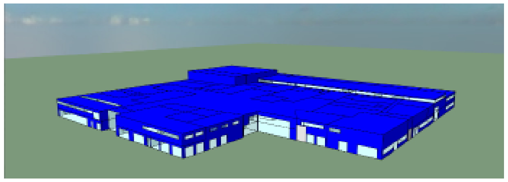
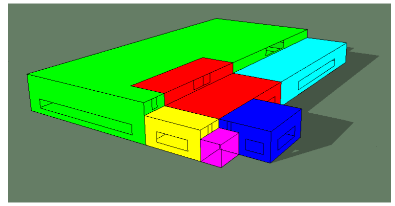
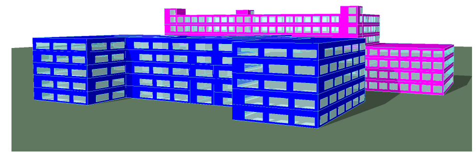
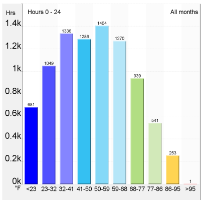
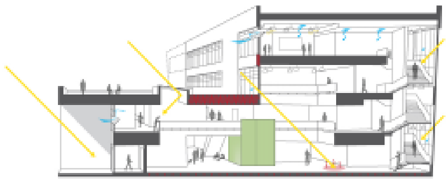
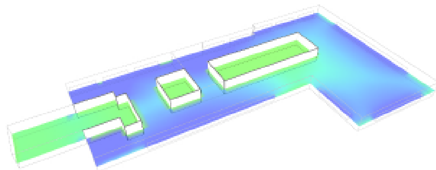
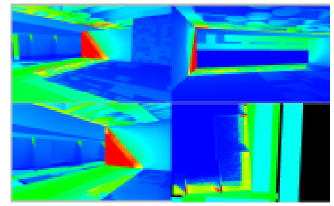
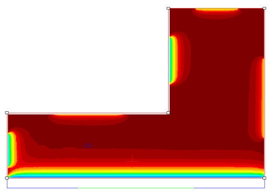
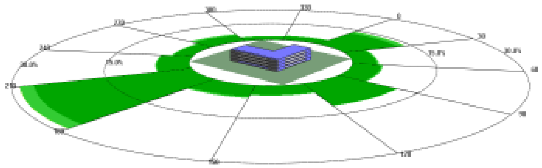
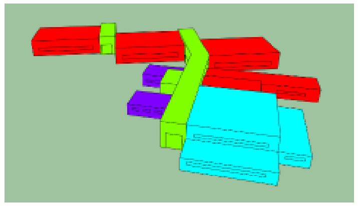
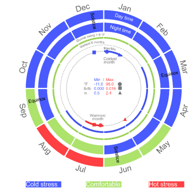












Rocky Mountain Green 2015

Ten Bad Decisions You're Making From Energy Analysis

meGROUP

Learning Objectives

- Identify ten energy model perceptions that may be leading owners and design teams to make decisions that are not beneficial for their project.
- Discuss potential construction and energy costs associated with these perceptions as well as energy savings and paybacks.
- Determine project-specific instances where these perceptions may hold true, but also why generalization is not applicable.

Overview

Introduction

10 Bad Decisions

Closing

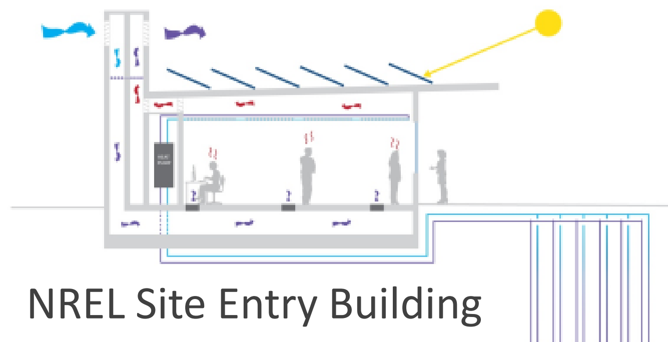
Questions and Answers

- Bad Decision
- The Risk
- The Takeaway

Why Are We Here?

Wayne Aspinall Building (Net Zero)

Bloch Business School (UMKC)



NREL Site Entry Building
(Near Net Zero)

Why Are We Here?

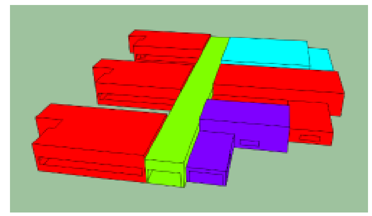
Bad Decision #1

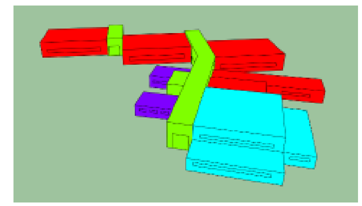
Use results from a **comparative model** for *prediction* – or –
Use results from a **predictive model** for *comparison analysis*

The Risk:

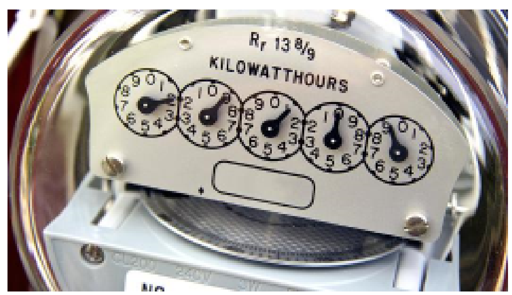
Disappointment when real results don't match modeled results – or –
Disinformation based on incomparable models

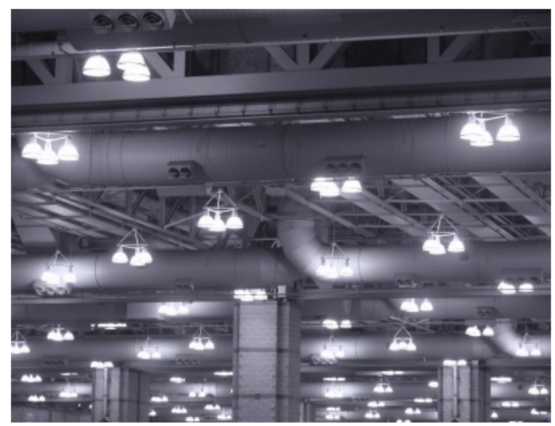
Comparative Energy Models are used to make singular design decisions based on comparable terms (apples to apples).





Predictive Energy Models are used to predict actual energy use and/or energy cost.





Comparative Analysis…

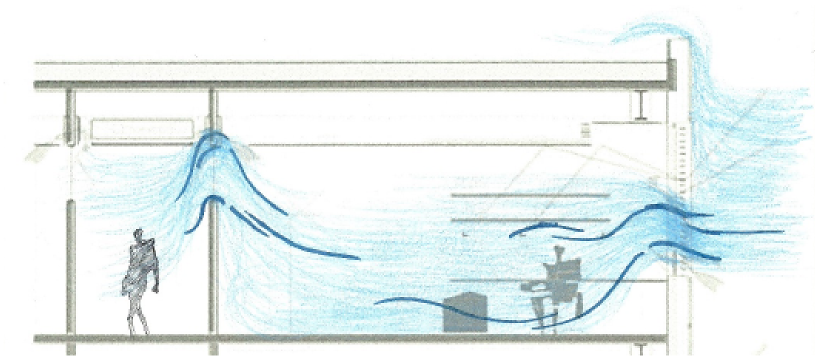
- Massing Analysis (all other variables held constant)
- Window Configuration / Daylighting Analysis (window to wall ratio held constant)
- Tinted vs. Clear Glass

Typically used to ***optimize*** building shape, orientation and space layout. Good for ***load reduction analysis*** prior to looking at lighting and mechanical equipment.

