Energy modeling for 2015 IECC compliance and net zero design.
Should architects do energy modeling?

March 24, 2020
8:30am – 11:30am

HAWAII STATE Energy Office

Hawaiʻi Energy

AIA Honolulu

U.S. GREEN BUILDING COUNCIL USGBC HAWAII

ASHRAE Hawaii Chapter

Motivations

Types of performance analysis

Energy modeling in design

Should architects do energy modeling?

Case studies

Energy modeling for code compliance

Making it work

Panel discussion

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

COURSE DESCRIPTION

Designers face increasing demands to deliver energy efficient buildings. Energy code stringency has increased significantly with adoption of the 2015 IECC. The AIA's 2030 Challenge sets ambitious energy design targets. The State seeks to be carbon neutral by 2045. And some clients are asking for zero energy buildings. Energy modeling plays an increasingly vital role in meeting these challenging energy performance goals.

This seminar and panel discussion provides guidance for designers and project managers on effectively integrating energy modeling into the design process and addresses the following questions.

- What are appropriate applications for energy modeling?
- When should I use energy modeling for energy code compliance?
- Should architects do energy modeling?
- How do I work effectively with an energy modeler?
- How do I plan for effective use of energy modeling in design?

LEARNING OBJECTIVES

At the end of this course, participants will be able to:

1. Choose effective energy modeling tasks to support design and meet energy efficiency targets
2. Identify useful energy analysis tasks for design architects
3. Develop a plan to use energy modeling during design
4. Craft a scope of work for an energy modeling specialist

Introductions

Presenters and panelists

- Erik Kolderup, PE, LEED AP, Kolderup Consulting
- Howard Wiig, State Energy Office
- Mark Ayers, AIA, LEED AP, Ferraro Choi
- Charles Chaloeicheep, PE, LEED AP, WSP
- Kim Claucherty, AIA, BSME, LEED AP, Ferraro Choi
- Samantha Nakamura, PE, LEED AP, WSP
- Lester Ng, LEED AP, AHL

Acknowledgments

- Sehun Nakama, Hawaii Energy
- Karen Shishido, Hawaii Energy
- Gail Suzuki-Jones, State Energy Office

Agenda

1. Motivations
2. Types of performance analysis
3. Applications of energy modeling in design
4. Should architects do energy modeling?
5. Case studies
6. Using energy modeling for code compliance
7. Making it work, planning for and managing energy modeling
8. Panel discussion

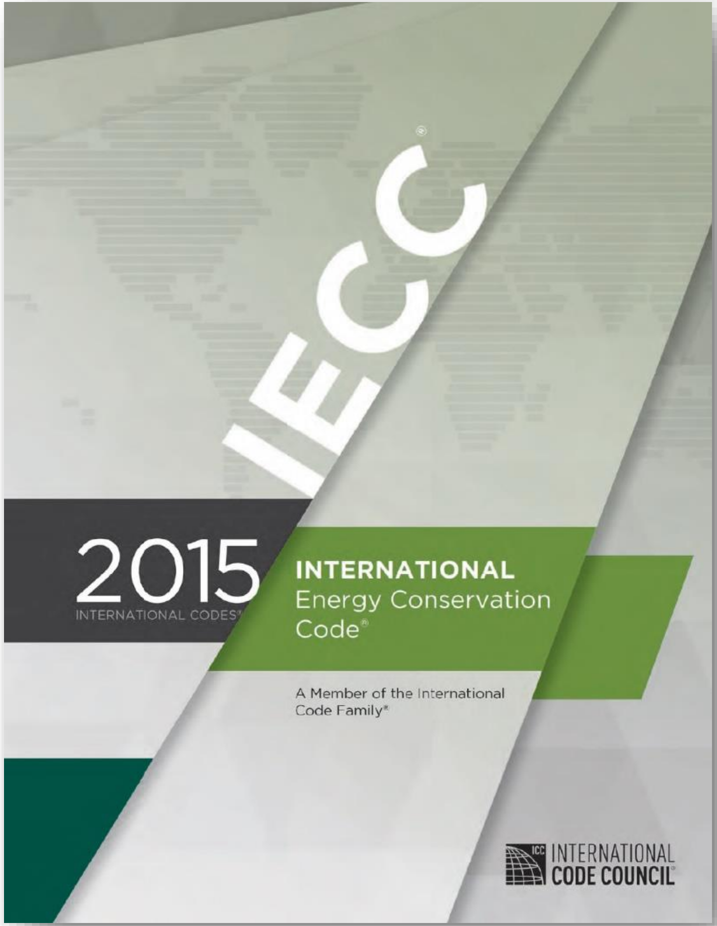
Motivations

Motivations

1. New energy code
2. Hawaii Clean Energy Goals - 100% by 2045
3. 2030 Challenge
4. Net zero energy and carbon emissions design goals
5. LEED, HI-CHPS
6. Costs and benefits
7. AIA commentary on climate change mitigation, 2017
8. AIA resolution in 2019 for Urgent and Sustained Climate Action.
9. Hawaii Energy incentives

Motivations

New energy code

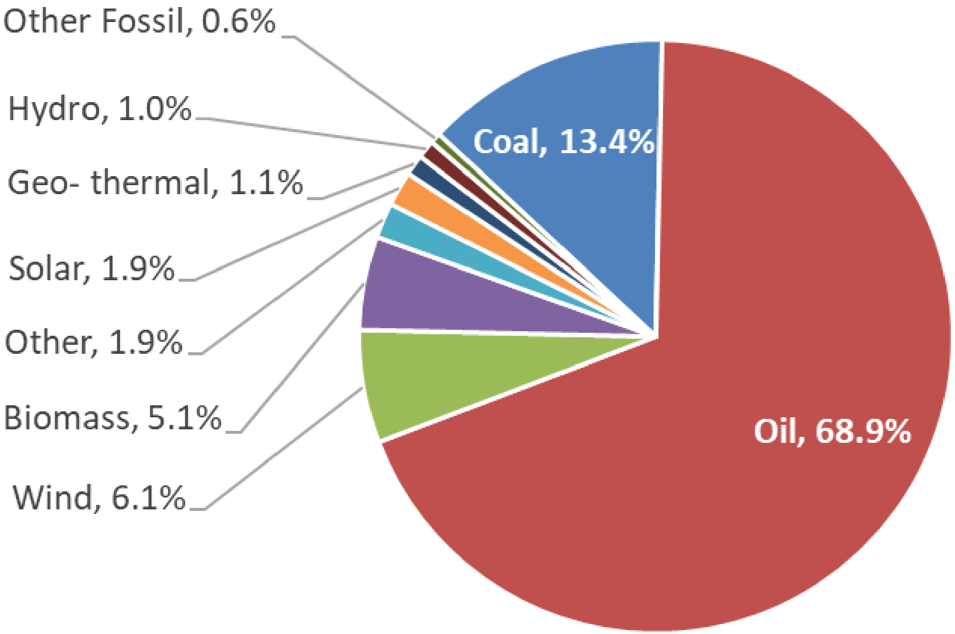


Motivations

Hawaii clean energy initiative

- 100% renewable by 2045
- Efficiency plays key role

2018 Electric Generation Mix



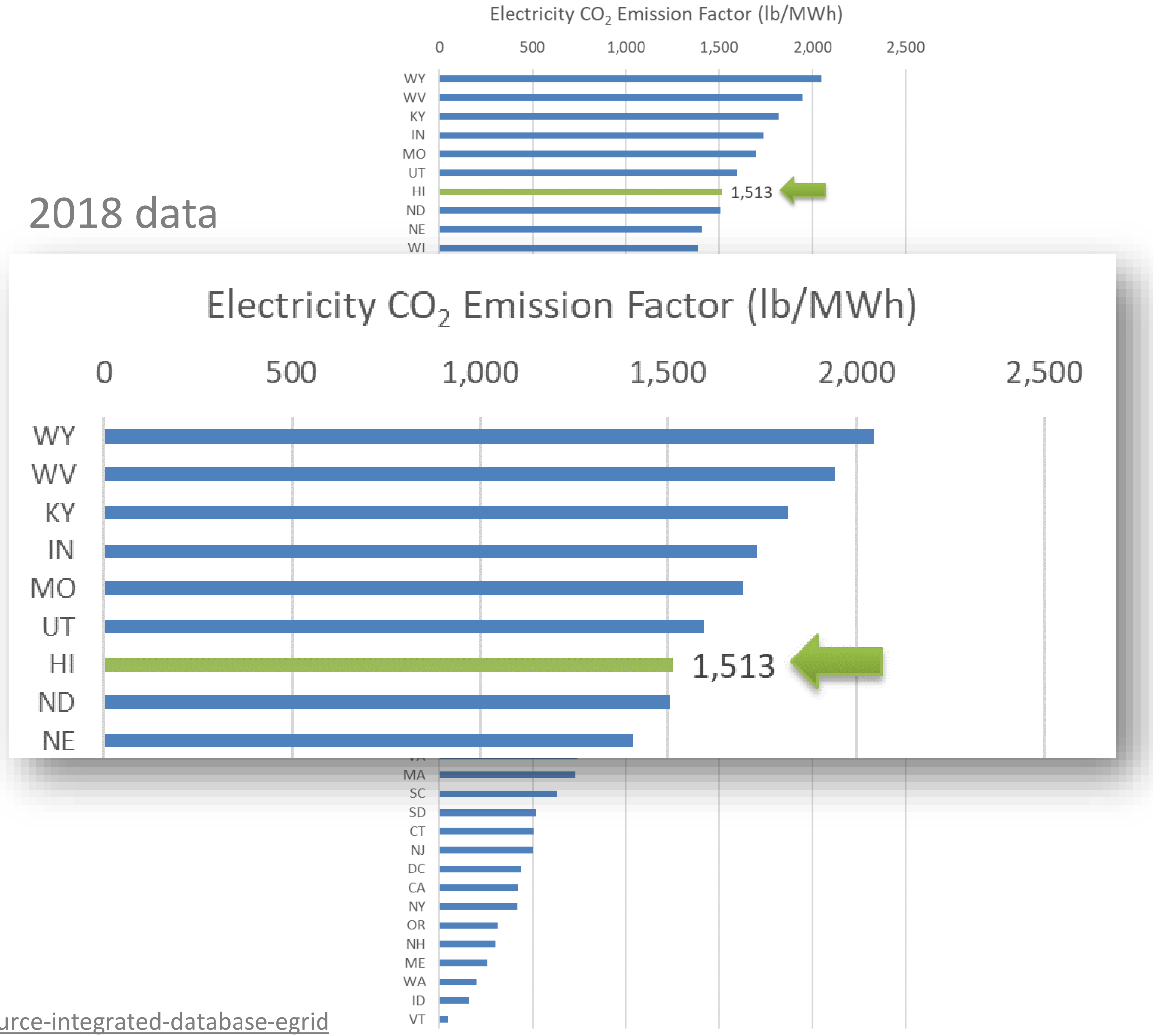
http://www.hawaiicleanenergyinitiative.org/

https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Motivations

CO_2 emissions

2018 data

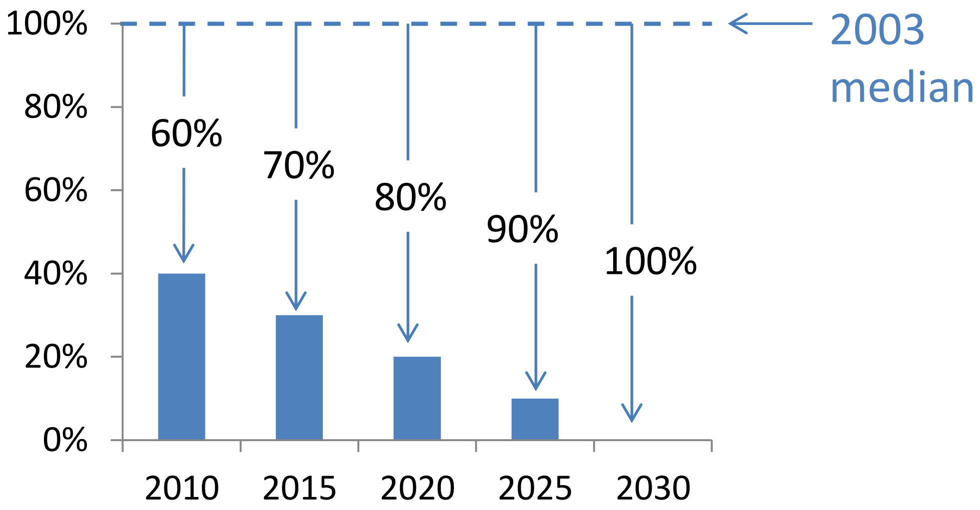


https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Motivations

AIA 2030 Commitment

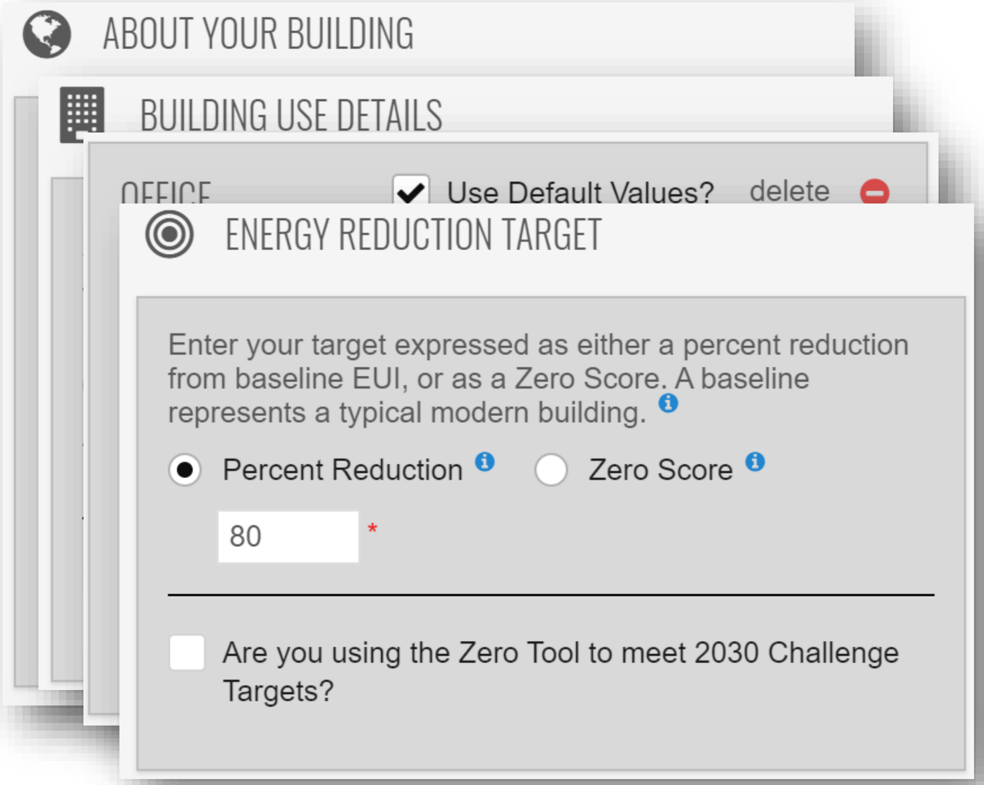
- Site EUI target
- kBtu/ft^2-yr



Motivations

AIA 2030 Commitment

- Site EUI target
- kBtu/ft^2-yr
- https://zerotool.org/zerotool/



Motivations

AIA 2030 Commitment

- Site EUI target
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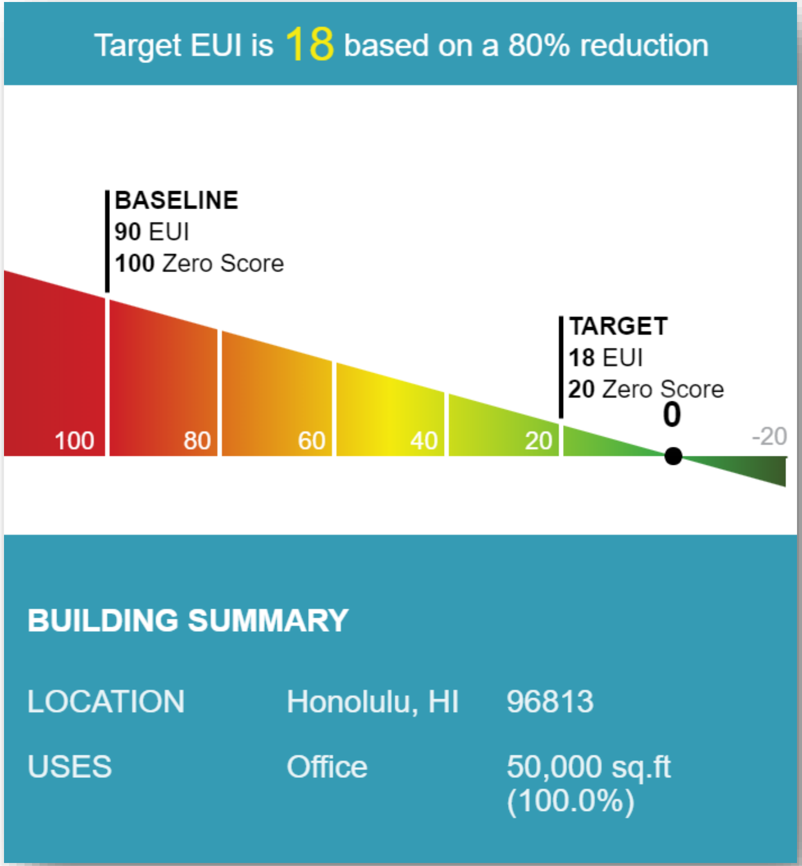


Motivations

AIA 2030 Commitment

Engage in iterative energy modeling throughout the entire design process to understand the interactive effects of various design decisions and to assess progress towards meeting the EUI target.

https://architecture2030.org/2030_challenges/2030-challenge/

Motivations

AIA commentary on climate change mitigation 2017

To meet 2030 goals

1. Engage in education
2. Engage in energy modeling
3. Engage in policy-making

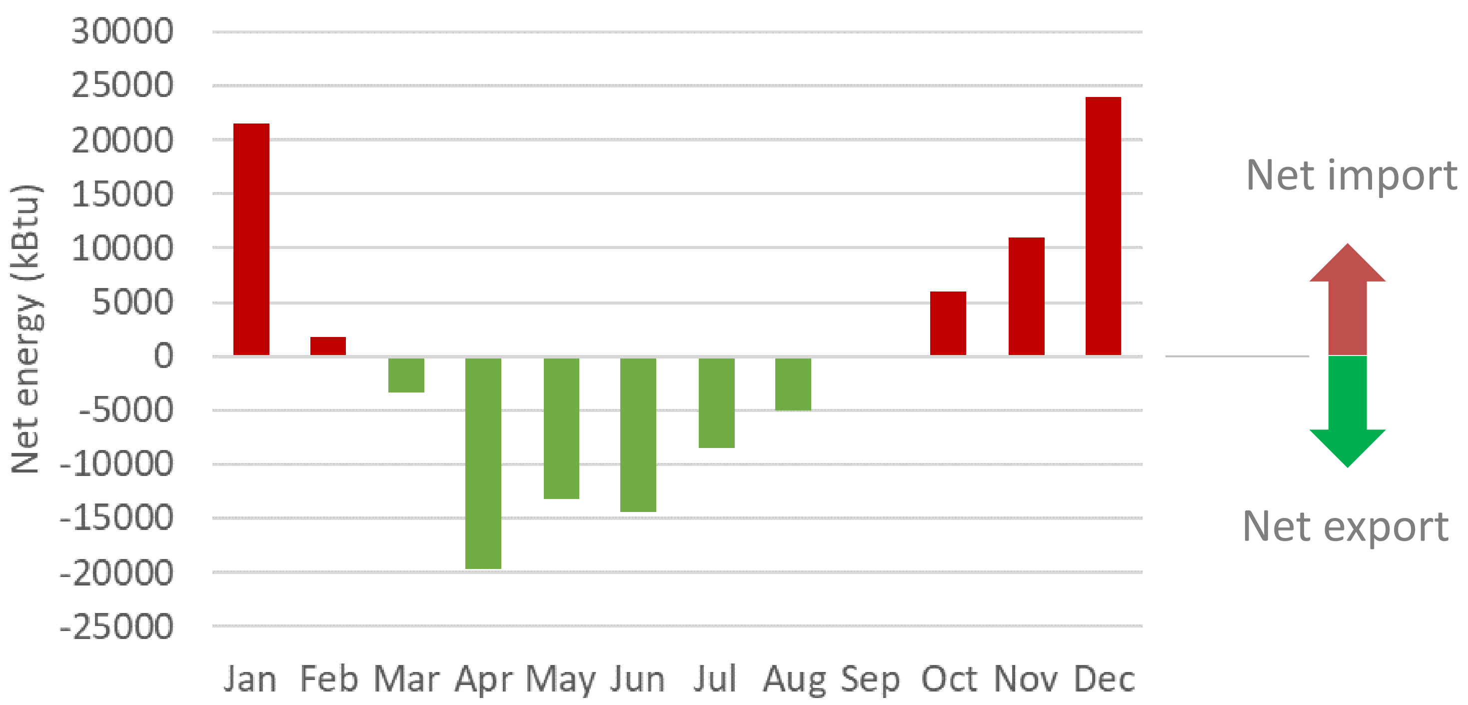
➡

This involves learning how to get more assistance from energy modeling and energy consultants to help make the right early decisions towards meeting our 2030 Challenge goals and our clients' quality and budgetary goals.

