

Seminar 2 – Building Simulation 101
Bringing Energy Simulation into Your Office

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Learning Objectives for this Session

- Appropriate applications for energy simulation programs
- Staffing alternatives for performing energy simulations
- Lessons learned from firms that perform energy simulations

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Motivations

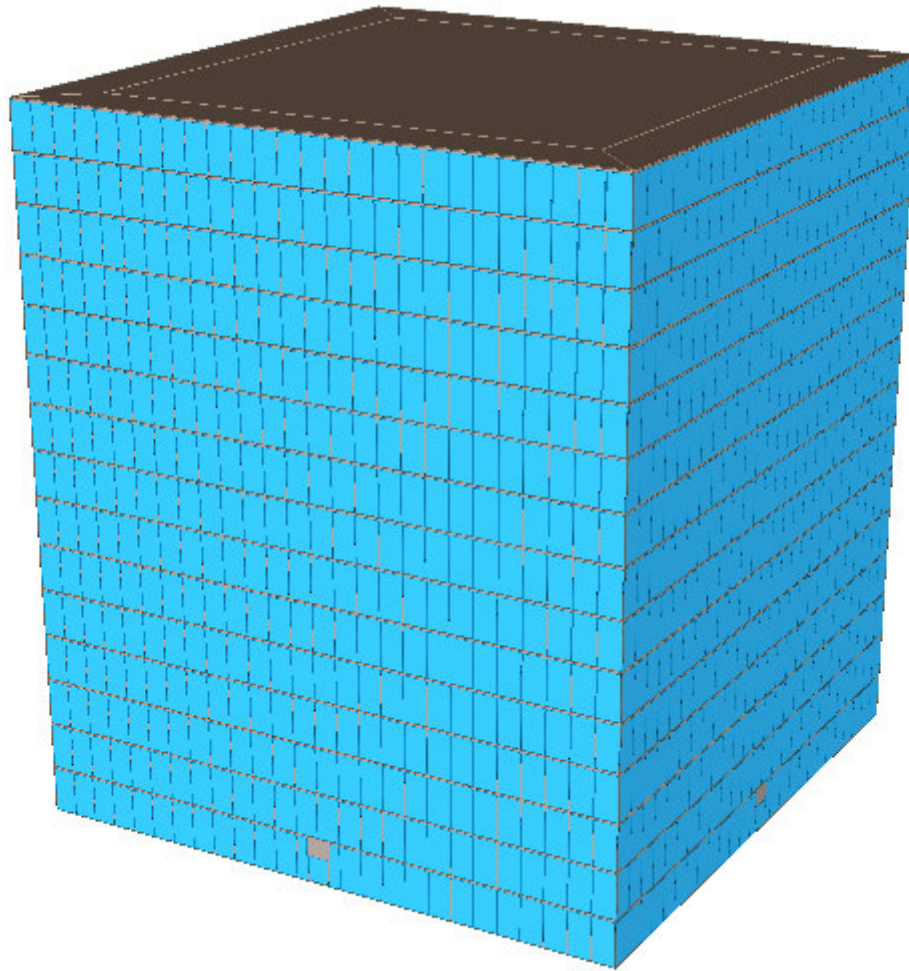
Energy

Lynn Bellenger

ASHRAE President Elect

“Modeling a Sustainable World”

What do you do?



(Window-Wall Ratio = 97%)

Appropriate Uses for Energy Simulation

Relative performance of design alternatives.

Design Studies

Compliance analysis



With care:

- Predicting absolute energy consumption
- System sizing studies
- Measurement and verification

Appropriate Uses for Energy Simulation

Design Studies

- Envelope design
 - Form, orientation, glazing, shading, insulation, daylighting
- System types
 - VAV vs. chilled beam
 - GSHP
 - Evaporative cooling
 - Etc...
- Control optimization
- Insights!

