ASHRAE Standard 209P “Energy Simulation-Aided Design for Buildings”

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IBPSA-USA SUMMER MEETING ST LOUIS

Jason Glazer, PE - GARD Analytics

Erik Kolderup, PE – Kolderup Consulting

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Public Review

BSR/ASHRAE Standard 209P

Public Review Draft

Energy Simulation Aided Design for Buildings except Low-Rise Residential Buildings

First Public Review (March 2016)
(Draft Shows Complete Proposed New Standard)

- First public review
  - March 25 to May 9, 2016
  - 84 Comments received from 14 commenters

Purpose and Scope

- Purpose:
  - Define minimum requirements for providing energy design assistance using building energy simulation and analysis.
- Scope:
  - This standard applies to new buildings or major renovations of, or additions to, existing buildings utilizing energy simulation during the design process. This standard does not apply to single-family houses, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes) and modular homes.

Who Complies

- *NOT* required for all buildings
- "utilizing energy simulation during the design process"
- Would be adopted by:
  - Organizations that certify high performance buildings
  - Utilities and agencies that provide incentives for low energy buildings
  - Building owners and architects seeking a uniform way to specify a scope of work for building energy modeling.

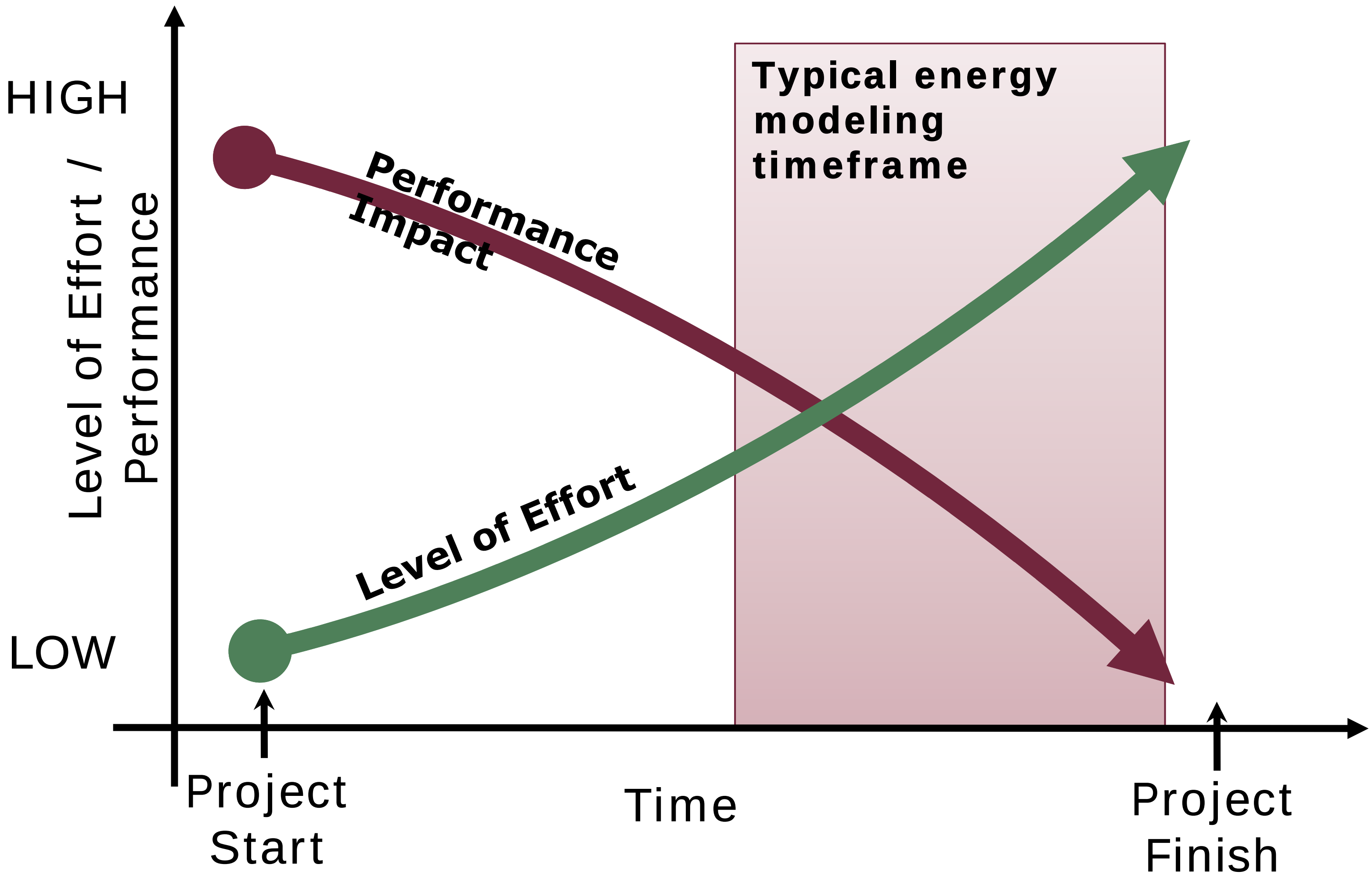
Brief History

- Spring 2011 - discussion on the BLDG-SIM list
- Community drafted the title, purpose and scope
- June 2011 endorsed by ASHRAE committees
  - TC 4.7 Energy Calculations
  - TC 2.8 Building Environmental Impacts and Sustainability
  - TC 7.6 Building Energy Performance
- October 2011 Approved soon after by ASHRAE Standards Committee
- First meeting in June 2012
- 26 voting members
- Full roster of 51 people

Why do we need this standard?

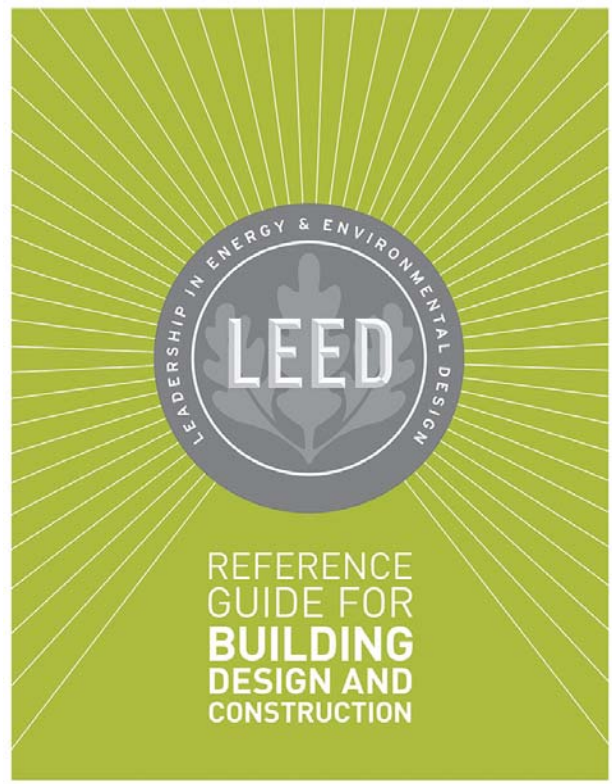
- Appendix G helped to spur building energy simulation modeling industry of today
- Often simulation applied only at the end of the design process to determine savings
- Simulation not used often enough in the process of making design decisions

When is energy modeling typically used?



LEED v4 Integrative Process Credit

- By end of SDs, use “simple box” energy model to explore how to reduce energy loads, analyzing the following:
  - Site conditions
  - Massing and Orientation
  - Building envelope
  - Lighting Levels
  - Thermal Comfort ranges
  - Plug and process loads
  - Operational parameters



LEED v4 (Optimize Energy Performance)

- Establish Source EUI energy target
- Analyze efficiency measures, focusing on load reduction and HVAC-related strategies
- Project potential energy savings and total project cost implications
- Account for results in decision making