Predictive Analysis…

- Budgeting for Utility Bills
- Determining Peak Loads
- Analyzing how spaces will feel with natural ventilation throughout the year

Typically used ***after*** major building components are set.



Source: https://www.pinterest.com/RMarchitect/arch-natural-ventilation/

Bad Decision #1

Predictive Model = Comparative Model

The Takeaway:

Ask questions – know the goal of the analysis

Think about…

The **DECISIONS** you're trying to make

The **INFORMATION** you need to make the decisions

Discuss the **INPUTS REQUIRED** to get accurate results

ASK QUESTIONS about model inputs and results

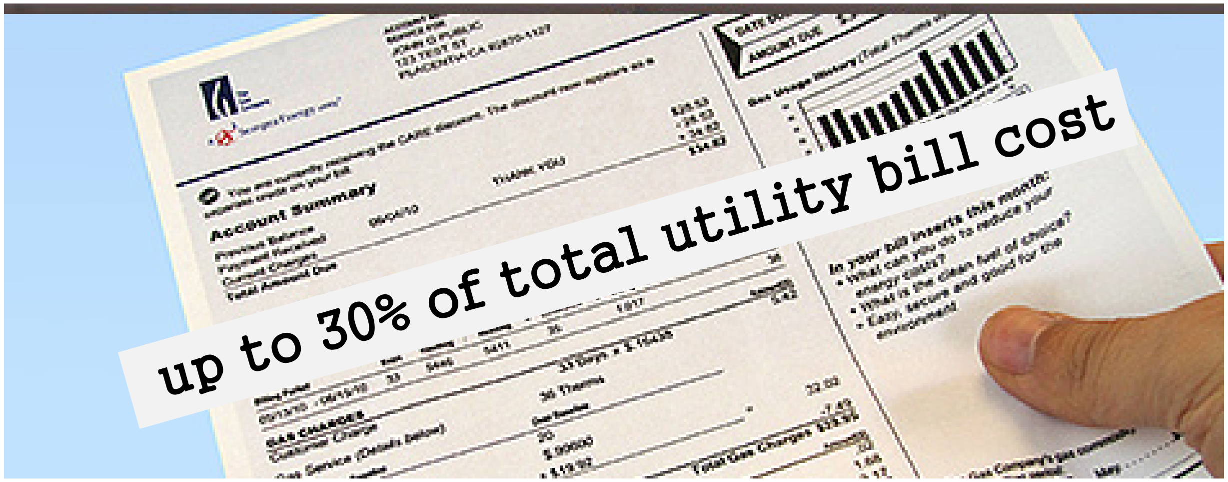
Comparative Models & Energy Cost

OFTEN EXCLUDED

- Taxes
- Tariffs
- Riders

SOMETIMES EXCLUDED

- Demand Charges
- Ratcheting



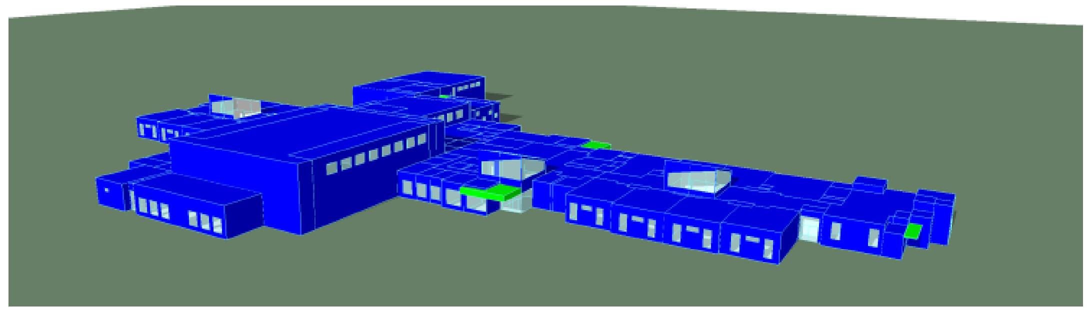
Bad Decision #2

Rate Structure and Demand Charges Are Not Accurately Accounted For In the Analysis

The Risk:

Demand charges and rate structure can be hugely influential on energy costs

I NEED TO SEE SOME MODELING RESULTS FOR OUR MEETING TOMORROW!



	Demand Estimation		
	Demand Estimation	Demand Mo. Average	True Demand per Mo.
Energy Usage (kbtu/sf/yr)	65.95 kbtu/sf	65.95 kbtu/sf	65.95 kbtu/sf
Energy Demand (kbtu/h)	0	737.9	Variable per Mo.
Energy Cost / kWh	12.30₵ + 20%	12.30₵	12.30₵
Demand Cost / kW Summer/Winter	0	$9.09	$11.75/8.05
Overall Energy Costs /sf	**$0.81**	**$1.26**	**$1.25**

Bad Decision #2

Rate Structure and Demand Charges Are Not Accurately Accounted For In the Analysis

The Takeaway:

Do the research on the rate structure, and factor that into each analysis, along with energy usage. Inform the owner what to expect.

APPLIED TO A 50,000 SF OFFICE BUILDING

	Demand Estimation		
	Demand Estimation	Demand Mo. Average	True Demand per Mo.
Overall Energy Costs /sf	**$0.81**	**$1.26**	**$1.25**
Variation From Actual	**-54.7%**	**+1.2%**	
Overall Energy Cost	**$37,070**	**$58,010**	**$57,340**

Tip: Rates are subject to change between you performing the model and the building actually being built!

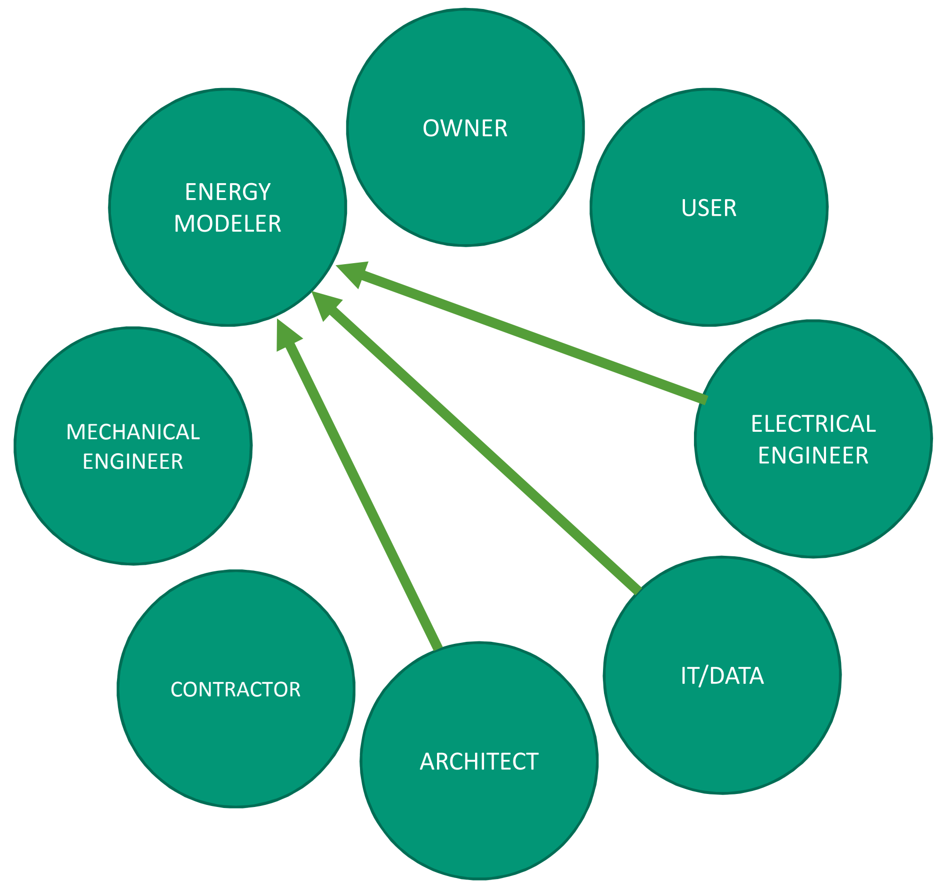
Bad Decision #3

Using modeling decisions in isolation from other disciplines or behaviors

The Risk:

The intent of the designer and/or the occupant behavior will be missed

Transfer of Information



Bad Decision #3

Using modeling decisions in isolation from other disciplines or behaviors

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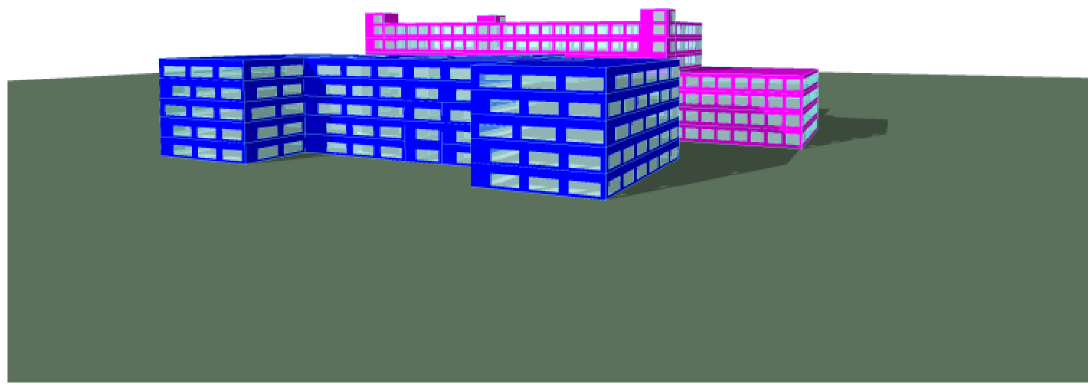
The intent of the designer and/or the occupant behavior will be missed



Model	Glazing %		
	30%	40%	50%
Energy Usage (kBtu/sf/yr)	65.3	62.1	58.7

Bad Decision #3

Using modeling decisions in isolation from other disciplines

The Takeaway:

Share as many assumptions as you can with the designer and user, and agree on these assumptions

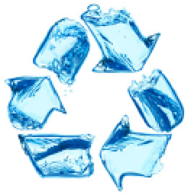
Model	Glazing %		
	30%	40%	50%
Shades	67.1	69.6	72.0
No Shades	65.3	62.1	58.7

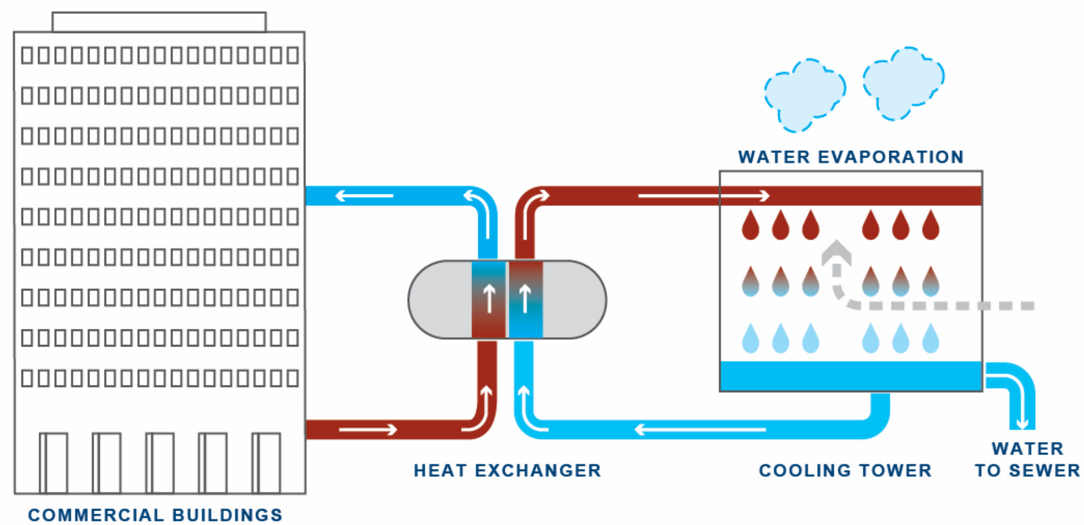
Bad Decision #4

Water usage and cost are excluded from the analysis

The Risk:

Assuming water usage and costs are accounted for





Source: http://business.edf.org/files/2012/05/Cooling_system22.jpg

Often (almost always) excluded from the model – especially with comparative analysis.

Bad Decision #4

Water usage and cost are excluded from the analysis

The Takeaway:

Ensure water is accounted for when looking at…

Existing systems

Evaporative Cooling, etc.

Total Energy Cost Analysis

Bad Decision #5

Exterior Shading Doesn't Payback

The Risk:

The analysis is leaving out some important factors.

Model	Shading Comparison	
	No Shading	Shading
Building SF	150,000	150,000
Energy Usage kbtu/SF/yr	64.2	61.5
Energy Cost per SF	$1.51	$1.46
Upgrades Cost	0	$160,000

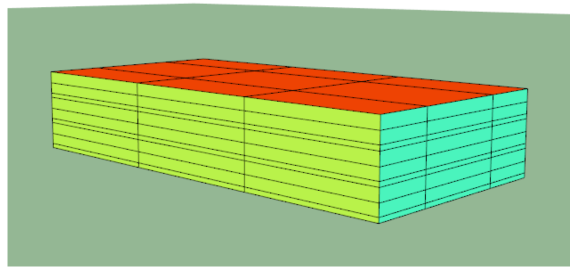
ROI: 20.5 years

Bad Decision #5

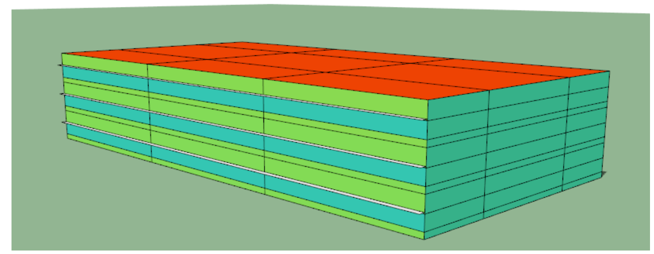
Exterior Shading Doesn't Payback

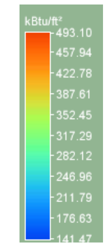
The Takeaway:

Consider load reduction too, and how that affects the plant sizing



No Shades





With Shades

Model	Shading Comparison	
	No Shading	Shading
Building SF	150,000	150,000
Energy Usage kbtu/SF	64.2	61.5
Energy Cost per SF	$1.51	$1.46
Upgrades Cost	0	$160,000
Plant Savings Cost	0	$93,300
ROI (years)	0	8.5

