

DOCKET

07-BSTD-1

DATE MAY 18 2006

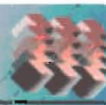
RECD. APR 29 2008

2008 Title 24 Nonresidential CASE Insulation Proposal

PG&E Codes & Standards Program
CEC Staff Workshop May 18, 2006



**Pacific Gas and
Electric Company..**



Codes & Standards Enhancement Project

Overview of proposal

- Update the 2008 envelope criteria using Life-Cycle Cost Methodology
- Move to a U-factor approach
- Create a separate category for retail
- Climate zone groupings



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Changes from Previous Insulation CASE Report

- Updated 2008 TDV Curves with updated present value
- Updated RS Means Cost Values
 - Standing seam roofs have an added second metal deck costs for rigid insulation
 - Screw down roof cost of \$1.74 and standing seam roof cost of \$2.82.
 - Cost for R-19 cavity insulation from \$0.48 to \$0.46. The regression analysis for extrapolated values recomputed.
- Construction Assemblies
 - Mass walls from exterior insulation to interior insulation
 - Wood-framed and other roofs use 24 in. O.C. with insulation underneath rather than 16 in. O.C. attic insulation
- Floor insulation levels now included



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Description of simulation models

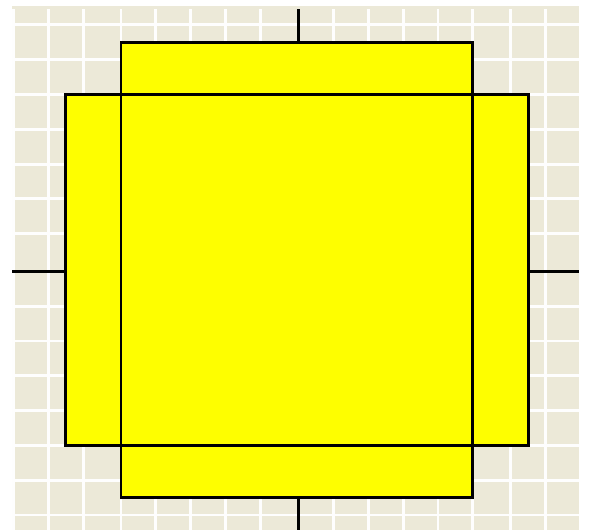
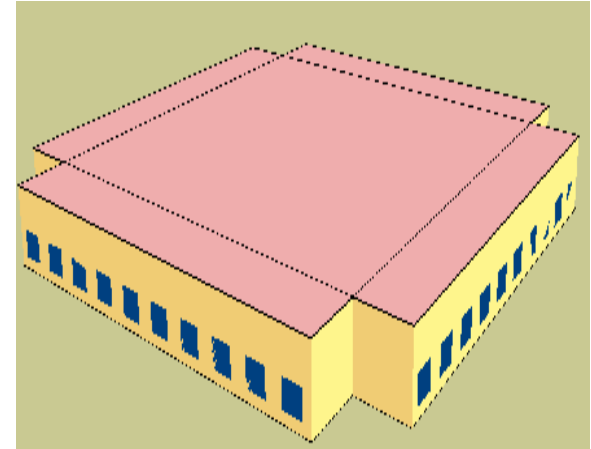
■ Geometry

- A 5-zone model
- Four exterior zones (100 ft X 15 ft)
- One interior zone (100 ft X 100 ft) Space height 13 ft

■ Fenestration: The fenestration is set to 30% for daytime and 24-hour occupancy and 10% for retail occupancy.

■ HVAC systems

- One packaged single zone (PSZ) system for each zone. Ducted return.
- Cooling EER 9.5 (COOLING-EIR = 0.2846), fan power at 0.35 W/cfm
- Integrated air-side economizer
- Outside air 0.15 cfm/ft²
- Gas heating



Life-cycle Cost Analysis

- Life-cycle Cost Analysis
 - $TDV = C0 + C1 \times U\text{-factor}$
 - $LCC = \text{Initial_Cost (incremental)} + PV_{TDV} \times TDV$
- Cost data from R.S. Means 2005
- 30% operating and profit markup
- 1.088 California adjustment factor
- Regression analysis for missing values



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Roofs – Wood-framed walls LCC for CZ3

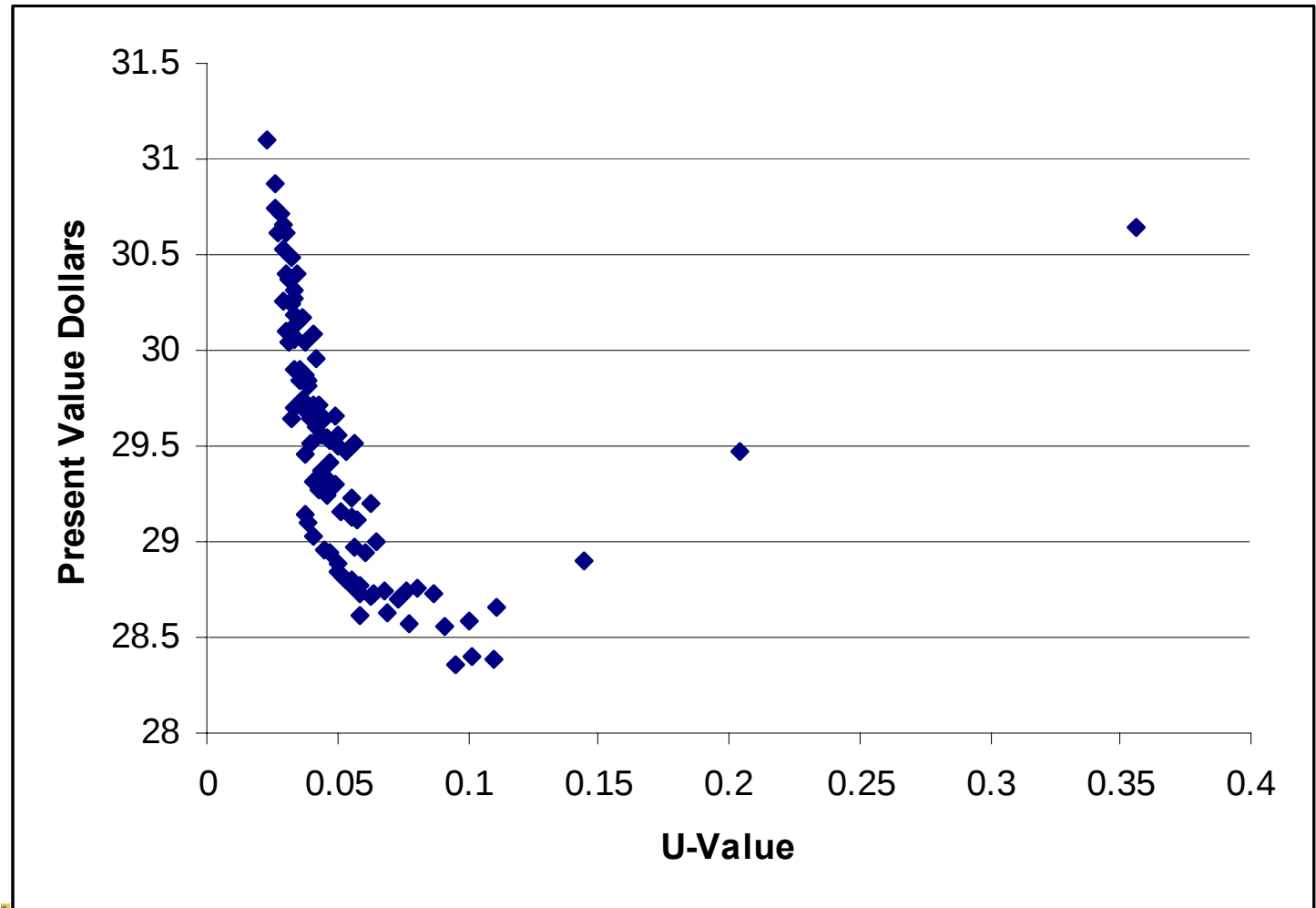
Cavity R	Sheathin g R	U-value	Incremental Cost	TDV total	TDV cost	LCC	Rank
R-15	None	0.095	0.764377	189.0305	27.59316	28.35754	1
R-11	None	0.11	0.622825	190.2289	27.76809	28.39091	2
R-13	None	0.102	0.721911	189.5897	27.67479	28.39671	3
None	R-8	0.091	1.005014	188.711	27.54652	28.55153	4
None	R-10	0.077	1.18903	187.5925	27.38325	28.57228	5
None	R-7	0.1	0.934238	189.43	27.65147	28.58571	6
None	R-14	0.059	1.443823	186.1545	27.17334	28.61716	7
R-21	None	0.069	1.343321	186.9534	27.28996	28.63328	8
None	R-6	0.111	0.877618	190.3088	27.77975	28.65737	9
R-11	R-4	0.073	1.358892	187.2729	27.33661	28.6955	10



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Roofs – Wood-framed walls LCC for CZ3



Metal building roof

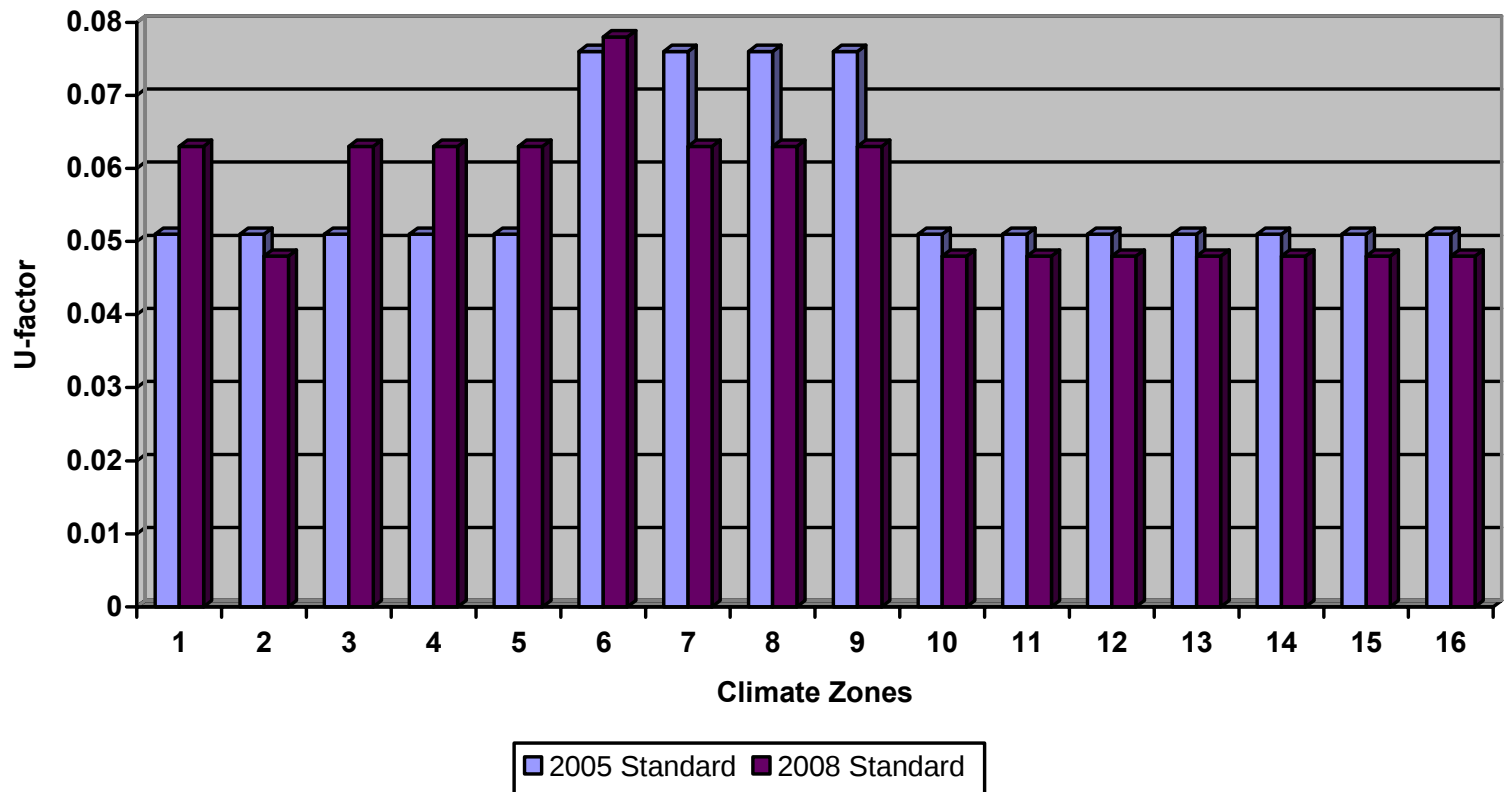


Figure 1 –Metal Building Roof (Daytime)
Statewide Energy Impacts (ft²-yr): TDV=0.222, kWh=0.010, therm=0.000

