

## Early Collaboration Between Engineers and Architects

“Ways of working effectively, together, to create  
successful energy-efficient designs”

*presented to*

**SimBuild 2008**

*by*

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*and*

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*July 30, 2008 through August 1, 2008*

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## Summary

- ✓ Oregon Energy Code Compliance – 3 methods
  - u Prescriptive
  - u Simplified Trade-off Approach (STA) – CodeComp
  - u Whole Building Approach
- ✓ Envelope analysis
- ✓ Efficiency vs. costs
- ✓ Overall building efficiency

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## Different ways of looking at the world

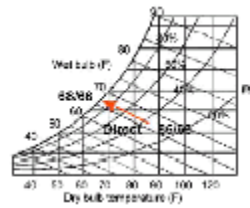
Physical world (visual images)



Numbers (quantitative)

Energy = Mass  $\times$  (speed of light in vacuum)<sup>2</sup>

$$\frac{1}{2} V^2 = P + \rho g Z + Const$$



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## Simplified Trade-off Approach with CodeComp

Balancing the envelope components for an efficient,  
code-compliant building



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## Glass, Glass, and More Glass...

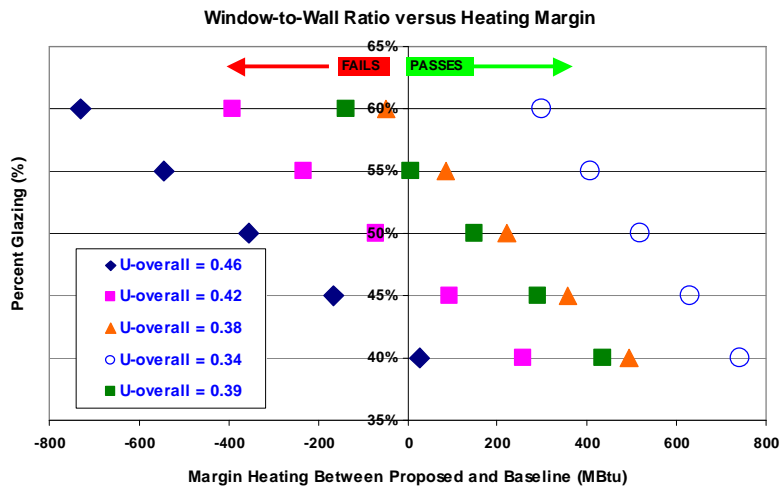


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## How window to wall ratio affects the design



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## More window to wall ratio problems

North & East Window Shading Coefficient	North & East Window Shading Coefficient																							
	0.33	0.36	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75														
0.55	-81	-82	FAIL	-179	118	FAIL	-80	95	FAIL	-205	107	FAIL	-243	57	FAIL	-291	95	FAIL	-339	288	FAIL	-387	328	FAIL
0.50	-36	-42	FAIL	-72	75	FAIL	-110	112	FAIL	-147	147	FAIL	-184	181	FAIL	-221	215	FAIL	-258	249	FAIL	-295	285	FAIL
0.45	10	1	PASS	-17	38	FAIL	-53	75	FAIL	-88	107	FAIL	-125	141	FAIL	-161	174	FAIL	-197	209	FAIL	-233	241	FAIL
0.40	14	-25	FAIL	28	-1	FAIL	4	32	PASS	-21	57	FAIL	-65	103	FAIL	-101	135	FAIL	-137	169	FAIL	-173	203	FAIL
0.35	174	75	FAIL	92	41	FAIL	81	7	FAIL	27	77	PASS	7	61	FAIL	41	35	FAIL	75	129	FAIL	109	163	FAIL
0.30	184	-195	FAIL	161	-81	FAIL	118	-47	FAIL	65	-19	FAIL	52	23	PASS	18	55	PASS	-34	89	FAIL	-47	129	FAIL