ASHRAE Standard 209 Structure

1. Purpose
2. Scope
3. Definitions
4. Utilization
5. General Requirements
6. Design Modeling Cycles
7. Construction and Operations Modeling
8. Post-Occupancy Energy Performance Comparison

General Requirements

- Software Requirements
- Modeler Credentials
- Climate and Site Analysis
- Benchmarking
- Energy Charrette
- Establish Energy Performance Goals
- General Modeling Cycle Requirements

Design Modeling Cycles

1. Simple Box Model
2. Conceptual Design
3. Load Reduction
4. HVAC System Selection
5. Design Refinement
6. Design Integration & Optimization
7. Energy Simulation-Aided Value Engineering

Construction/Operations Modeling Cycles

8. As-Designed Performance
9. Change Orders
10. As-Built Performance

- Comparison of Design to Actual

Compliance

Required: all of these activities

- 5.3 Climate and Site Analysis
- 5.4 Benchmarking
- 5.5 Energy Charrette
- 5.6 Energy Performance Goals in OPR
- 5.7 General Modeling Cycle Requirements + 6.3 Modeling Cycle #3 Load Reduction Modeling

Compliance

Required: <u>one</u> of the following

5.7	+	6.1 Modeling Cycle #1 – Simple Box Modeling
5.7	+	6.2 Modeling Cycle #2 – Conceptual Design Modeling
5.7	+	6.4 Modeling Cycle #4 – HVAC System Selection Modeling
5.7	+	6.5 Modeling Cycle #5 – Design Refinement
5.7	+	6.6 Modeling Cycle #6 – Design Integration and Optimization
5.7	+	6.7 Modeling Cycle #7 – Energy Simulation Aided Value Engineering

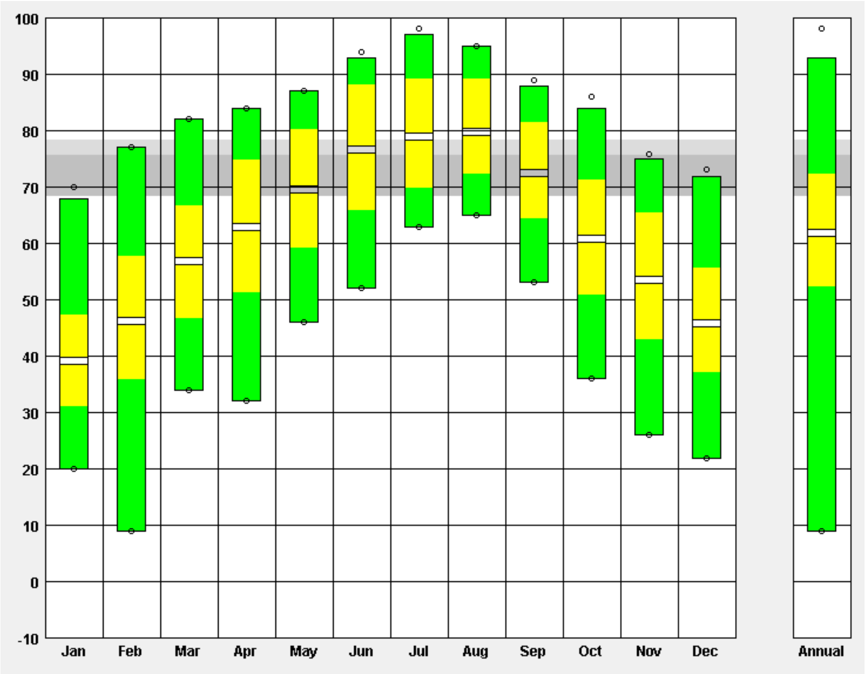
Compliance

Optional (if required by adopting authority)

5.7	+	7.1 Modeling Cycle #8 – As-Design Energy Performance
5.7	+	7.2 Modeling Cycle #9 – Contemplated Change Orders
5.7	+	7.3 Modeling Cycle #10 – As-Built Energy Performance
5.7	+	8. Post-Occupancy Energy Performance Comparison