Metal building roof

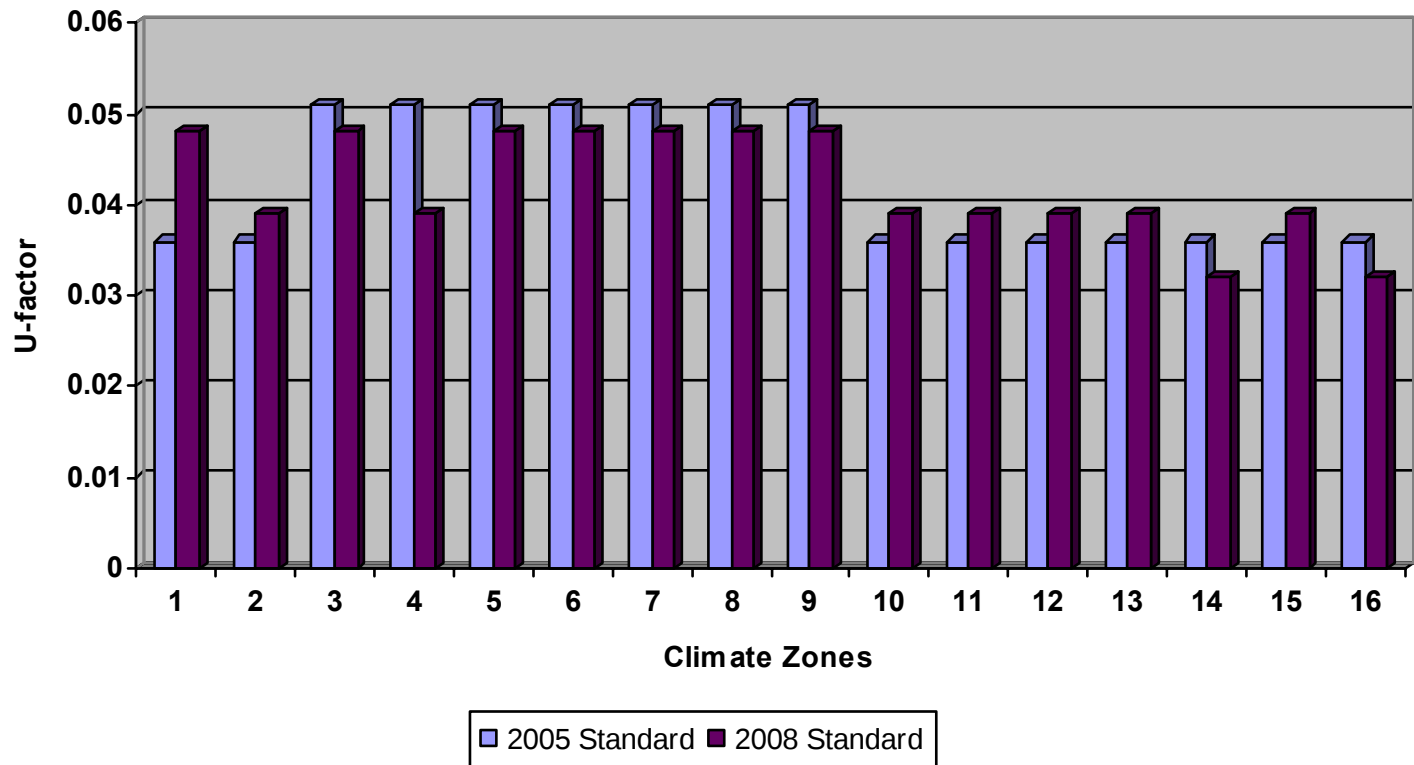


Figure 1 – Metal Building Roof (24-hour)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=3.761, kWh=0.112, therm=0.016

Metal building roof

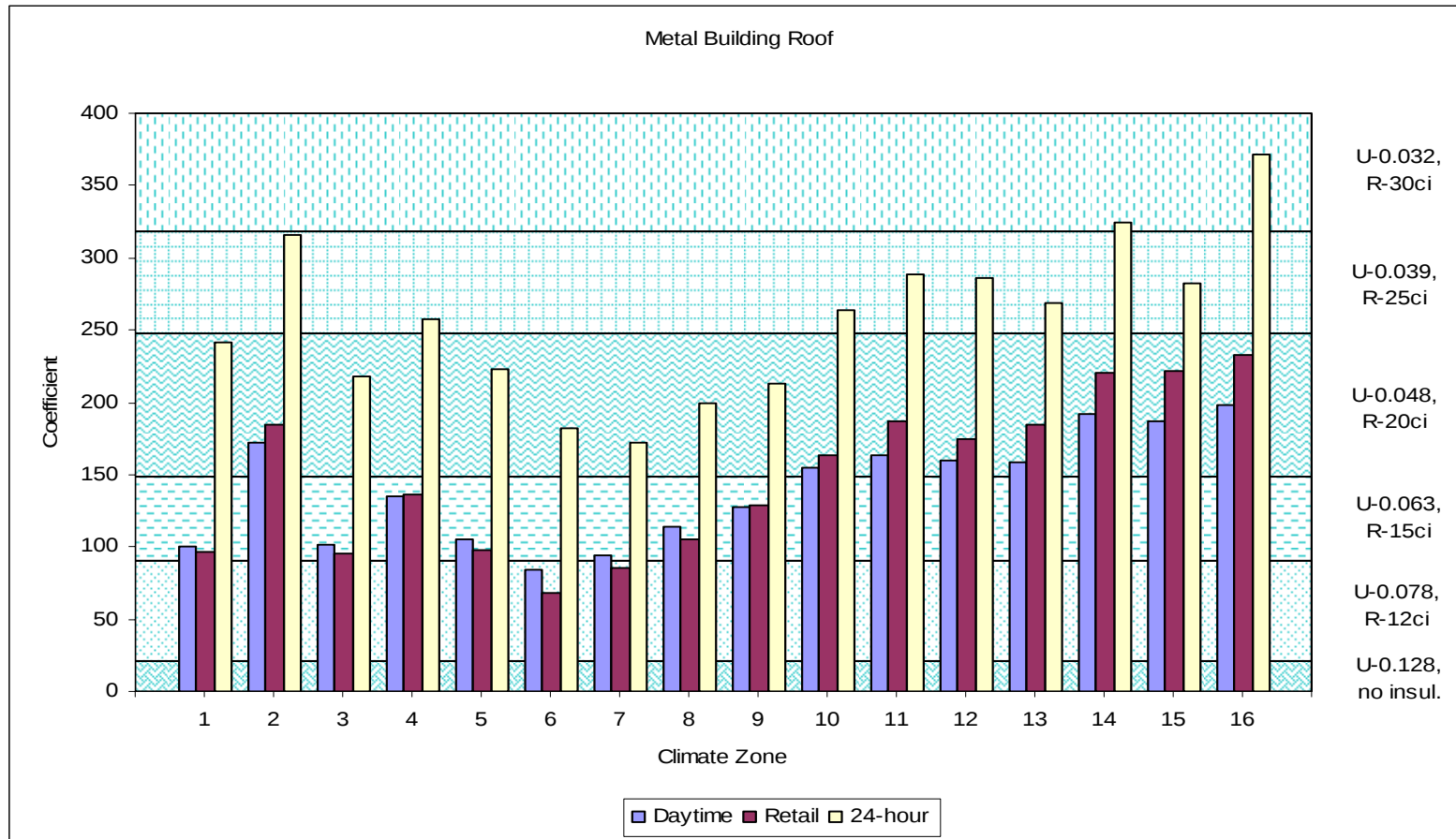


Figure 1 – Metal Building Roof Coefficients (cool roofs)

Metal building roof

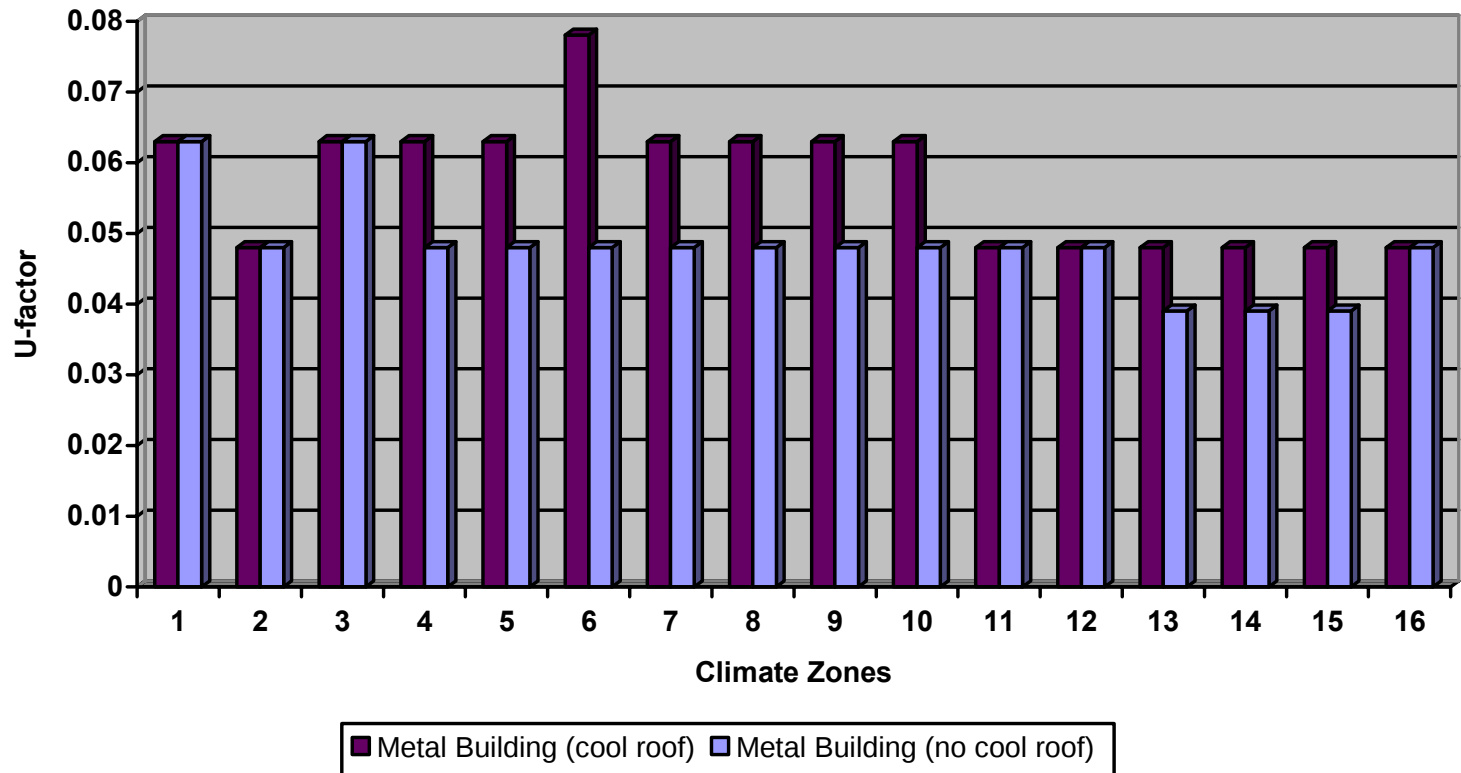


Figure 1 – Daytime Roof Insulation Cool Roof Sensitivity Analysis for Metal Buildings