http://content.aia.org/sites/default/files/2017-04/AIA-Commentary_climate-change-mitigation.pdf

Motivations

Net zero energy/carbon



Motivations

HI-CHPS

COLLABORATIVE FOR HIGH PERFORMANCE CHPS SCHOOLS

Mechanically Conditioned Projects	Naturally Conditioned Projects	EE.C1.1 Utilize the Energy Prerequisite EE.P1 for quantifying reductions in total site energy use compared to the most current adopted version of ASHRAE 90.1 by the State of Hawaii. Points are awarded according to the percentage saved over a baseline building.
2 points	3 points	17% minimum reduction
4 points	5 points	20% minimum reduction
6 points	7 points	22% minimum reduction
8 points	9 points	25% minimum reduction
9 points	10 points	27% minimum reduction
11 points	12 points	30% minimum reduction
12 points	13 points	34% minimum reduction
13 points	14 points	37% minimum reduction
15 points	16 points	40% minimum reduction
16 points	17 points	44% minimum reduction
17 points	18 points	47% minimum reduction
19 points	20 points	50% minimum reduction
21 points	22 points	55% minimum reduction
23 points	24 points	60% minimum reduction

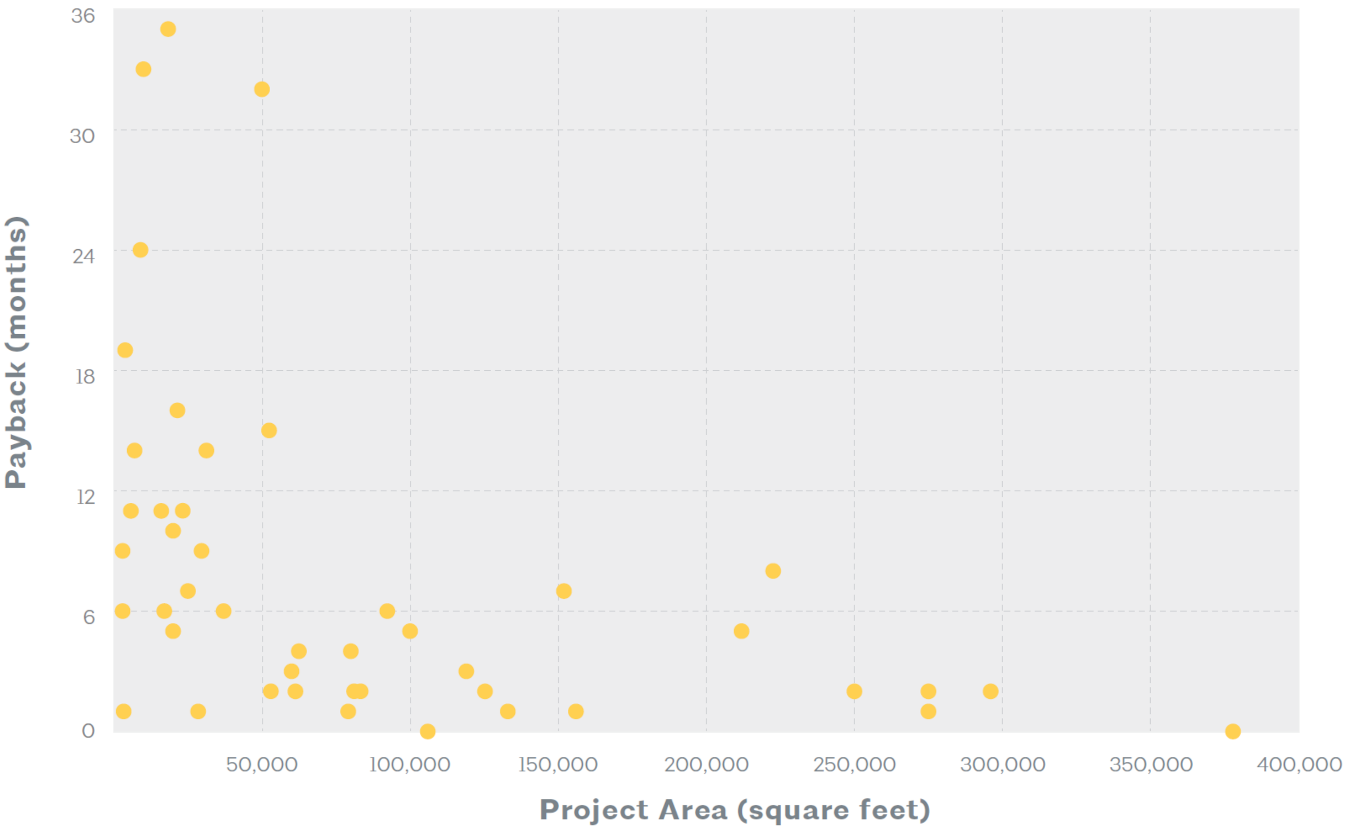
Motivations

LEED

- Credit: Integrative Process
- Prerequisite: Minimum Energy Performance
- Credit: Optimize Energy Performance

Motivations

Payback



Credit: HOK & TLC Engineering for Architecture
Source: Architect's Guide to Building Performance (AIA 2019)

Motivations

Hawaii Energy incentives

Commercial New Construction Incentives

Existing rebates – (systems-based):

HVAC and Lighting, standard and custom rebates with energy code as baseline

NEW Whole Building Approach, Energy modeling incentive:

$1k bonus incentive each for owner and design team

$5k for energy model

$0.12/kWh on savings above 2015 IECC baseline*

Now seeking pilot projects for 2020-2021

*Design must be 10% more efficient than baseline to qualify

Edmundo Ramos

Energy Advisor:

Retail, New Construction

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CELEBRATING A DECADE

Hawaiʻi Energy

10

EMPOWERING EFFICIENCY

Motivations

Critical carbon emission targets

New approaches to energy modeling

Early and integrated

Audience poll

Audience poll

Your role

- Architect – project manager
- Architect – designer
- HVAC engineer
- Electrical engineer
- Energy efficiency specialist
- Building official
- Government – project manager
- Government – policy
- Contractor
- Other

Types of performance analysis

Types of performance analysis

Lighting, daylight and glare

Solar and shading

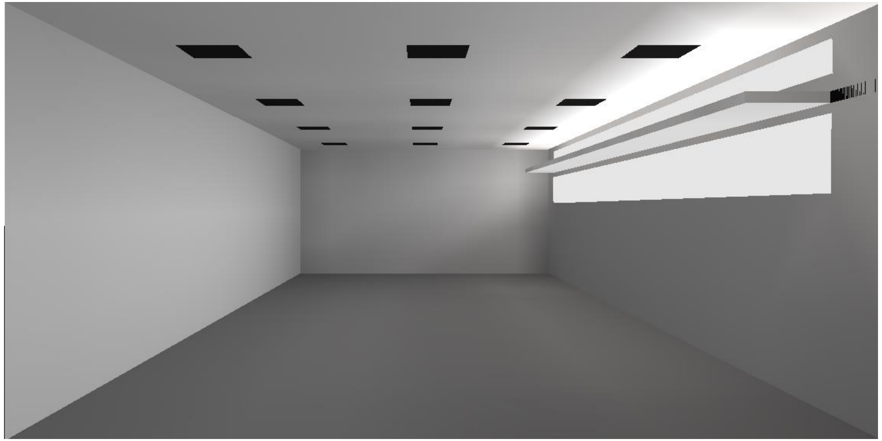
Natural ventilation

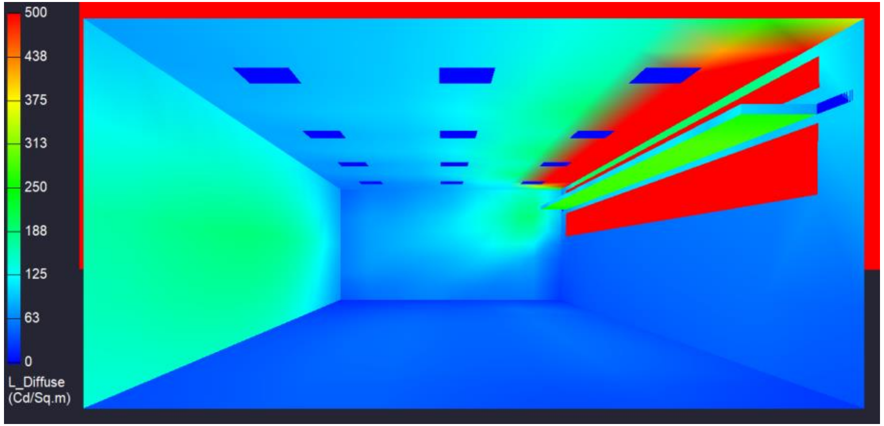
Envelope/façade

Whole-building energy simulation

Types of performance analysis

Lighting, daylight and glare



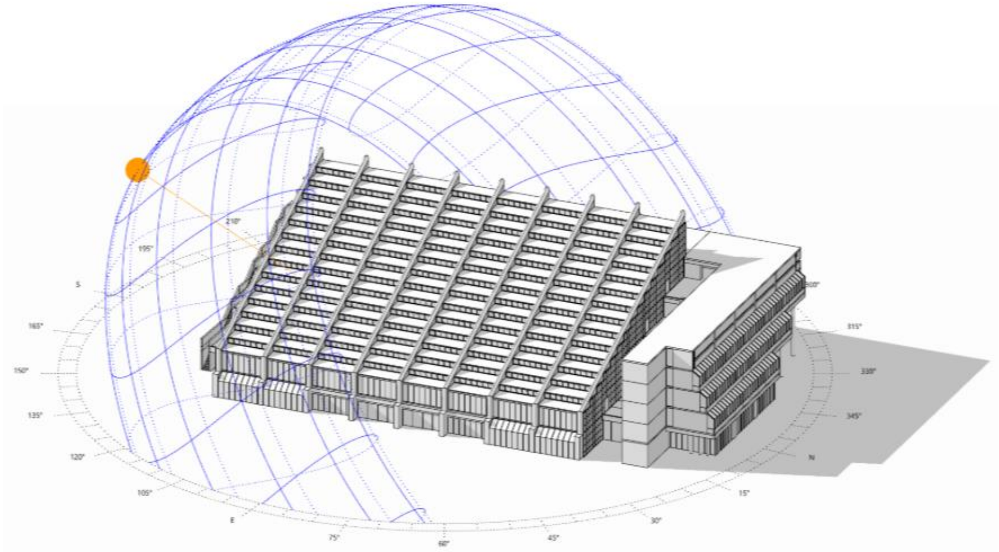


Example tools

- Diva (Radiance)
- ElumTools, AGi32
- Autodesk lighting analysis
- Sefaira
- LightStanza

Types of performance analysis

Solar and shading



Example tools

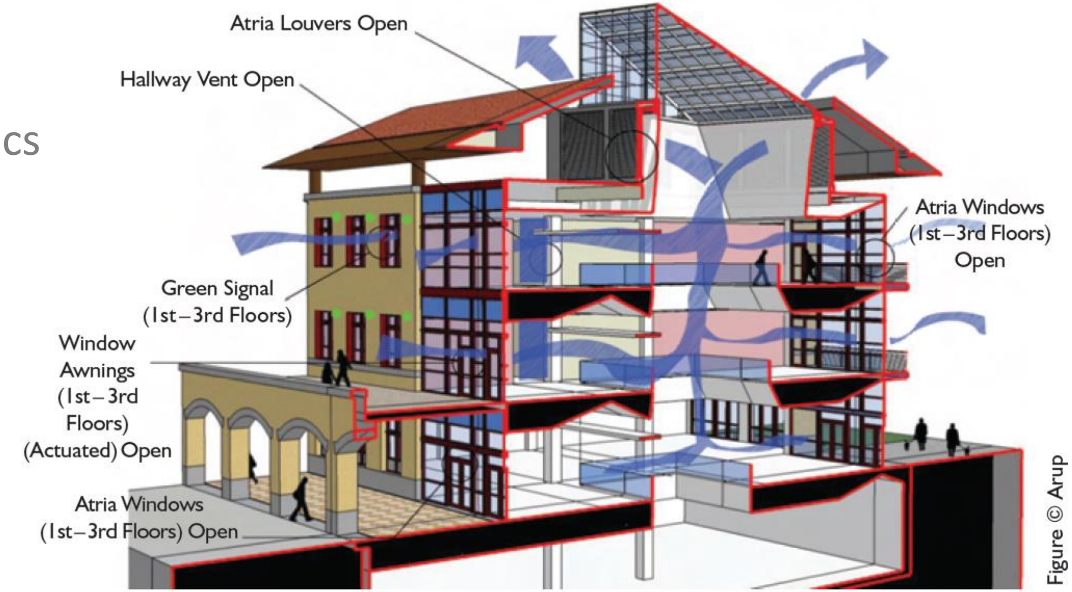
- Sketchup
- Revit
- Climate Studio
- …

https://www.solemma.com/ClimateStudio.html

Types of performance analysis

Natural ventilation

- Climate analysis
- Airflow network
- Computational fluid dynamics



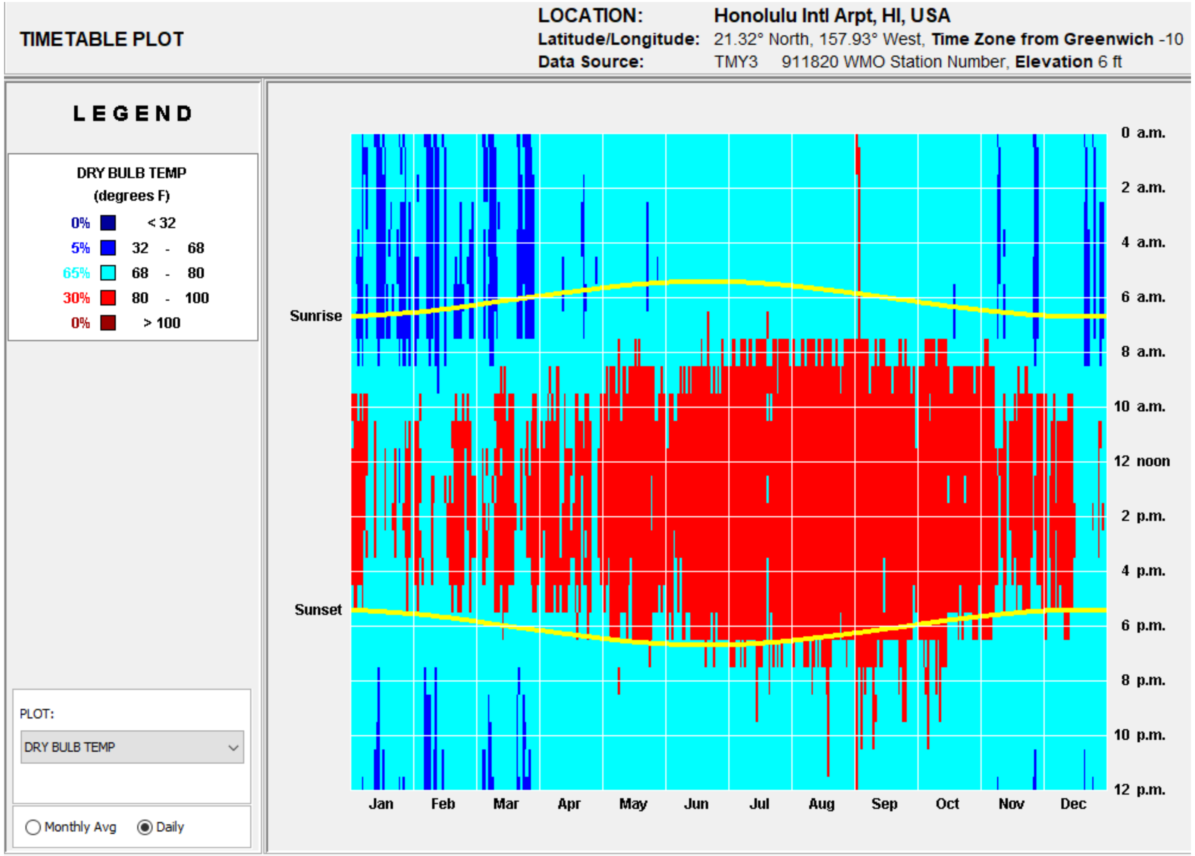
Types of performance analysis

Natural ventilation

- Climate analysis

Example tools

- Climate Consultant



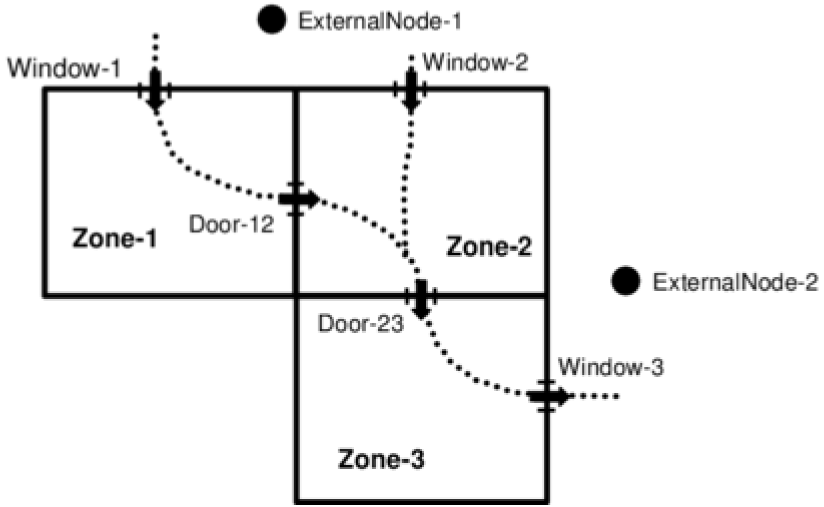
Types of performance analysis

Natural ventilation

- Airflow network

Example tools

- EnergyPlus
- IES Virtual Environment



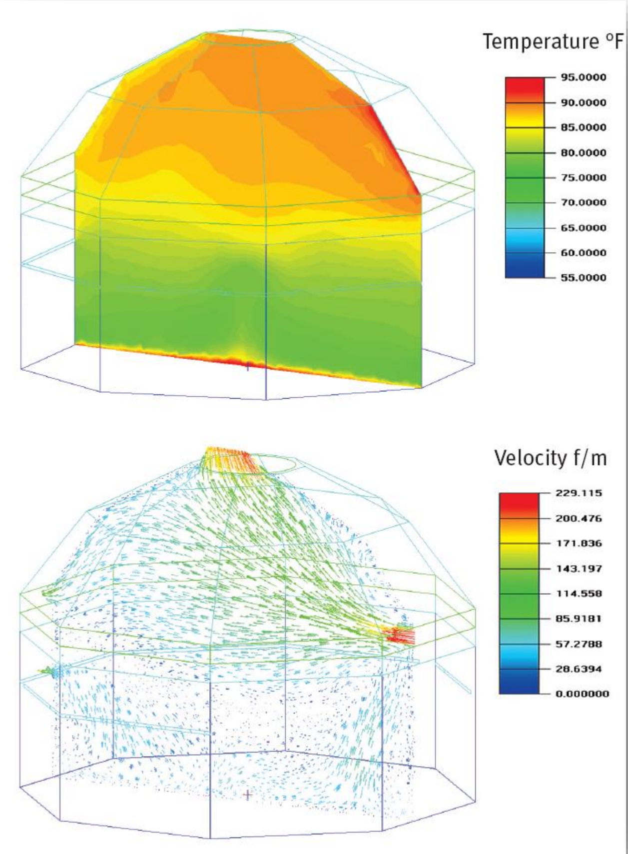
Types of performance analysis

Natural ventilation

- Computational fluid dynamics

Example tools

- Fluent
- OpenFoam
- IES Virtual Environment
- DesignBuilder
- Autodesk CFD

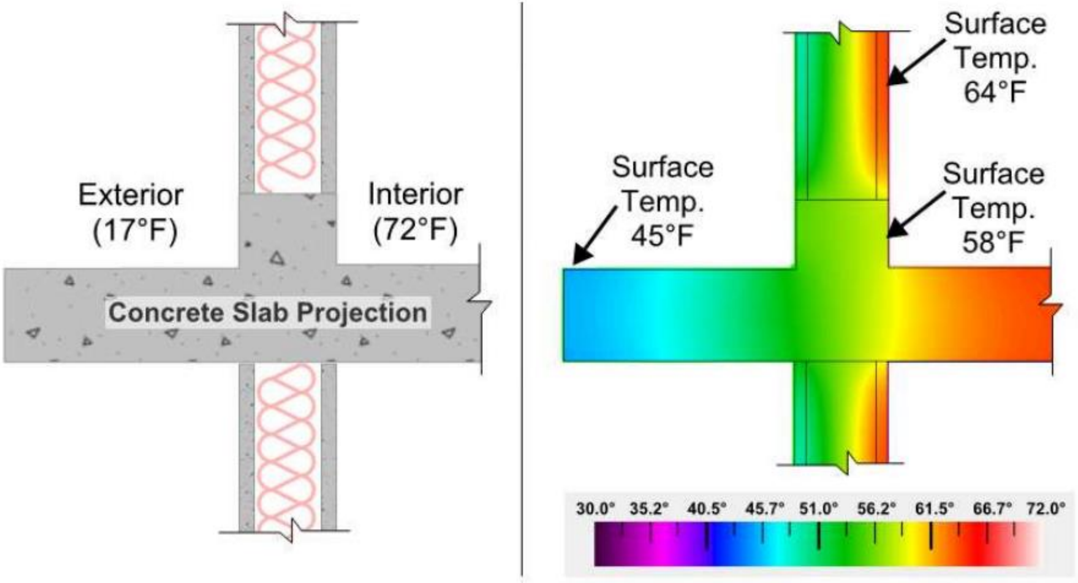


Types of performance analysis

Envelope/façade

Example tools

- Therm (2D)
- Heat3 (3D)