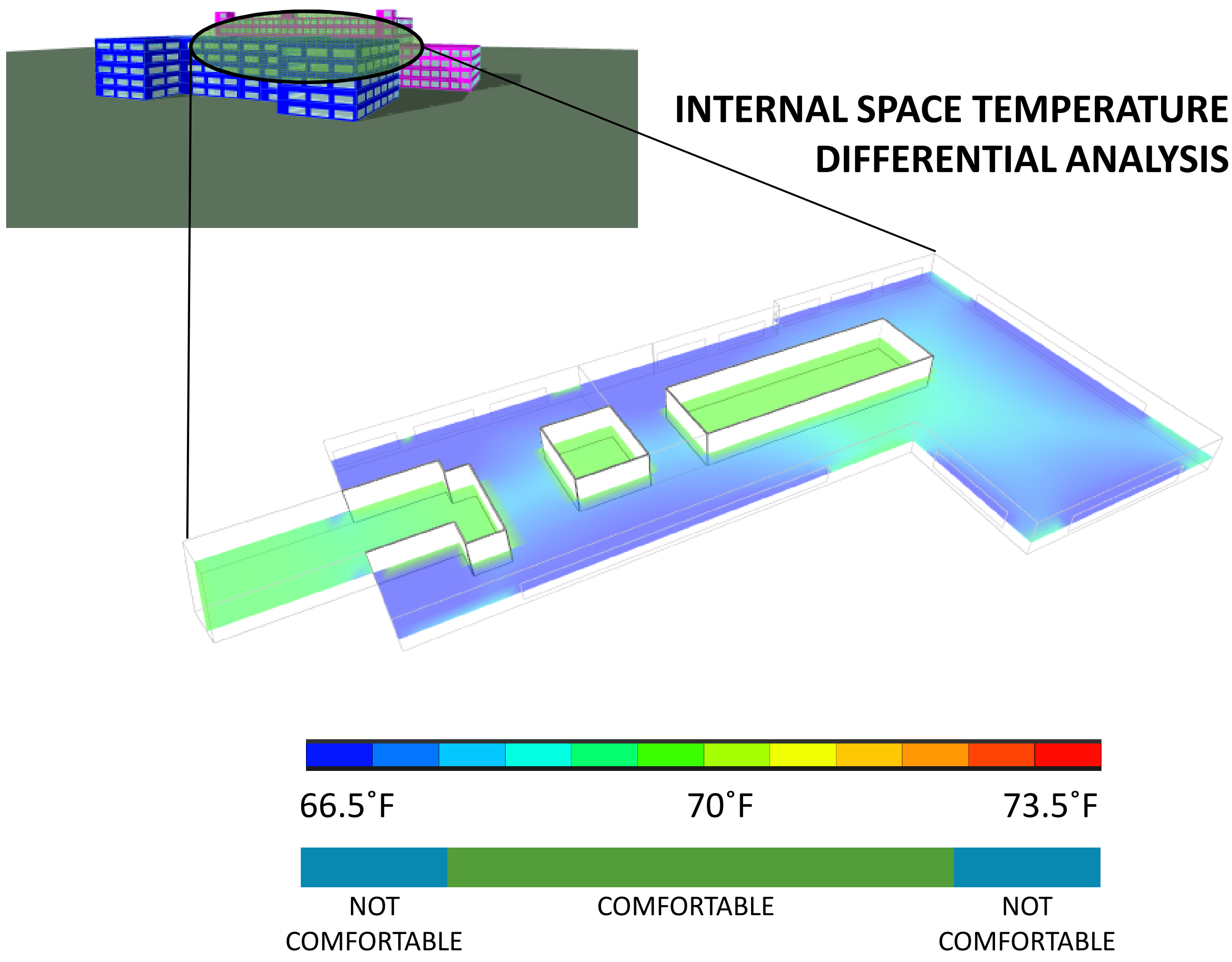
Tip: Reduction in Cooling has greater cost savings than reduction in heating

Bad Decision #6

Considering Energy Analysis More Important Than Comfortable People

The Risk:

We forget for whom we are designing buildings!



Bad Decision #6

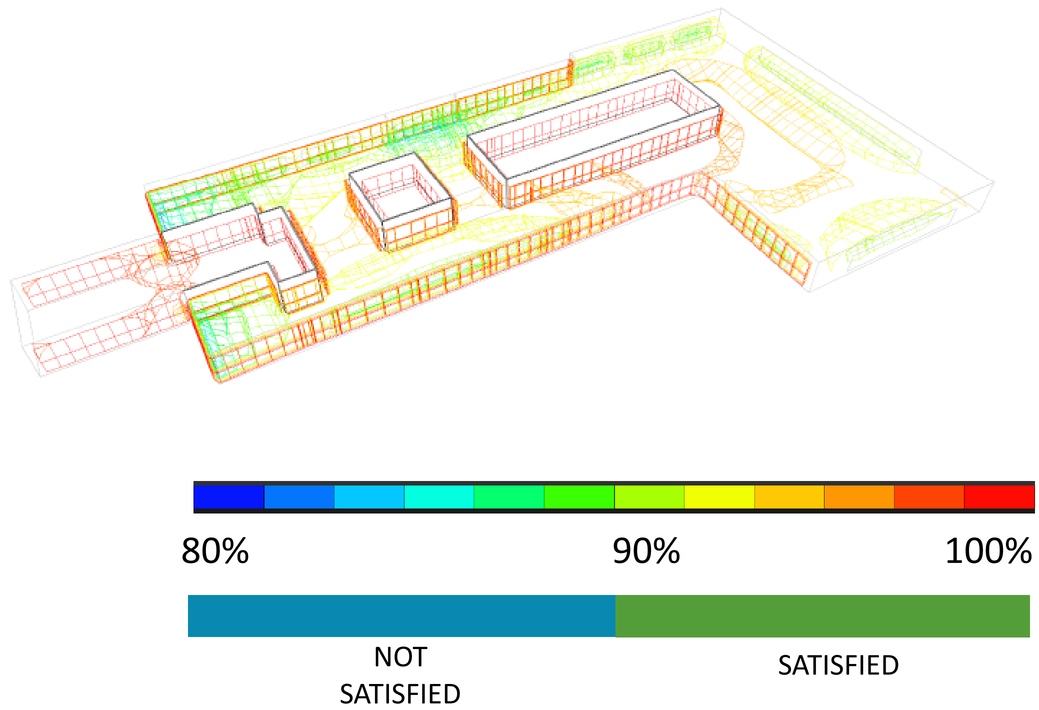
Considering Energy Analysis More Important Than Comfortable People

The Takeaway:

Think about how people are going to inhabit the space, and point decisions towards that.

Thermal Comfort: **Thermal comfort** is the condition of mind that expresses satisfaction with the thermal environment and is assessed by ***subjective*** evaluation (ANSI/ASHRAE Standard 55).

PREDICTED MEAN VOTE (PMV) ANALYSIS



Bad Decision #7

More Glass =
More Natural Light =
Energy Savings (or a
Better Design)

The Risk:

Adding too much glass without proper analysis can lead to significant increases in heating & cooling loads

https://suzannrosecaputo.files.wordpress.com/2012/02/glass-pav-ext-5x.jpg

http://www.polar-ray.com/media/wysiwyg/LED_Light_Bulb.jpg

Tip: IECC 2012 requires automatic daylight controls for spaces with greater than 30% WWR

Bad Decision #7

More Glass =
More Natural Light =
Energy Savings (or a
Better Design)

The Takeaway:

Early analysis of window size and layout can yield:

1. Great views
2. Well daylit spaces
3. Right-sized mechanical systems

It’s not the quantity of glass that optimizes daylight.

It’s strategic placement and thoughtful glass type selection.

- Keep windows close to interior surfaces
- Separate view windows from daylight windows
- Visible Transmittance recommendation of 28-35%

Bad Decision #8

Selecting VAV systems with reheat because system comparisons aren’t favorable

The Risk:

The model may represent actual operation, but it doesn't meet code in the model or in real life

VAV systems are **often modeled & operated incorrectly**.

Pinching down VAV boxes can bring ventilation rates down ***well below* code requirement**.

Energy savings may be realized, but occupants are not getting the required ventilation air.