North & West Window Shading Coefficient	North & West Window Shading Coefficient																							
	0.33	0.36	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75														
0.55	52	2	PASS	25	62	PASS	-17	16	FAIL	-45	128	FAIL	-82	164	FAIL	-119	199	FAIL	-156	237	FAIL	-192	292	FAIL
0.50	57	-18	FAIL	82	24	PASS	29	10	PASS	-2	62	FAIL	-39	120	FAIL	-75	165	FAIL	-112	194	FAIL	-148	228	FAIL
0.45	63	-46	FAIL	89	-14	FAIL	75	20	PASS	34	64	PASS	2	85	PASS	-32	122	FAIL	-68	150	FAIL	-104	198	FAIL
0.40	171	-85	FAIL	145	-52	FAIL	111	-18	FAIL	77	18	PASS	43	80	PASS	6	84	PASS	-25	110	FAIL	-59	152	FAIL
0.35	221	-134	FAIL	186	-88	FAIL	152	-58	FAIL	116	-32	FAIL	84	12	PASS	58	46	PASS	16	82	PASS	-16	114	FAIL
0.30	261	-195	FAIL	227	-128	FAIL	193	-94	FAIL	120	-68	FAIL	125	-29	FAIL	91	8	PASS	-27	47	PASS	-23	70	PASS

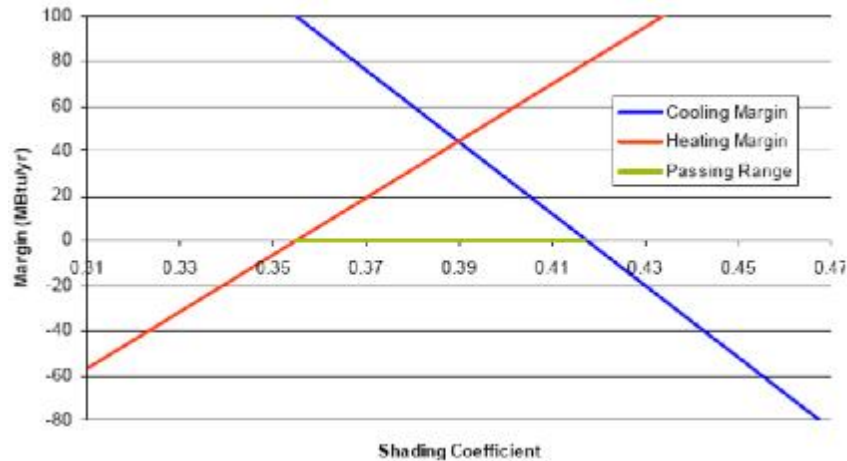
North & West Window Shading Coefficient	North & West Window Shading Coefficient																							
	0.33	0.36	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75														
0.65	94	-32	FAIL	57	46	PASS	29	133	PASS	-5	217	FAIL	-42	307	FAIL	-74	384	FAIL	-106	461	FAIL	-137	537	FAIL
0.60	122	-62	FAIL	66	12	PASS	65	65	PASS	21	165	PASS	-3	224	FAIL	-37	308	FAIL	-71	382	FAIL	-102	459	FAIL
0.55	173	-84	FAIL	84	-25	FAIL	100	20	PASS	68	102	PASS	34	162	PASS	6	223	PASS	-34	290	FAIL	-68	359	FAIL
0.50	207	-130	FAIL	122	-62	FAIL	136	8	FAIL	100	45	PASS	71	100	PASS	37	154	PASS	3	202	PASS	-31	292	FAIL
0.45	244	-164	FAIL	161	-94	FAIL	173	-25	FAIL	142	-11	FAIL	128	22	PASS	74	77	PASS	42	121	PASS	6	192	PASS
0.40	281	-175	FAIL	247	-158	FAIL	213	-100	FAIL	179	-68	FAIL	145	-34	FAIL	111	8	PASS	73	30	PASS	42	-88	PASS