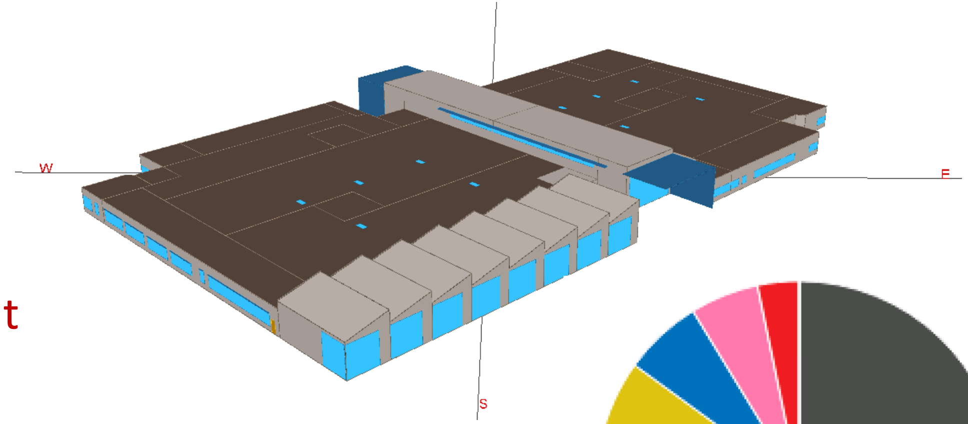
Sarah Rentfro and Anthony Nicastro Simpson Gumpertz & Heger Inc., Washington, DC, STATE OF THE INDUSTRY – COMPUTER-AIDED SIMULATION OF HIGH-PERFORMANCE BUILDING ENCLOSURES

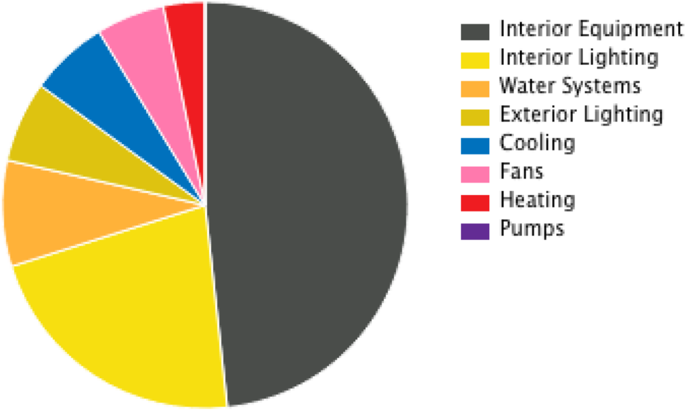
Types of performance analysis

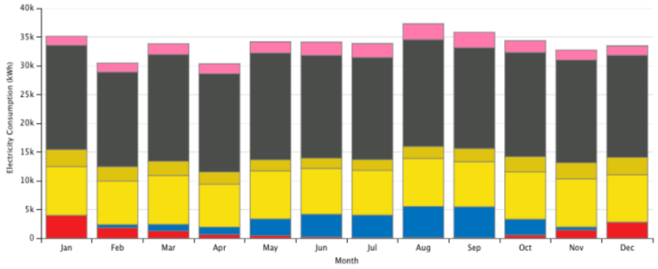
Whole building energy simulation

Example tools

- eQUEST
- IES Virtual Environment
- Trane Trace
- Carrier HAP
- DesignBuilder
- OpenStudio








Architect's Guide to
Building Performance
Integrating performance simulation
in the design process

- Simulations commonly led or performed by architects (red)
- Simulations commonly led or performed by BPS professionals (dark blue)

BUILDING PERFORMANCE SIMULATION

SINGLE ASPECT SIMULATION

- Massing and orientation (red)
- Solar and shading (red)
- Daylight and glare (red)
- Envelope/façade (red)
- Thermal comfort (dark blue)
- Natural ventilation (dark blue)

WHOLE BUILDING ENERGY SIMULATION

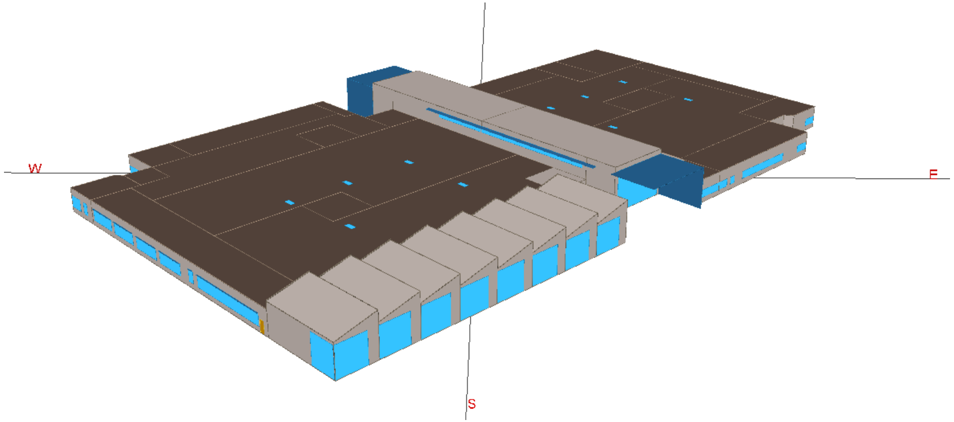
- Simple box modeling
- Conceptual design
- Load reduction
- HVAC system selection
- Design refinement integration and optimization
- Simulation aided value engineering
- As-designed energy performance
- Change orders
- As-built energy performance
- Post-occupancy

Energy modeling in design

Energy modeling in design

Roles

- Explore ideas
- Identify priorities
- Provide insights
- Challenge rules of thumb
- Optimize
- Track design performance



Energy modeling in design

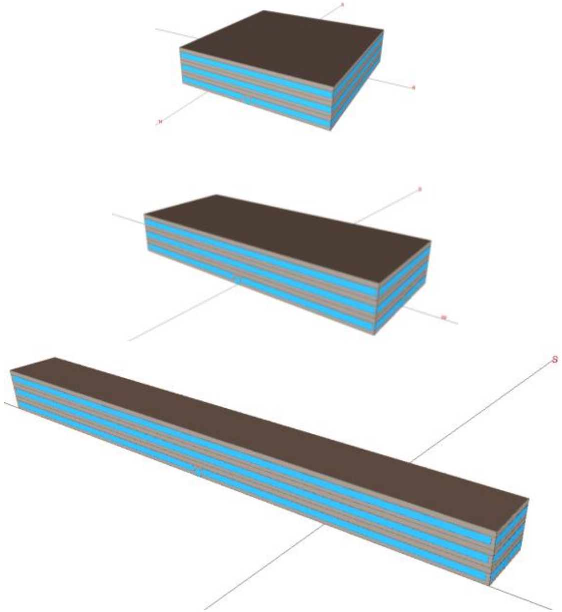
Design questions

- Building form alternatives
- Fenestration area & orientation
- Window type
- Opaque envelope constructions
- Thermal mass impact
- Impact on HVAC system size
- HVAC system type
- Natural ventilation feasibility
- Thermal comfort strategy
- Meeting performance target?
- Required PV capacity

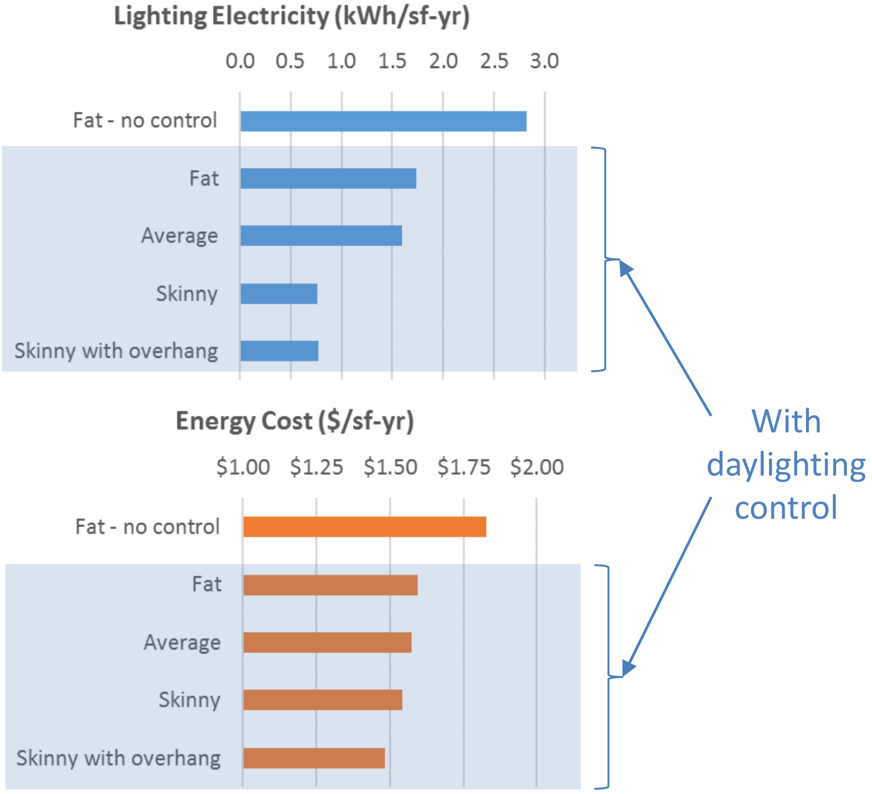
Energy modeling in design

Question:

Impact of building form on energy cost?



Three 75,000 ft² alternatives



Energy simulation results for Sacramento, CA

Energy modeling in design

Airport Terminal – Proposal Stage

Baseline Design

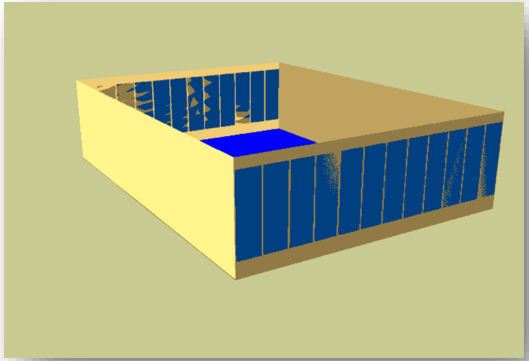
- Boarding area (60 ft slice)
- East/west glass
- Code compliant

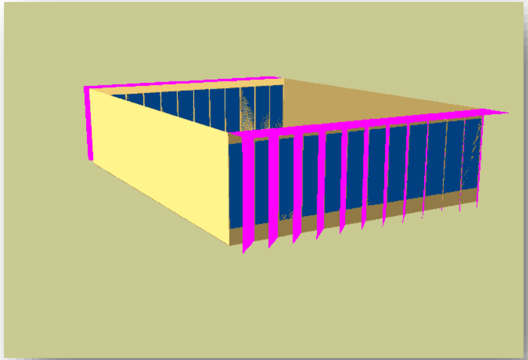
Improved Design

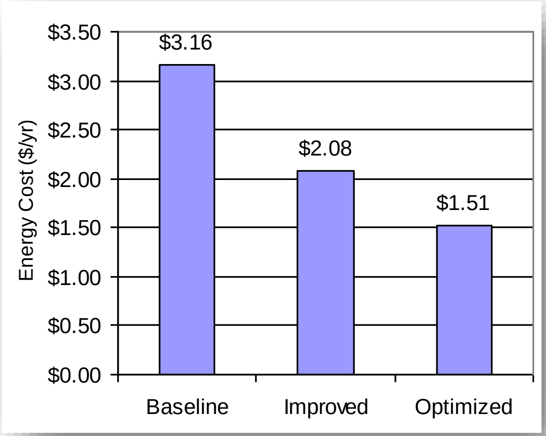
- Efficient lighting
- High performance glazing
- Exterior shading

Optimized Design

- Daylighting controls
- Displacement ventilation
- Demand control ventilation



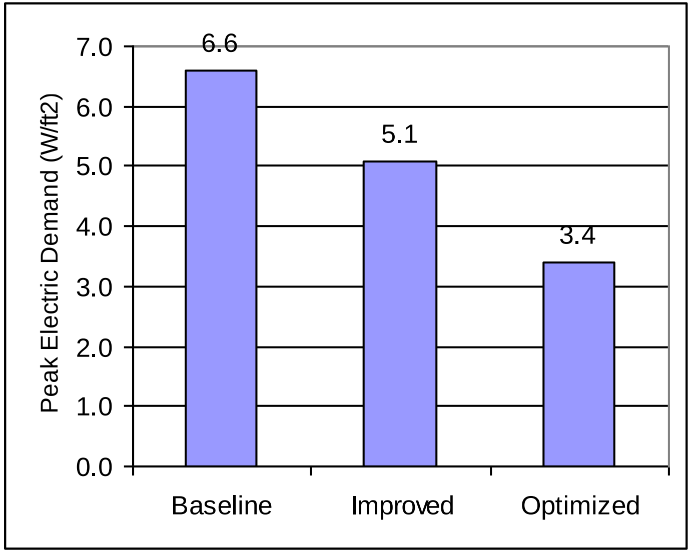




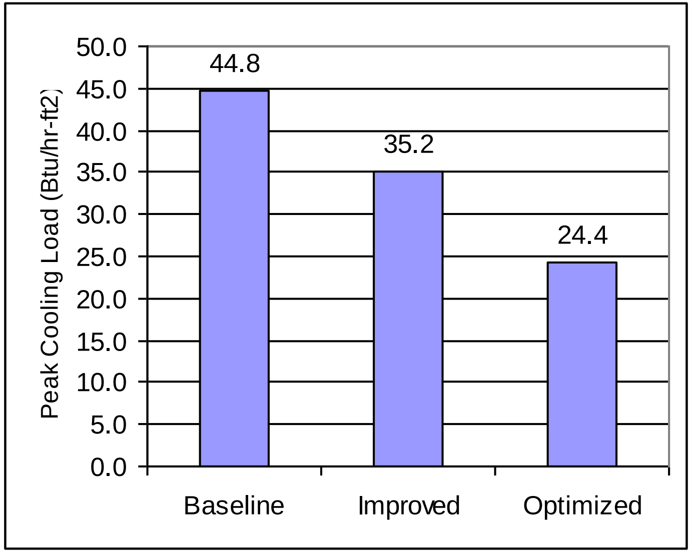
Energy modeling in design

Airport Terminal – Proposal Stage

Peak Electric Demand (watts/ft^2)

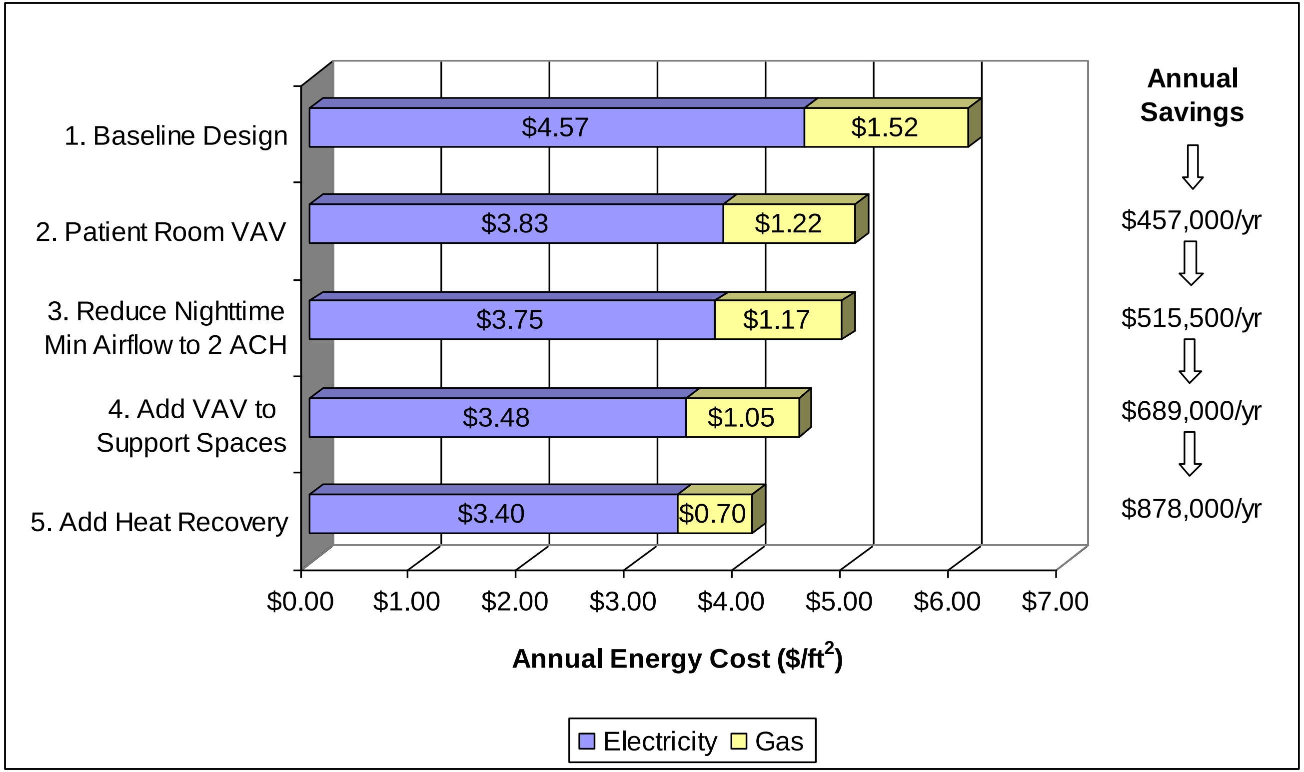


Peak Cooling Load (Btu/hr-ft^2)



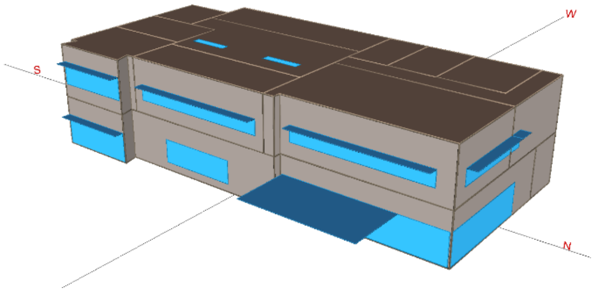
Energy modeling in design

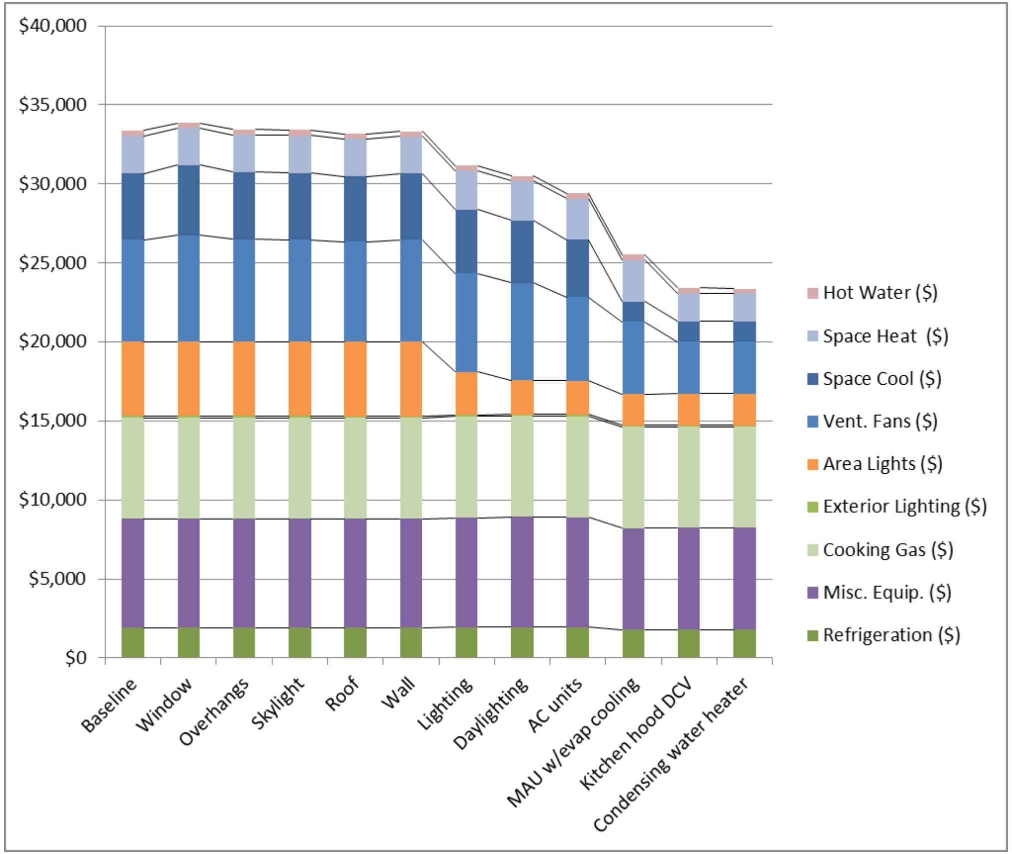
Hospital HVAC options



Energy modeling in design

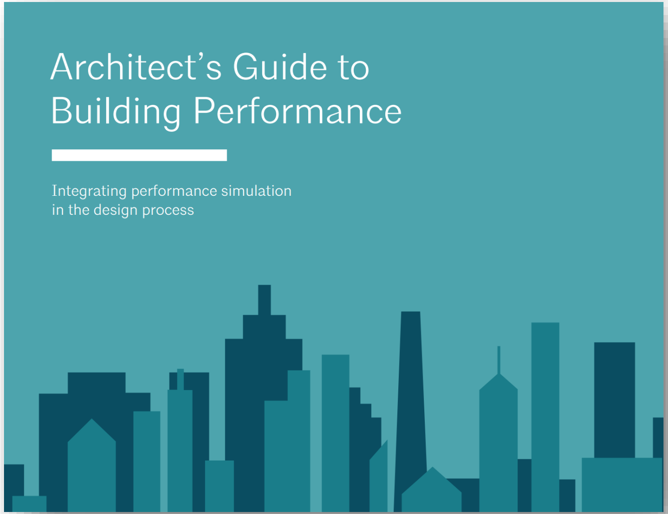
End-use energy
Impact of efficiency measures