Bad Decision #8

Selecting VAV systems with reheat because system comparisons aren't favorable

The Takeaway:

Modeling proper ventilation rates gives a realistic view of VAV system energy use

Comparison of other systems vs. a VAV baseline will not tell the whole story unless VAV is modeled correctly

Input Required → Minimum Zone Flow

Program Default = 30%

Do you know how this is actually modeled?

TABLE G3.1.1B Baseline System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
1. PTAC	Packaged terminal air conditioner	Constant volume	Direct expansion	Hot-water fossil fuel boiler
2. PTHP	Packaged terminal heat pump	Constant volume	Direct expansion	Electric heat pump
3. PSZ-AC	Packaged rooftop air conditioner	Constant volume	Direct expansion	Fossil fuel furnace
4. PSZ-HP	Packaged rooftop heat pump	Constant volume	Direct expansion	Electric heat pump
5. Packaged VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Direct expansion	Hot-water fossil fuel boiler
6. Packaged VAV with PFP Boxes	Packaged rooftop VAV with reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler
8. VAV with PFP Boxes	VAV with reheat	VAV	Chilled water	Electric resistance

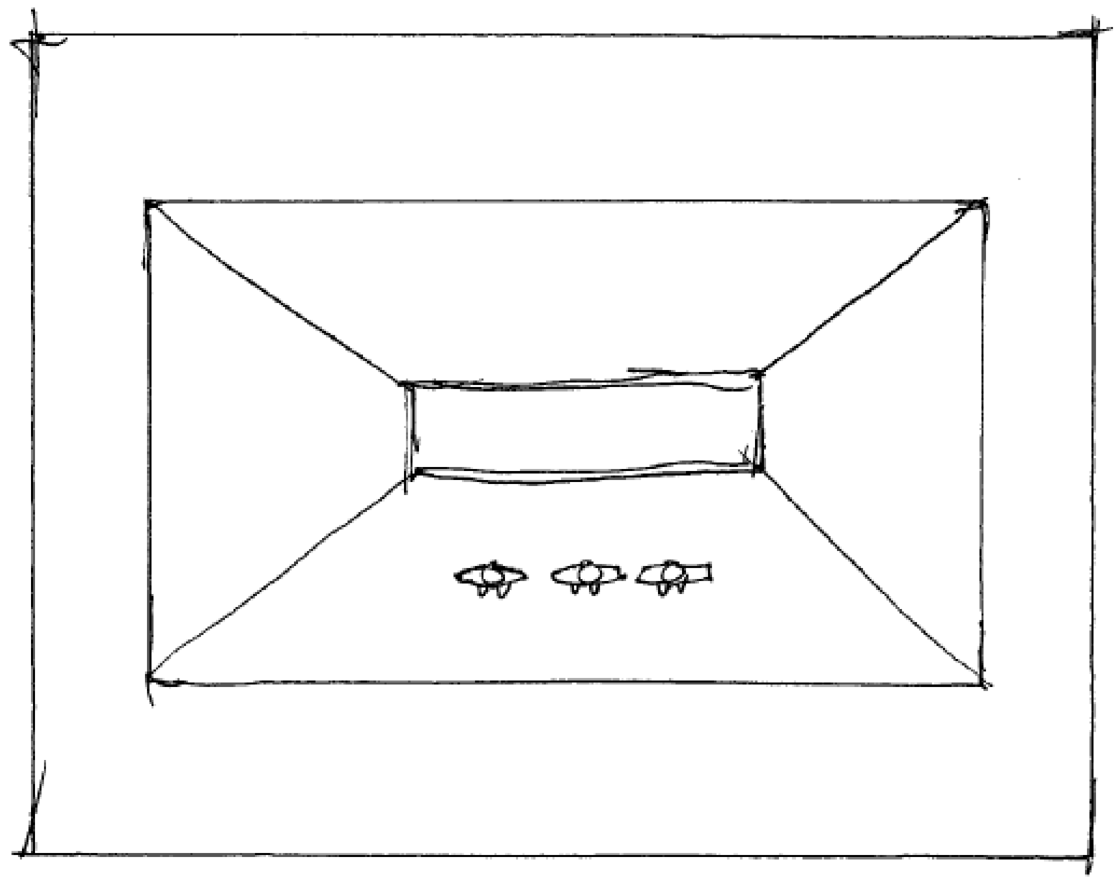
Bad Decision #9

Not making envelope improvements, because they don't matter

Especially for a cooling-dominated building in a heating-dominated climate

The Risk:

More energy use due to incorrect zoning in the model

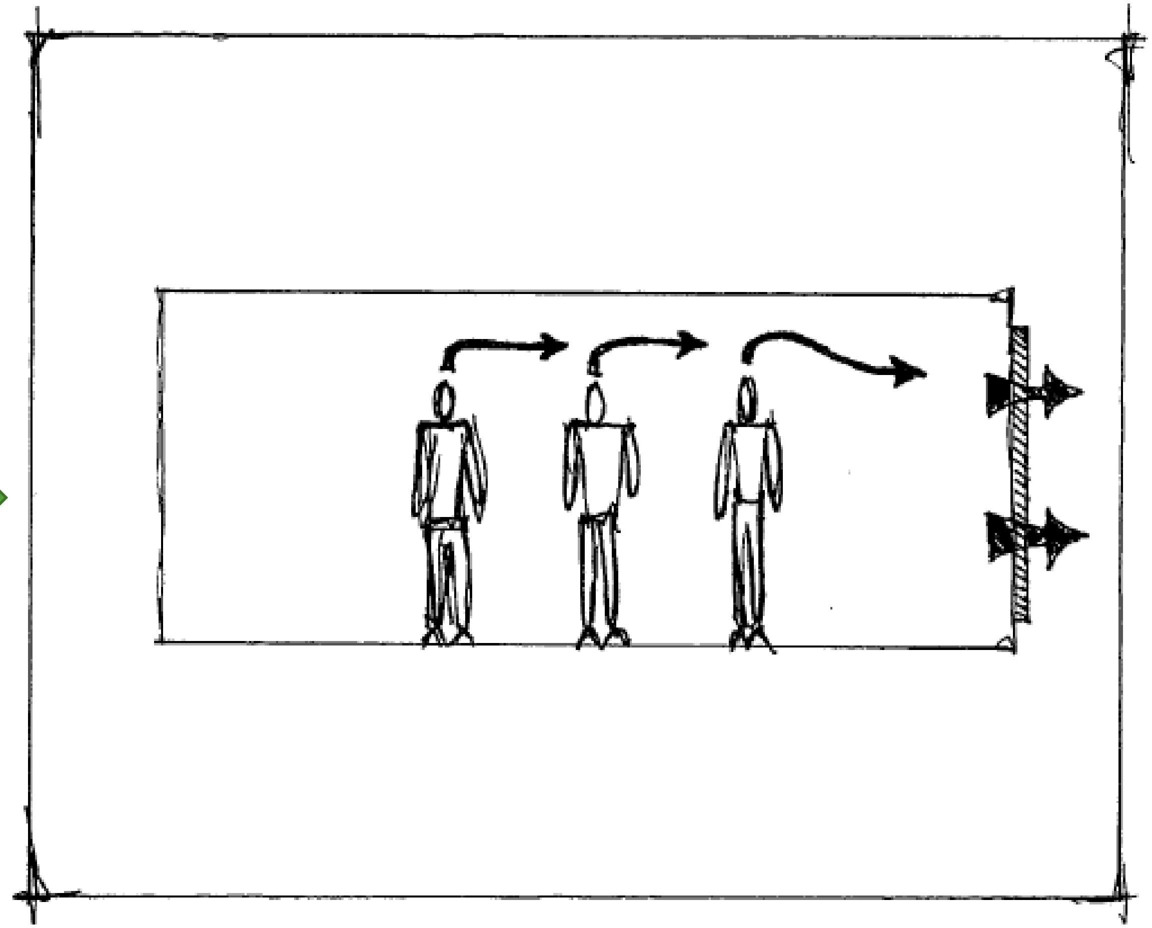


Bad Decision #9

Not making envelope improvements, because they don't matter

Especially for a cooling-dominated building in a heating-dominated climate

What You Think is Happening…

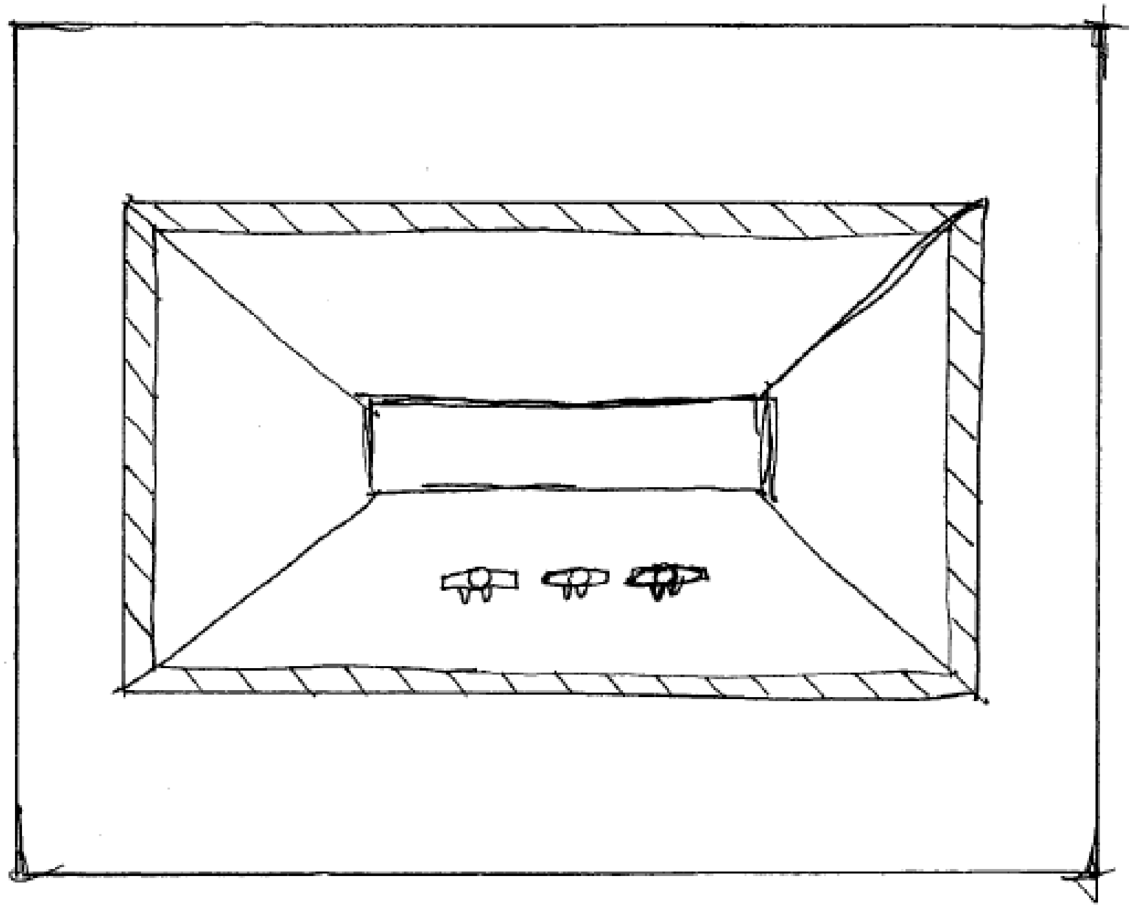


Bad Decision #9

Not making envelope improvements, because they don't matter

Especially for a cooling-dominated building in a heating-dominated climate

What is Actually Happening…

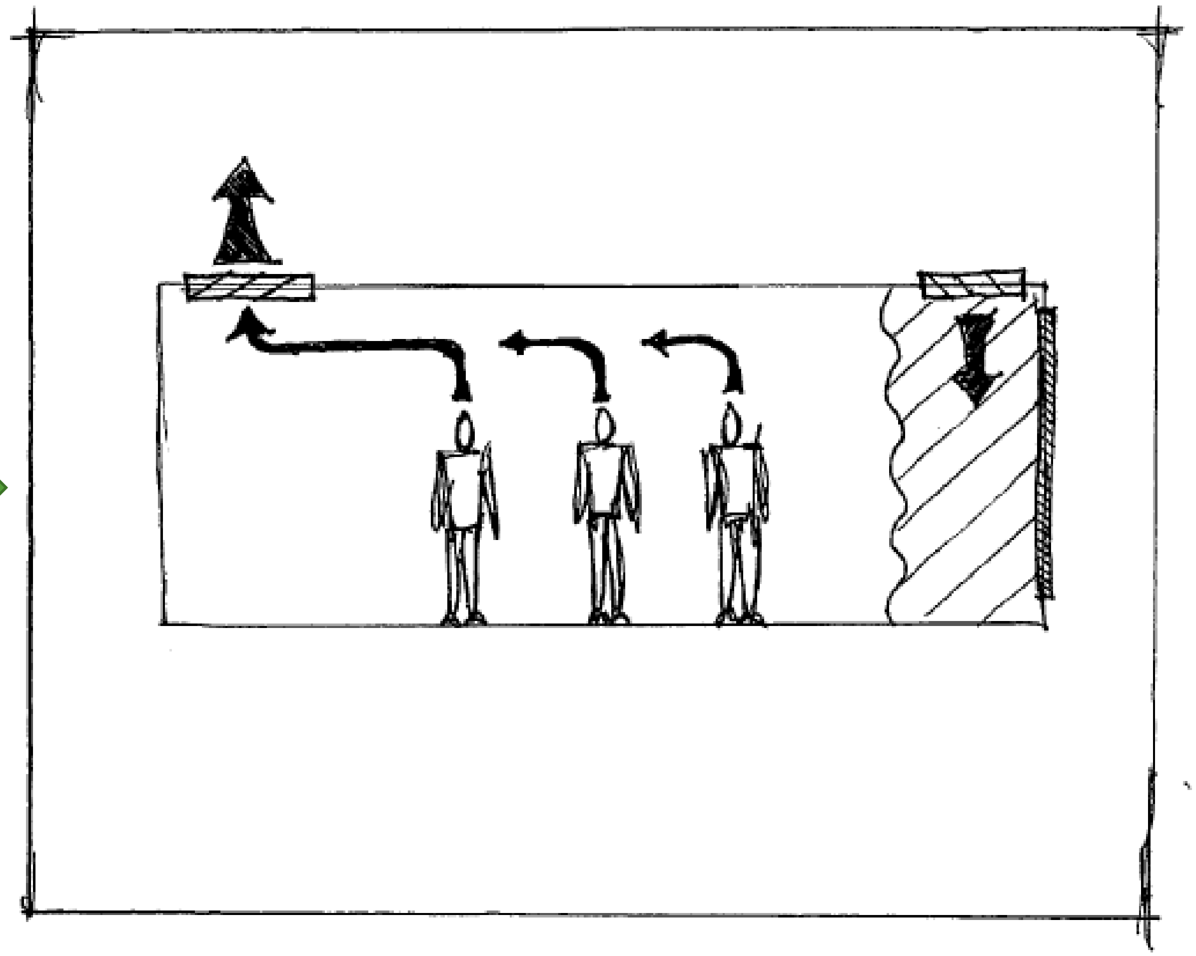


Bad Decision #9

Not making envelope improvements, because they don't matter

Especially for a cooling-dominated building in a heating-dominated climate

What is Actually Happening…

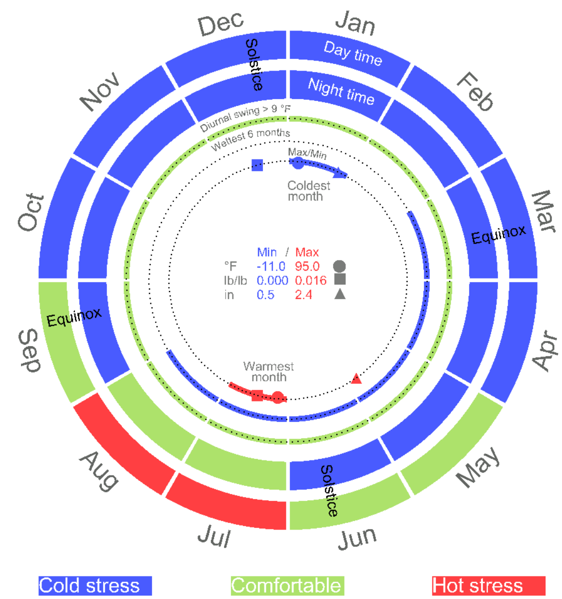


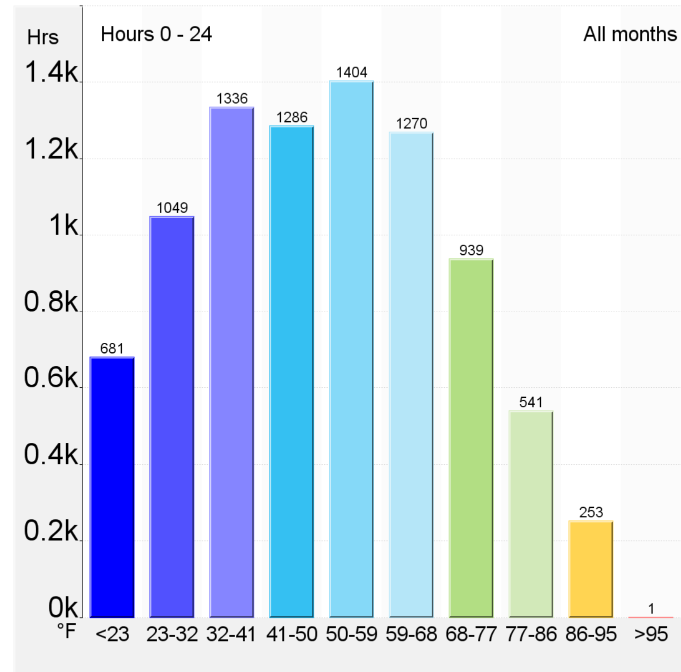
Bad Decision #9

Not making envelope improvements, because they don't matter

The Takeaway:

Envelope improvements may pay off faster than the results show