Metal building roof

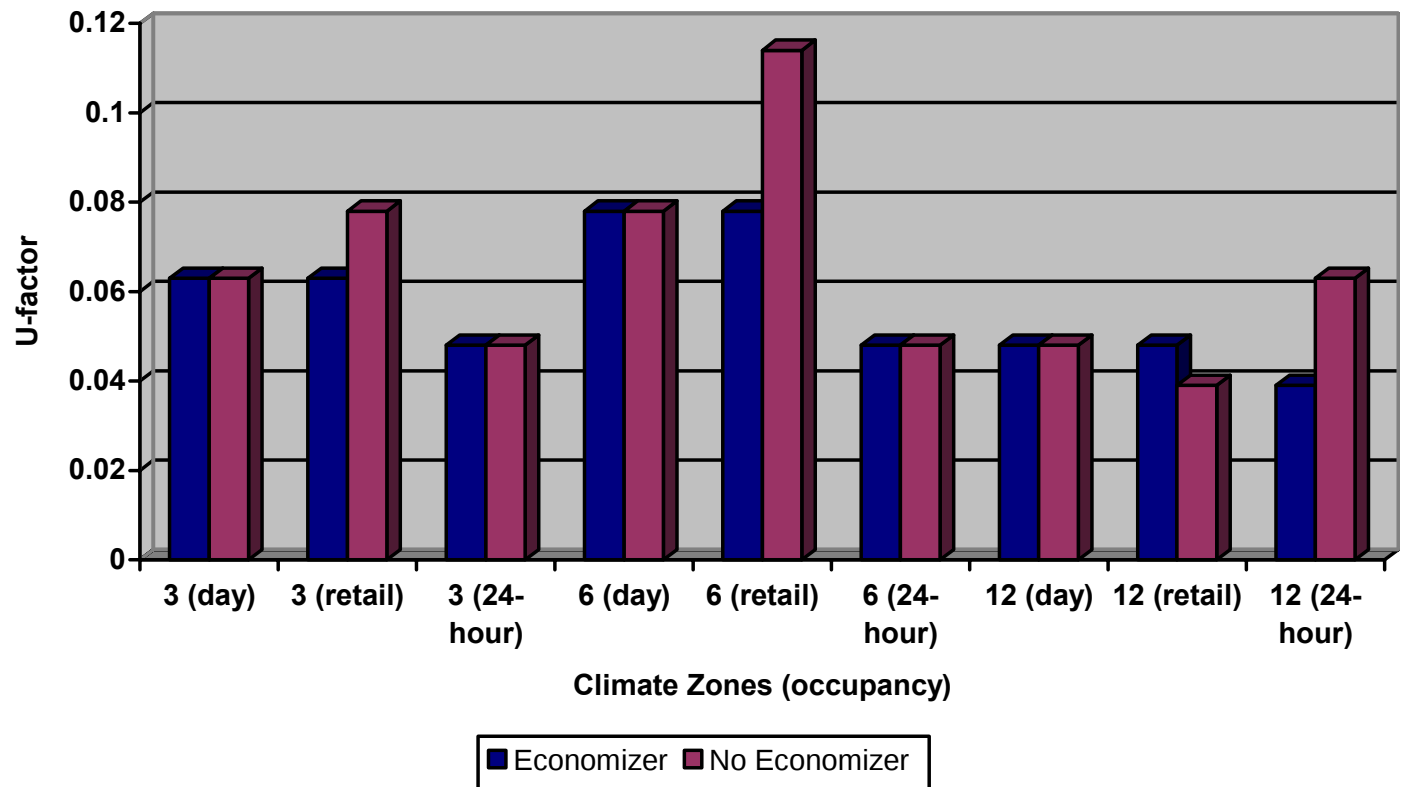


Figure 1 – Economizer Insulation Sensitivity Analysis for Metal Building Roof

Wood-framed and other roofs

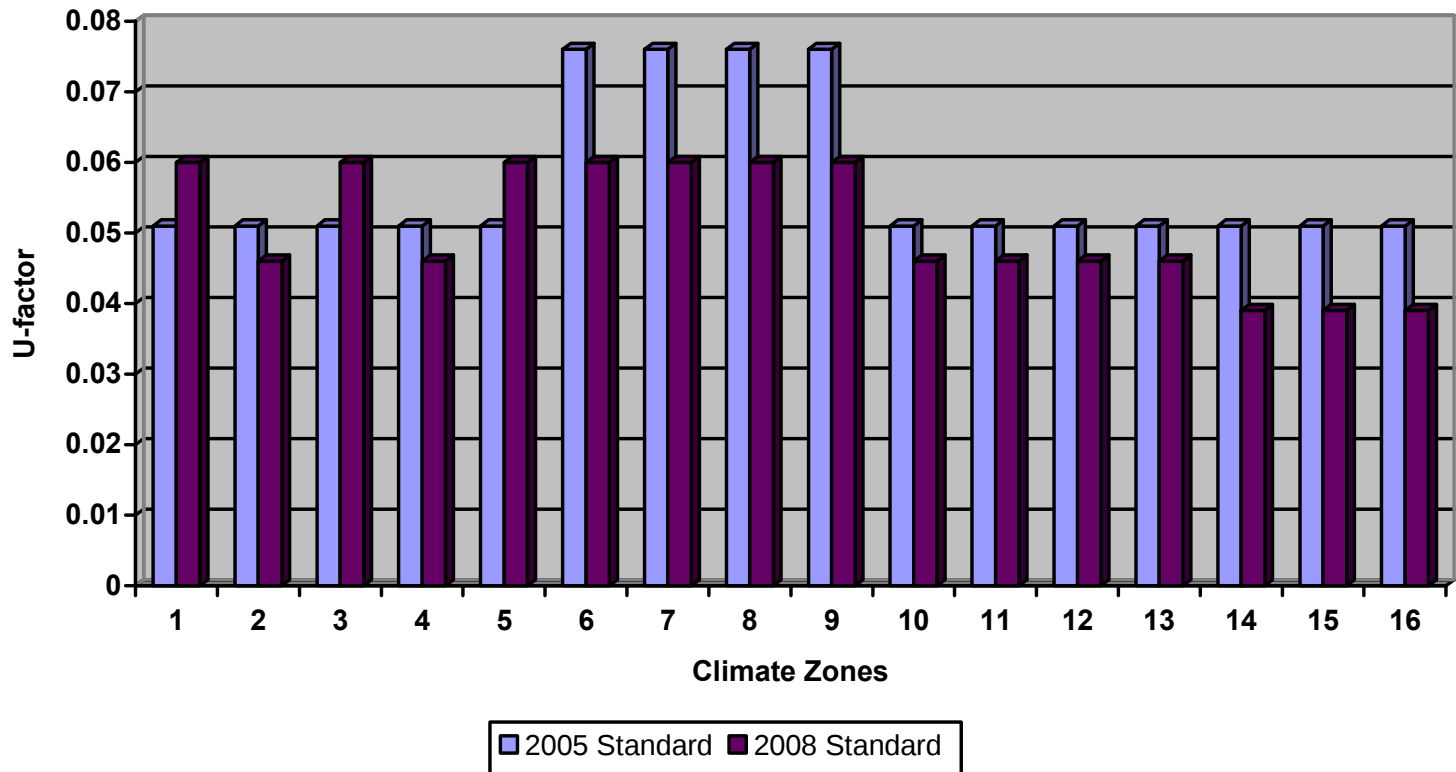


Figure 1 – Wood-framed and Other Roof (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=0.838, kWh=0.027, therm=0.002

Wood-framed and other roofs

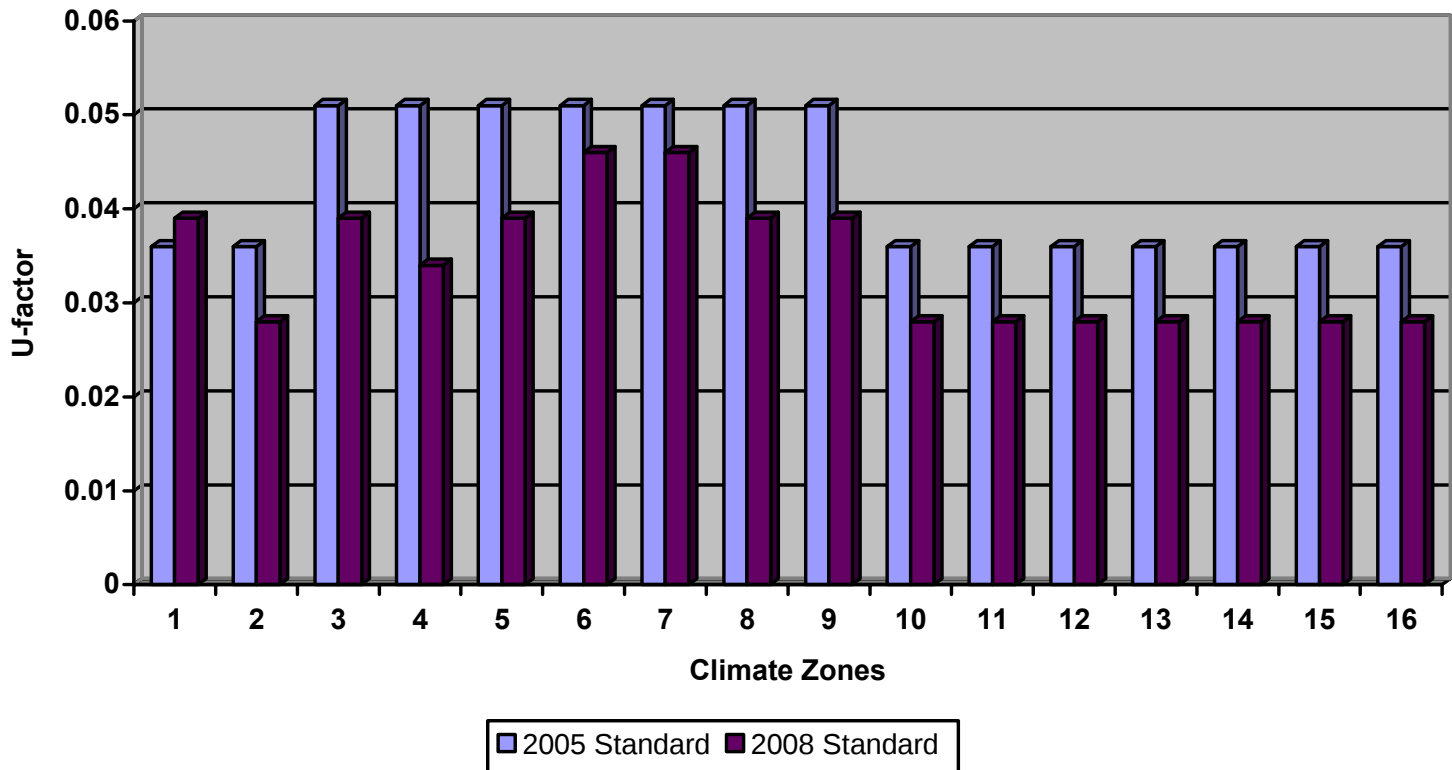


Figure 1 – Wood-framed and Other Roof (24-hour)
Statewide Energy Impacts (ft²-yr): TDV=5.802, kWh=0.168, therm=0.024

Wood-framed and other roofs

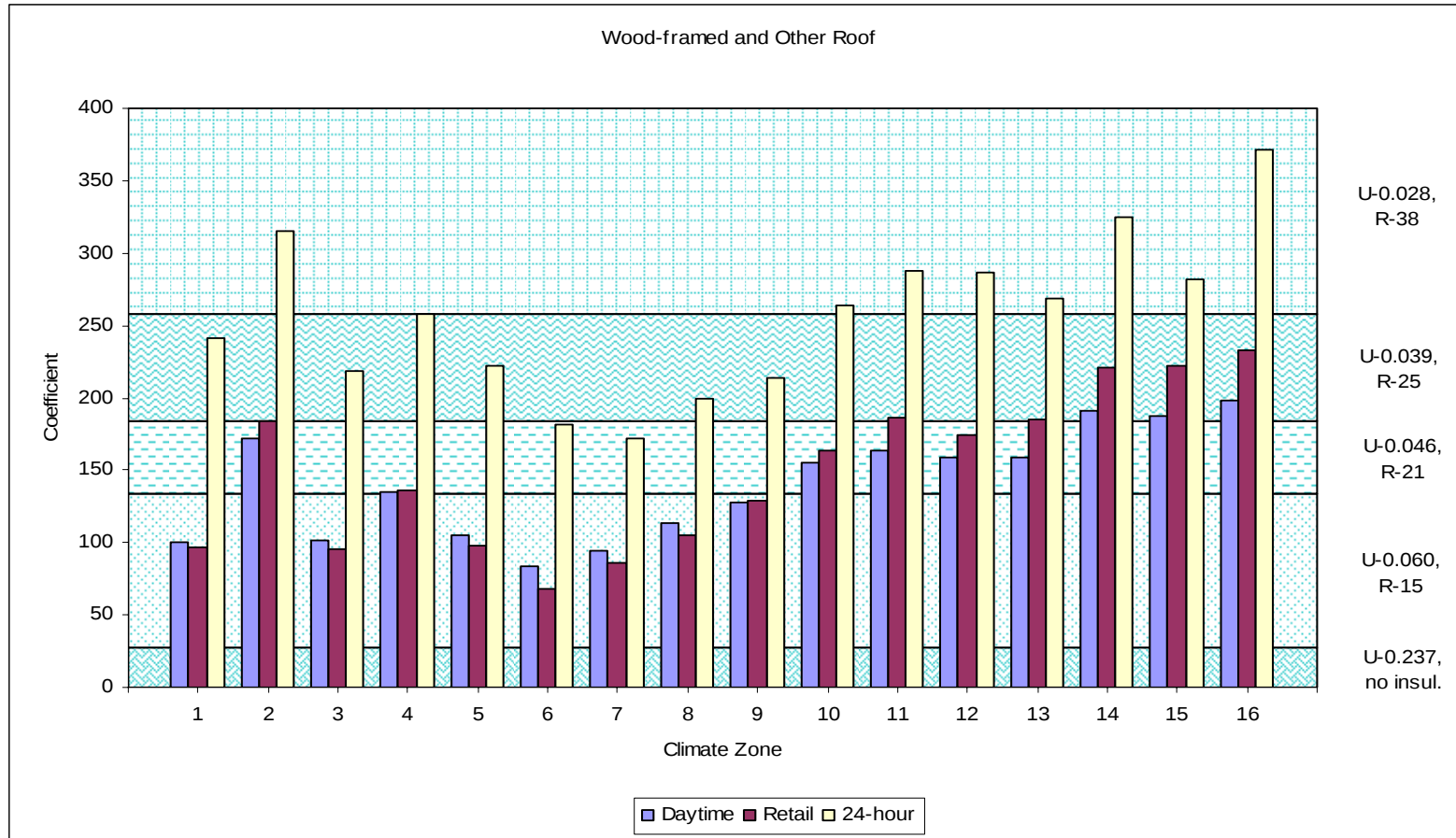


Figure 1 – Wood-framed and Other Roof Coefficients

Metal building wall

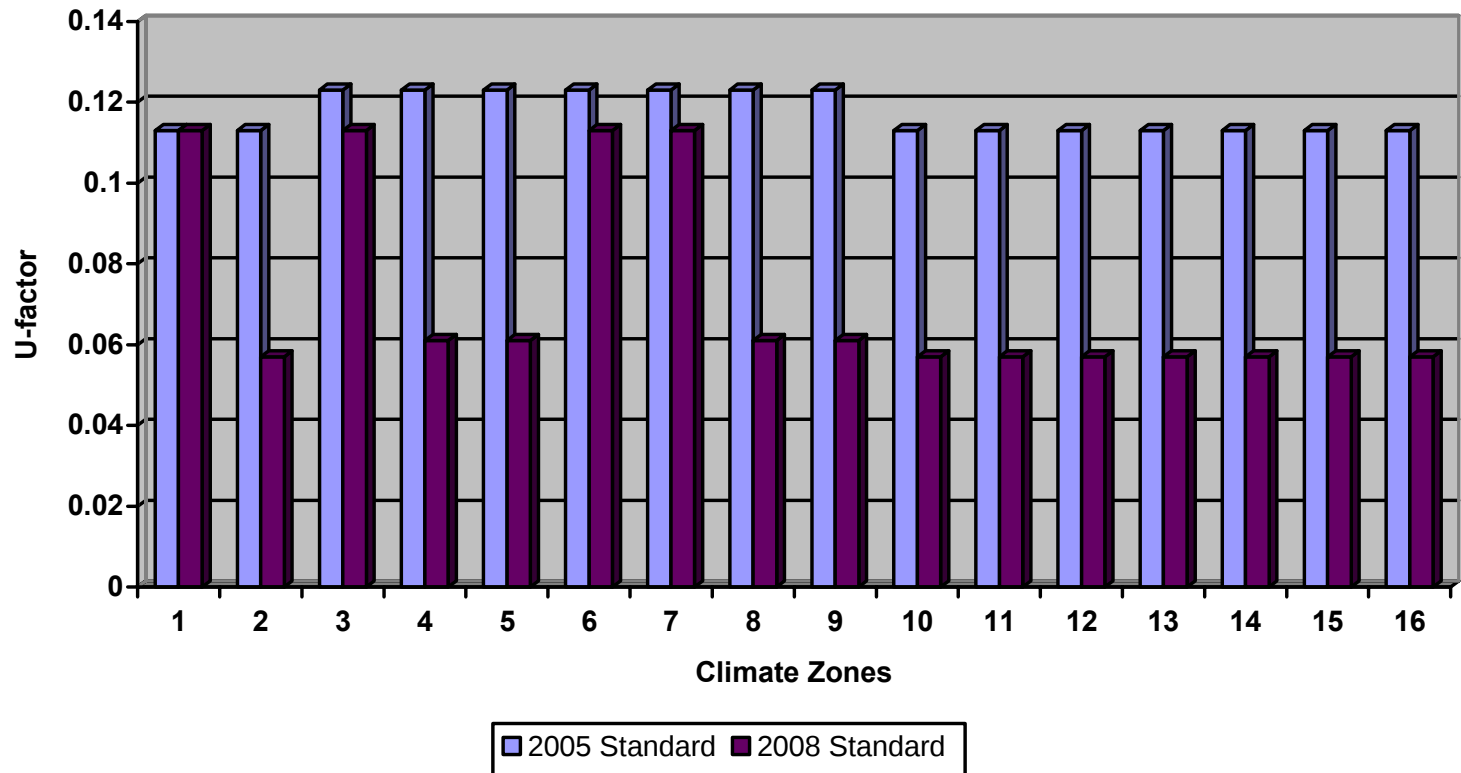


Figure 1 – Metal Building Wall (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=5.554, kWh=0.262, therm=0.013