5.3 Climate and Site Analysis

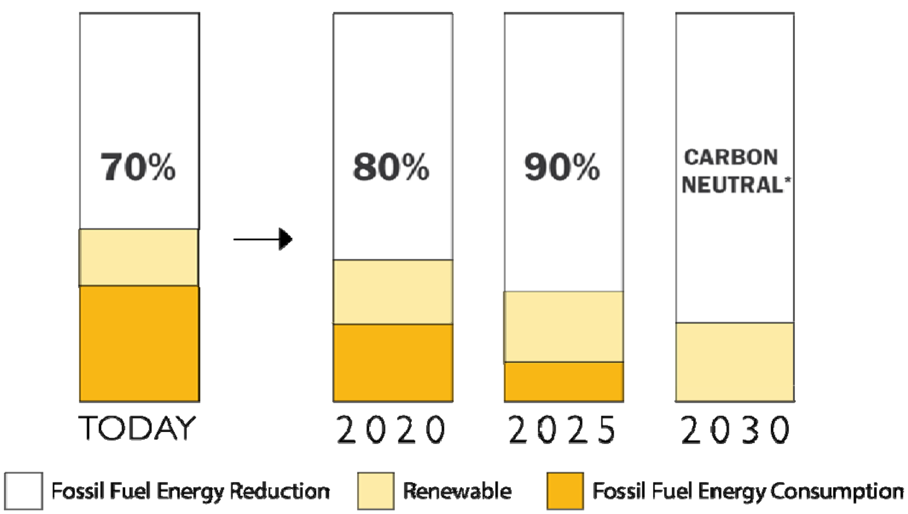
- Review local climate data
- Assess site characteristics
- Create list of climate- and site-specific design strategies



5.4 – 5.6 Benchmarking, Charrette, Performance Goals

Benchmarking / Overall Goals

- CBECS database
- Energy Star Target Finder
- AIA 2030 Challenge
- DOE Building Performance Database



The 2030 Challenge

*Using no fossil fuel GHG-emitting energy to operate.

Charrette Topics

- Purpose of energy modeling in project
- Project performance metrics and goals
- Results of any previous modeling
- Financial criteria for decision making
- Project schedule and follow-up items