In our climate, it's less than 60°F for **65%** of the year, and **less than 50°F** for **50%** of the year

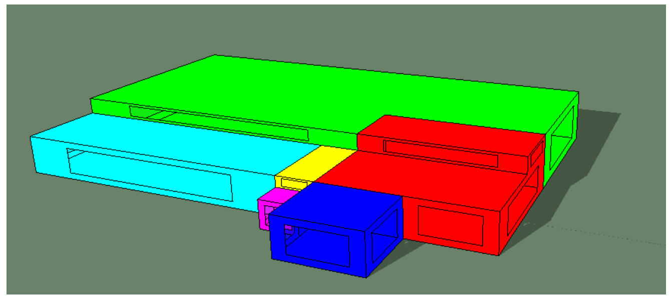
Bad Decision #10

Performing Reactive Modeling Rather Than Proactive Modeling

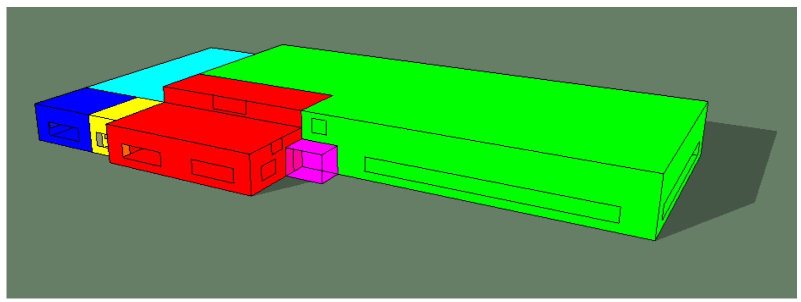
The Risk:

The modeling results have no influence in shaping the design. Report card modeling doesn't help.

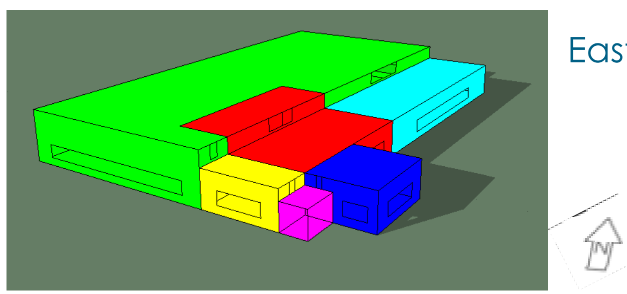
Massing Studies



South



Stretched South



East

Thermal Template

- SPACE: Conference/ Meeting/ Multipurpose
- SPACE: Corridor/ Transition
- SPACE: Library - Reading area
- SPACE: Office - Enclosed
- SPACE: Restrooms
- SPACE: Vestibule

Bad Decision #10

Performing Reactive Modeling Rather Than Proactive Modeling

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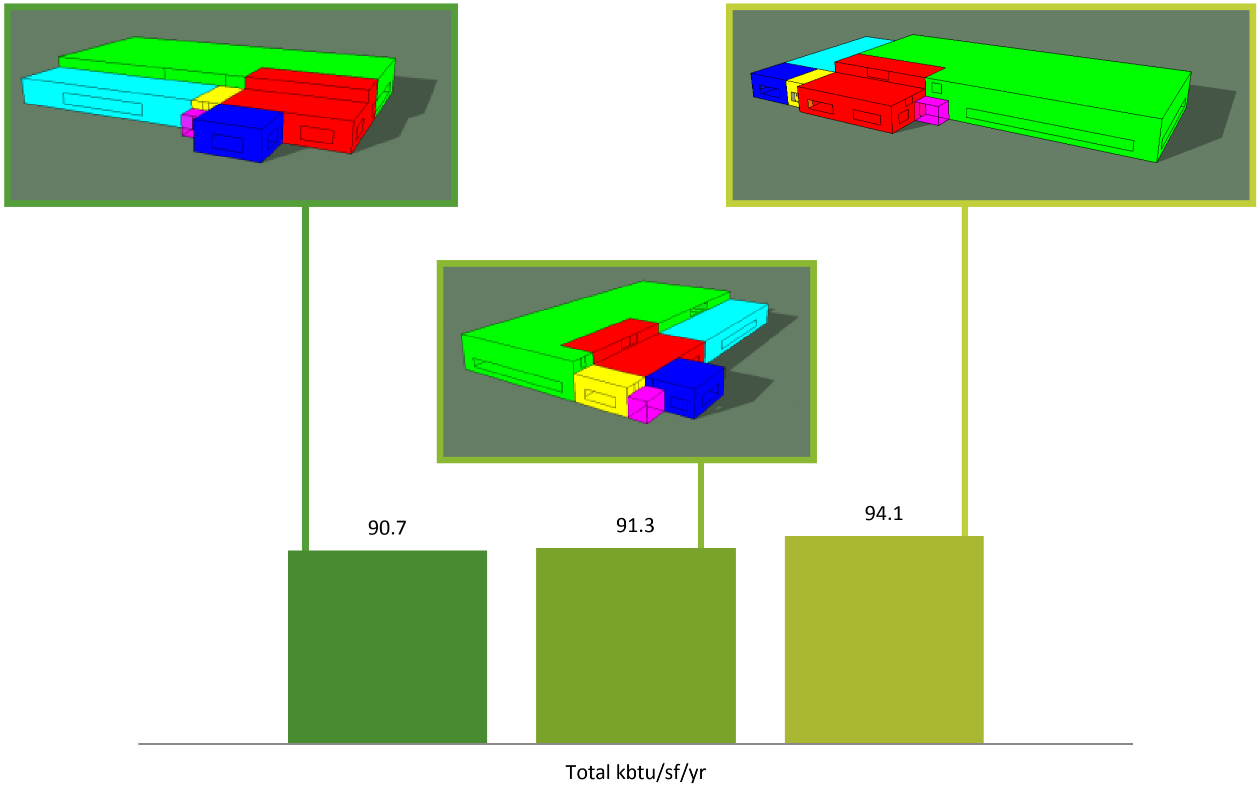
The modeling results have no influence in shaping the design. Report card modeling doesn't help.