Energy modeling in design

Design questions



Thermal loads, p. 52-53

Solar studies and shading, p. 57

Daylight and glare, p. 64-65

Thermal comfort, p. 70

Envelope simulation, p. 76

Natural ventilation, p. 81-83

Simple box modeling, p. 87

Energy modeling in design

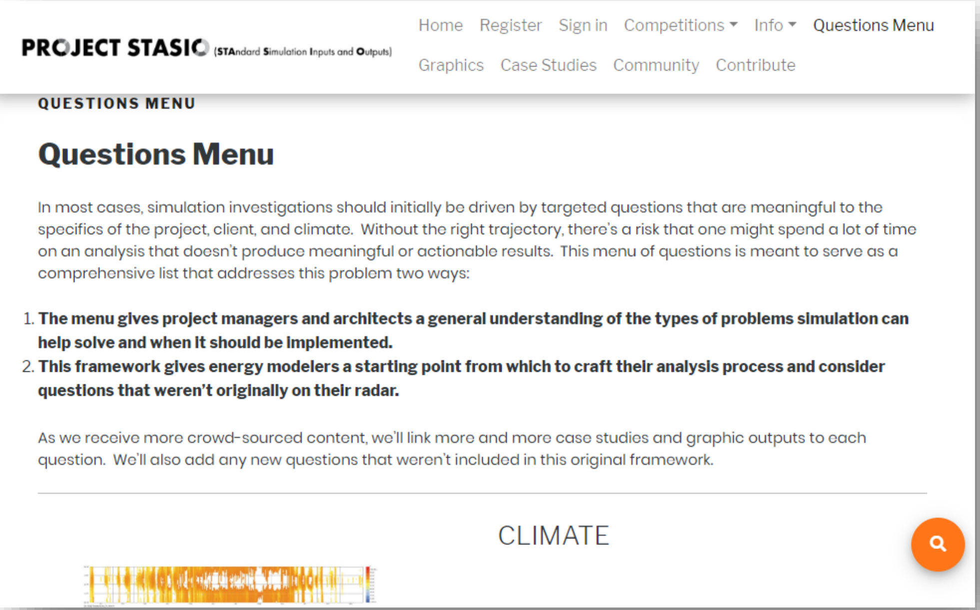
PROJECT STASIO (STAndard Simulation Inputs and Outputs)

IBPSA-USA

Graphics

Case studies

Design questions

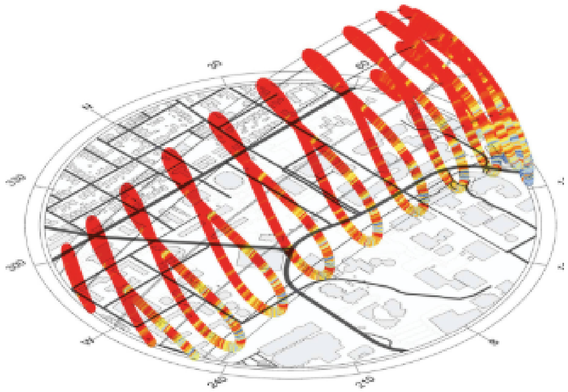


https://projectstasio.com/

PROJECT STASIO (STAndard Simulation Inputs and Outputs)

Home Register Sign in Competitions Info Questions Menu

Graphics Case Studies Community Contribute



SOLAR LOADS, SHADING, AND GLAZING

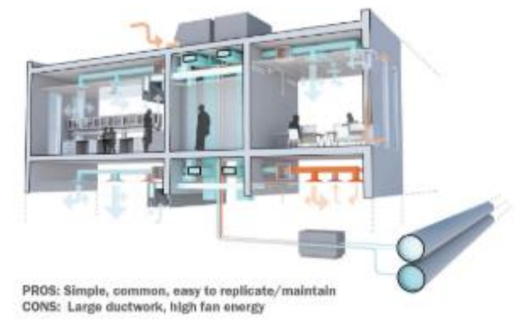
Solar

- Which Massing/Orientation options are preferable for Solar Gain?
- How much solar gain is beneficial?
- What is the optimum SHGC for energy use?
- How much can I downsize cooling system with a lower SHGC?
- How much do different window shading designs reduce solar insolation during the peak hour, day, season, or month?

PROJECT STASIO (STAndard Simulation Inputs and Outputs)

Home Register Sign in Competitions Info Questions Menu

Graphics Case Studies Community Contribute



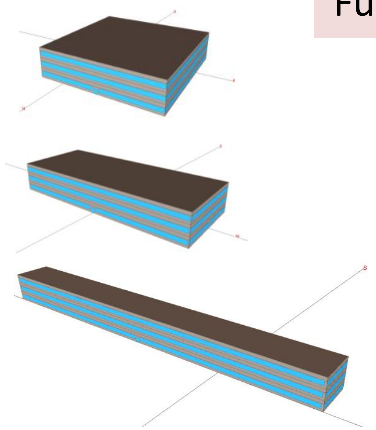
WHOLE BUILDING ANALYSIS

Energy

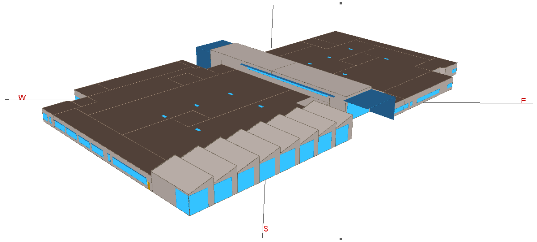
- **What are my energy end uses ranked from highest to lowest?**
- **What is the approximate EUI of my building? How close am I to hitting my % better than code or reference building energy target?**
- **How much more energy will my building use if the occupant density or use schedules vary from initial assumptions?**
- **How sensitive is my building to different window to wall area ratios?**

Energy modeling in design

Analysis plan
Simple box model



Simplified models
Fundamental decisions



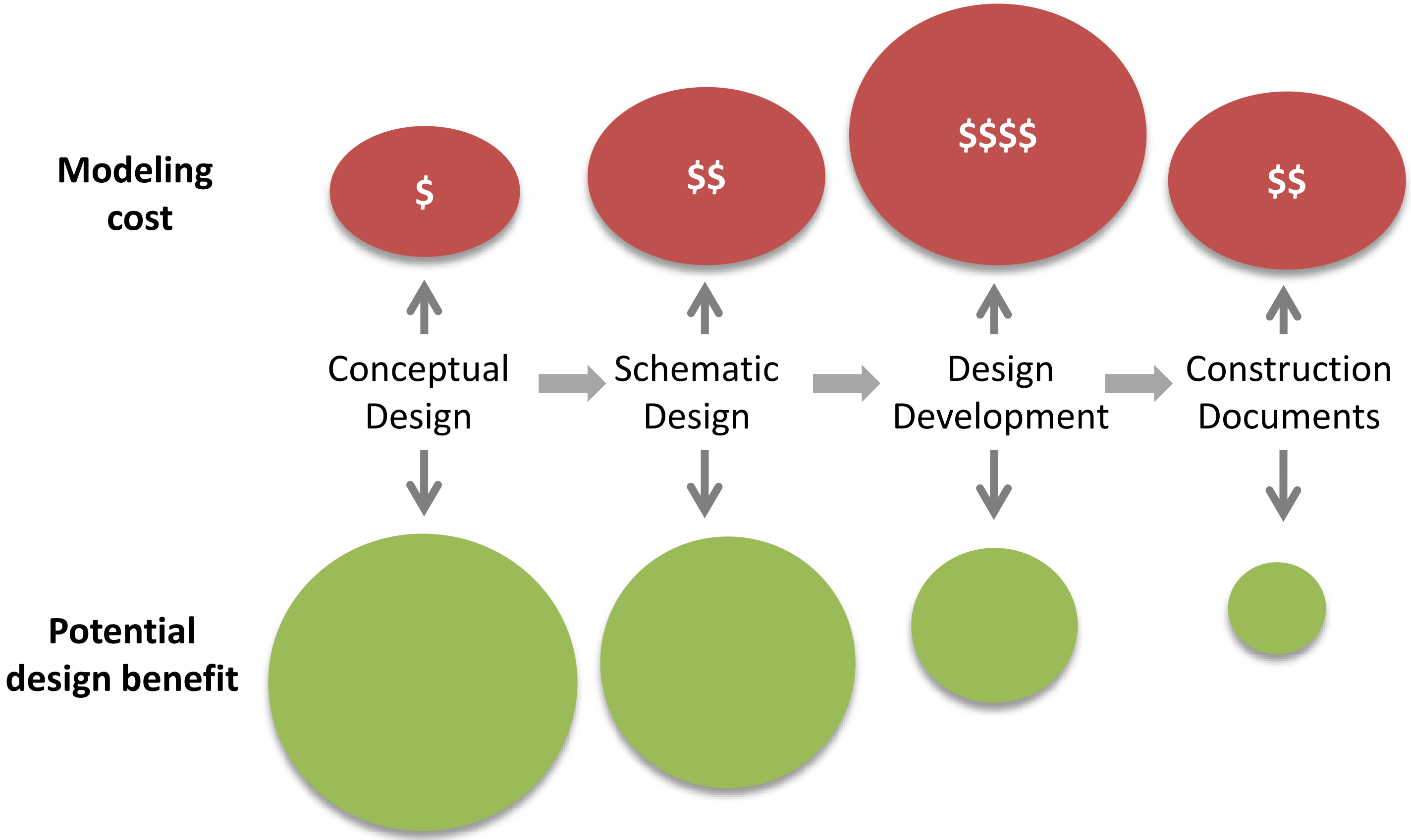
More detailed models
Specific design decisions

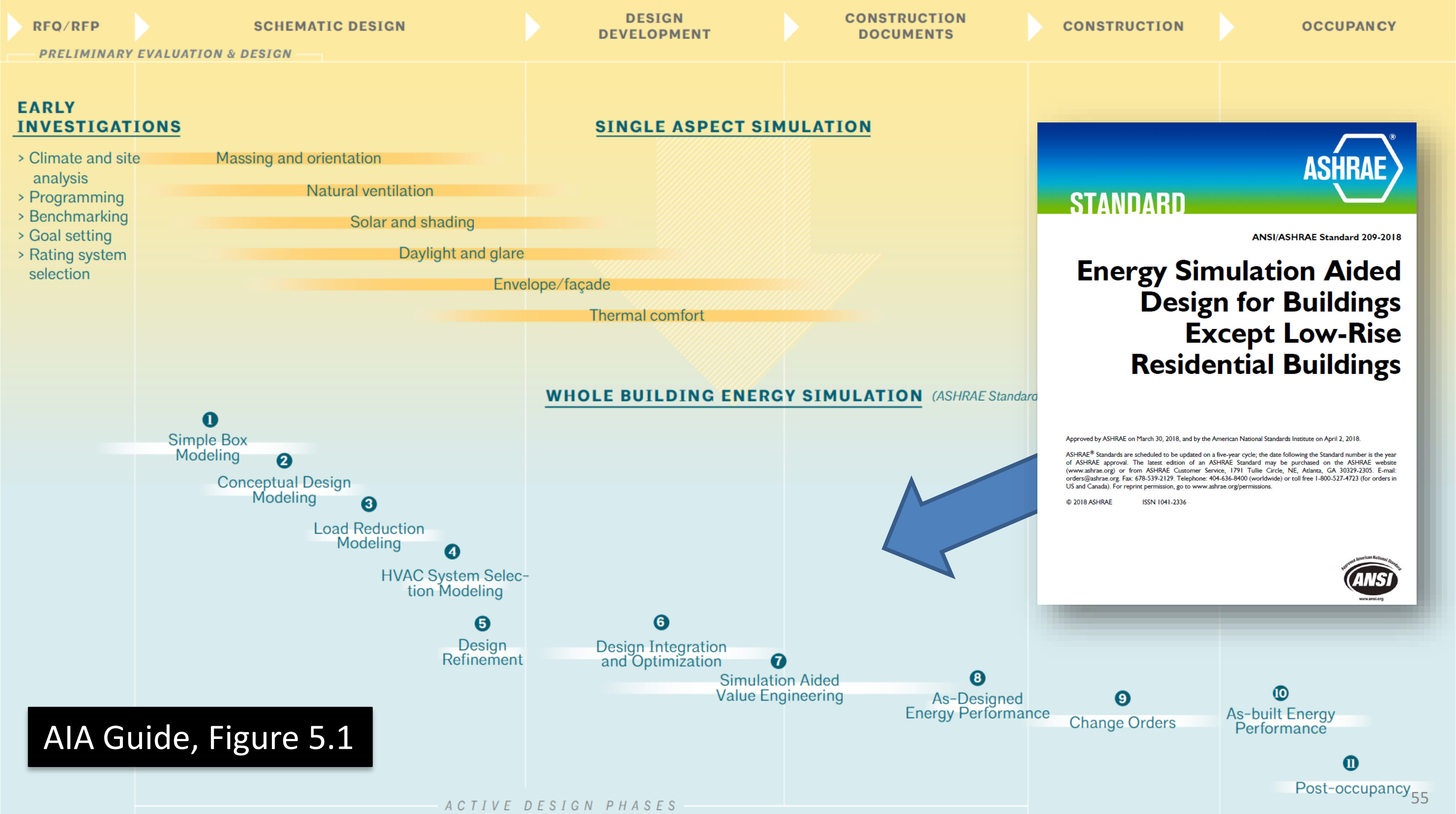
Value engineering
Verify design performance

Energy code compliance modeling

PRE-DESIGN | SCHEMATIC DESIGN | DESIGN DEVELOPMENT | CONSTRUCTION DOCS

Energy modeling in design





AIA Guide, Figure 5.1

Energy modeling in design

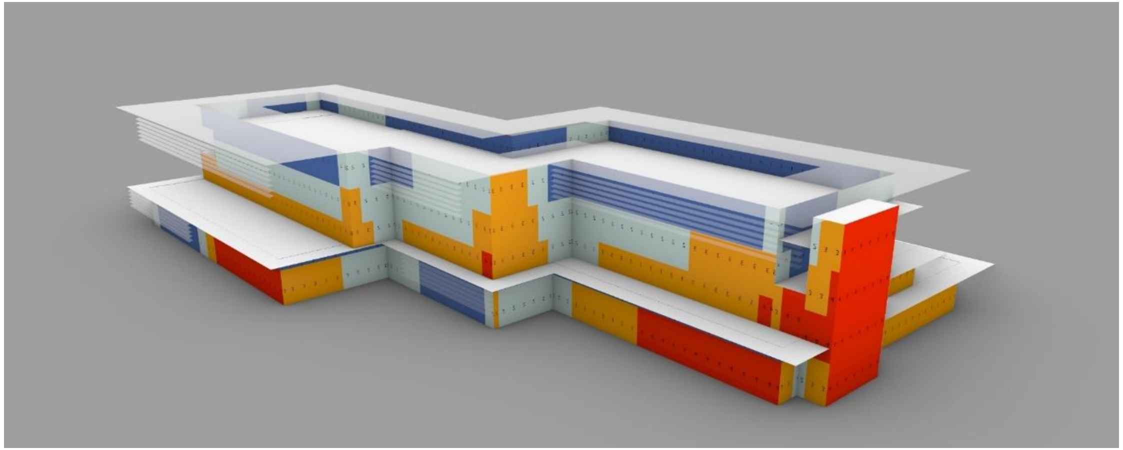
Example insights

- Cooling system can be 20% smaller with improved window shading
- Improved roof insulation increases hours of natural ventilation comfort
- Adding heat recovery is more cost effective than thermal-break window frames
- High efficiency AC means 5 fewer PV panels needed for net zero

Should architects do energy modeling?

Should architects do energy modeling?

Poll



Source: Elisa Jue, SmithGroup

Should architects do energy modeling?

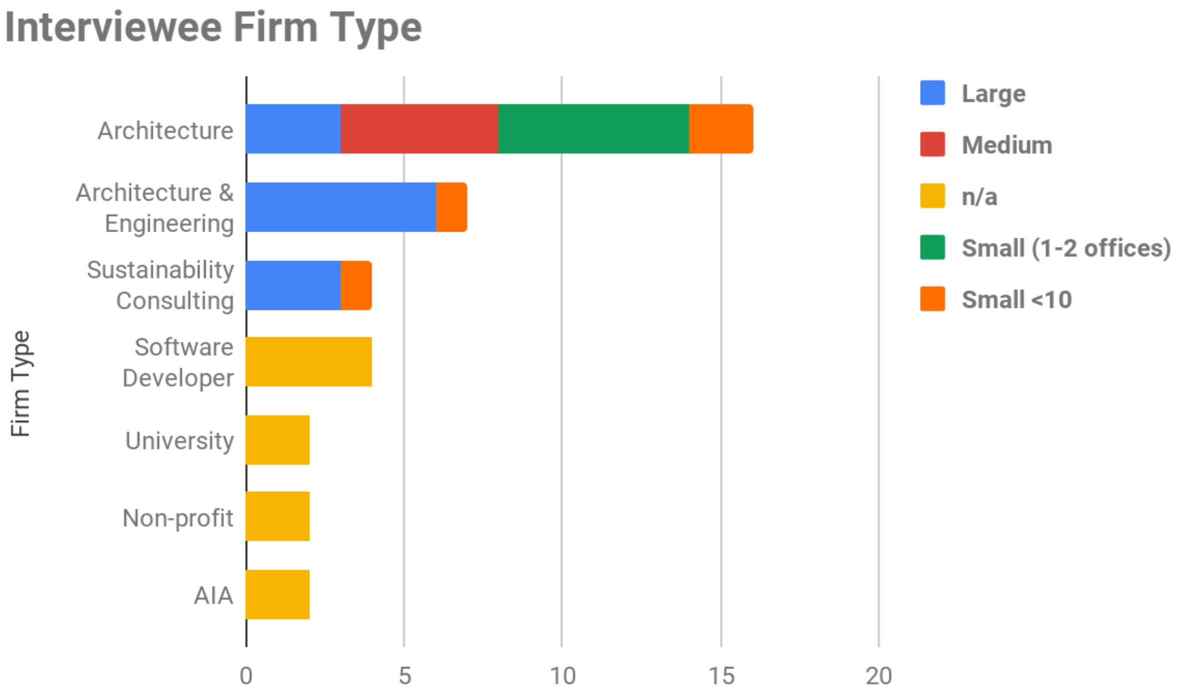
Do architects do energy modeling?

- 2019 IBPSA-USA study
- Interviews with 40 architects
- https://www.ibpsa.us/news/bem-collaborative-architect-outreach

USA Regional Affiliate - International Building Performance Simulation Association

IBPSA-USA

Should architects do energy modeling?