Compliance Analysis

- Energy code compliance
- LEED™ credit EAc1
- Utility incentives
- Policy compliance
- Designed to meet EnergyStar
- Net zero design targets

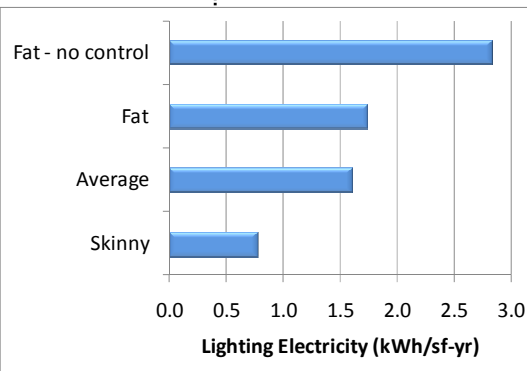
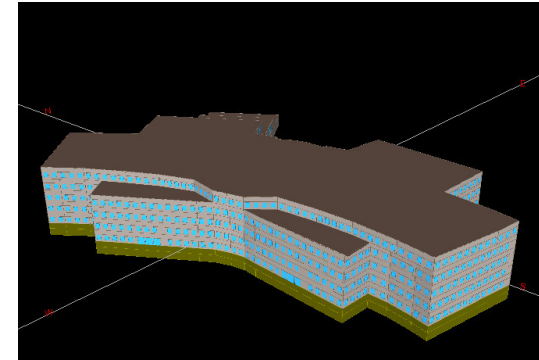
Appropriate Timing For Energy Simulation

