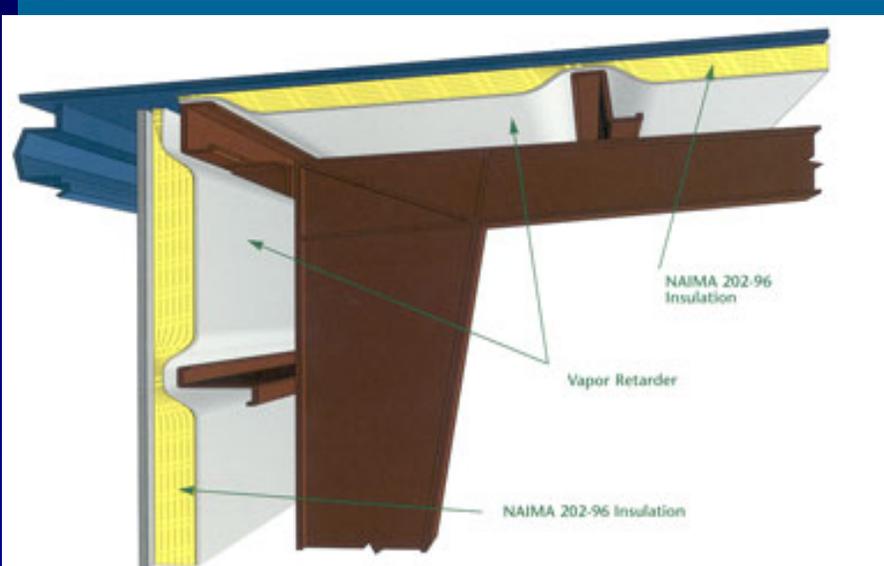
ASHRAE 90.1 &
International Energy Conservation Code

Methods of Compliance

- Prescriptive
 - Individual components meet minimum requirements
 - Tables in 90.1 or IECC
- Trade-off
 - Allows the use of some lesser performing components if you “make it up” in other areas of the building
 - ComCheck
- Energy Cost Budget (Whole Building)
 - Building has an “Energy Budget”, computer model
 - Most Complex, and most comprehensive method
 - DOE 2 (E-Quest), Energy Plus

NAIMA Prescriptive Solutions

“ASHRAE 90.1 Compliance for Metal Building Systems”



Current Typical Metal Building Designs

Images used with permission from NAIMA

NAIMA Prescriptive Solutions

**Through-Fastened
w/R-19
U=0.098**

**SSR
w/R-19
U=0.065**

**SSR
2 Layers R-19
U=0.046**

ASHRAE = 0.065

TABLE 1A: SCREW DOWN ROOFS (8' PURLIN SPACING)

NAIMA 202-90* (Rev. 2000) R VALUE	2" W/WRK SCREW DOWN ROOF 12" Decking Spacing	4" W/WRK SCREW DOWN ROOF 12" Decking Spacing
10	0.08	0.07
11	0.08	0.07
12	0.08	0.07
13	0.08	0.07
14	0.08	0.07

TABLE 1B: SIDE WALLS (4' RIB SPACING)

NAIMA 202-90* (Rev. 2000) R VALUE	2" W/WRK SCREW DOWN WALL 12" Decking Spacing	4" W/WRK SCREW DOWN WALL 12" Decking Spacing
10	0.04	0.04
11	0.04	0.04
12	0.04	0.04
13	0.04	0.04
14	0.04	0.04