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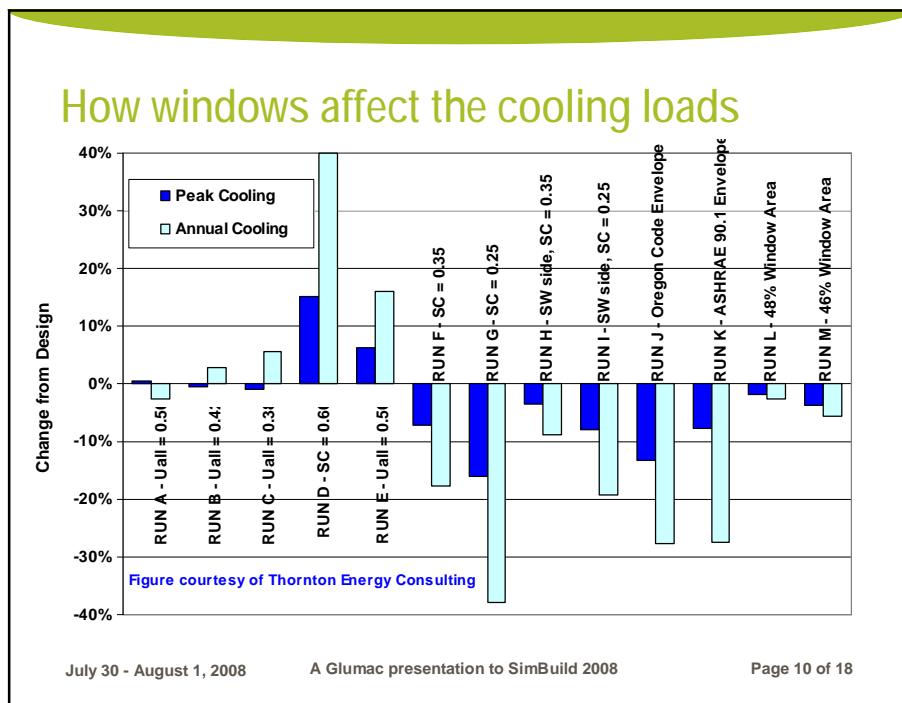
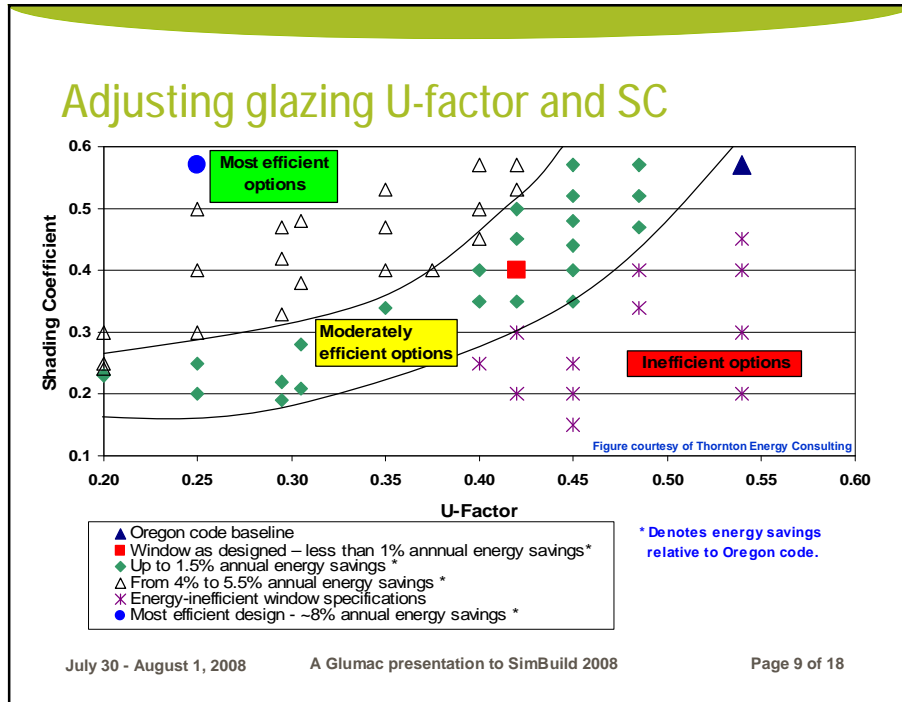
## Adjusting the glazing shading coefficient