Baseline model, set performance goals, e.g. Energy Star score, LEED points

Fundamental design alternatives with simple models

Specific design alternatives with more detailed models

Update models, produce compliance documentation



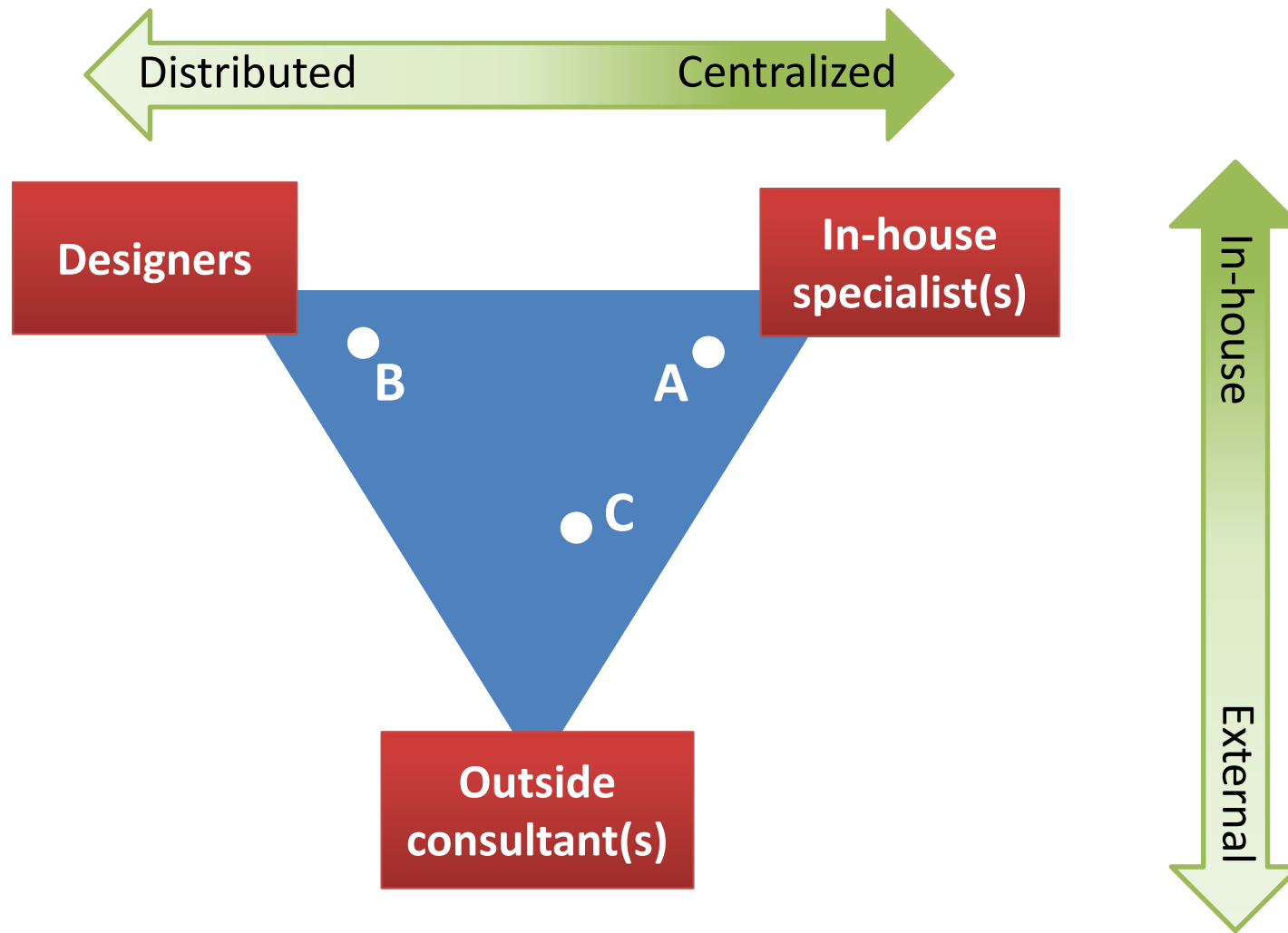
Pre-Design

Schematic
Design

Design
Development

Construction
Documents

Simulation Staffing Options

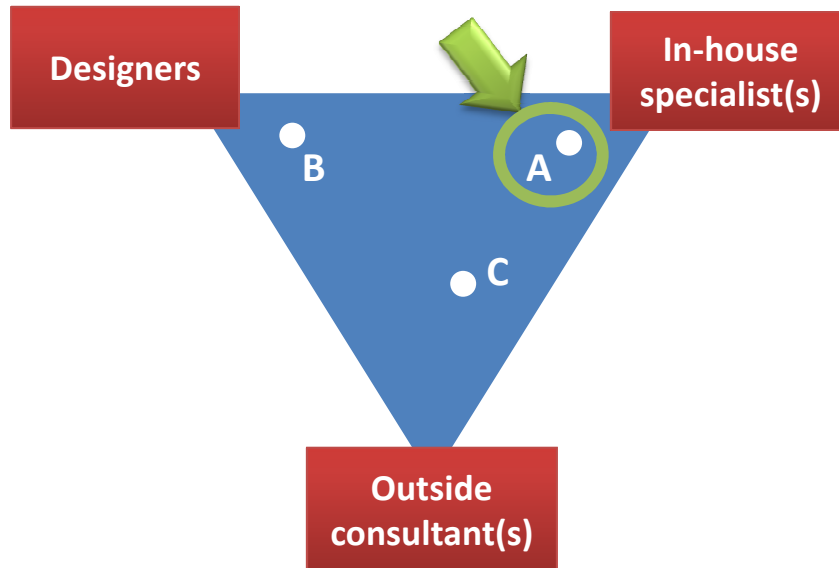


Simulation Staffing Options – “Firm A”



In-house specialists

1 modeler per 5-10 designers.
Also provides simulation services.



PROS

Depth of simulation experience.
In-house knowledge & skills.
Modest training cost.
Additional service opportunity.



CONS

Specialist may not have design knowledge.
Potential burnout.
Lack of career path.
Impact of specialist departure.