Metal building wall

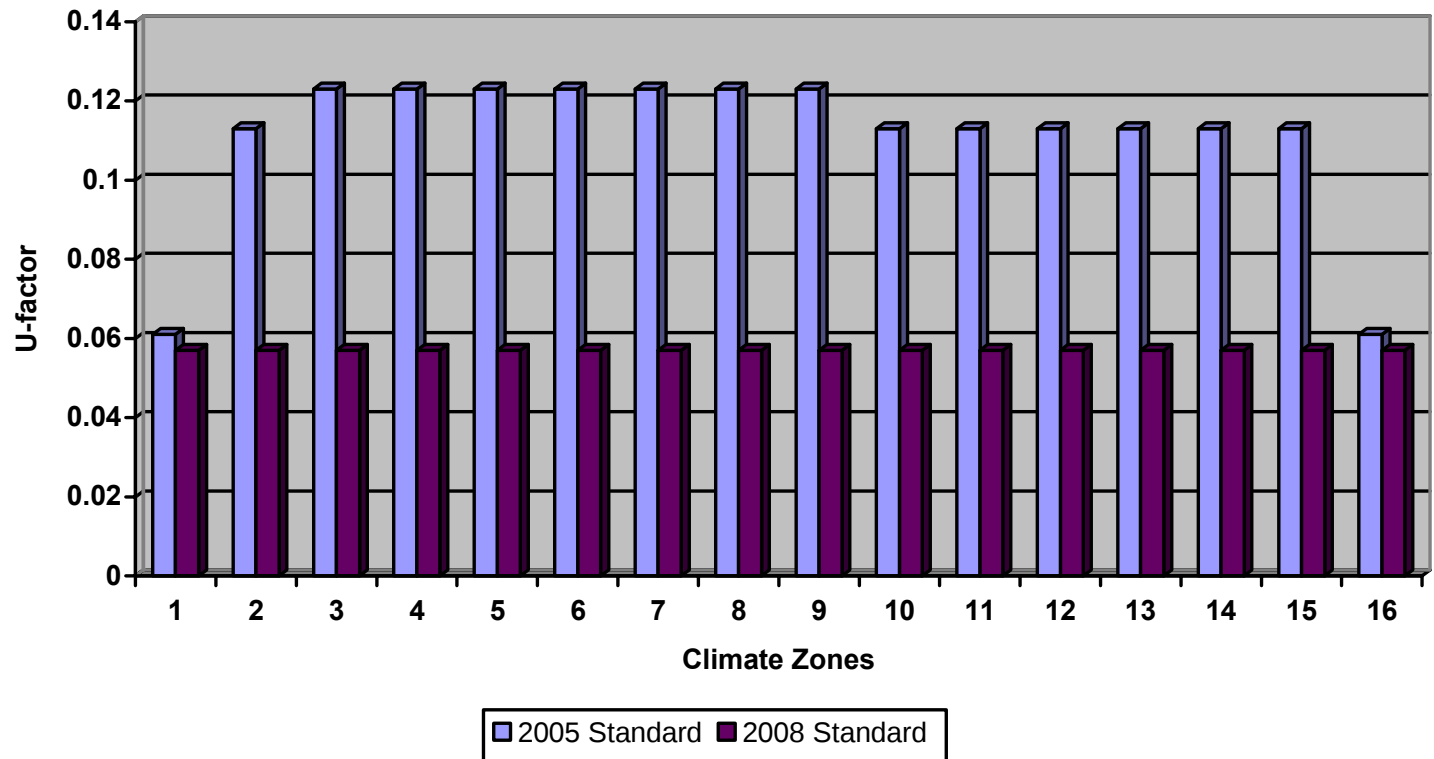


Figure 1 – Metal Building Wall (24-hour)
Statewide Energy Impacts (ft²-yr): TDV=11.138, kWh=0.586, therm=0.040

Metal-framed wall

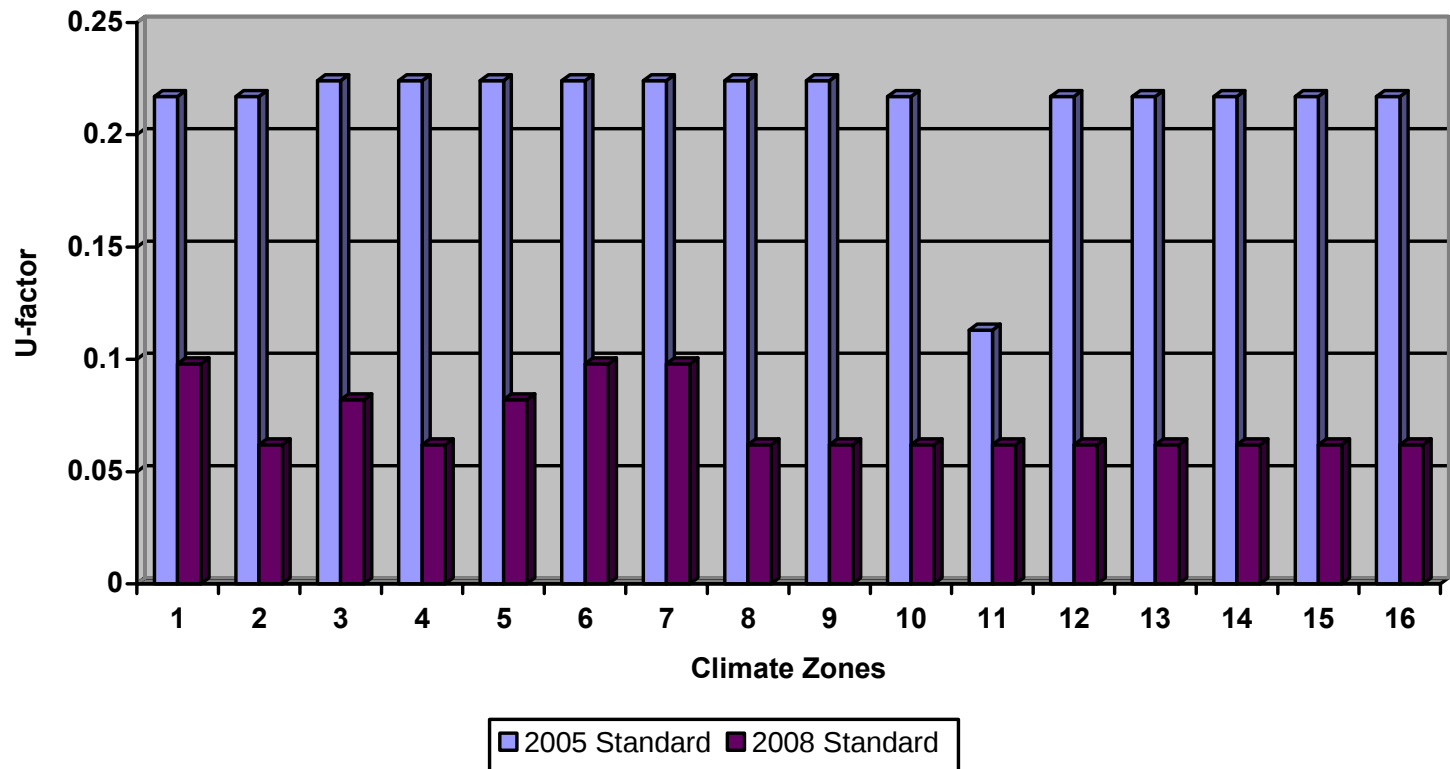


Figure 1 – Metal-framed Wall (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=17.505, kWh=0.821, therm=0.044

Metal-framed wall

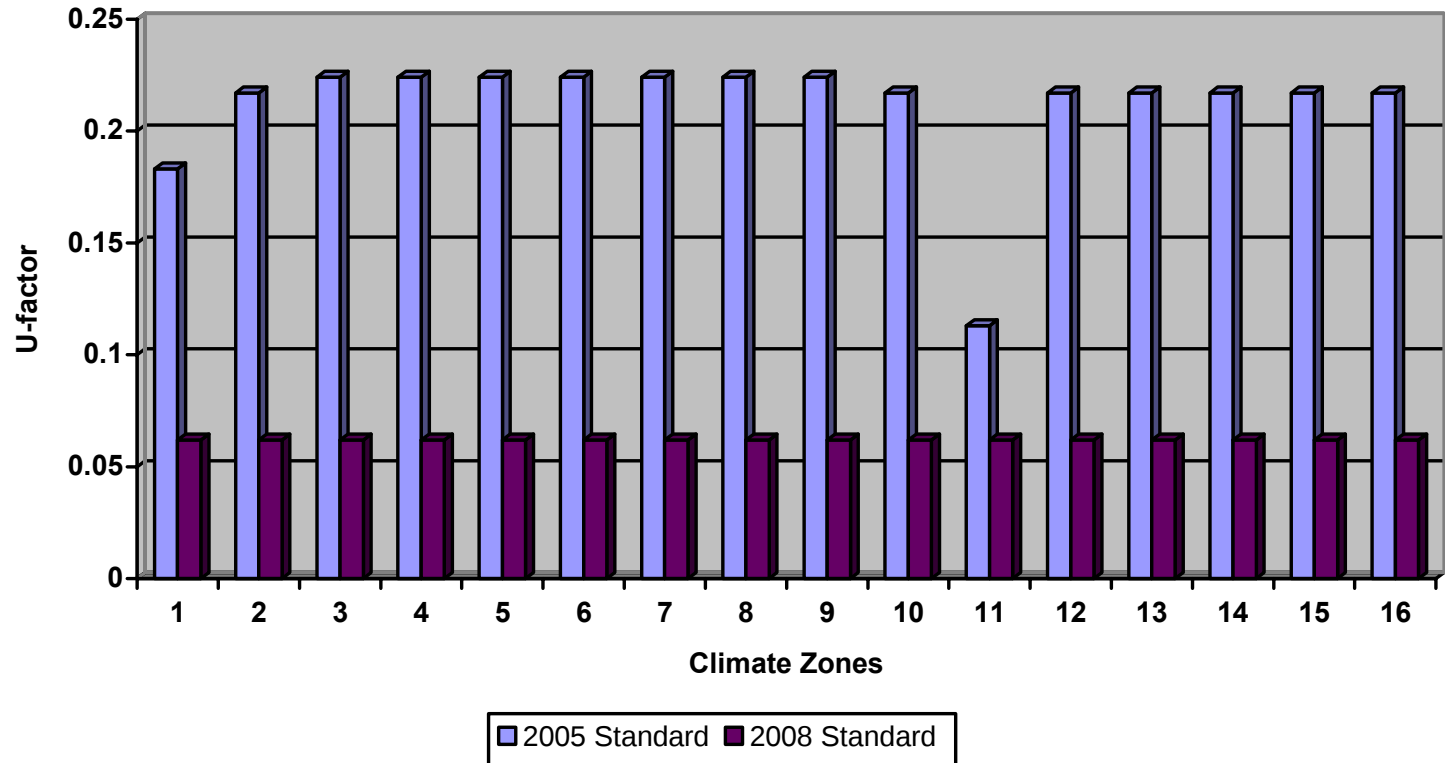


Figure 1 – Metal-framed Wall (24-hour)
Statewide Energy Impacts (ft²-yr): TDV=28.985, kWh=1.524, therm=0.103

Mass ($7.0 \leq HC < 15.0$) wall

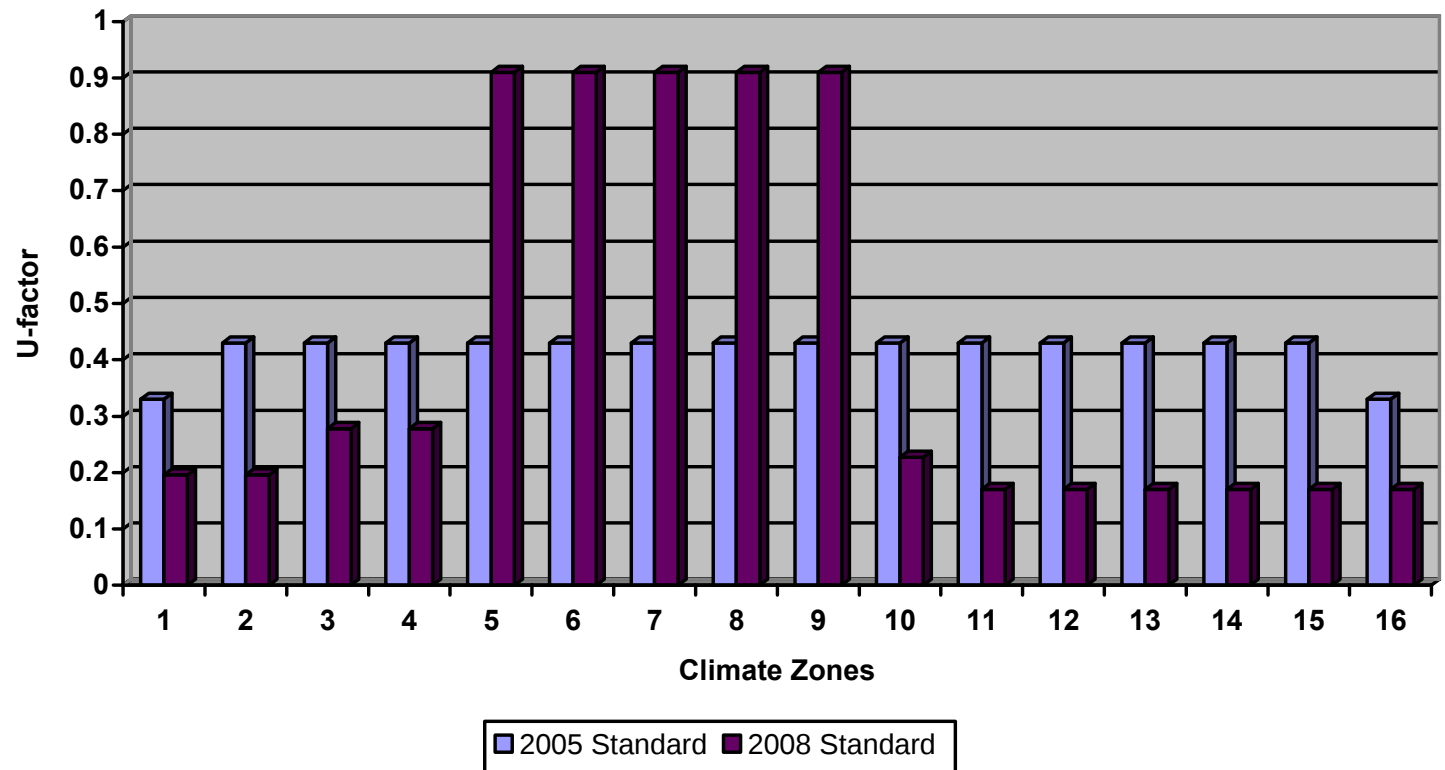


Figure 1 – Mass ($7.0 \leq HC < 15.0$) Wall (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=4.311, kWh=0.066, therm=0.016