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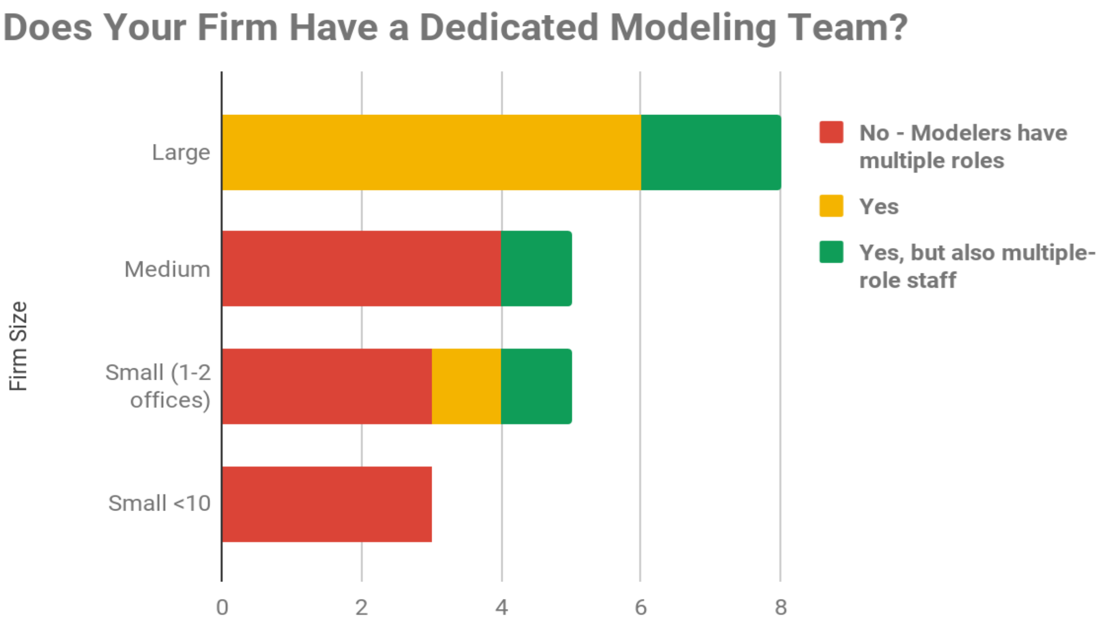
Should architects do energy modeling



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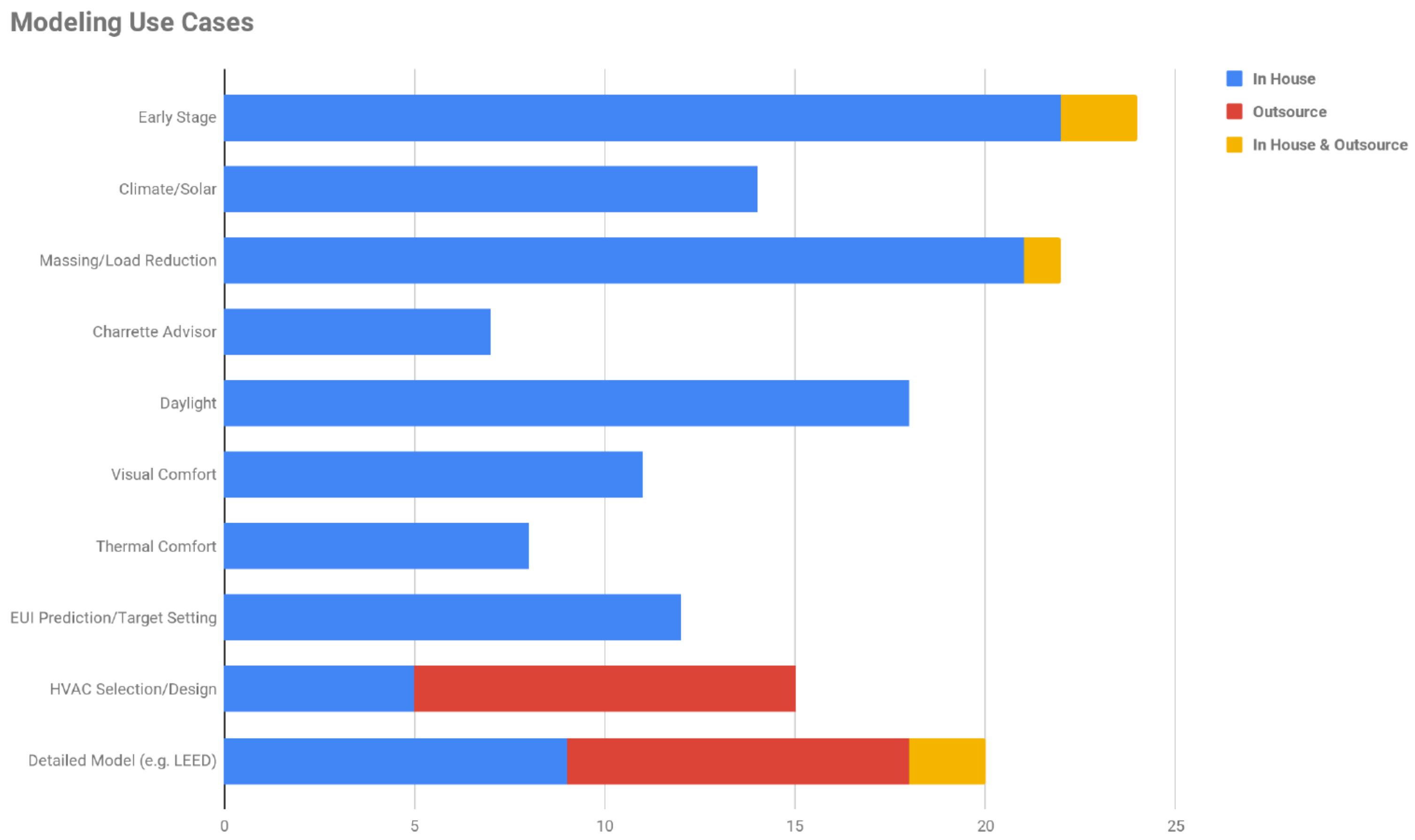


Should architects do energy modeling?

Early-design energy modeling tools (examples)

	Input	Energy Calcs	Other functions
Autodesk Insight	FormIt Pro, Revit	DOE2.2, EnergyPlus	
Cove.Tool	Revit, Rhino, SketchUp	EnergyPlus	Daylight, water
Diva for Rhino	Rhino	Single-zone loads	Daylight, Radiation
Sefaira	Sketchup Studio	EnergyPlus	Daylight, comfort
Solemma Climate Studio	Rhino	EnergyPlus	Daylight & lighting, comfort, PV, natural ventilation

Should architects do energy modeling?

Should architects do energy modeling?

Yes,

but not alone

Collaboration

1. Confidence in results
2. Integrated design

Case studies

KOHALA HIGH SCHOOL: DOE STEM/Science Facilities – Designed to Inspire

FERRARO CHOI

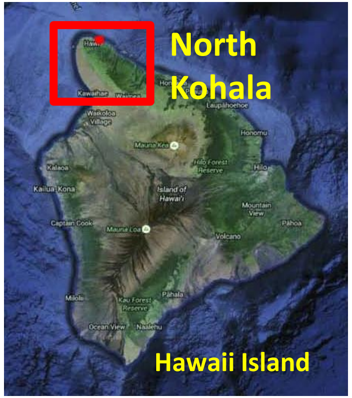
wsp

KI CONCEPTS

fermata
MAKES GREEN BUILDINGS HAPPEN

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

KOHALA HIGH SCHOOL: **location and history**

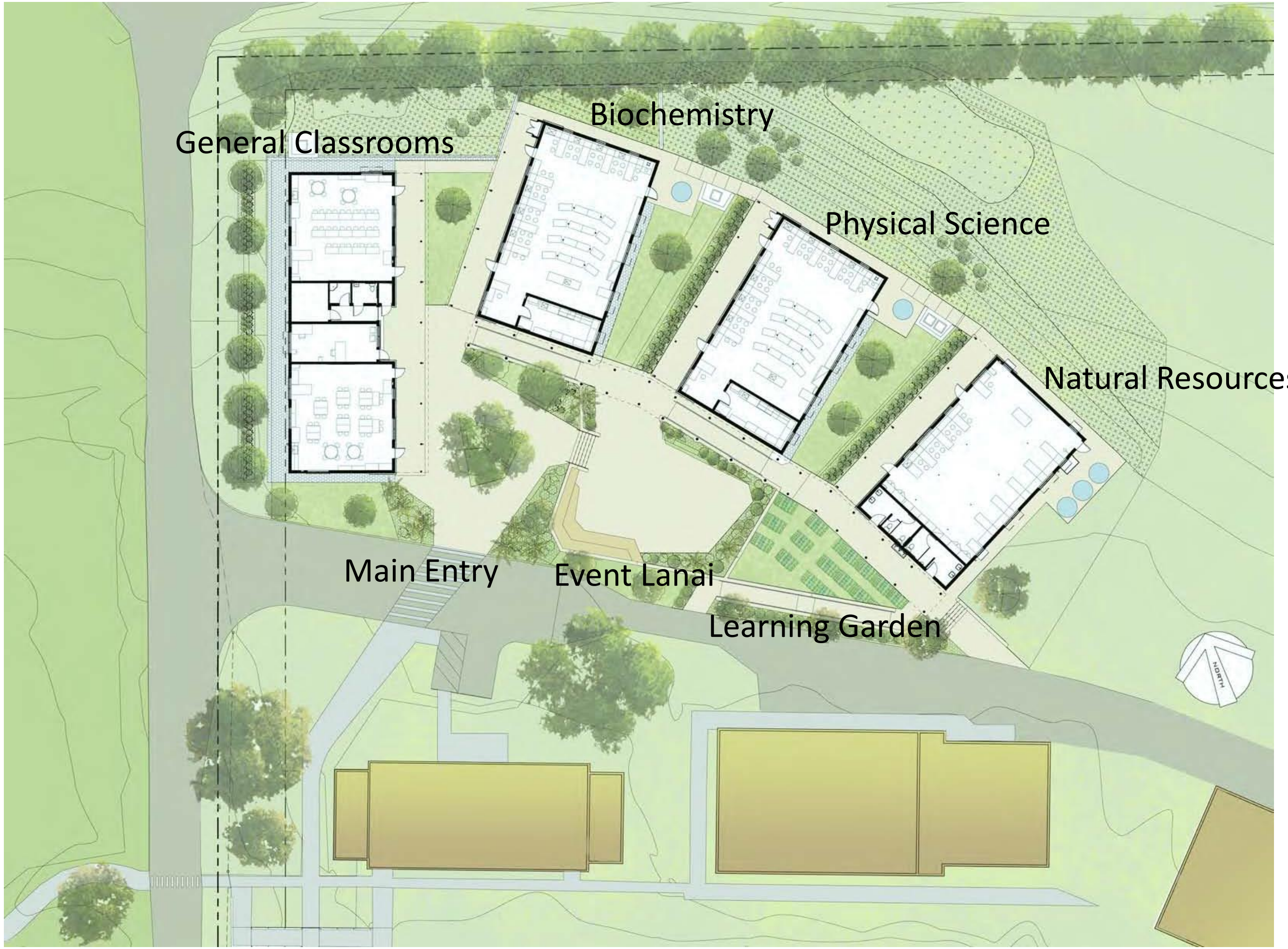


KOHALA HIGH SCHOOL: **site plan**

KOHALA HIGH SCHOOL: **project site**

KOHALA HIGH SCHOOL: **project site**

KOHALA HIGH SCHOOL: **site plan**




ST2

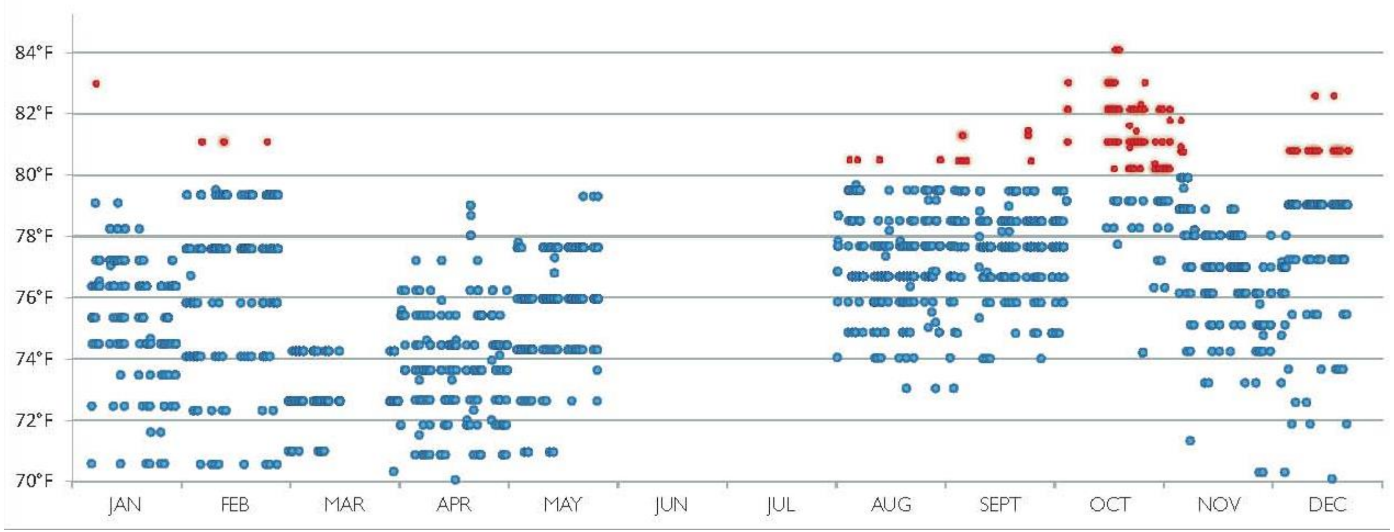

ST
ST4


ST2

KOHALA HIGH SCHOOL: **mixed mode – thermal comfort with natural ventilation**

BOE Policy 6700: Air conditioning may be installed if the "Effective Temperature", as determined by the ASHRAE Standard 55, exceeds 80°F for 18 school days in classrooms and 25 weekdays in administration/staff facilities during any 12 month period.

Naturally ventilated classrooms and administrative/staff spaces therefore meet ASHRAE comfort standards when the Effective Temperature is 80°F or less.



KOHALA HIGH SCHOOL: **mixed mode – thermal comfort with natural ventilation**

"Effective Temperature" as defined by ASHRAE can be simply described as the **"Feels Like Temperature"** sensation that occupants perceive.

Factors impacting the Effective Temperature on a naturally ventilated indoor environment include:

Nature Controlled

1. **Outdoor air temperature**
2. **Relative humidity**

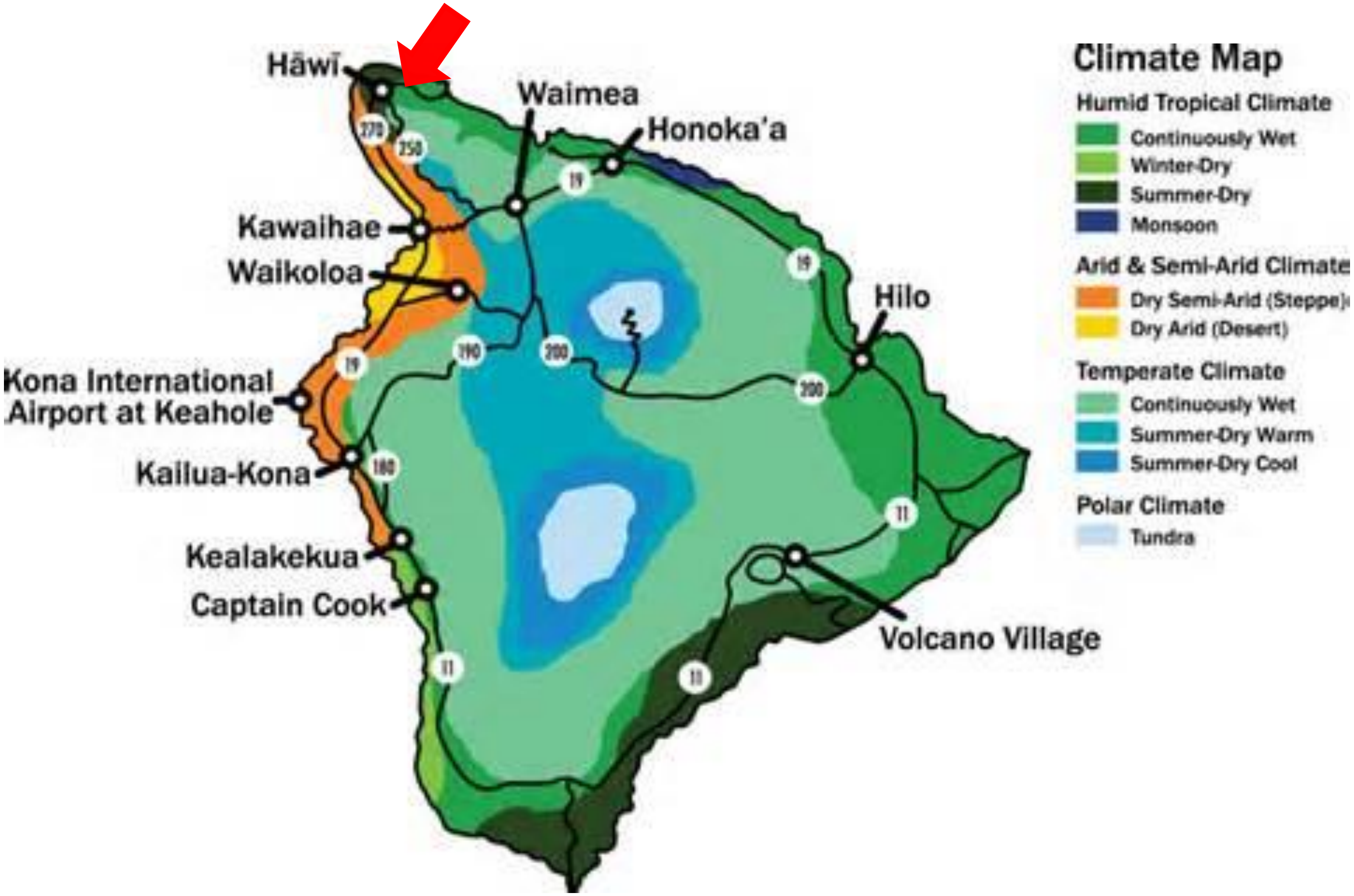
Designer Controlled

3. **Indoor air temperature**
4. **Air movement**
5. **External heat gain (radiant solar)**
6. **Internal heat gain (lighting, equipment, people)**
7. **Air changes**

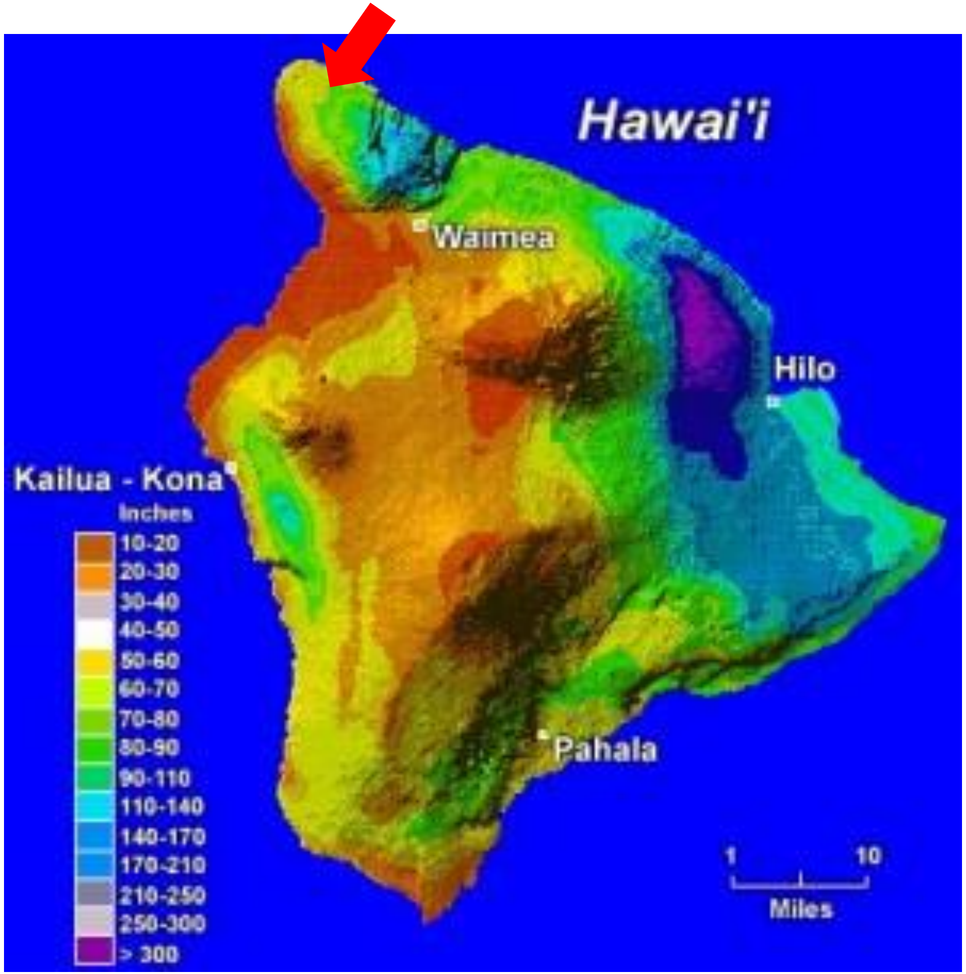
For naturally ventilated spaces, achieving an indoor Effective Temperature of 80°F or less is achievable when outdoor air temperature and relative humidity do not exceed approximately 83°F and 75%, respectively.

At the project site, annual temperature data indicate that the months of November through April meet the criteria above. Therefore the natural ventilation mode is a viable strategy for comfort and energy conservation.