TABLE 2C: STANDING SEAM ROOF - DOUBLE LAYER

NAIMA 202-90* (Rev. 2000) R VALUE	R VALUE
10	0.04
11	0.04
12	0.04
13	0.04
14	0.04

TABLE 2D: STANDING SEAM ROOF - SINGLE LAYER

NAIMA 202-90* (Rev. 2000) R VALUE	R VALUE
10	0.04
11	0.04
12	0.04
13	0.04
14	0.04

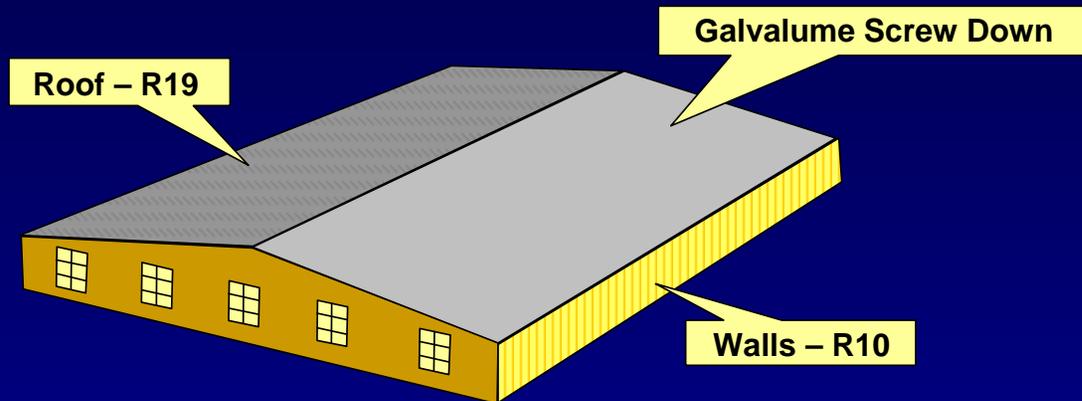
NAIMA 202-90* (Rev. 2000) Insulation
Vapor Retarder
Thermal Block
Double Layer
Single Layer
2nd Layer NAIMA 202-90* (Rev. 2000) Insulation

Prescriptive Method (Cont'd)

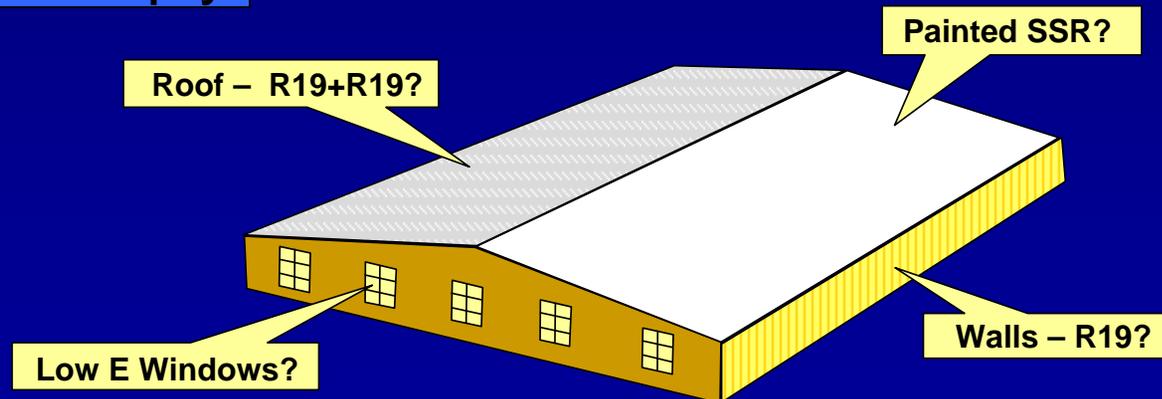
- Through-fastened Roofs
 - Can't use over-purlin insulation for conditioned buildings
 - For through-fastened, R19 gives U-value of 0.098
 - $U_{\text{max(allow)}} = 0.065$ for most climate zones (90.1-2004)
 - Solutions
 - Use between purlin, rigid or suspended systems
 - Use Envelope Trade-Off Method
 - Note: For semi-heated buildings a single layer is allowable due to lower U-factor requirements

Trade-Off Approach (Example)

Now



Options To Comply



Conditioned vs. Semi-Heated

- *Conditioned* - Cooled space, heated space, or indirectly conditioned space
- *Cooled* - Output capacity exceeds 5 Btu/h.ft² of floor area

Btu/ h.ft ²	5	10	15	20	25
CZ	1,2	3	4,5	6,7	8

- *Heated* —
- *Semi-Heated*: Enclosed space, equipment output capacity greater than 3.4 Btu/h.ft² of floor area but not greater than conditioned space

Cool Roof Credit

- Reflectance ≥ 0.70
- Emittance ≥ 0.75

$$U_{roofadj} = U_{roofproposed} \times Factor_{roofmultiplier}$$

HDD65	Roof U-Factor Multiplier
0-900	0.77
901-1800	0.83
1801-2700	0.85
2701-3600	0.86
>3600	1.00