Mass ($7.0 \leq HC < 15.0$) wall

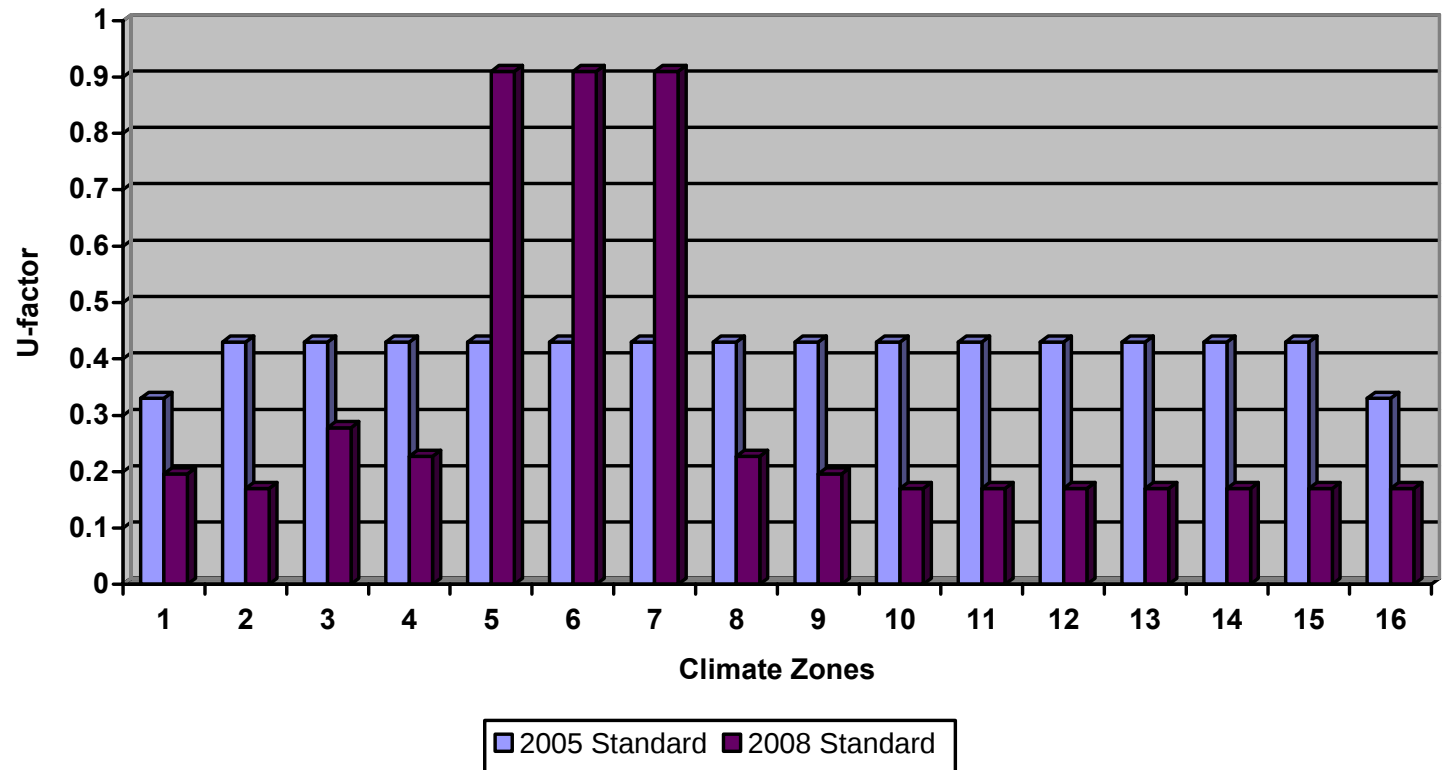


Figure 1 – Mass ($7.0 \leq HC < 15.0$) Wall (Retail)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=12.603, kWh=0.507, therm=0.040

Mass ($7.0 \leq HC < 15.0$) wall

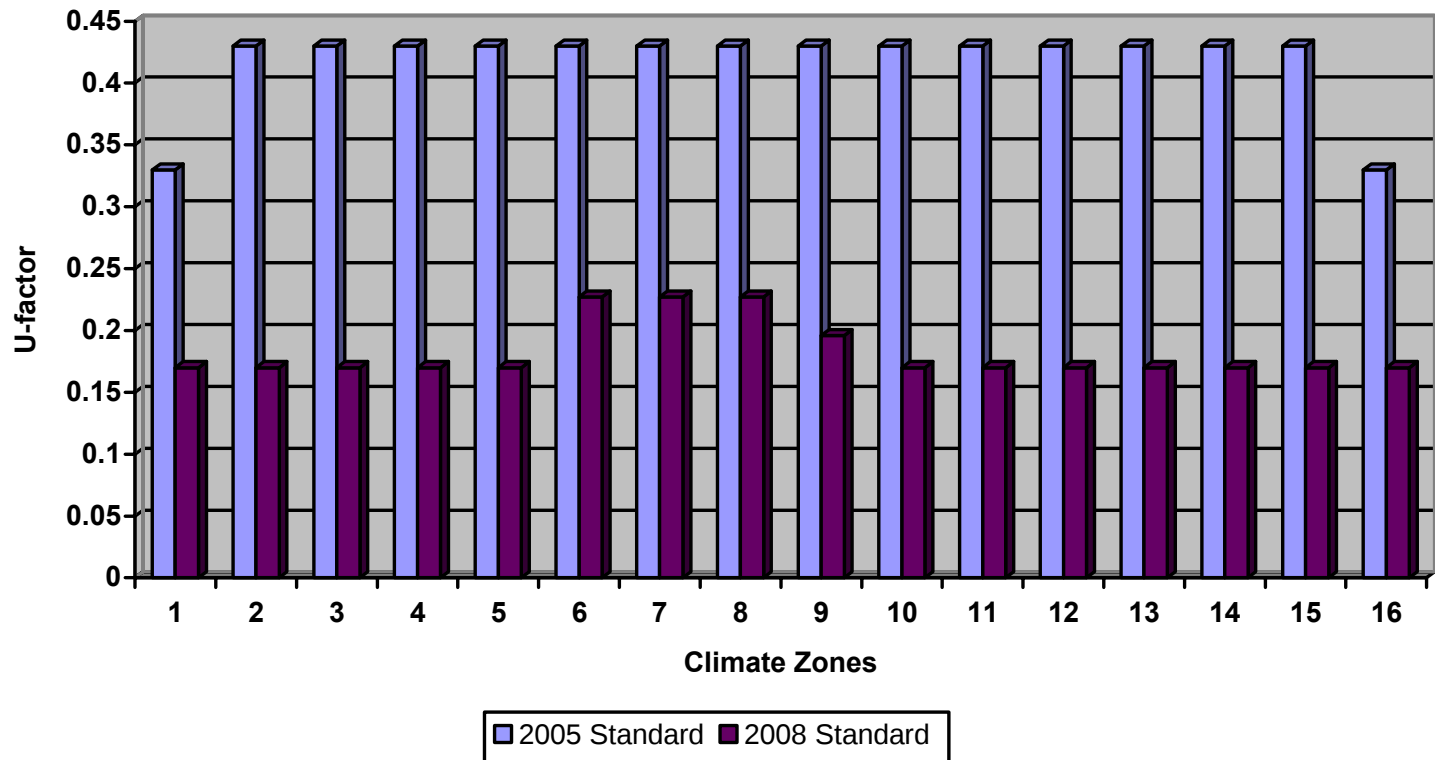


Figure 1 – Mass ($7.0 \leq HC < 15.0$) Wall (24-hour)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=23.344, kWh=0.500, therm=0.118

Mass ($15.0 \leq HC$) Wall

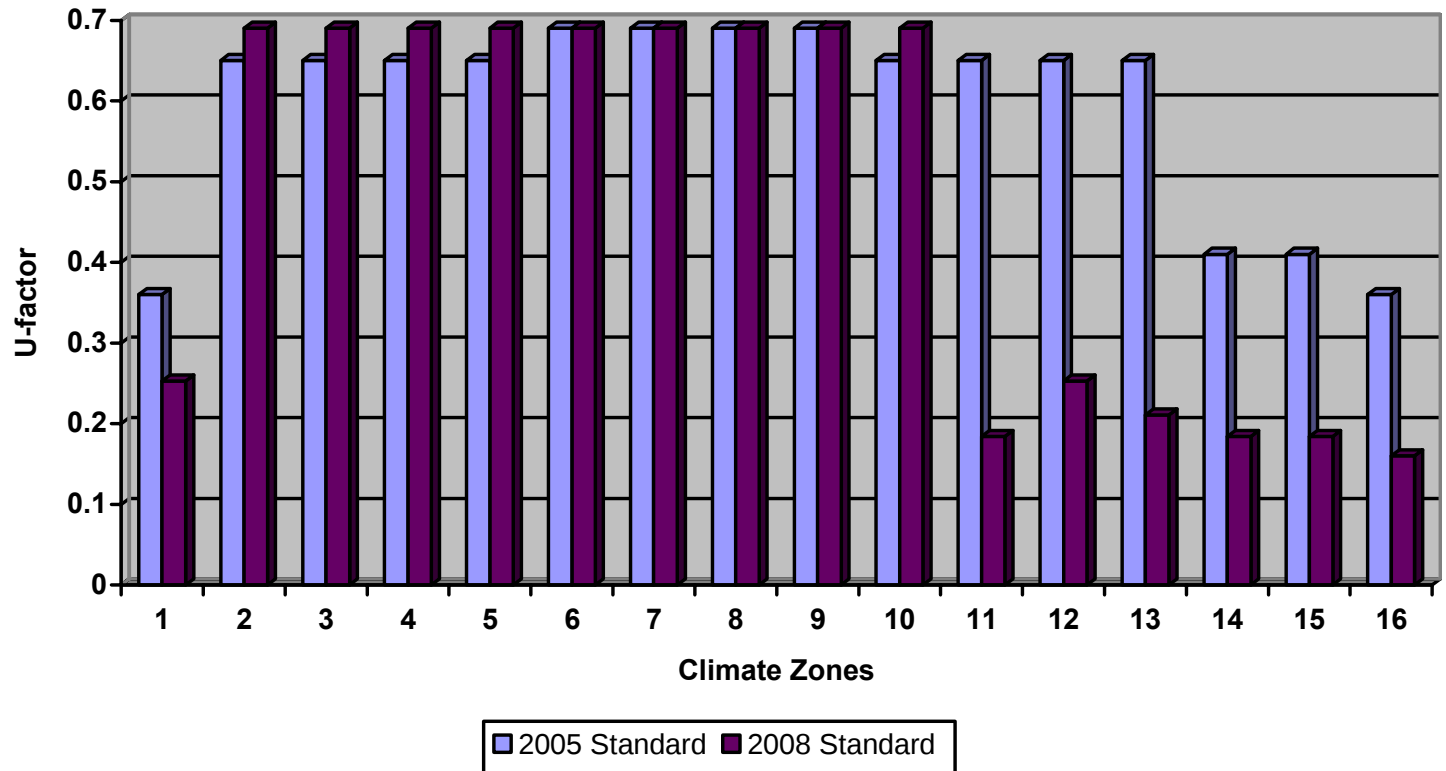


Figure 1 – Mass ($15.0 \leq HC$) Wall (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=5.286, kWh=0.062, therm=0.022

Mass ($15.0 \leq HC$) Wall

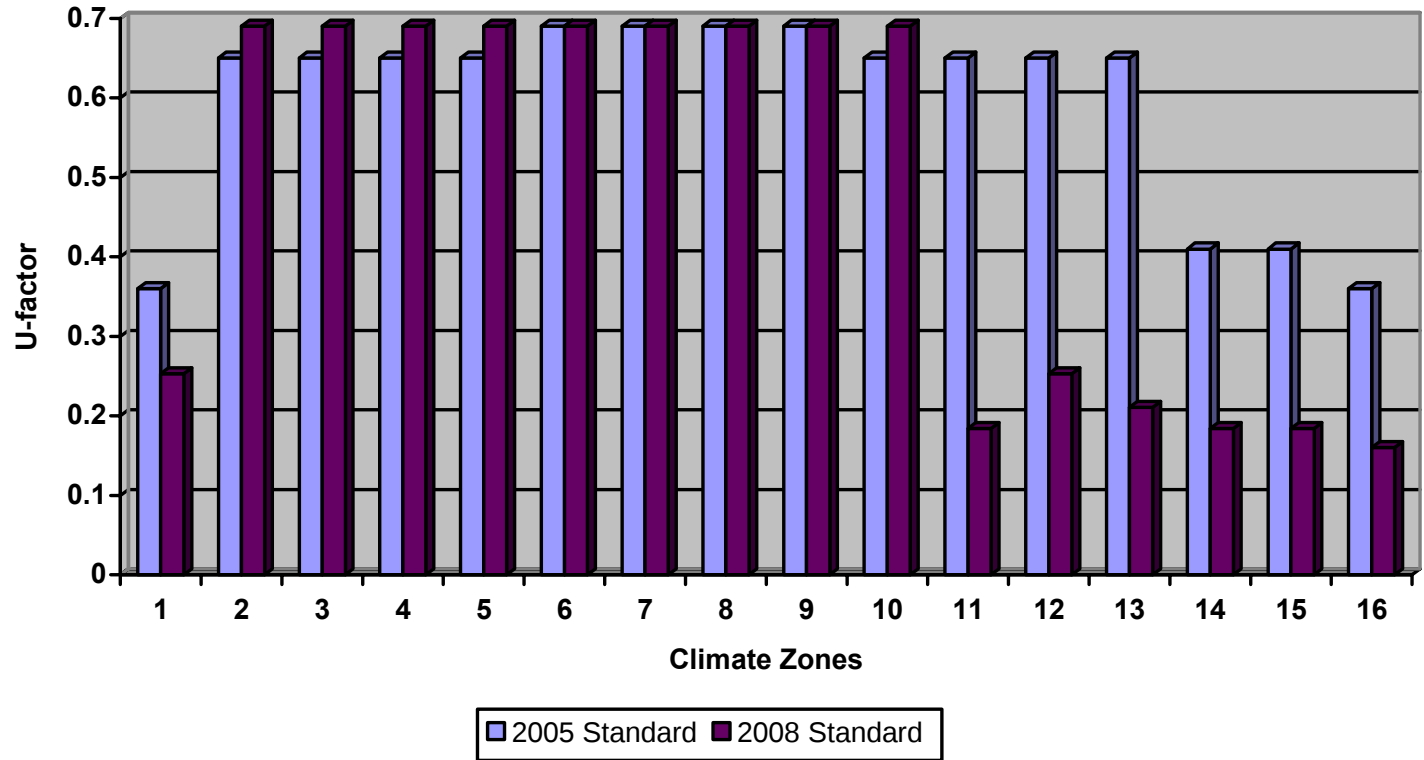


Figure 1 – Mass ($15.0 \leq HC$) Wall (Retail)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): $\text{TDV}=10.520$, $\text{kWh}=0.365$, $\text{therm}=0.038$