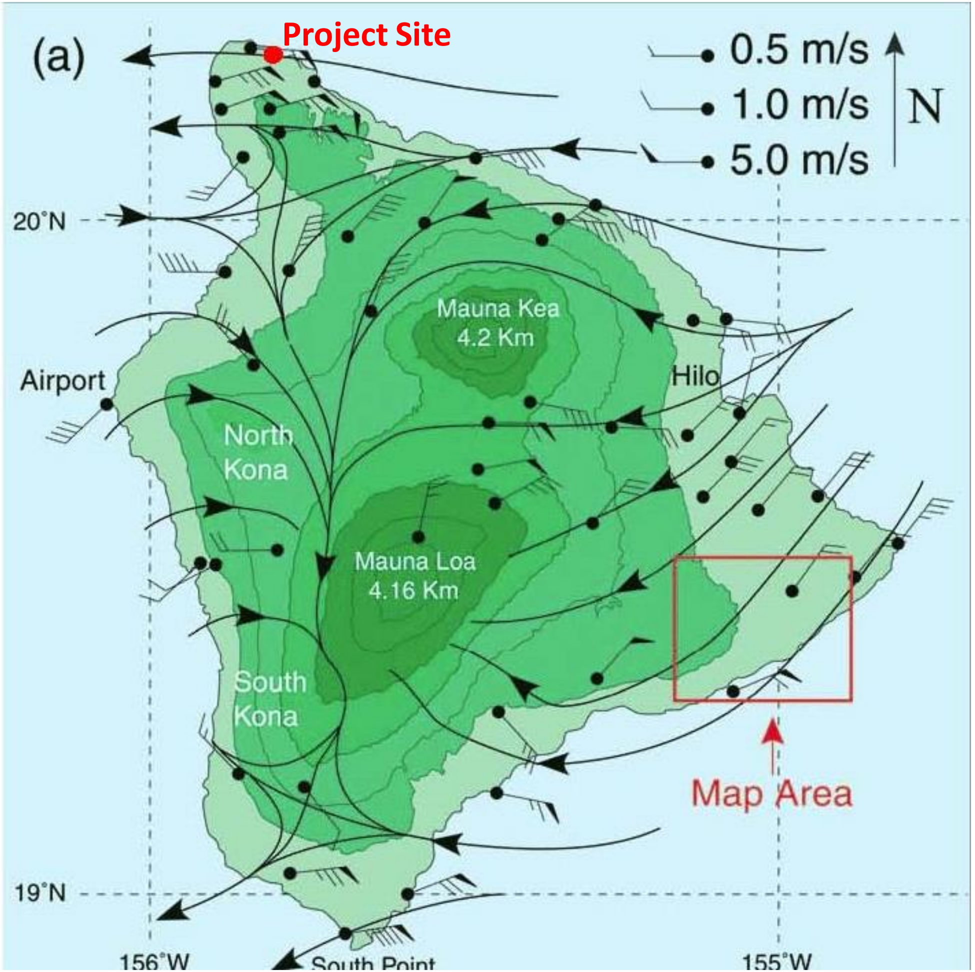
KOHALA HIGH SCHOOL: **weather data - microclimate**



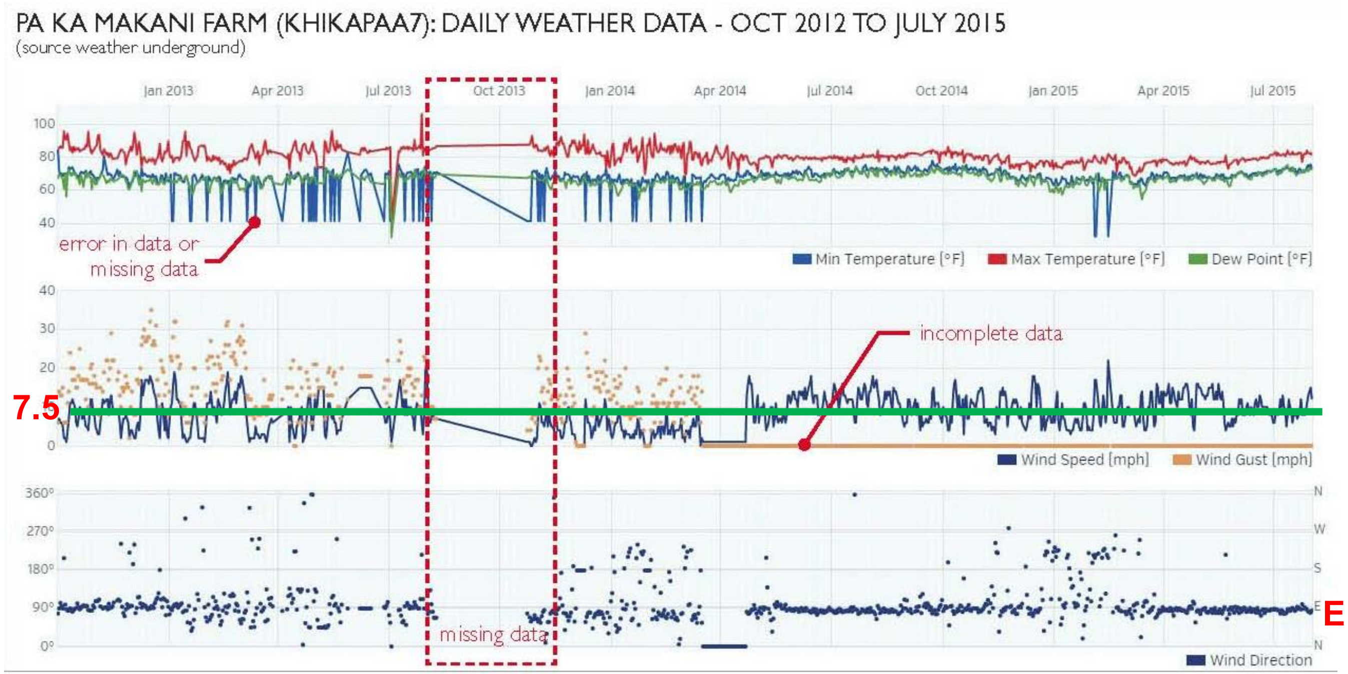
KOHALA HIGH SCHOOL: **weather data - microclimate**



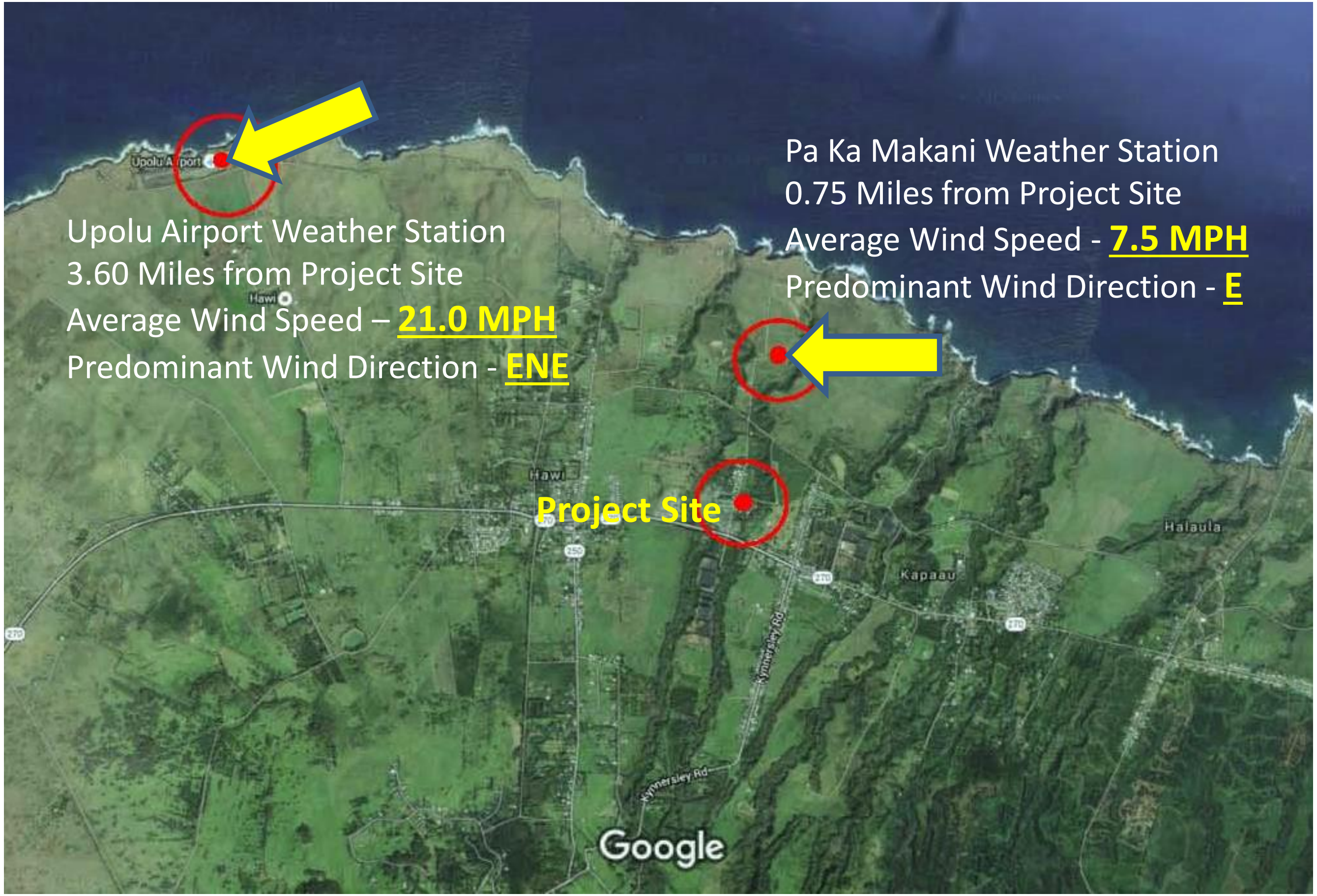
KOHALA HIGH SCHOOL: **weather data - microclimate**



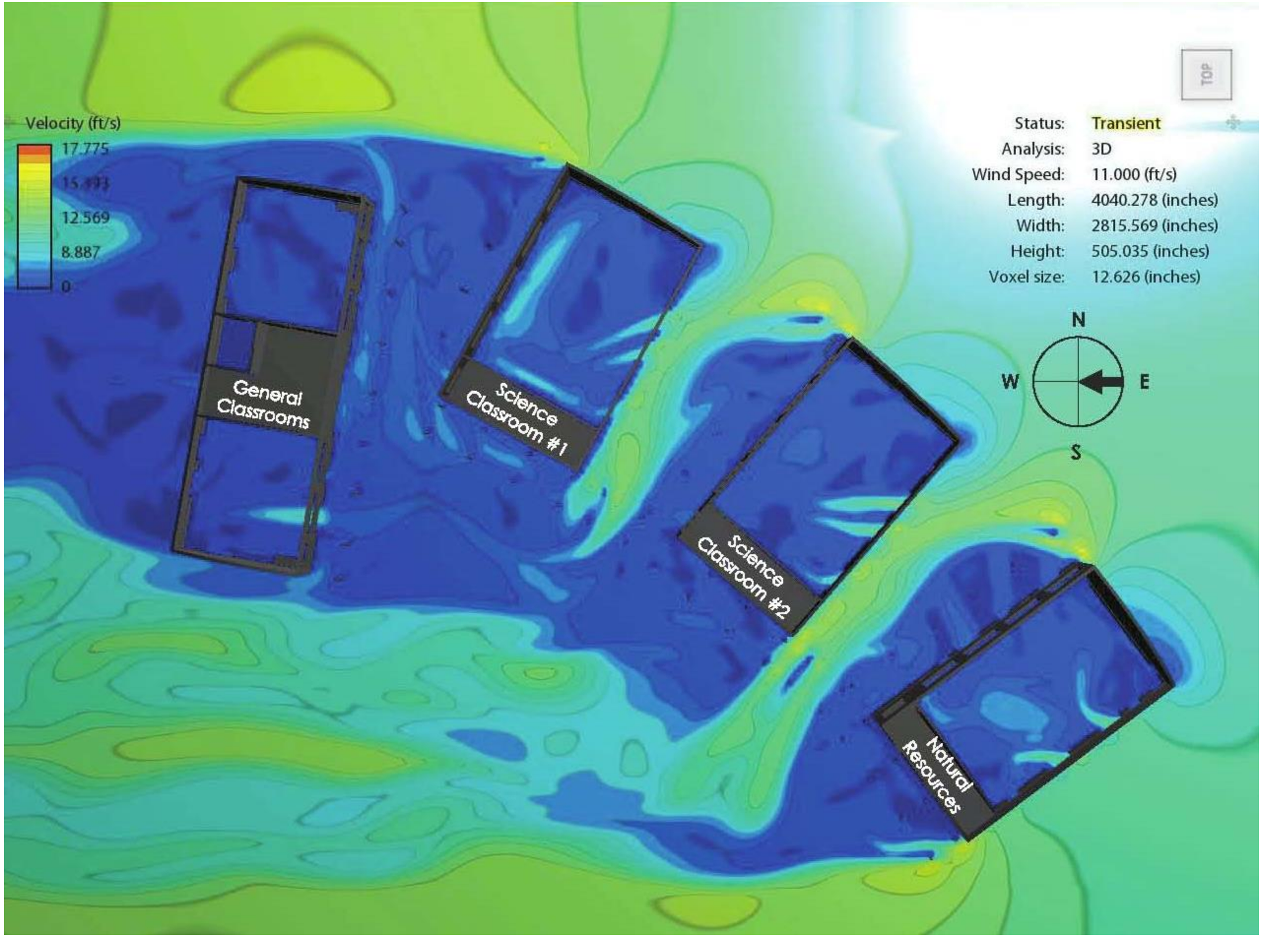
KOHALA HIGH SCHOOL: **weather data – microclimate**



KOHALA HIGH SCHOOL: **weather data - microclimate**

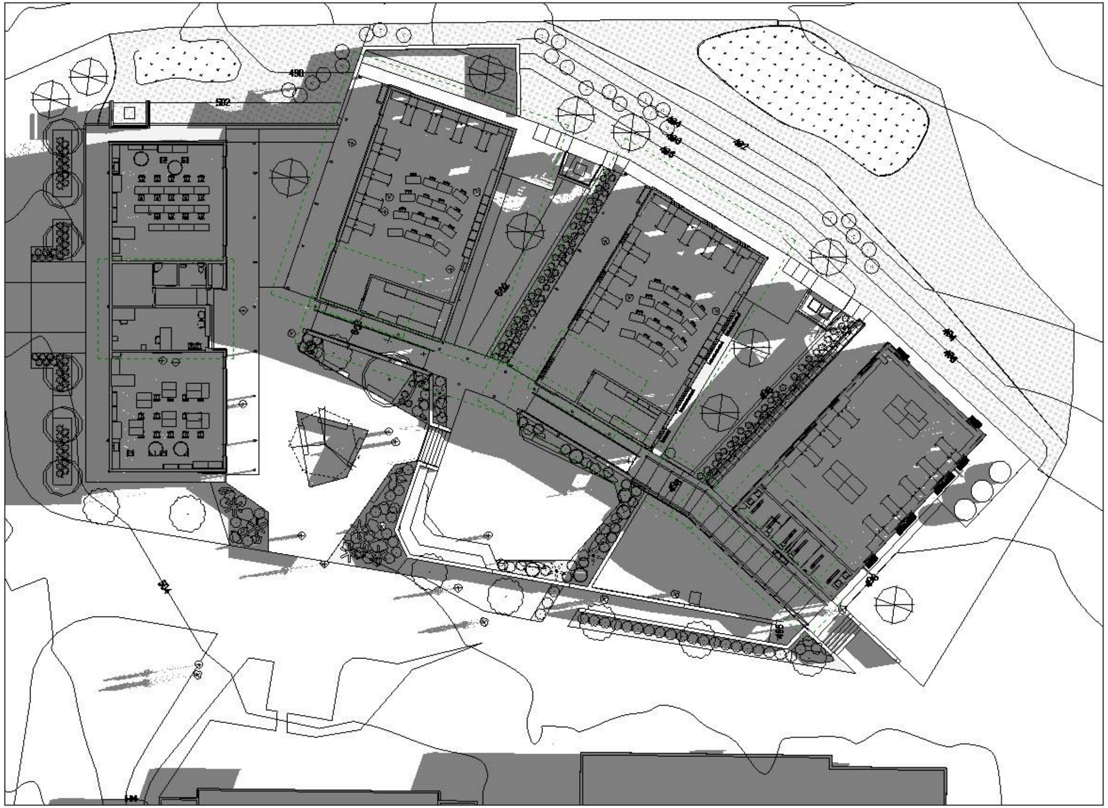


KOHALA HIGH SCHOOL: **computer modeling – cross ventilation effectiveness**



KOHALA HIGH SCHOOL: **computer modeling – cross ventilation effectiveness**

KOHALA HIGH SCHOOL: **shading studies**

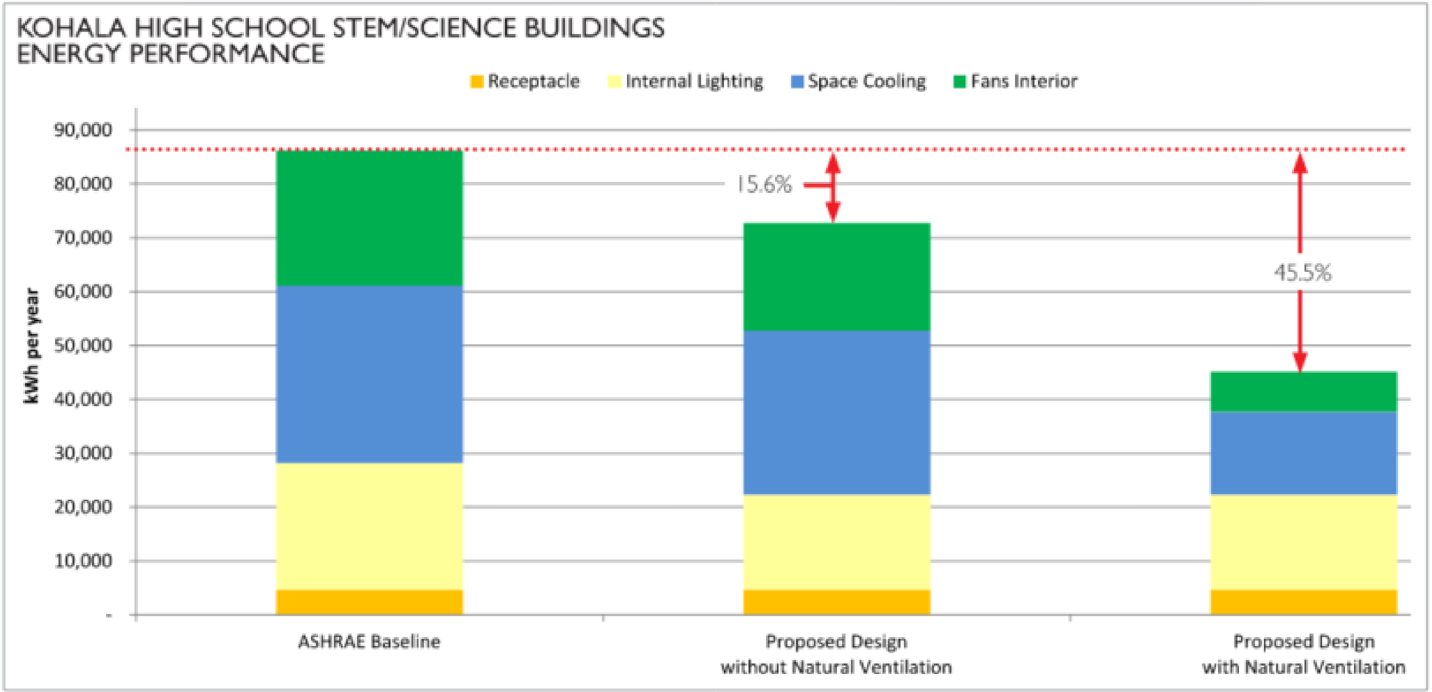


Fall/Spring Equinox 8:00am

KOHALA HIGH SCHOOL: **simplified controls**

Percentage of School Hour in Cooling		Jan	Feb	Mar	Apr	May	July	Aug	Sept	Oct	Nov	Dec	Total
School Hours	7am to 8 am	0%	0%	0%	0%	0%	0%	18%	48%	13%	5%	0%	9%
	8am to 9am	0%	0%	0%	5%	18%	100%	86%	100%	40%	20%	0%	30%
	9am to 10 am	0%	5%	0%	18%	59%	100%	95%	100%	93%	35%	0%	44%
	10am to 11am	18%	21%	29%	45%	88%	100%	100%	100%	100%	50%	23%	60%
	11am to Noon	47%	42%	36%	82%	88%	100%	100%	100%	100%	60%	46%	72%
	Noon to 1pm	59%	63%	50%	82%	94%	100%	100%	100%	100%	55%	69%	78%
	1pm to 2pm	59%	68%	57%	86%	94%	100%	100%	100%	100%	70%	85%	83%
	2pm to 3pm	65%	58%	57%	91%	100%	100%	100%	100%	100%	60%	69%	81%
	3pm to 4pm	47%	47%	43%	77%	100%	100%	100%	100%	100%	45%	38%	72%

KOHALA HIGH SCHOOL: **energy results**



KOHALA HIGH SCHOOL: **DOE STEM/Science Facilities**

FERRARO CHOI

wsp

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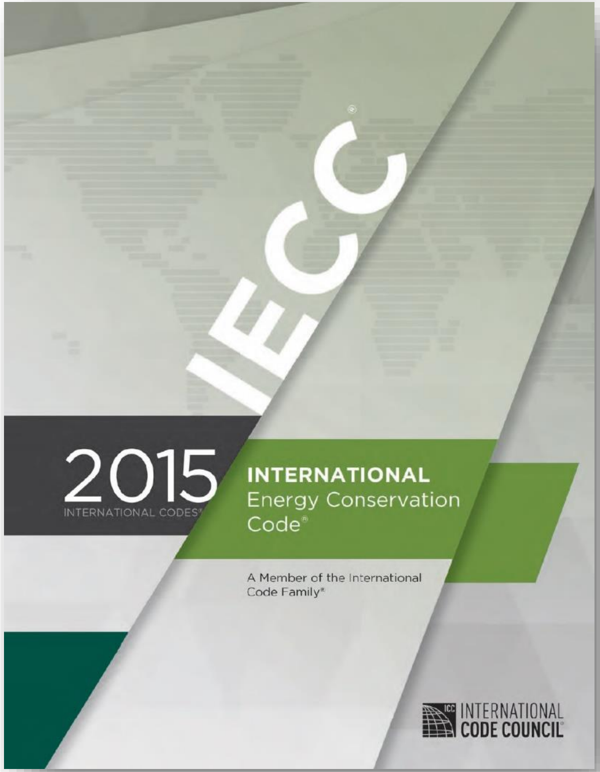
Energy modeling for code compliance