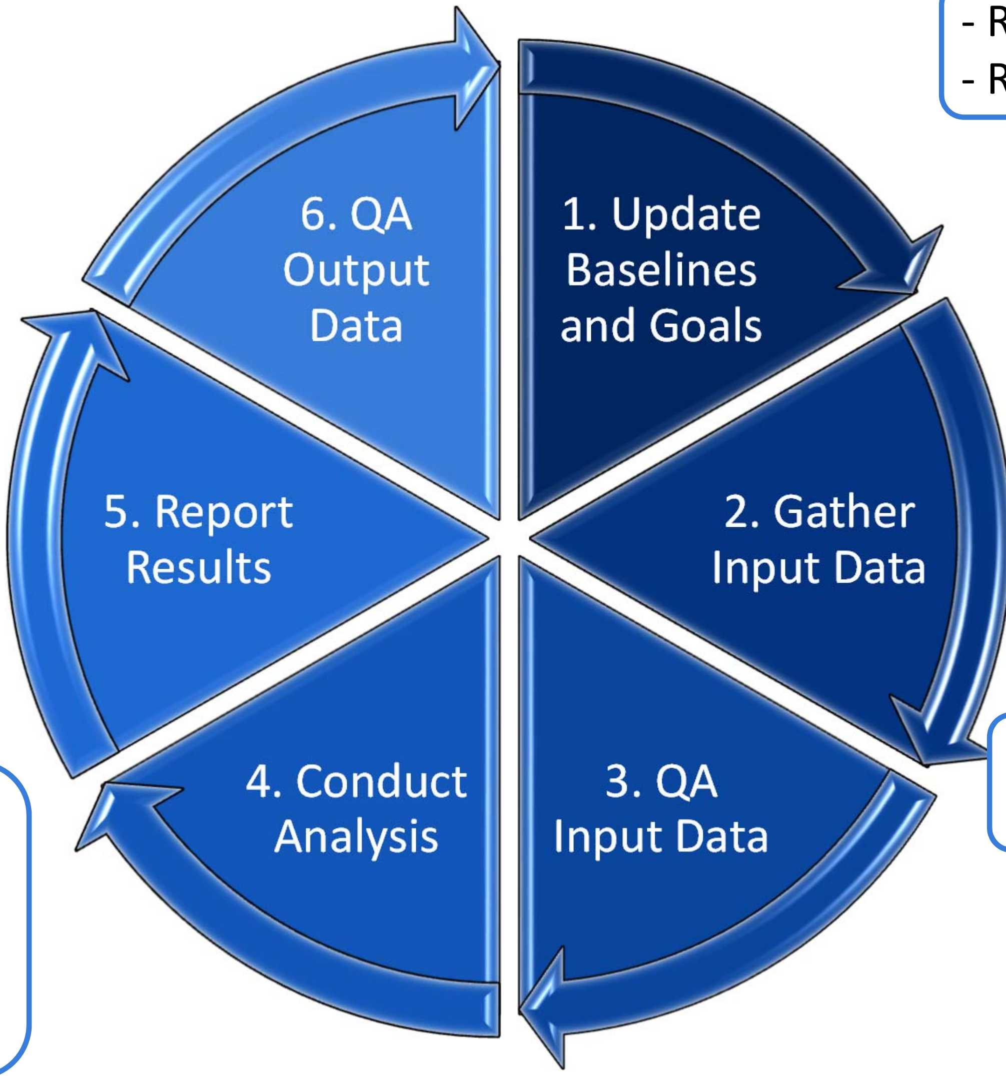
energy ENERGY STAR

5.6 Energy Performance Goals in OPR

- Overall Building Energy Goals
- Discipline- or System-specific energy goals
  - Envelope
  - Lighting/Daylighting
  - Plugs/Process Loads
  - Service Water Heating
  - HVAC

	Item	Component	Recommendation
	Form/space planning	Proper zoning	Group similar space types within the building footprint.
Envelope	Roofs	Insulation entirely above deck	R-30.0 c.i.
		Solar reflectance index (SRI)	Comply with Standard 90.1*
	Walls	Mass (HC > 7 Btu/ft^2)	R-13.3 c.i.
		Steel framed	R-13.0 + R-7.5 c.i.
		Below-grade walls	R-7.5 c.i.
	Floors	Mass	R-14.6 c.i.
		Steel framed	R-38.0
	Slabs	Unheated	Comply with Standard 90.1*
		Heated	R-20 for 24 in.
	Doors	Swinging	U-0.50
		Nonswinging	U-0.50
	Vestibules	At primary visitor building entrance	Comply with Standard 90.1*
	Continuous air barriers	Continuous air barriers	Entire building envelope
	Vertical fenestration (full assembly—NFRC rating)	Window-to-wall ratio	40% of net wall (floor-ceiling)
		Thermal transmittance	Nonmetal framing windows = 0.38 Metal framing windows = 0.44
		Solar heat gain coefficient (SHGC)	Nonmetal framing windows = 0.26 Metal framing windows = 0.38
		Light-to-solar gain ratio (LSG)	All orientations ≥ 1.5
		Exterior sun control	South orientation only – PF = 0.5
Daylighting/ Lighting	Form-driven daylighting option	All spaces	Comply with LEED for healthcare credits IEQ 8.1 (daylighting) and IEQ 8.2 (views)
		Diagnostic and treatment block	Shape the building footprint and form such that the area within 15 ft of the perimeter exceeds 40% of the floorplate.
		Inpatient units	Ensure that 75% of the occupied space not including patient rooms lies within 20 ft of the perimeter.
		Staff areas (exam rooms, nurse stations, offices, corridors); public spaces (waiting, reception); and other regularly occupied spaces as applicable	Design the building form to maximize access to natural light, through sidelighting and toplighting.
	Nonform-driven daylighting option	Staff areas (exam rooms, nurse stations, offices, corridors) and public spaces (waiting, reception)	Add daylight controls to any space within 15 ft of a perimeter window.
	Interior finishes	Room interior surface average reflectance	Ceilings ≥ 80% Walls ≥ 70%
	Interior lighting	Lighting power density (LPD)	Whole building = 0.9 W/ft^2 Space-by-space per Table 5-4
		Light source efficacy (mean lumens per watt)	T8 & T5 > 2 ft = 92 T8 & T5 < 2 ft = 85 All other >50
		Ballasts—4 ft T8 Lamps	Nondimming = NEMA Premium Dimming= NEMA Premium Program Start
		Ballasts—Fluorescent and HID	Electronic
		Dimming controls daylight harvesting	Dim all fixtures in daylighted zones.
		Lighting controls—General	Manual ON, auto/timed OFF in all areas as possible.
		Surgery task lights	Use LED lights exclusively.
		Exit signage	0.1–0.2 W Light Emitting Capacitor (LEC) exit signs exclusively