ASHRAE 90.1-2007

- 90.1-2007 being finalized for print
 - First significant increases in building insulation requirements since 1999
 - Metal building insulation requirements are the same as 2004 standard.
 - Why? Addendum going out for public review that modifies the metal building requirements
 - For public review in Fall 2007

ASHRAE 90.1-2004

Conditioned Buildings

Climate Zone	1	2	3	4	5	6	7	8
MB Roof	0.065 R-19	0.049 R-13 +R-19						
MB Walls	0.113 R-13	0.113 R-13	0.113 R-13	0.113 R-13	0.113 R-13	0.113 R-13	0.057 R-13 + R-13	0.057 R-13 + R-13

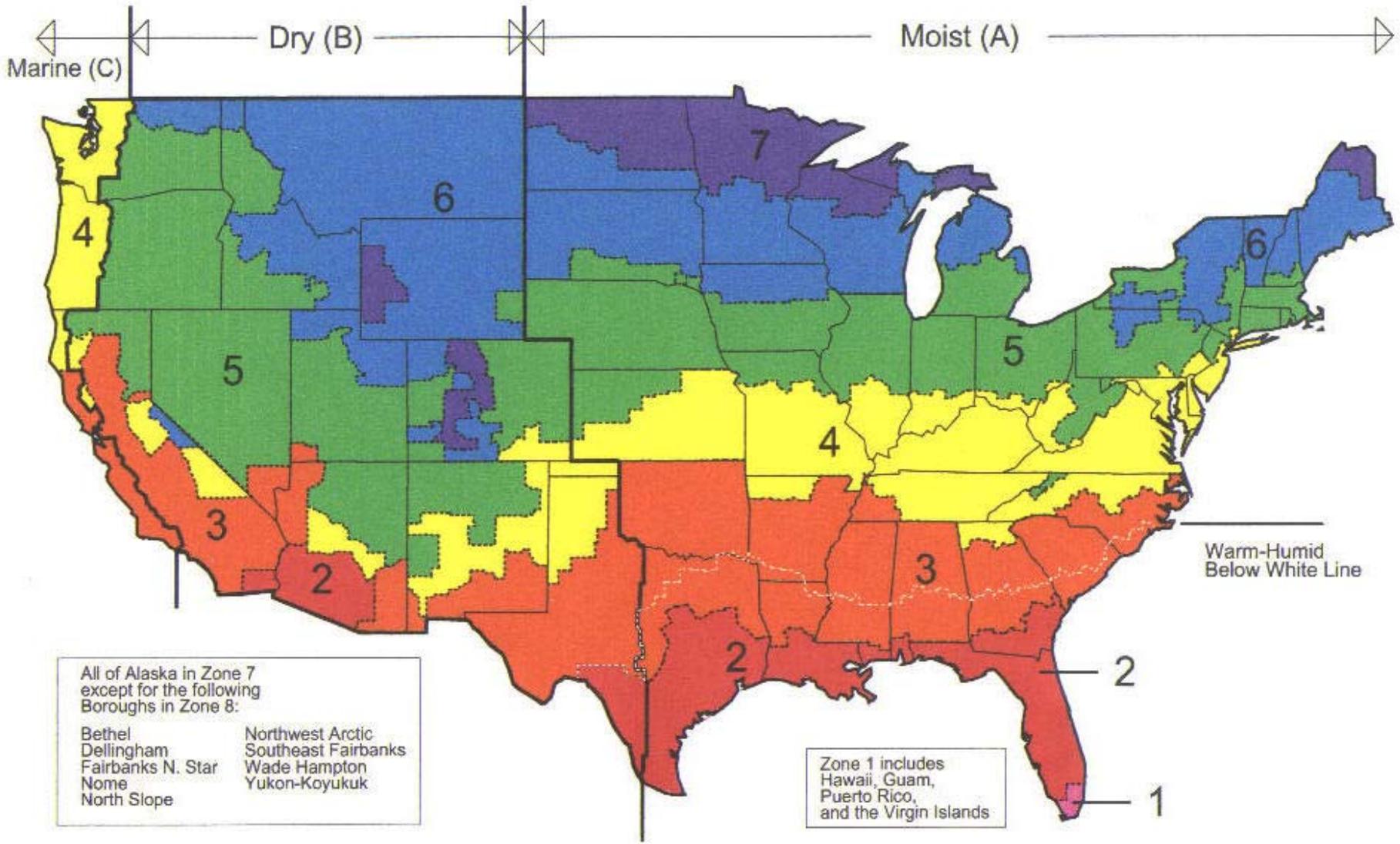
Addendum for MB

Will be release for PR in Fall 07

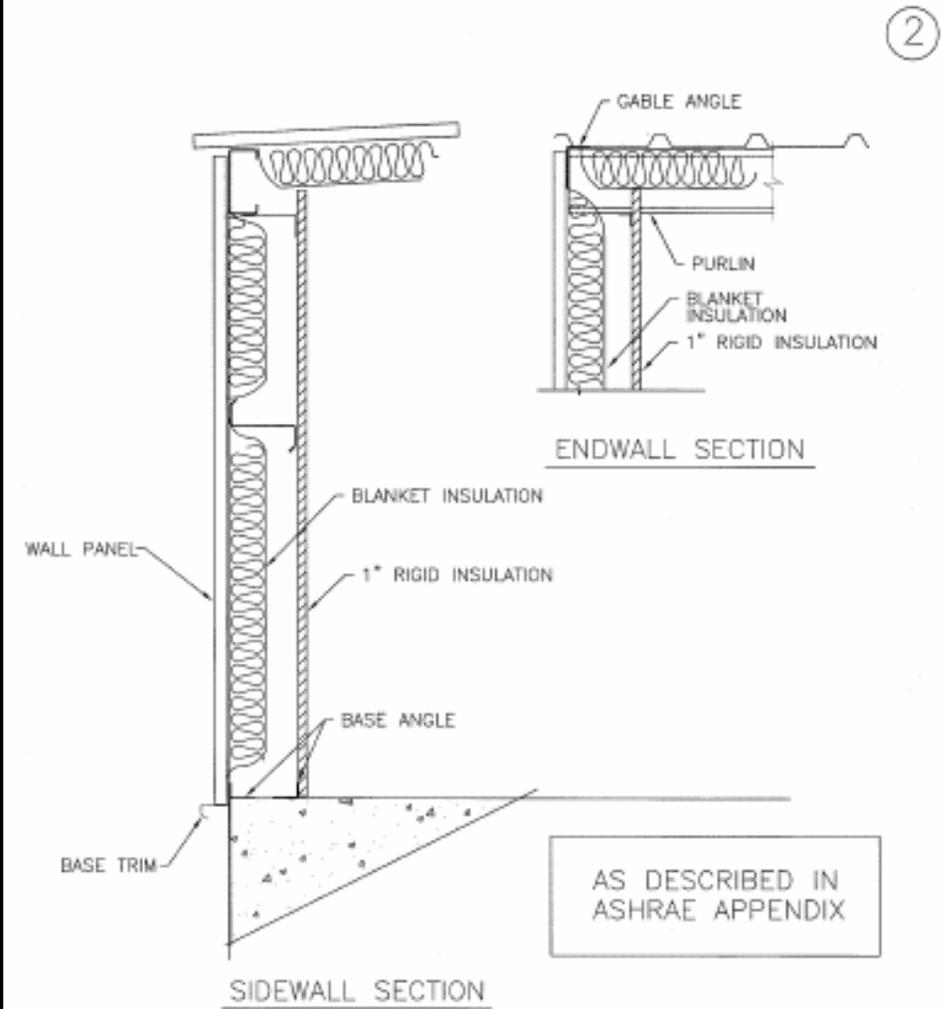
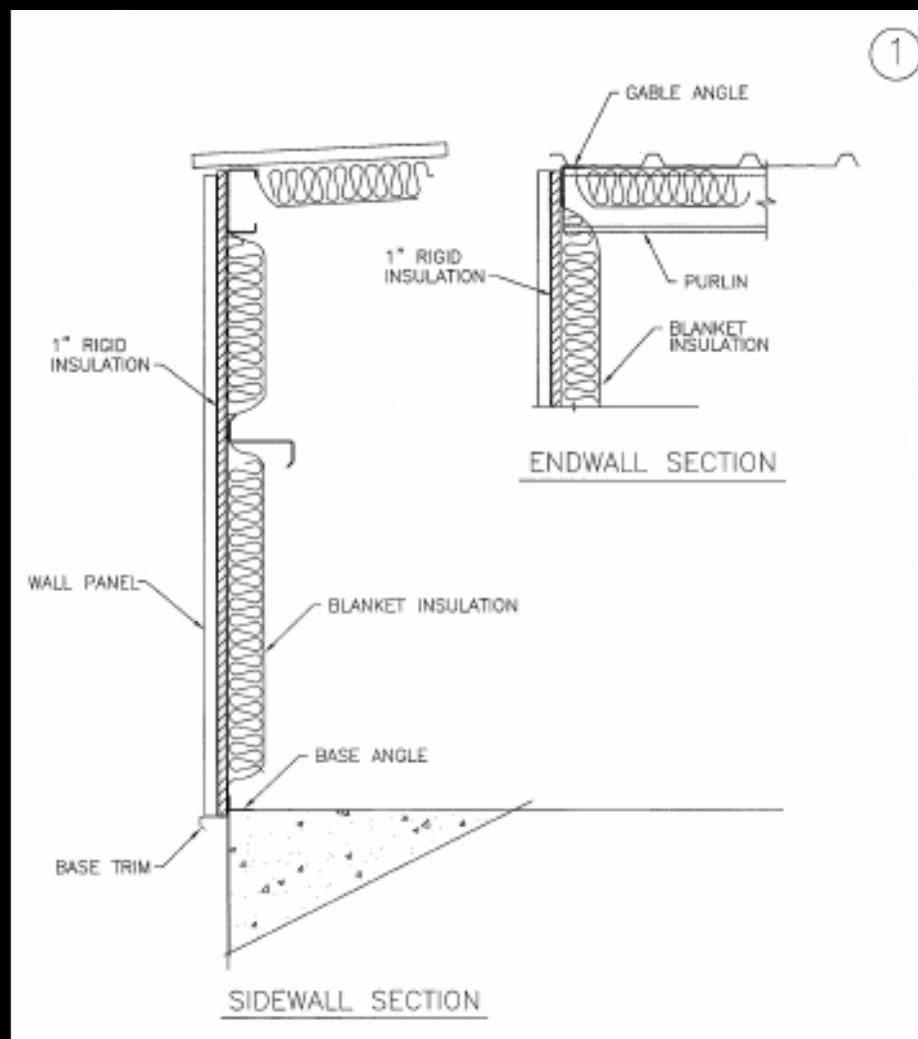
Conditioned Buildings

