Rocky Mountain Green 2015
Ten Bad Decisions You’re Making From Energy Analysis
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

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

The Takeaway:
Ask questions – know the goal of the analysis
Comparative Models & Energy Cost

OFTEN EXCLUDED

• Taxes
• Tariffs
• Riders

SOMETIMES EXCLUDED

• Demand Charges
• Ratcheting

up to 30% of total utility bill cost
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!**

<table>
<thead>
<tr>
<th>Demand Estimation</th>
<th>Demand Mo. Average</th>
<th>True Demand per Mo.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Usage (kbtu/sf/yr)</td>
<td>65.95 kbtu/sf</td>
<td>65.95 kbtu/sf</td>
</tr>
<tr>
<td>Energy Demand (kbtu/h)</td>
<td>0</td>
<td>737.9</td>
</tr>
<tr>
<td>Energy Cost / kWh</td>
<td>12.30¢ + 20%</td>
<td>12.30¢</td>
</tr>
<tr>
<td>Demand Cost / kW Summer/Winter</td>
<td>0</td>
<td>$9.09</td>
</tr>
</tbody>
</table>

**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.

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

### APPLIED TO A 50,000 SF OFFICE BUILDING

<table>
<thead>
<tr>
<th>Demand Estimation</th>
<th>Demand Estimation</th>
<th>Demand Mo. Average</th>
<th>True Demand per Mo.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Energy Costs /sf</td>
<td>$0.81</td>
<td>$1.26</td>
<td>$1.25</td>
</tr>
<tr>
<td>Variation From Actual</td>
<td>-54.7%</td>
<td>+1.2%</td>
<td></td>
</tr>
<tr>
<td>Overall Energy Cost</td>
<td>$37,070</td>
<td>$58,010</td>
<td>$57,340</td>
</tr>
</tbody>
</table>
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
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

<table>
<thead>
<tr>
<th>Model</th>
<th>Glazing %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Usage (kBtu/sf/yr)</td>
<td>30%</td>
</tr>
<tr>
<td>65.3</td>
<td>62.1</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Model</th>
<th>Glazing %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30%</td>
</tr>
<tr>
<td>Shades</td>
<td>67.1</td>
</tr>
<tr>
<td>No Shades</td>
<td>65.3</td>
</tr>
</tbody>
</table>
Bad Decision #4

Water usage and cost are excluded from the analysis

The Risk:
Assuming water usage and costs are accounted for

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

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Shading Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shading</td>
<td>Shading</td>
</tr>
<tr>
<td>Building SF</td>
<td>150,000</td>
</tr>
<tr>
<td>Energy Usage kbtu/SF/yr</td>
<td>64.2</td>
</tr>
<tr>
<td>Energy Cost per SF</td>
<td>$1.51</td>
</tr>
<tr>
<td>Upgrades Cost</td>
<td>0</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Shading Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Shading</td>
</tr>
<tr>
<td>Building SF</td>
<td>150,000</td>
</tr>
<tr>
<td>Energy Usage kbtu/SF</td>
<td>64.2</td>
</tr>
<tr>
<td>Energy Cost per SF</td>
<td>$1.51</td>
</tr>
<tr>
<td>Upgrades Cost</td>
<td>0</td>
</tr>
<tr>
<td>Plant Savings Cost</td>
<td>0</td>
</tr>
<tr>
<td>ROI (years)</td>
<td>0</td>
</tr>
</tbody>
</table>
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](https://www.ashrae.org) 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

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?
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.
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.
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
Final Remarks

Great Opportunities
Mandy Redfield, PE, LEED AP BD+C
mandy.redfield@megroup.com
Miles Dake, EIT, Assoc. AIA, LEED AP BD+C
miles.dake@megroup.com