Typical Energy Modeling "Cycle"



- Reflect latest design
- Refine OPR goals

- Project-specific data
- Incremental costs

- Refer to specific Modeling Cycle for purpose, applicability, and analysis

- Narrative
- Inputs
- Outputs relative to goals

Design-Phase Modeling Cycles

Conceptual Design
- #1 Simple Box Modeling
- #2 Conceptual Design Modeling

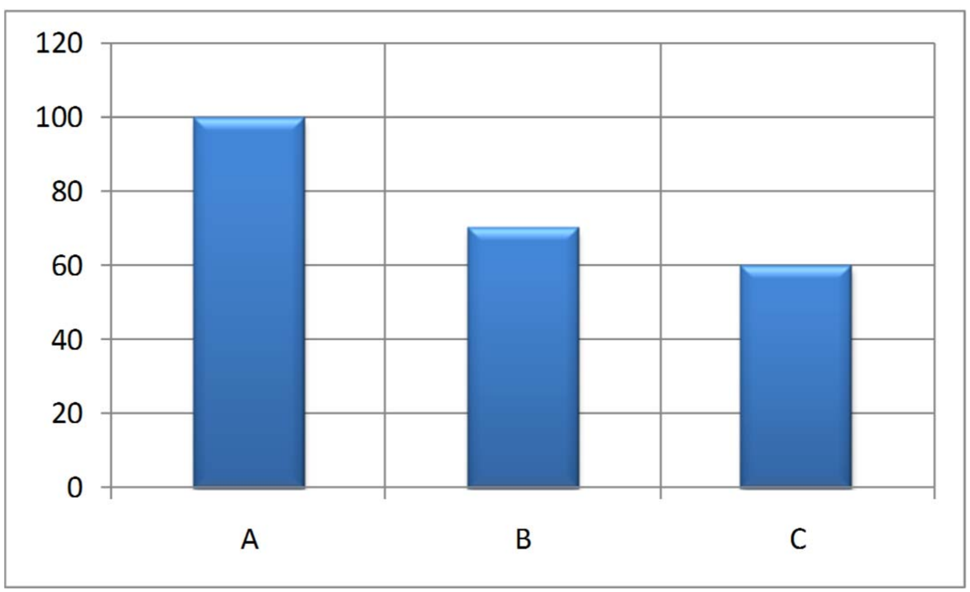
Schematic Design
- #3 Load Reduction Modeling
- #4 HVAC System Selection

Design Development
- #5 Design Refinement
- #6 Integration & Optimization

Construction Documents
- #7 Energy-Simulation-Aided Value Engineering

Modeling Cycle #3: Load Reduction Modeling

- Determine which design strategies have biggest impact on HVAC system sizing and energy consumption.
- Prior to the end of <u>schematic design</u>.
- Develop a list of load reduction strategies and use energy model to evaluate their effect on performance



Construction/Operations Phase Modeling Cycles

Construction

#8 As-Designed Performance

#9 Contemplated Change Orders

Operations

#10 As-Built Performance

- Compare Design and Actual Performance

QUESTIONS?