Massing Studies



Bad Decision #10

Performing Reactive Modeling Rather Than Proactive Modeling

The Takeaway:

Discuss with the design team when and how you can provide results that will positively influence the design.

It's not something separate to think about, it's another constraint to add to the designer's list.

IT Requirements

View Corridors

User Group Needs

Access and Entry

Circulation

Codes & Zoning

Uses

Daylight

Energy Usage & Cost

Grading and Water Runoff

Orientation

Thermal Comfort

Soils Conditions

Program Requirements

MEP Systems

Materiality

Form

Acoustics

BONUS Bad Decision

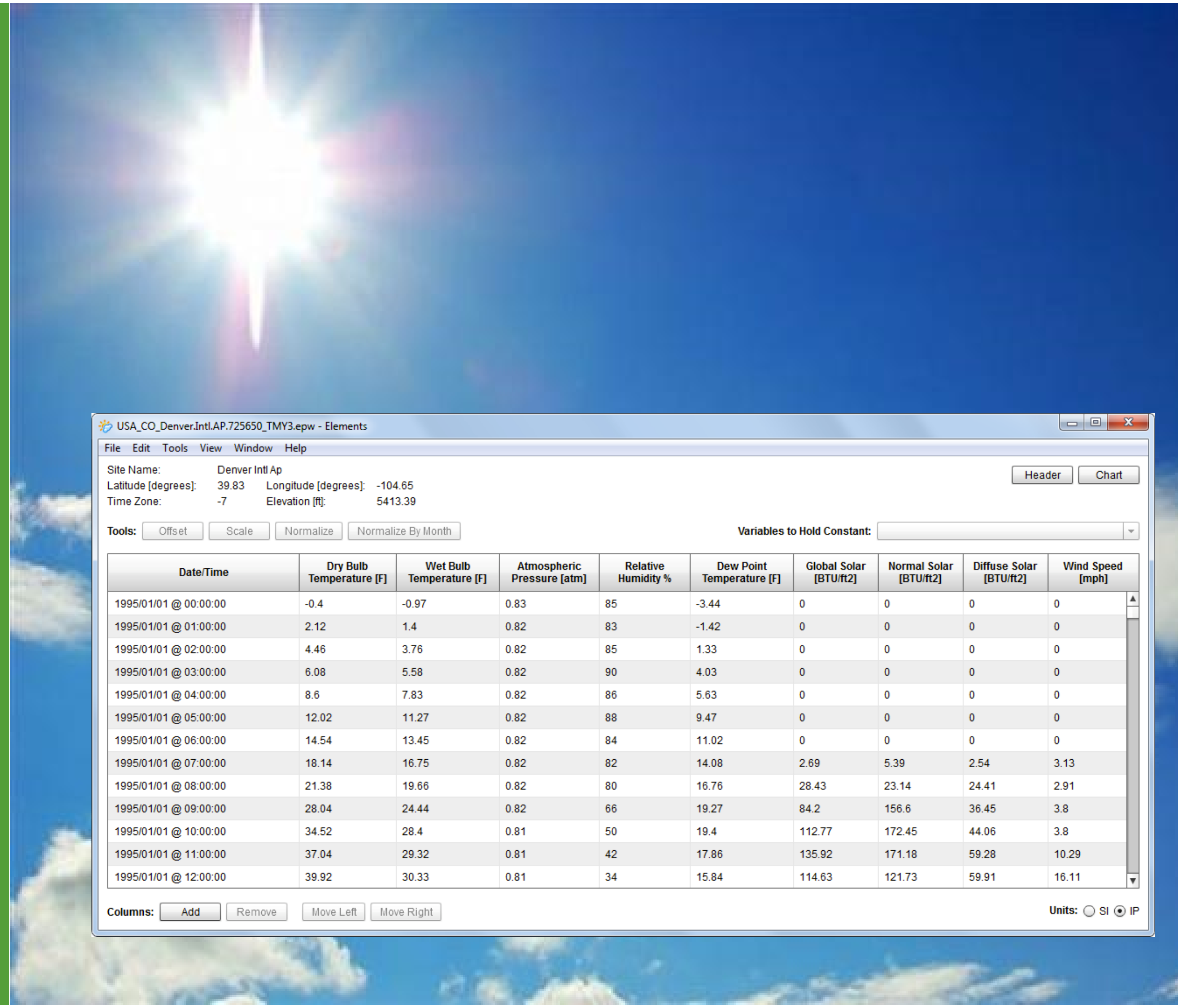
Not checking your weather files…

The Risk:

Bad results!

The Takeaway:

Check your weather file if something seems off



Date/Time	Dry Bulb Temperature [F]	Wet Bulb Temperature [F]	Atmospheric Pressure [atm]	Relative Humidity %	Dew Point Temperature [F]	Global Solar [BTU/ft2]	Normal Solar [BTU/ft2]	Diffuse Solar [BTU/ft2]	Wind Speed [mph]
1995/01/01 @ 00:00:00	-0.4	-0.97	0.83	85	-3.44	0	0	0	0
1995/01/01 @ 01:00:00	2.12	1.4	0.82	83	-1.42	0	0	0	0
1995/01/01 @ 02:00:00	4.46	3.76	0.82	85	1.33	0	0	0	0
1995/01/01 @ 03:00:00	6.08	5.58	0.82	90	4.03	0	0	0	0
1995/01/01 @ 04:00:00	8.6	7.83	0.82	86	5.63	0	0	0	0
1995/01/01 @ 05:00:00	12.02	11.27	0.82	88	9.47	0	0	0	0
1995/01/01 @ 06:00:00	14.54	13.45	0.82	84	11.02	0	0	0	0
1995/01/01 @ 07:00:00	18.14	16.75	0.82	82	14.08	2.69	5.39	2.54	3.13
1995/01/01 @ 08:00:00	21.38	19.66	0.82	80	16.76	28.43	23.14	24.41	2.91
1995/01/01 @ 09:00:00	28.04	24.44	0.82	66	19.27	84.2	156.6	36.45	3.8
1995/01/01 @ 10:00:00	34.52	28.4	0.81	50	19.4	112.77	172.45	44.06	3.8
1995/01/01 @ 11:00:00	37.04	29.32	0.81	42	17.86	135.92	171.18	59.28	10.29
1995/01/01 @ 12:00:00	39.92	30.33	0.81	34	15.84	114.63	121.73	59.91	16.11

Final Remarks

Great Opportunities

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