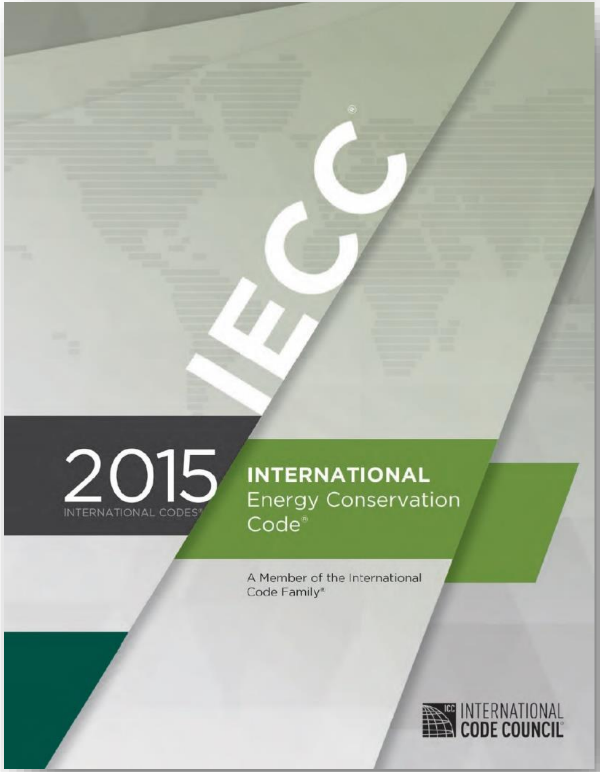
C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C404, C405.2, C405.3, C405.5, C405.6 and C407. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Mandatory requirements

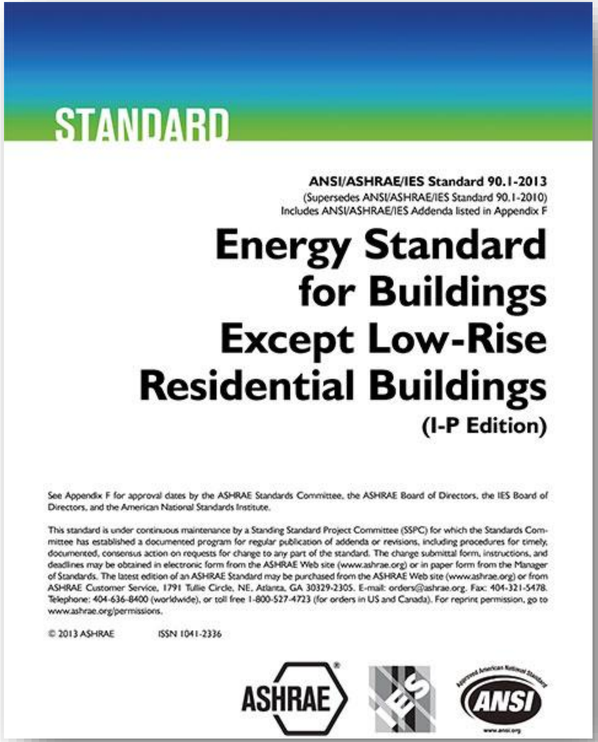
and

C407. Total Building Performance

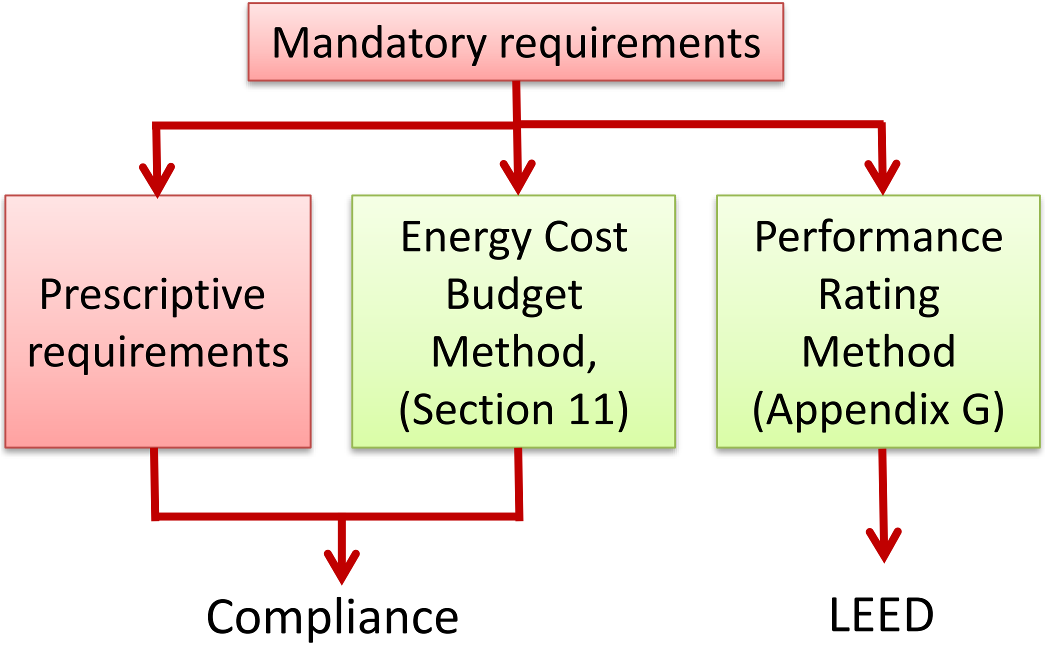


Mandatory requirements

- C402.5 Air leakage – thermal envelope
- C403.2 Provisions applicable to all mech. systems
- C404 Service water heating
- C405.2 Lighting controls
- C405.3 Exit signs
- C405.5 Exterior lighting
- C405.6 Sub-metering



ASHRAE Standard 90.1-2013



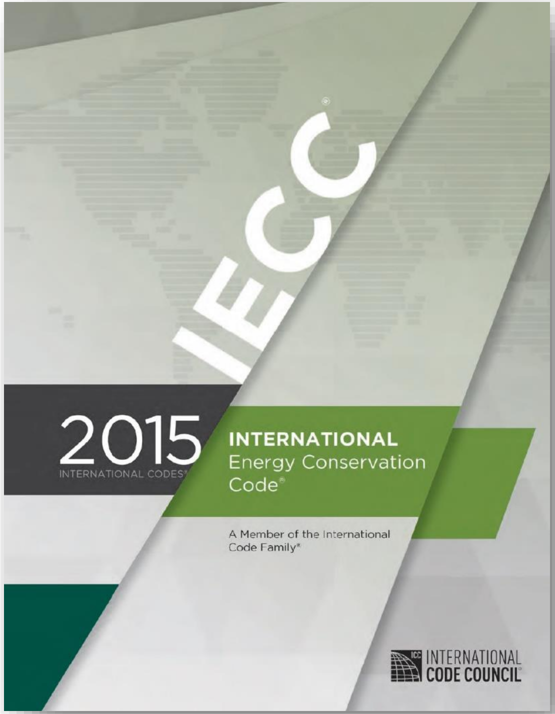
Free online viewer

https://ashrae.iwrapper.com/ViewOnline/Standard_90.1-2013_I-P

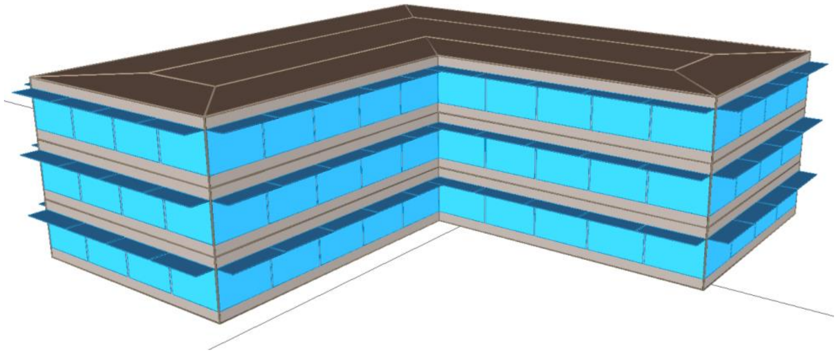
Energy modeling for code compliance

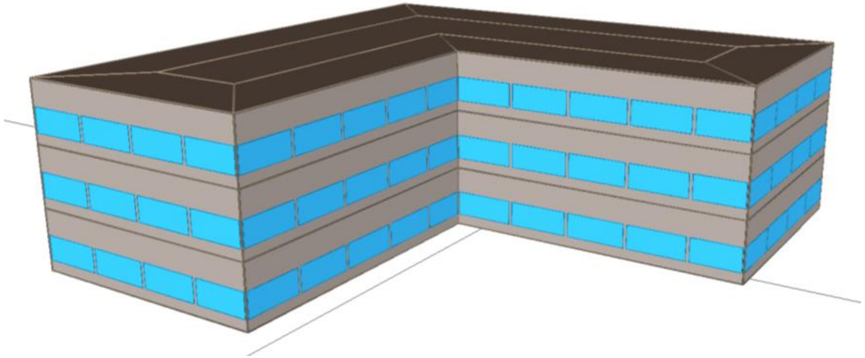
Section C407 Total Building Performance

- How it works
- Why use it
- What earns credit
- How it compares to Standard 90.1



Energy modeling for code compliance





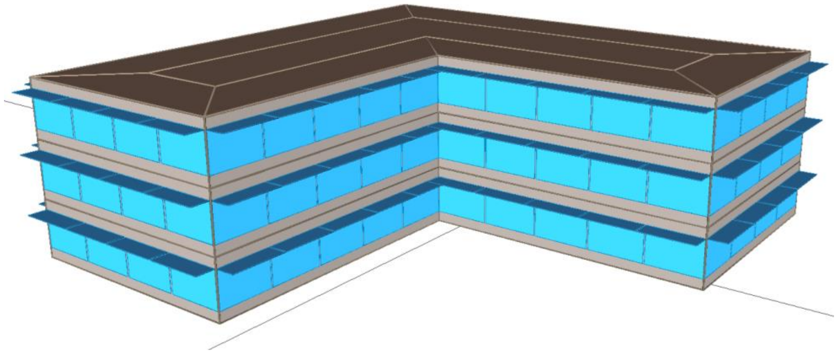
Proposed design
$/year

≤

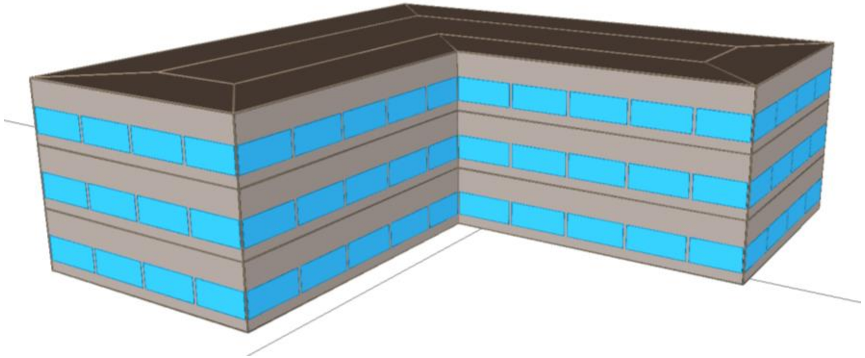
Standard reference design
$/year x 0.85

Energy modeling for code compliance

Proposed design model



Standard reference design model



As designed

- Envelope
- HVAC
- Domestic hot water
- Interior lighting
- Exterior lighting
- Plug loads

Same for both models

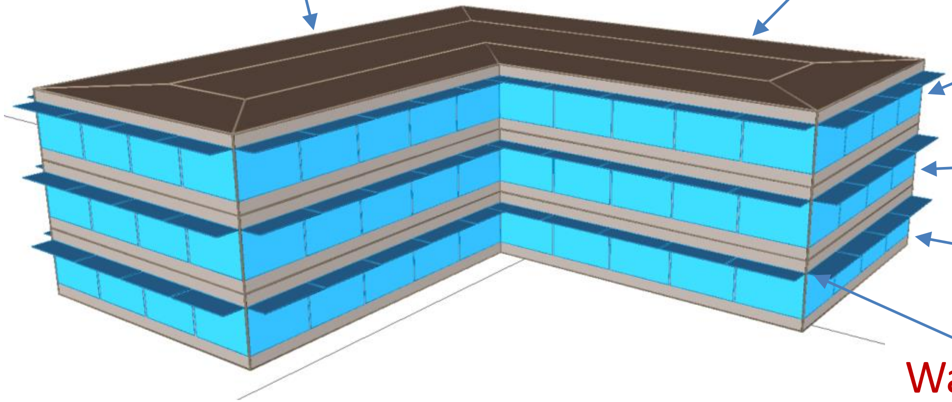
- Floor area
- Building form
- Plug loads
- Occupancy schedule
- HVAC schedule
- Utility rates
- Weather data

Per section C407

- Standard constructions and glazing
- Standard HVAC type & efficiency
- Standard DHW and lighting
- No exterior shading
- Window-wall ratio capped at 40%
- Skylight-roof ratio capped at 3%

Energy modeling for code compliance

Why use it?

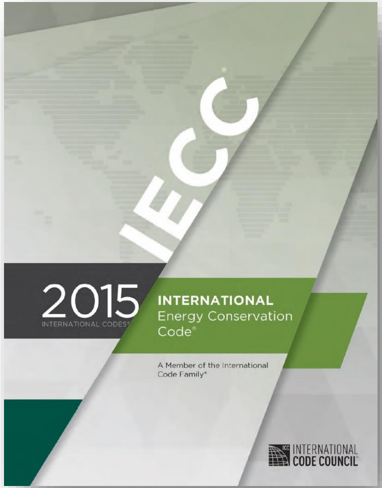


Energy modeling for code compliance

Typical measures that get credit

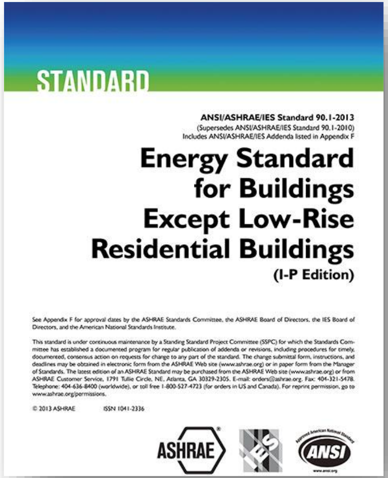
- Low lighting power
- Exterior window shading
- Envelope constructions that exceed prescriptive requirements
- Efficient HVAC equipment
- Efficient HVAC system type

Energy modeling for code compliance



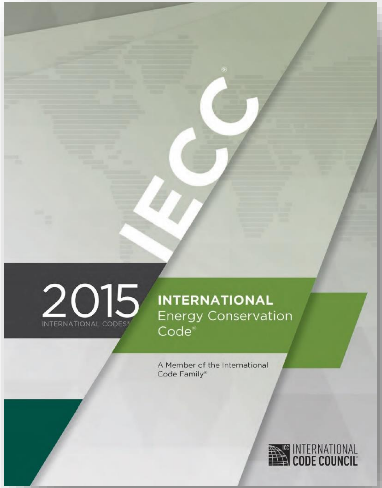
Total Building Performance Method

?

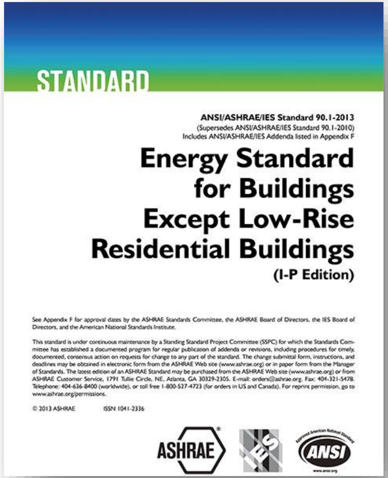


Energy Cost Budget Method

Energy modeling for code compliance



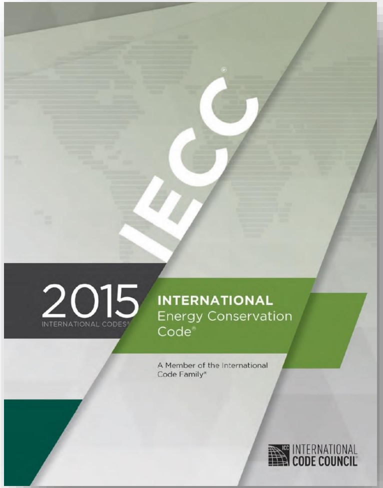
Total Building Performance Method

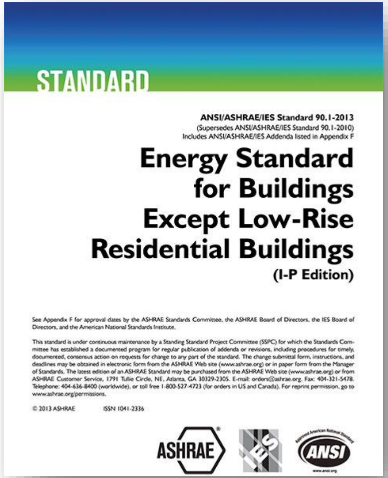


Energy Cost Budget Method

15% savings required

Energy modeling for code compliance





Total Building Performance Method

Mandatory

- Energy recovery ventilation
- Kitchen exhaust systems

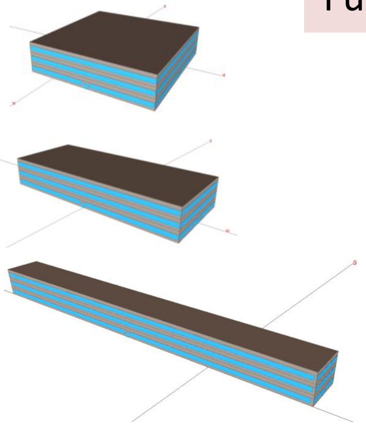
Energy Cost Budget Method

Mandatory

- End-use monitoring, ≥25,000 ft^2
- Automatic receptacle control

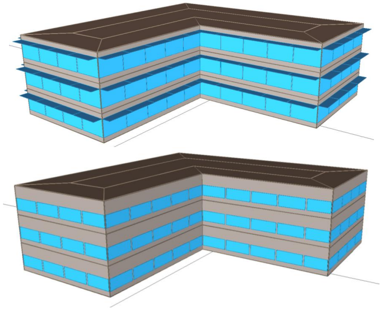
Energy modeling for code compliance

Analysis plan
Simple box model



Simplified models
Fundamental decisions

More detailed models
Specific design decisions



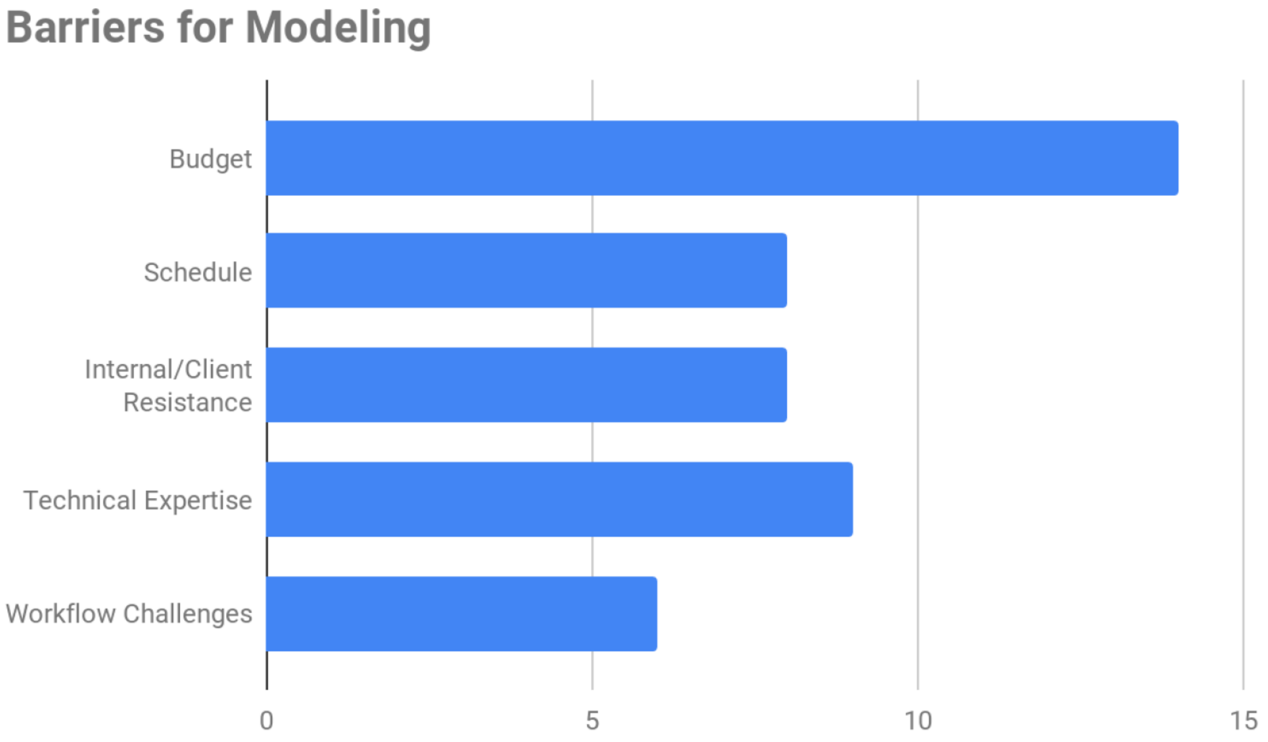
Value engineering
Verify design performance

Energy code compliance modeling

PRE-DESIGN | SCHEMATIC DESIGN | DESIGN DEVELOPMENT | CONSTRUCTION DOCS

Making it work

Making it work

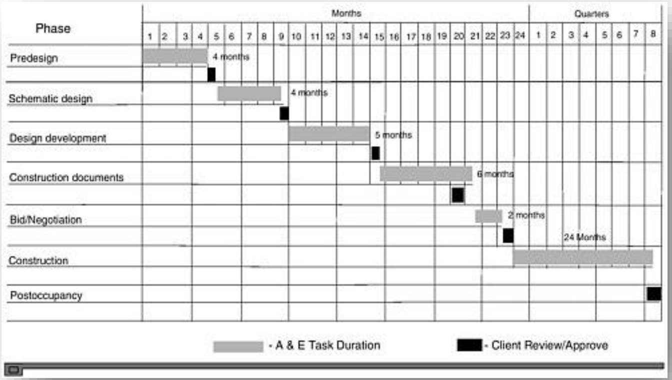


https://www.ibpsa.us/news/bem-collaborative-architect-outreach

Making it work

Planning for and managing energy modeling

- Early planning
- Scope of work examples
- Budget
- Working with a modeler
- Talking to a client



Goals

- Timely information
- Maximum value

Making it work – Early planning

RFP
- Construction budget
- Performance goals

Proposal
- Team
- Budget

Win!