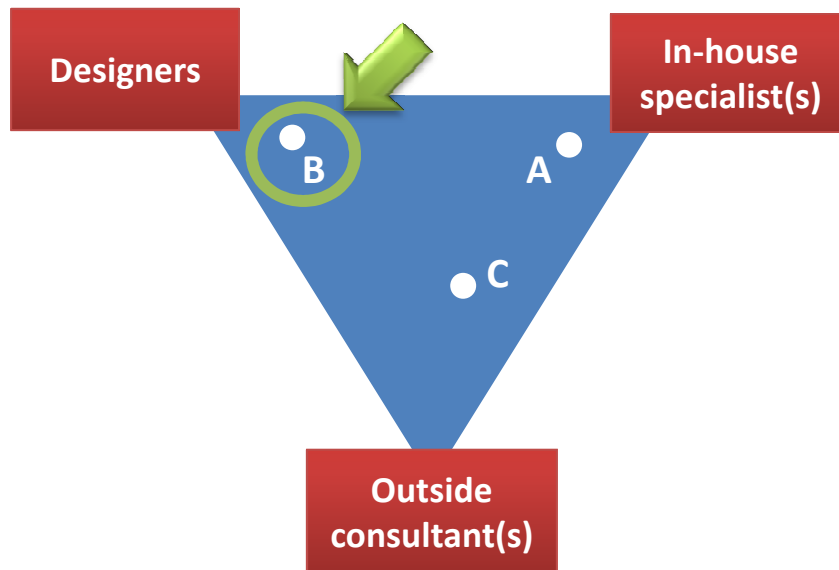


Simulation Staffing Options – “Firm B”



“Everyone does everything”

Simulation, load calcs, design, drafting...



PROS

Develop design intuition.
Grow as a designer.
More likely to be used early in design.
Avoid burnout.
Avoid “career path” issue.



CONS

Possibly less time efficient.
Less depth of simulation experience.
Higher training cost.
Not everyone likes analysis.

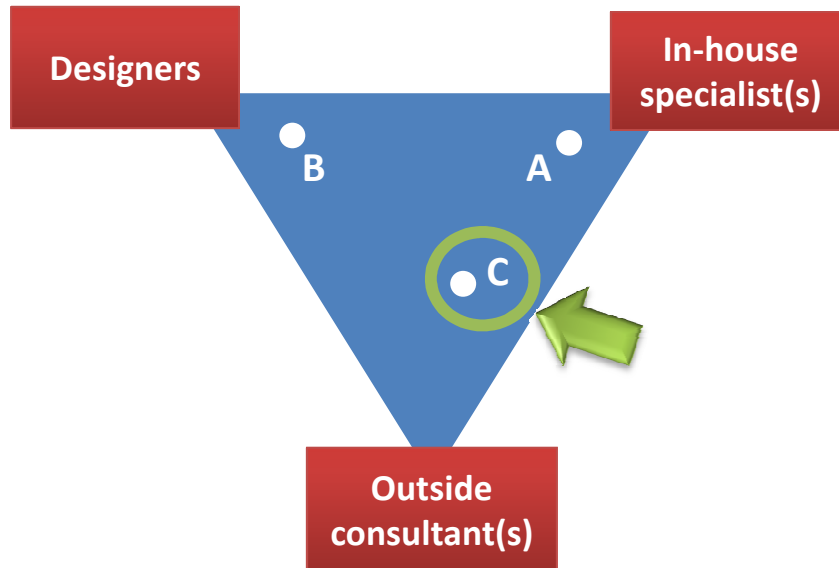


Simulation Staffing Options – “Firm C”



Mixed staffing strategy

1 modeler per ~15 designers.
A few designers dabbling.
Outside consultants for overload & special cases.



PROS

Some in-house knowledge & skills.
Lower training cost.
Cost efficiency.



CONS

Potentially longer turn-around.
Less likely to get early simulation.
Potential burnout.
Lack of career path.
Less experience retained in-house.
Impact of specialist departure.



Getting Paid for Simulation

- Additional fee is typical
- Typical scope items
 - Analysis of building enclosure design alternatives
 - LEED credit EA1 energy efficiency incentive
 - Energy code compliance
 - Designed to earn EnergyStar
 - Federal tax deductions



Choosing Simulation Software



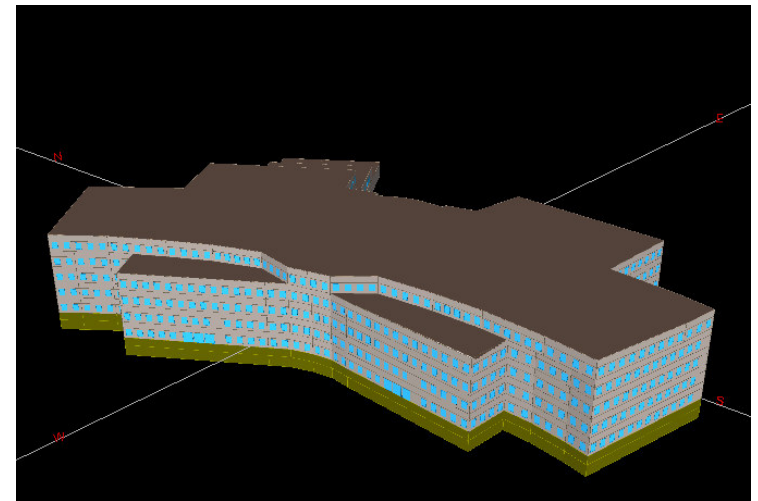
- Certifications - tax deduction, code compliance
- Training and support
- Community – user groups, consultants
- Price
- Source code/calc methods available for review
- General capabilities
 - Automatic code/LEED baseline generation
 - Calculation speed
 - Hourly outputs
- Enclosure & daylighting capabilities... ➡
- HVAC capabilities... ➡