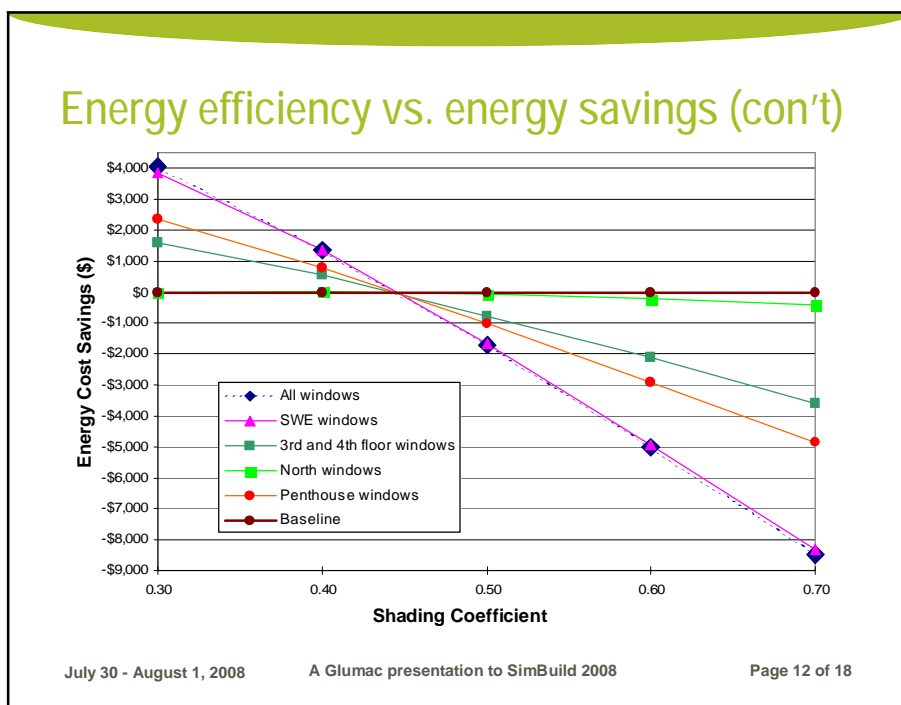
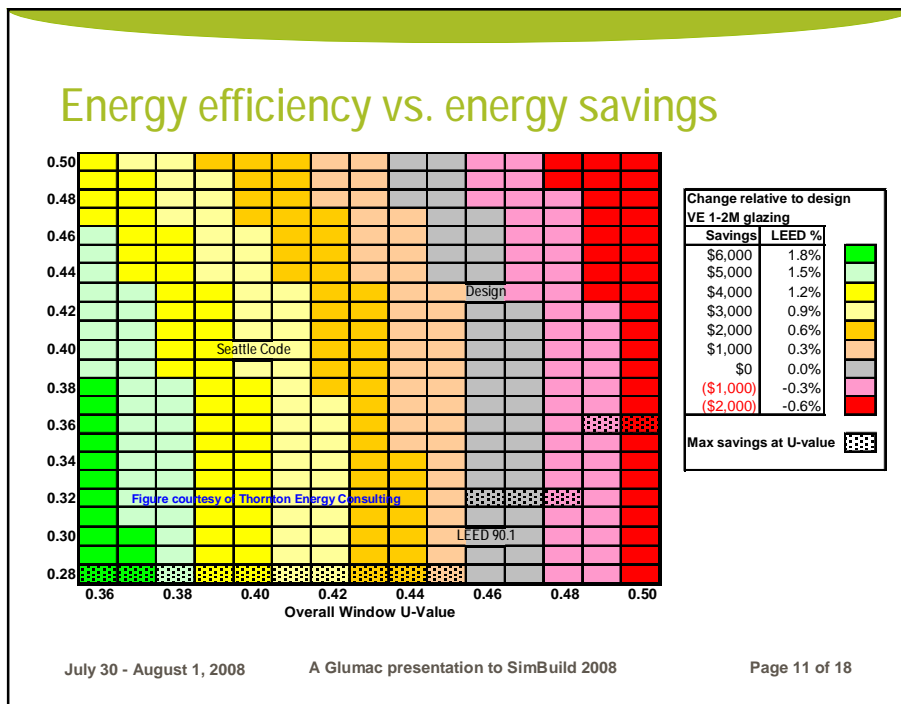