Mass ($15.0 \leq HC$) Wall

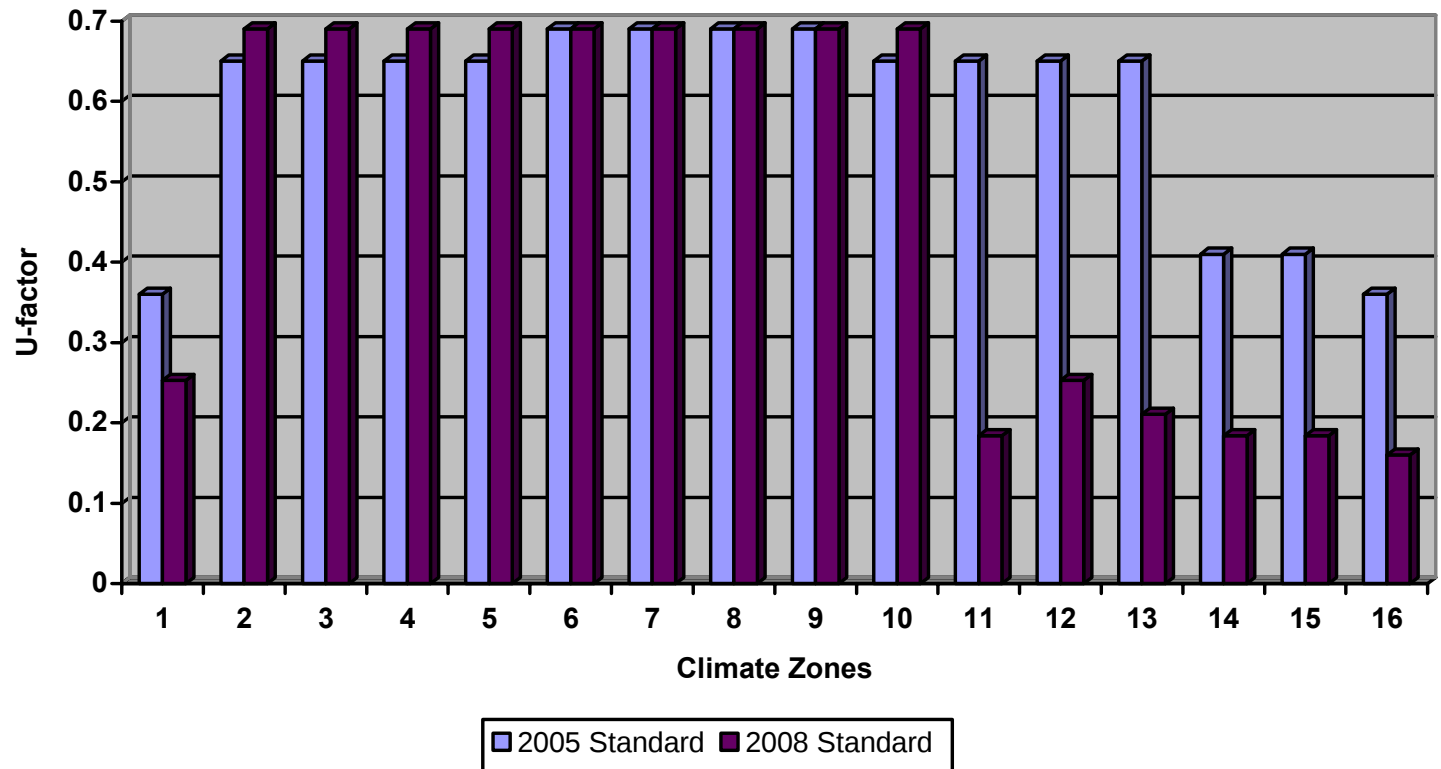


Figure 1 – Mass ($15.0 \leq HC$) Wall (24-hour)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=8.626, kWh=0.198, therm=0.038

Wood-framed and Other Wall

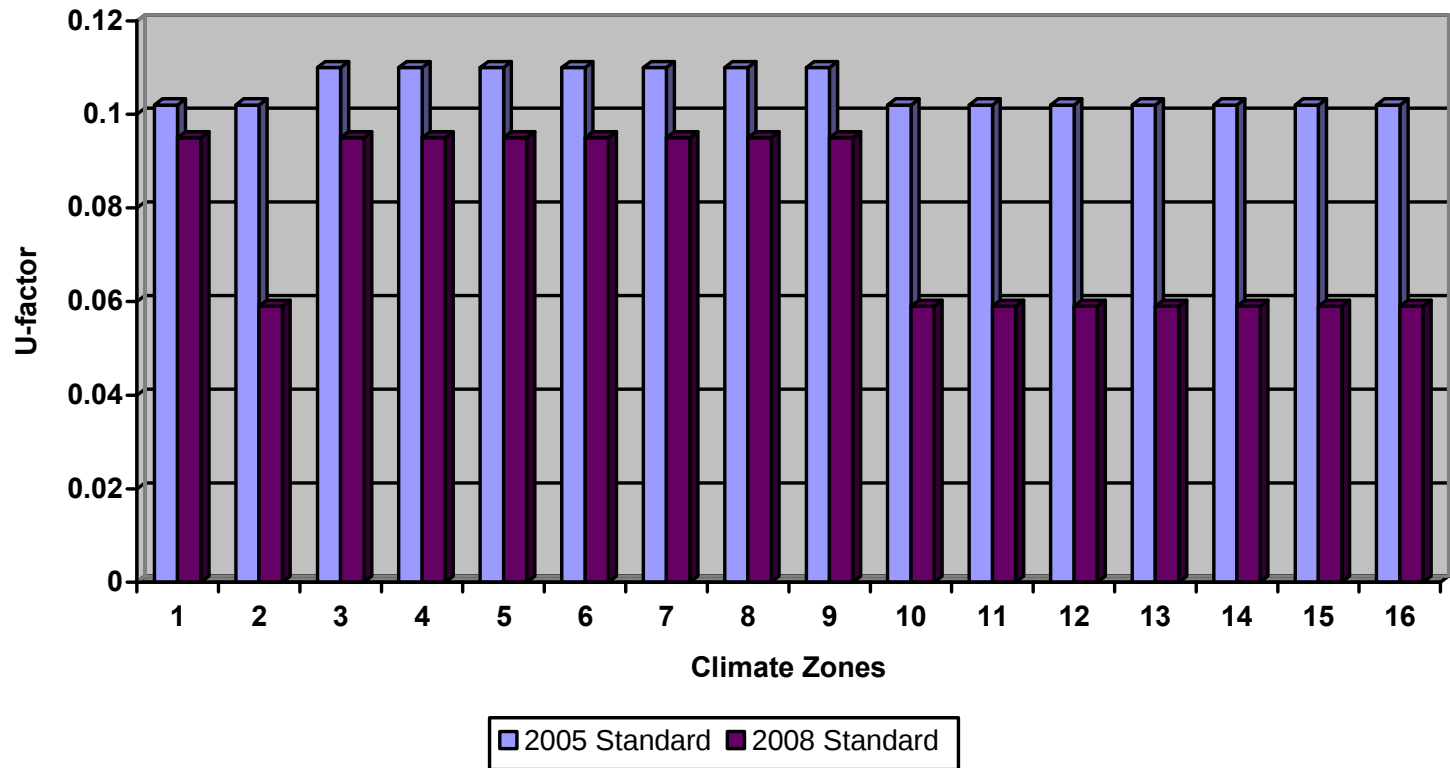


Figure 1 – Wood-framed and Other Wall (Daytime)
Statewide Energy Impacts (ft²-yr): TDV=3.428, kWh=0.159, therm=0.006

Wood-framed and Other Wall

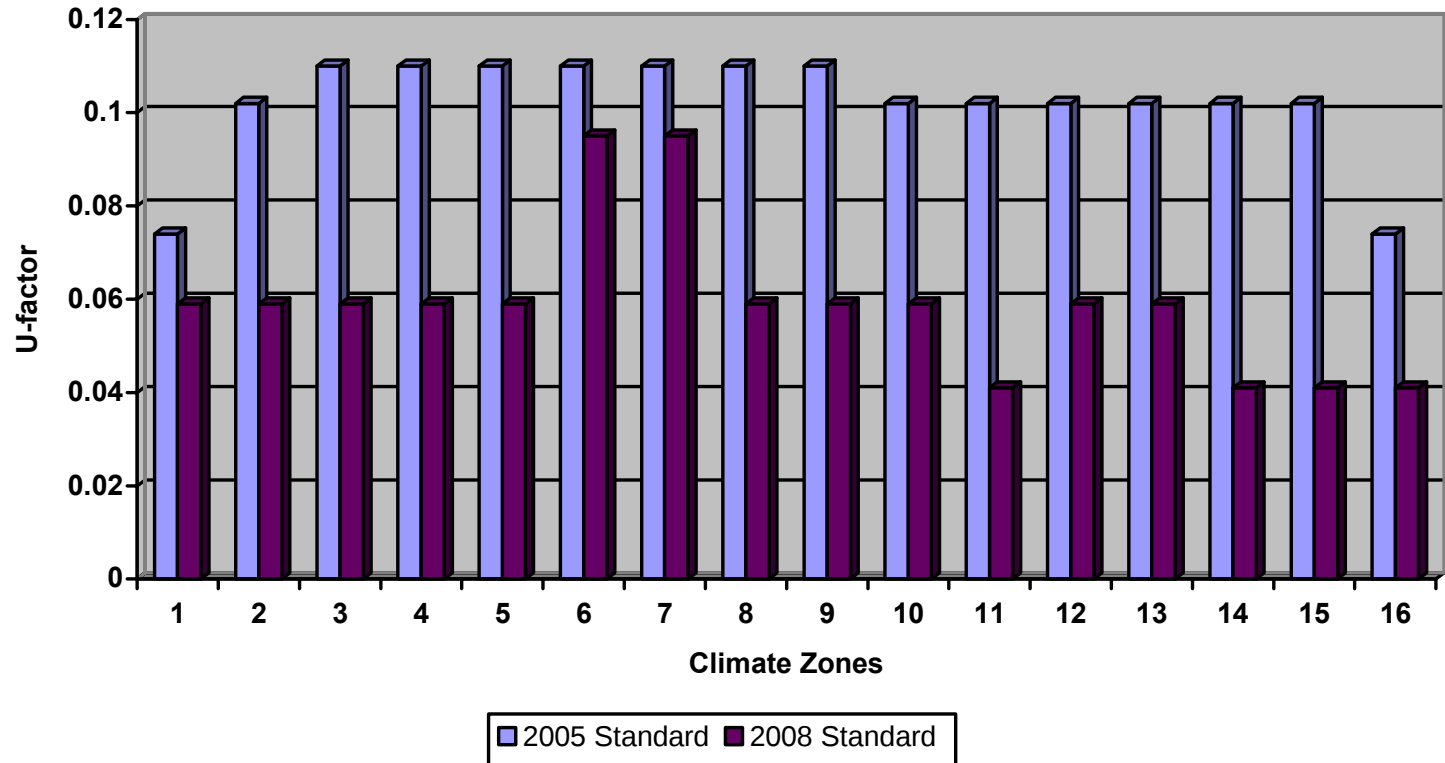


Figure 1 – Wood-framed and Other Wall (24-hour)
Statewide Energy Impacts (ft²-yr): TDV=7.644, kWh=0.394, therm=0.027