Climate Zone	1	2	3	4	5	6	7	8
MB Roof	0.065 R-19 0 %	0.055 R-13 + R-13 18 %	0.055 R-13 + R-13 18 %	0.055 R-13 + R-13 18 %	0.055 R-13 + R-13 18 %	0.049 R-13 + R-19 33 %	0.049 R-13 + R-19 33 %	0.035 R-11 + R-19 LS 40 %
MB Walls	0.093 R-16 22 %	0.093 R-16 22 %	0.084 R-19 35 %	0.084 R-19 35 %	0.069 R-13 + R-5.6ci 64 %	0.069 R-13 + R-5.6ci 64 %	0.057 R-19 + R-5.6ci 0 %	0.057 R-19 + R-5.6ci 0 %

Map of DOE's Proposed Climate Zones



How will "ci" the walls be built?



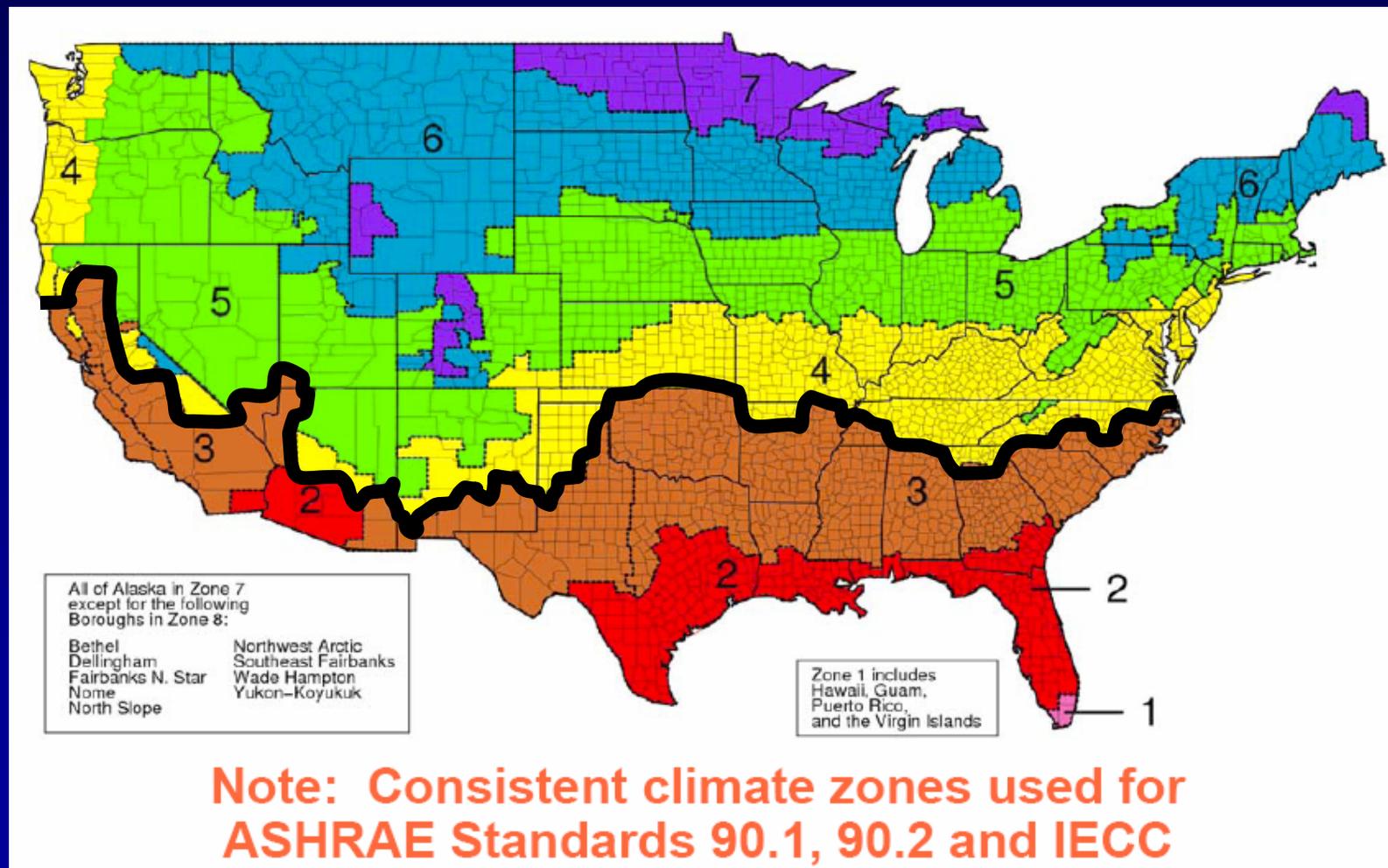
Why the Increase?

- Primarily increased fuel costs
- HVAC Downsizing now implemented
- Updated constructions for metal buildings
 - Many zones now have 2 layer fiberglass roofs
 - Addition of “liner systems” (ls)
 - For walls, rigid insulation + fiberglass in several zones
 - Elimination of 2 layer fiberglass walls

Mandatory Cool Requirement?

- At recent Chicago meeting, 90.1 Envelope Subcommittee proposal was created for mandatory cool roofs
- Passed Main Committee 31-0-1
- Proposal not out for public review yet. Expect Fall 2007
- Climate zones 1 – 3 mandatory
 - $R < 0.70$, $E < 0.75$
 - Ventilated roofs
 - Ballasted roofs
- No trade off for insulation