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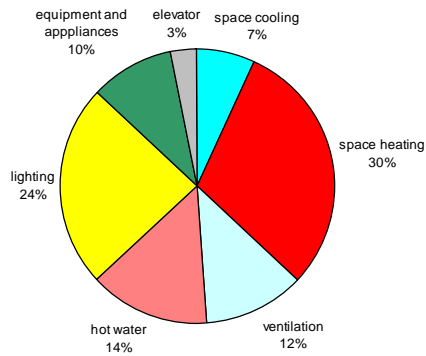
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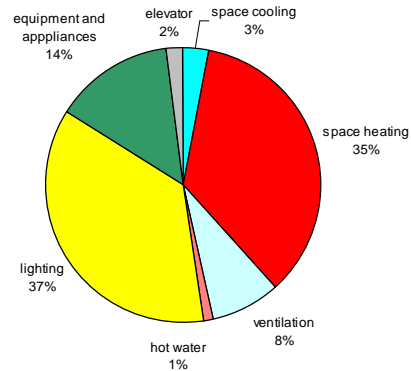


## Identifying energy efficiency measures (EEMs)

Energy End Uses for a Typical High Rise Apartment



Energy End Uses for a Typical Office Building



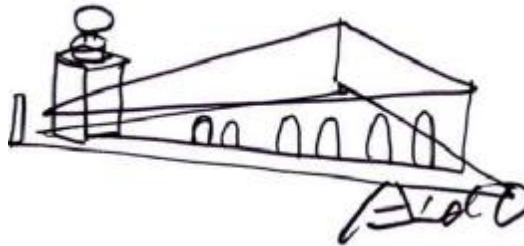
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## Solution: Start compliance work early!

Preliminary CodeComp models are easy to create and provide direction for the building's compliance



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## Energy Efficient Building – From the Start

A building cannot meet the 2030 challenge  
without an integrated design



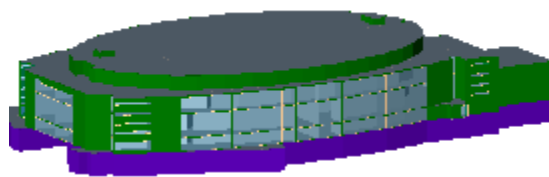
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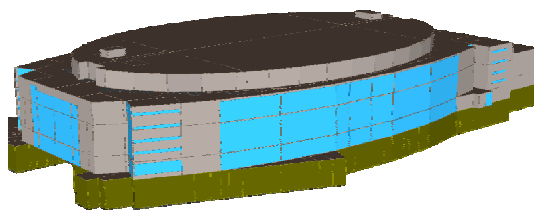
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## Making early collaboration easier

From Revit...



...to eQUEST



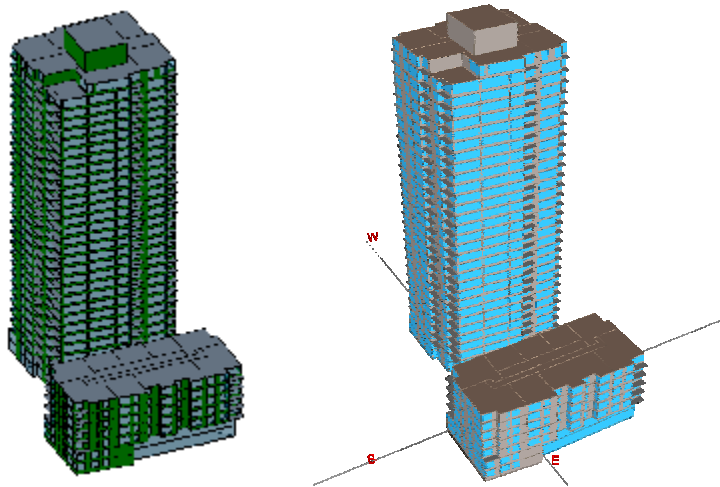
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## More Revit to eQUEST



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## By Collaborating with Engineers Early...

- ✓ Avoid costly redesign and change orders
- ✓ Make code compliance easy (and fun?)
- ✓ Optimize and design an energy efficient envelope, not just building systems
- ✓ Obtain that higher window-wall ratio you always wanted
- ✓ Track all energy efficiency measures from the start
- ✓ Makes it easier to get all 10 LEED EAc1 points

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