Choosing Simulation Software



Enclosure and daylighting capabilities

- Quick model development for early design studies
- CAD/BIM import and/or export
 - Data standards such as gbxml and IFC
- Solar shading; dynamic shade operation; adjacent structures shading
- Daylight illuminance and automatic daylighting control
- 3D visualization

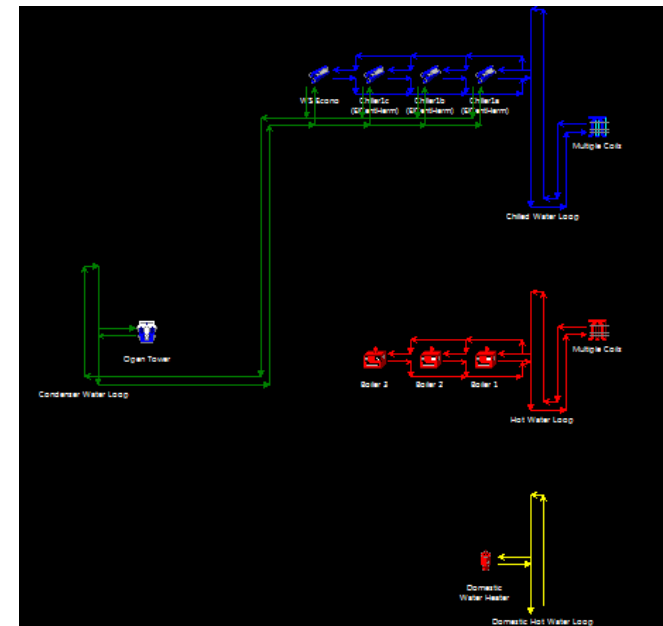


Choosing Simulation Software



HVAC capabilities

- Natural ventilation, mixed-mode operation, inter-zone airflow
- Ground-coupled heat rejection
- DOAS (separate ventilation and heating/cooling systems)
- Displacement ventilation
- Underfloor air distribution
- Variable refrigerant volume systems
- Chilled beams
- Radiant heating/cooling
- Evaporative cooling
- Thermal energy storage
- Partial-load performance models

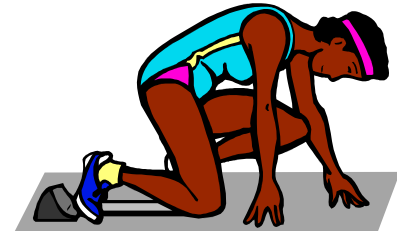


Lessons Learned



- Make a commitment, and don't skimp on training
- Develop a process for evaluating results
- Provide design mentors for simulation staff
- Verify models with actual performance data
 - “Get a dose of reality”
- Perform early what-if analyses
- Don't wait until it's too late!
- Consider benefits of “everyone does everything”

Some Resources for Getting Started



- Building Energy Software Tools Directory
 - www.eere.energy.gov/buildings/tools_directory/
- BLDG-SIM and associated email lists
 - www.onebuilding.org
- Energy Design Resources
 - Simulation Design Brief and Simulation Guidelines
 - www.energydesignresources.com
- Article “Simulation Literacy 101”
 - http://www.buildinggreen.com/features/mr/sim_lit_101.cfm
- International Building Performance Simulation Association (IBPSA)
 - Conference papers online
 - Local chapters forming... NY, SF, ...
 - www.ibpsa.org
 - www.ibpsa.us

Questions?

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