Mass Floor

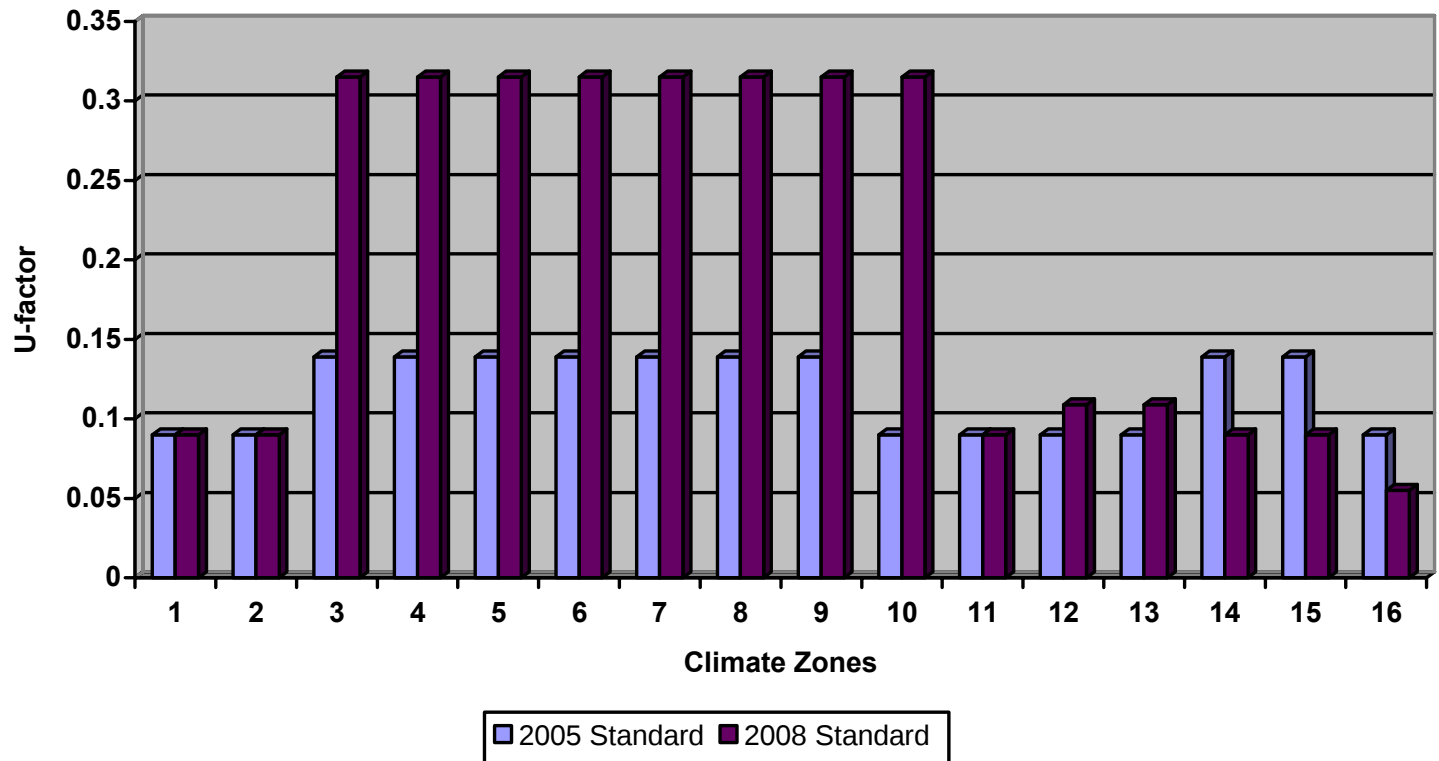


Figure 1 – Mass Floor (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=0.407, kWh=0.260, therm=-0.029

Mass Floor

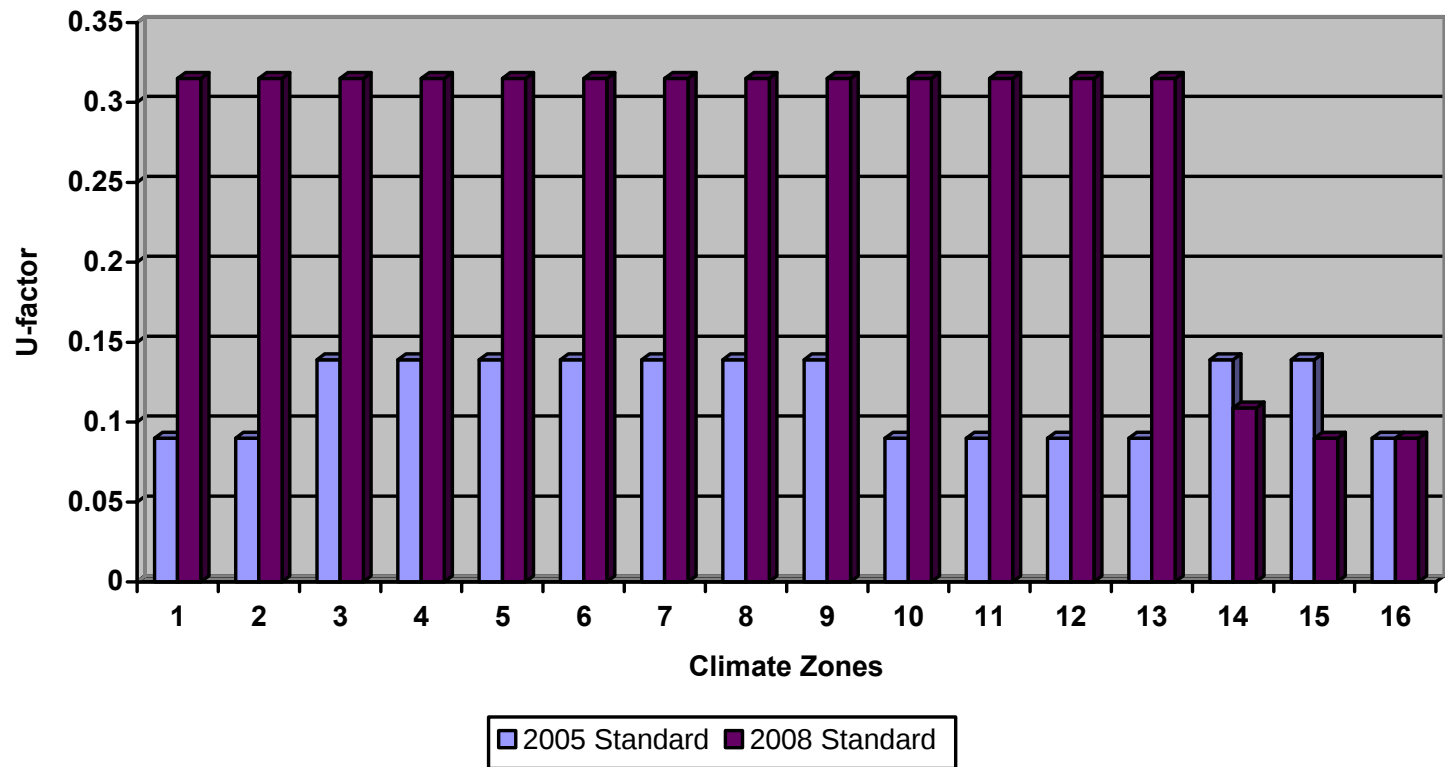


Figure 1 – Mass Floor (Retail)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=6.200, kWh=0.472, therm=-0.026

Mass Floor

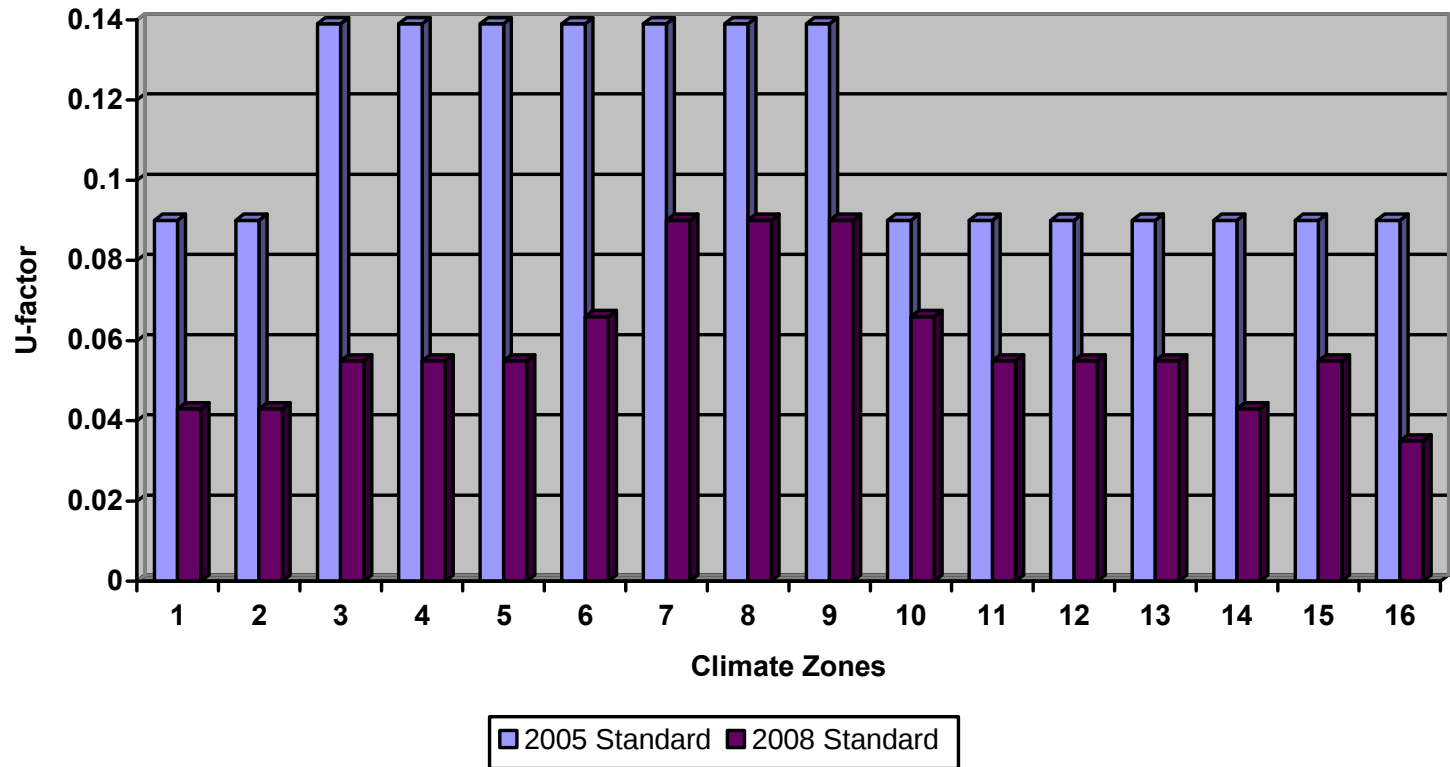


Figure 1 – Mass Floor (24-hour)
Statewide Energy Impacts (ft²-yr): TDV=7.655, kWh=-0.010, therm=0.050