ASHRAE / IECC Climate Zone Map

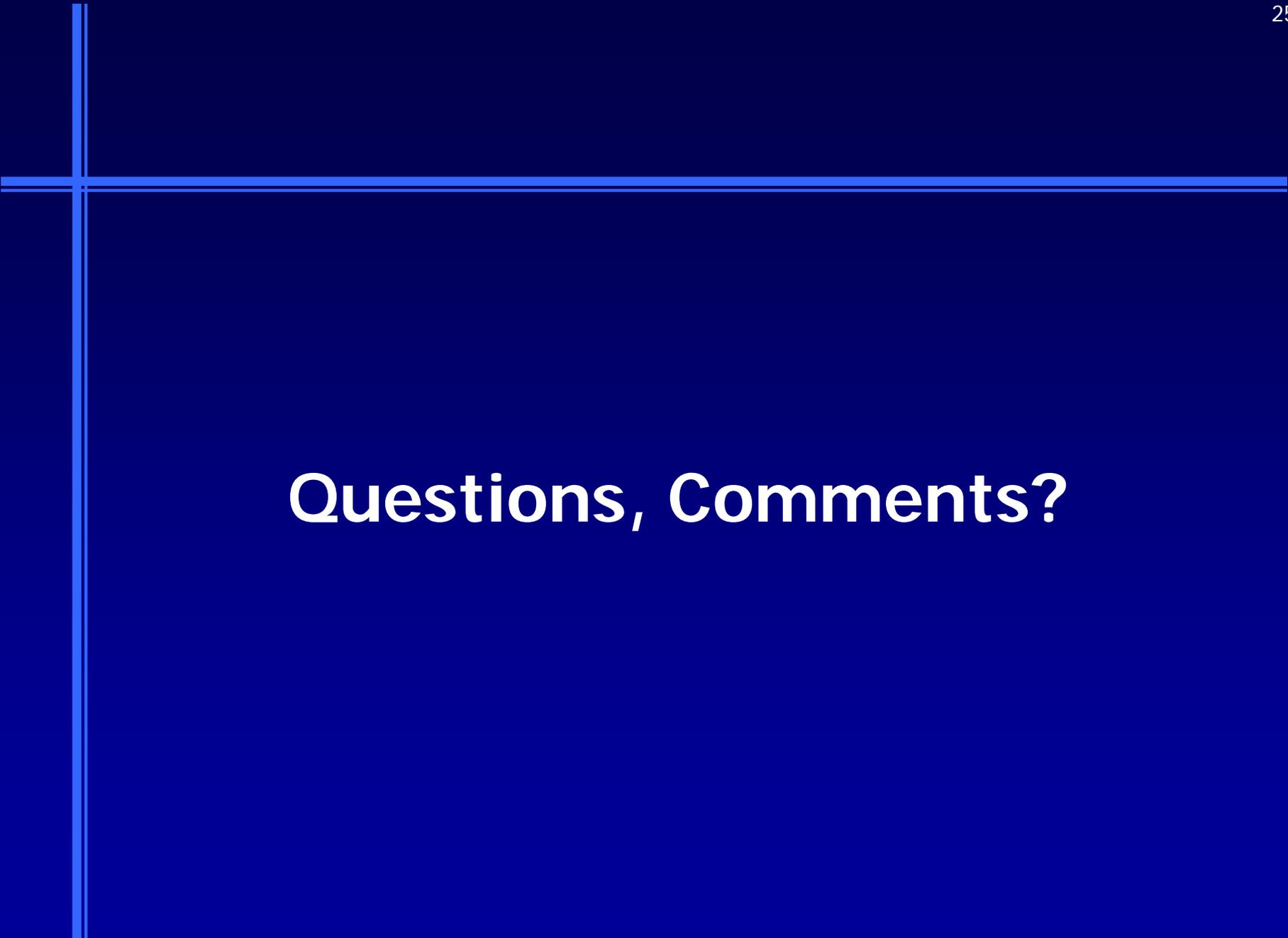


ASHRAE Advanced Energy Design Guides

- “Present *a way, but not the only way* to build energy efficient buildings that use significantly less energy than those built to the minimum code requirements”
- Project has extensive support from ASHRAE
- 30% energy savings when compared to ASHRAE 90.1-1999
- Future design guides may have 50% and 75% energy savings
 - 50% guide targeted for 5-8 yrs
 - 75% guide targeted for 7-10 yrs

Advanced Energy Design Guides

- AEDG for Small Office Buildings - Done
- AEDG for Small Retail Buildings - Done
- AEDG for Warehouse Buildings – In Progress
- AEDG for Schools – In Progress
- AEDG for Low-rise Hotel / Motel
- AEDG for Medium Size Office Buildings
- AEDG for Healthcare Facilities
- AEDG for Educational Facilities
- AEDG for Apartments



Questions, Comments?