Mass Floor

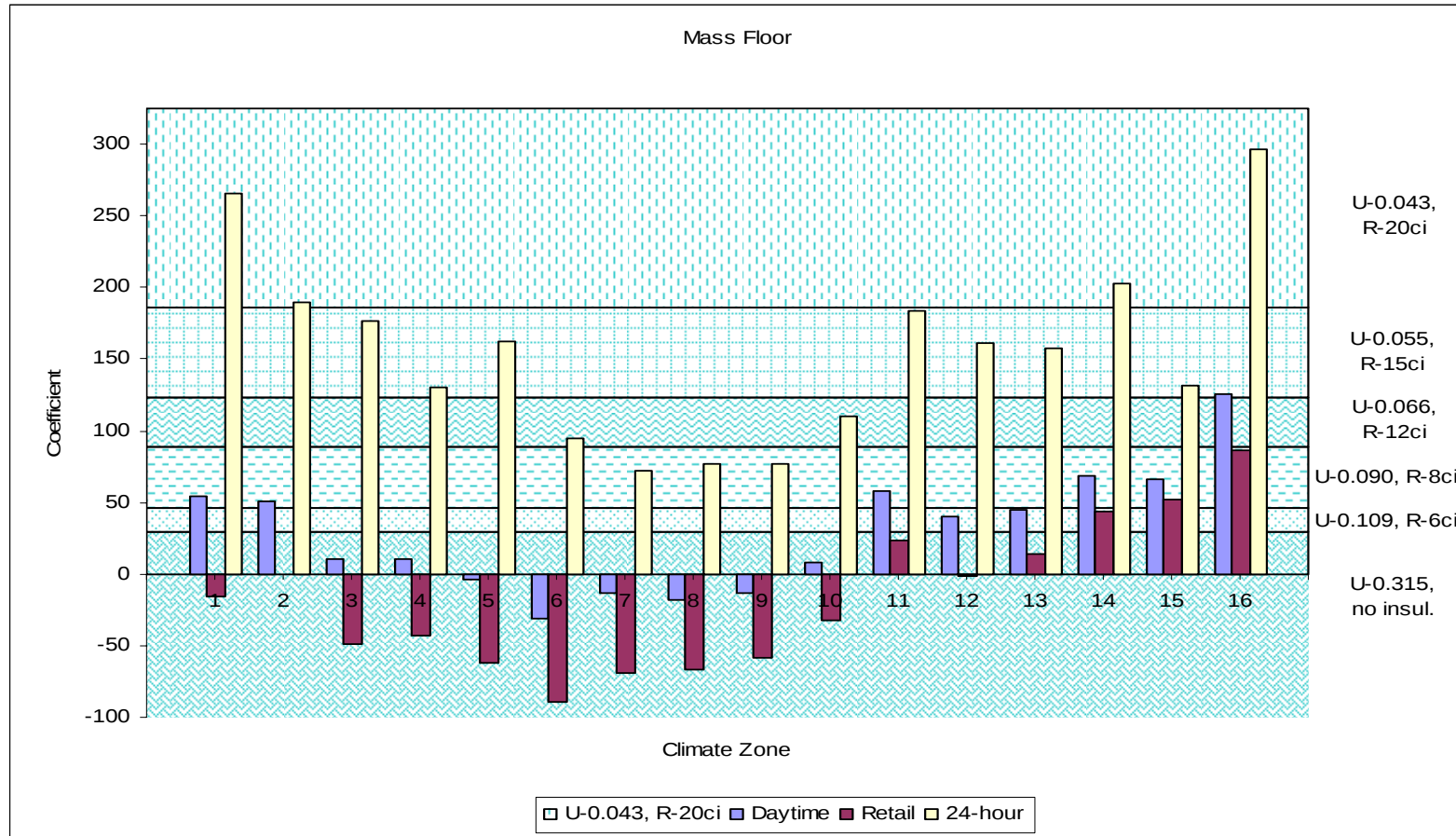


Figure 1 – Mass Floor Coefficients

Other Floor

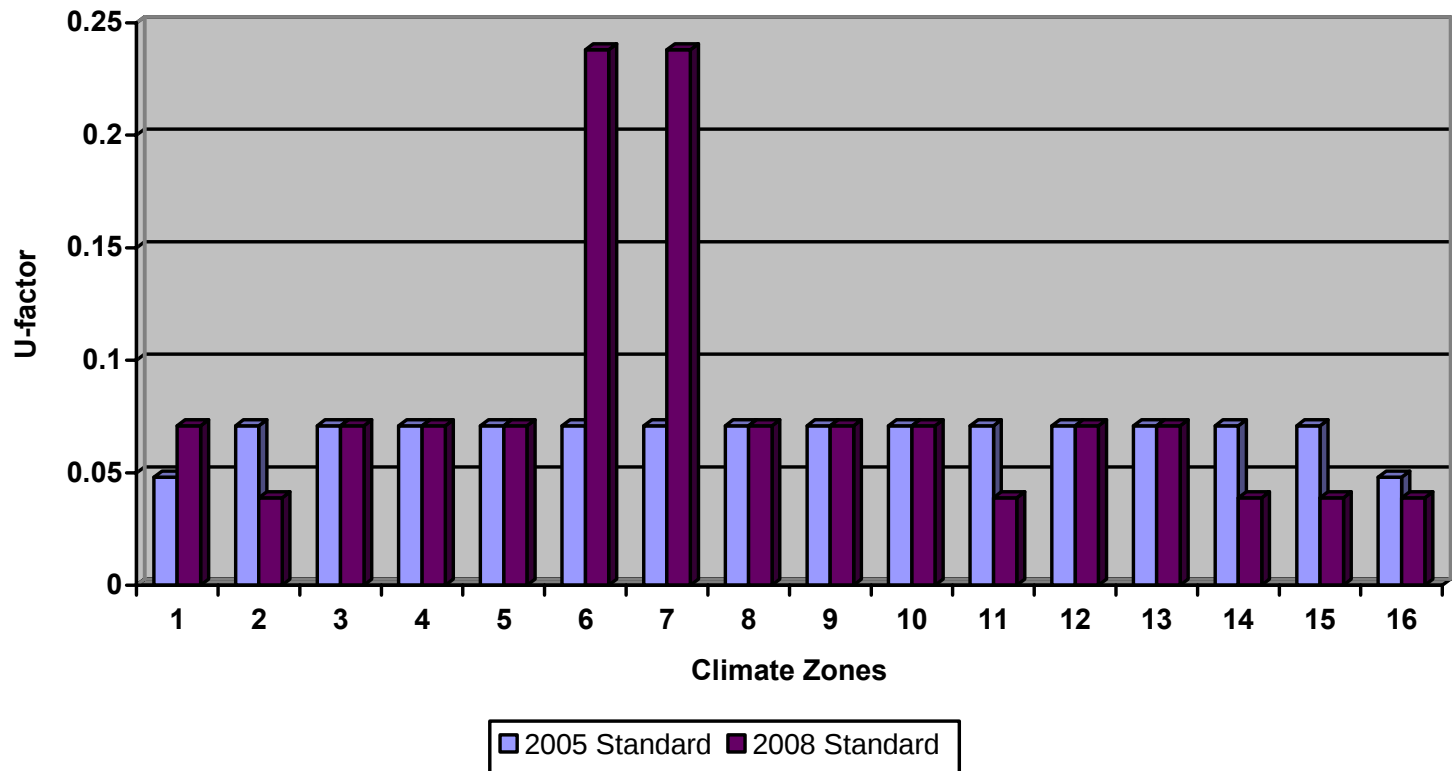


Figure 1 – Other Floor (Daytime)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=0.218, kWh=0.036, therm=-0.003

Other Floor

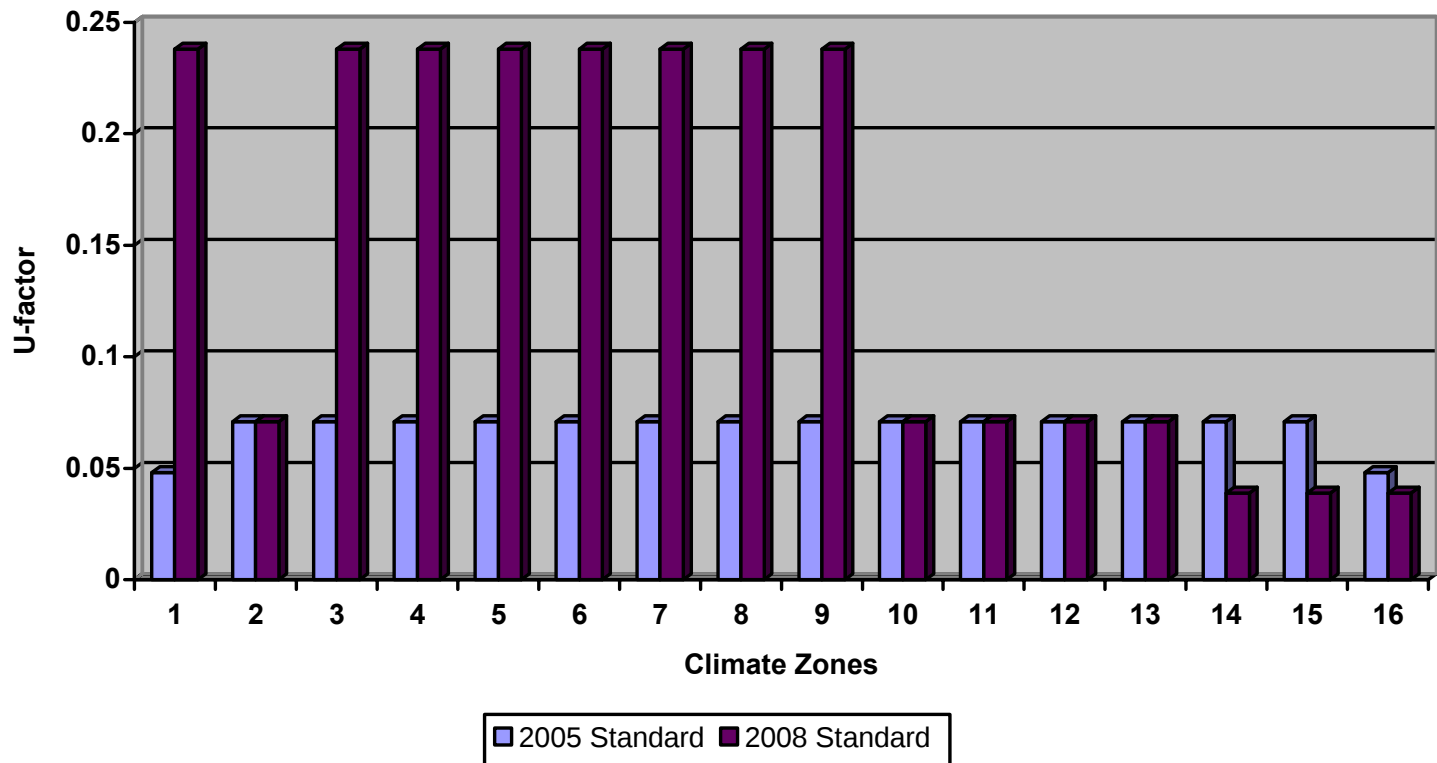


Figure 1 – Other Floor (Retail)
Statewide Energy Impacts ($\text{ft}^2\text{-yr}$): TDV=2.218, kWh=0.151, therm=-0.012

Other Floor

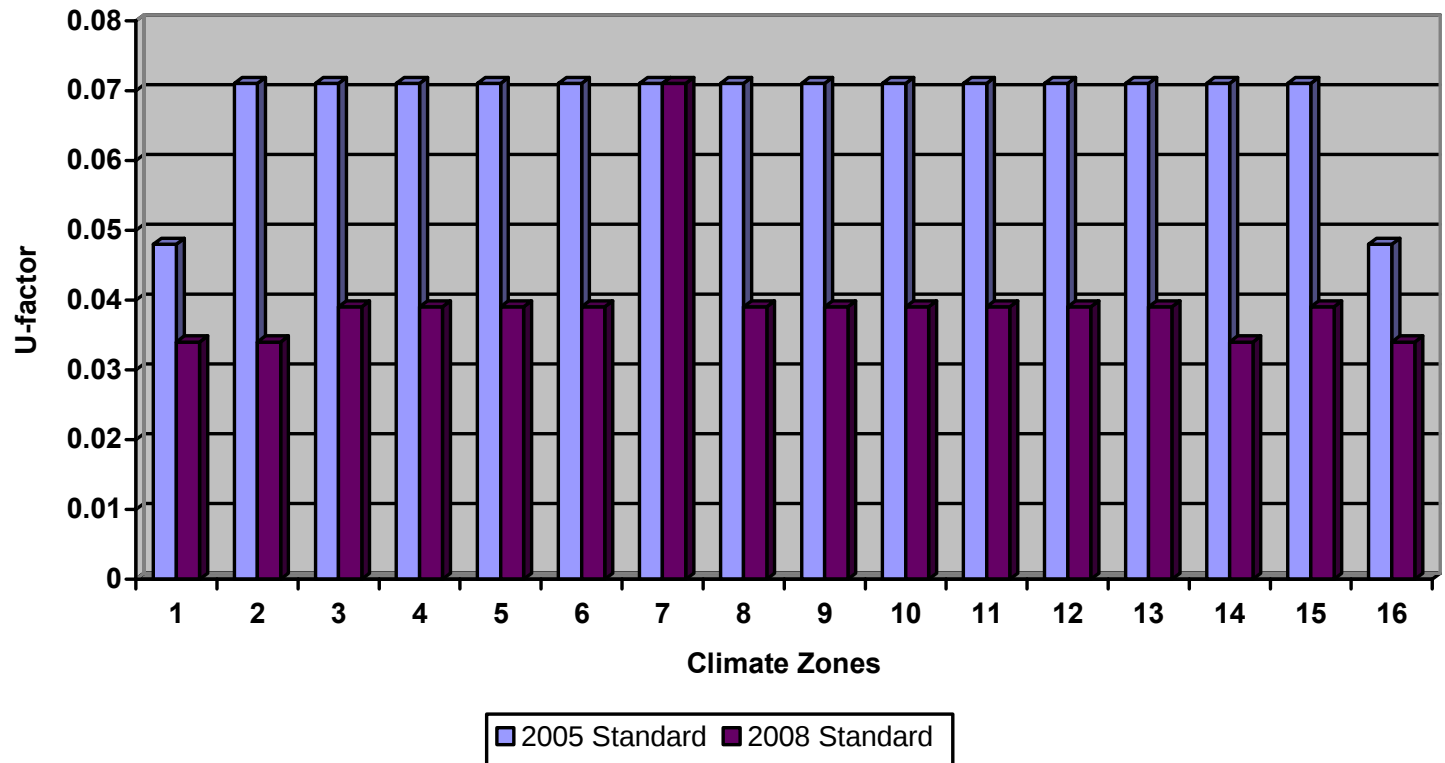


Figure 1 – Other Floor (24-hour)
Statewide Energy Impacts (ft^2 -yr): TDV=5.188, kWh=0.058, therm=0.029

Other Floor

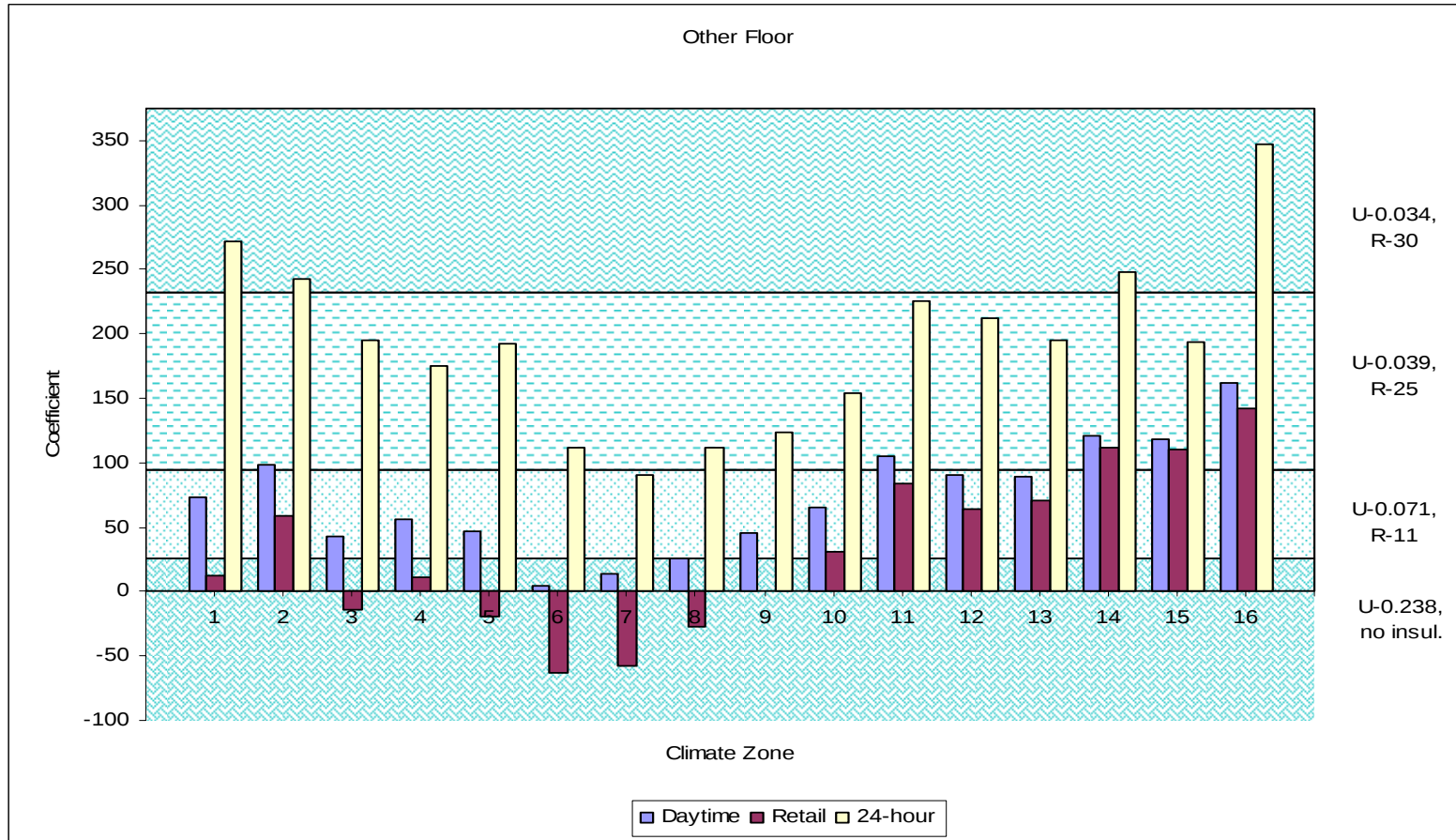


Figure 1 – Other Floor Coefficients

More Information

- Insulation CASE Report at <http://energy.ca.gov/title24/2008standards/documents/index.html#051806>
- Life-cycle cost results at http://www.archenergy.com/downloads/pub/sf/lcc_envelope_results.xls
- TDV curves at <http://www.ethree.com/TDV2008.html>



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- Proposal development, Architectural Energy Corp
 - Charlie Yu cyu@archenergy.com



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