Modeling scope of work

Performance modeling plan

1. What we want
   - Desired outcomes
   - Anticipated design questions
2. How we get it
   - Analysis type(s)
   - Ideal timing
   - Roles
   - Budget

Your best guess at planning time

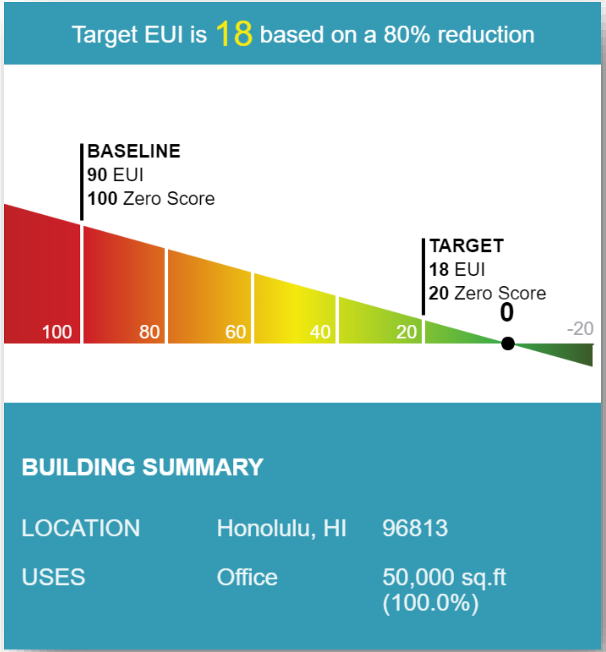
Making it work – Scope of work (credit EHDD)

SCHEMATIC DESIGN	Kickoff	Visioning & goal setting workshop	Targets. Initial design strategies
	50%	**Design performance model**	Simplified model Test design strategies
	100%	**50% SD energy model**	EUI vs. target. Recommendations
DESIGN DEVELOPMENT	Kickoff	Integrated design meeting	Select EEMs
	50% / 100%	**50% DD energy model**	EUI vs. target. Recommendations
CONSTRUCTION DOCUMENTS	Kickoff	Integrated design meeting	Select EEMs
	50% / 100%	**CD energy model**	EUI vs. target, PV sizing

Making it work – Scope of work (credit EHDD)

Intent

- Design with real energy use targets, rather than a “percentage-better-than-code” approach
- Set energy use intensity (EUI) targets early on
- Use comparative design performance modeling in initial stages to refine the design
- Track performance through energy modeling at each design phase



Making it work – ASHRAE Standard 209

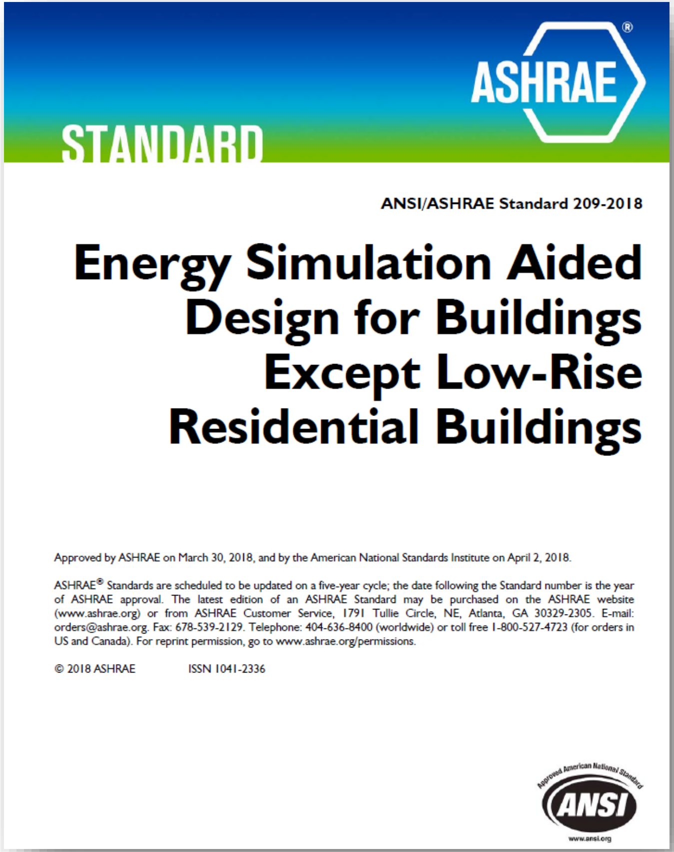
Process standard

Minimum requirements

- Four early activities
- Two design-phase modeling cycles

Optional modeling cycles

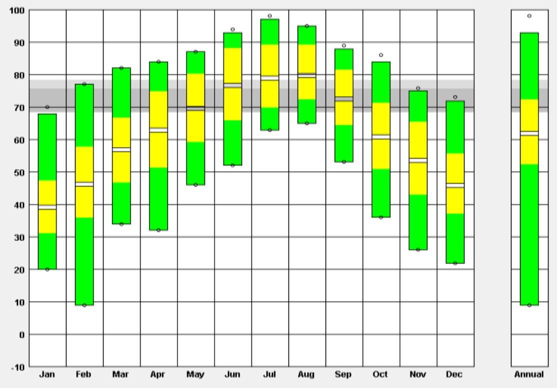
- Construction phase
- Occupancy phase



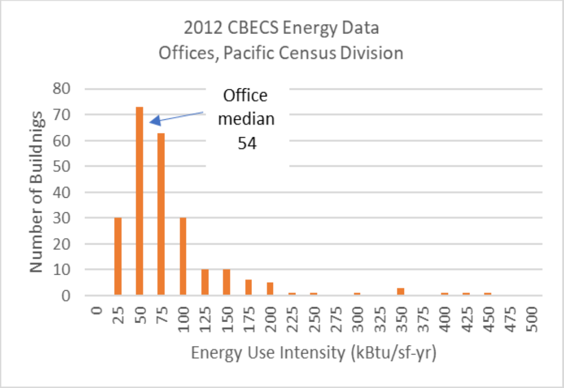
Making it work – ASHRAE Standard 209

General Requirements

Climate and Site Analysis

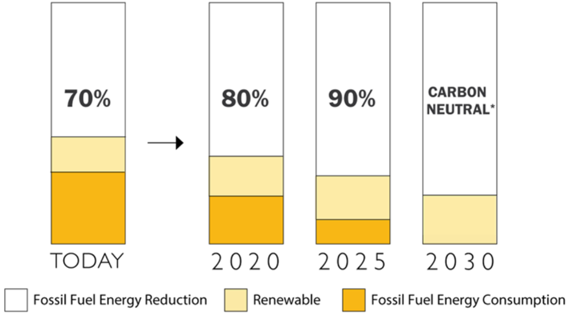


Benchmarking



Energy Charrette

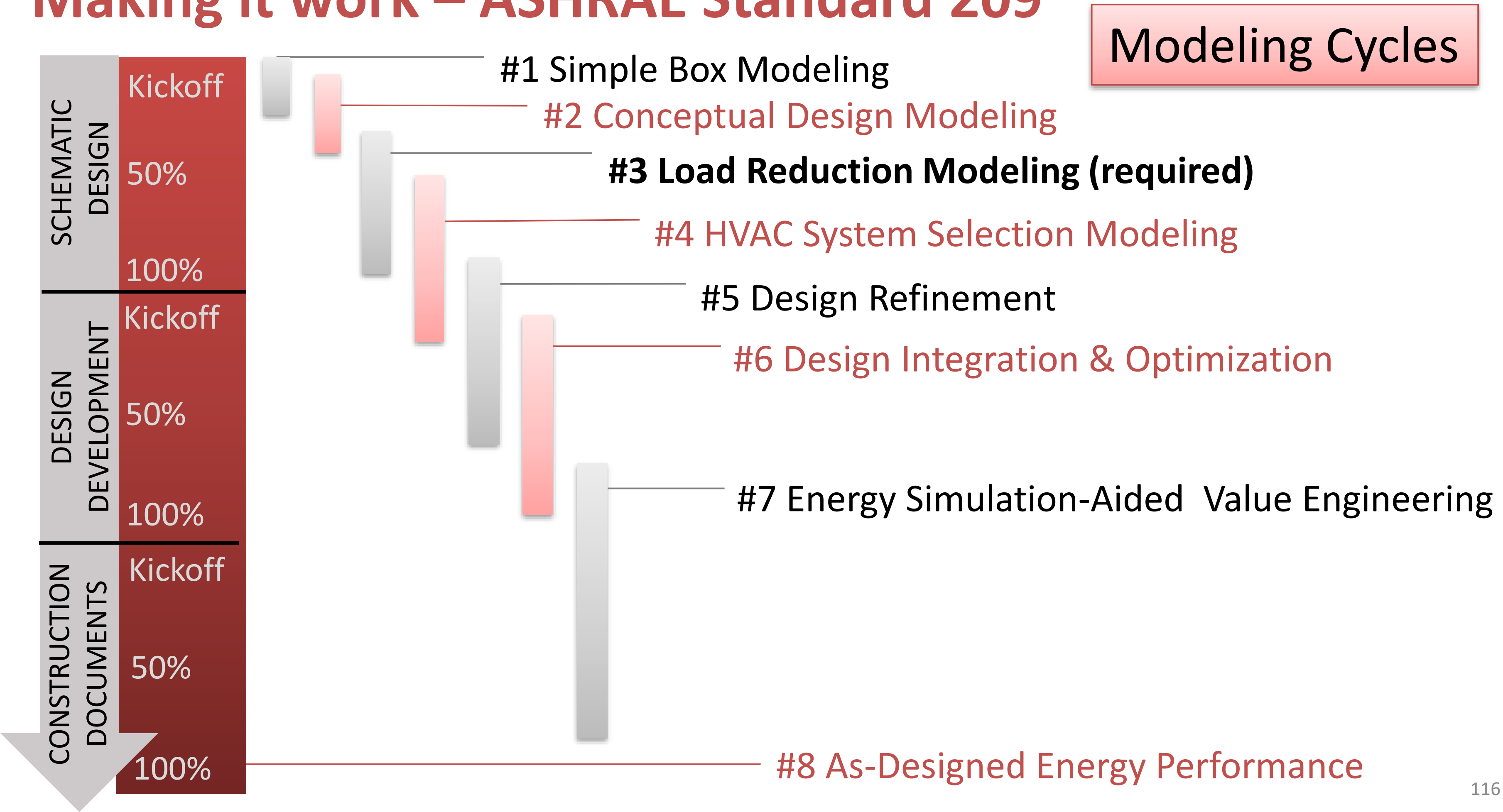
Establish Energy Performance Goals



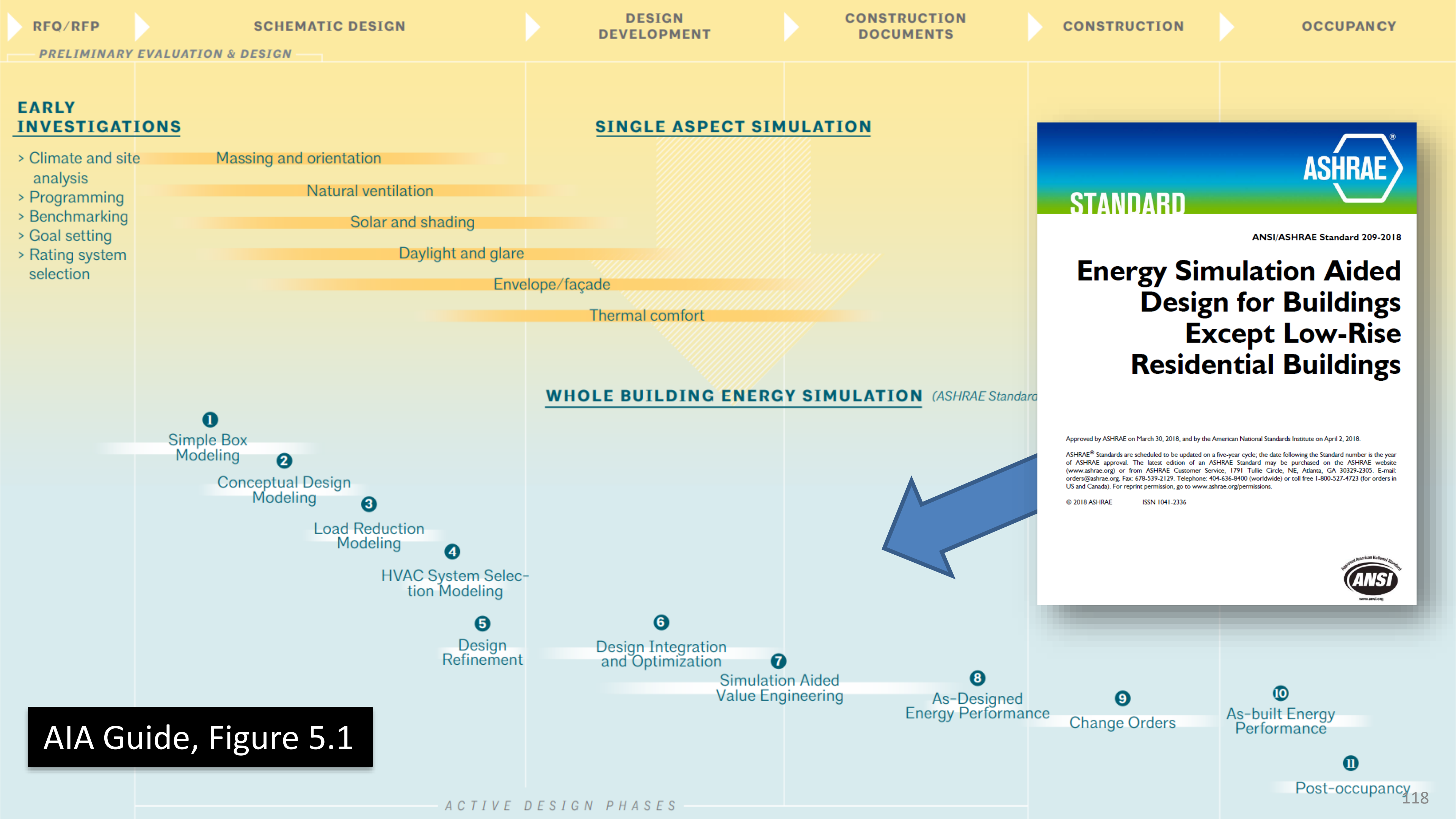
The 2030 Challenge

Source: ©2015 2030, Inc. / Architecture 2030. All Rights Reserved.
*Using no fossil fuel GHG-emitting energy to operate.

Making it work – ASHRAE Standard 209




Architect's Guide to
Building Performance
Integrating performance simulation
in the design process



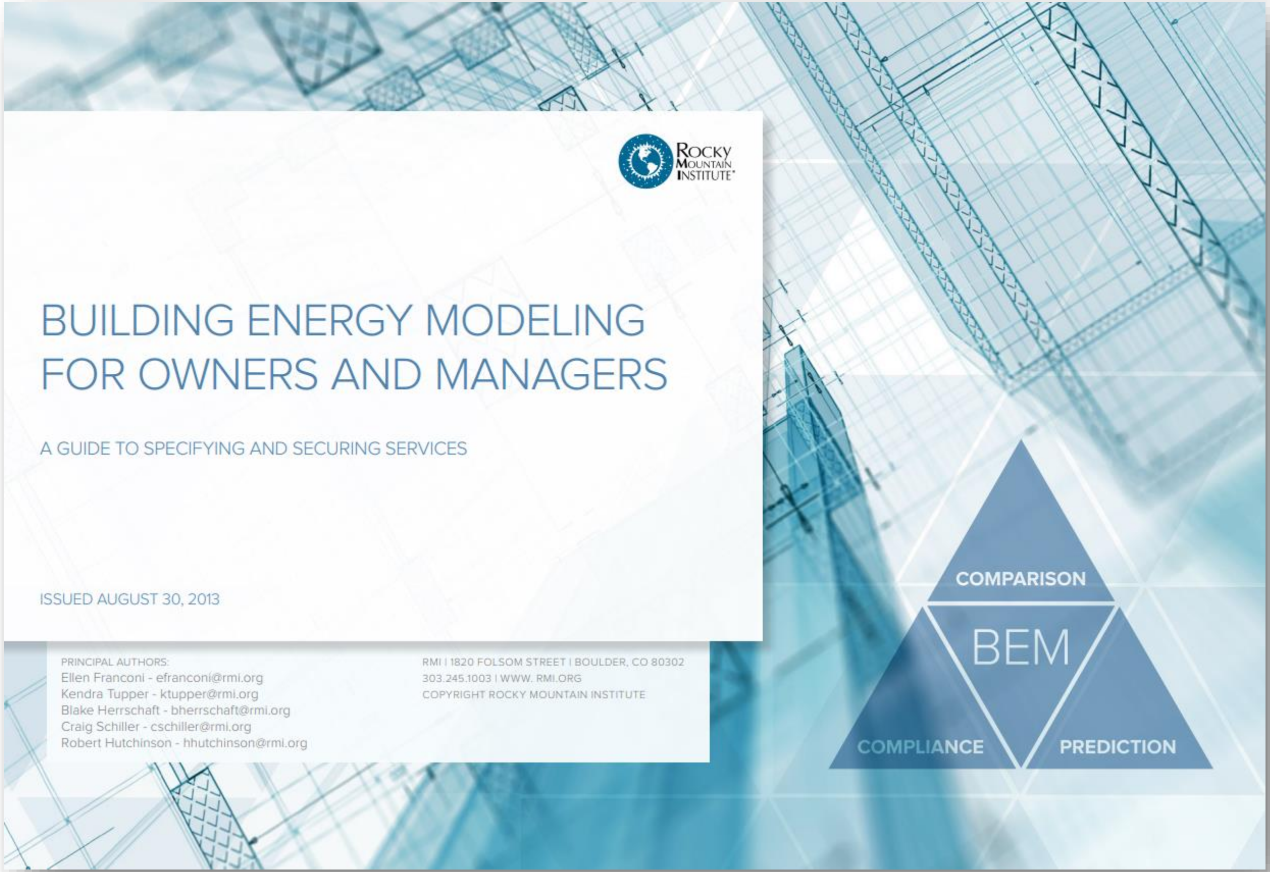
AIA Guide, Figure 5.1

Making it work – Scope of work (credit Kaiser Permanente)

SCHEMATIC DESIGN	Kickoff	Blocking and stacking energy study Building envelope studies	In pre-design phase
	50%	Preliminary LCC study	Whole building energy modeling Minimum 3 alternatives
	100%	Final LCC study	
DESIGN DEVELOPMENT	Kickoff		
	50%		
	100%	Updated energy model report	In Basis of Design
CONSTRUCTION DOCUMENTS	Kickoff		
	50%		
	100%	LEED documentation	

"Continuously update energy reports throughout the integrated design process"

Making it work – Scope of work



Rocky Mountain Institute

Includes a sample request for proposals

Making it work – Budget

Medium size, modest complexity

Making it work

RFP
- New bank branch
- 6,000 ft^2
- $3,000,000 construction budget
- Interested in net zero energy

Proposal
- Energy modeler on team
- Budget $4,000 + $5,000 option

Win!

Modeling scope of work
- Kickoff
- Concept phase
- Early SD
- Net zero tracking

Performance modeling plan

Desired outcomes
- Net zero energy

Anticipated design questions
- Magnitude of expected energy end-uses
- Fenestration/shading impact
- Impact of HVAC selection
- Photovoltaic sizing for net zero

Analysis types
- Shading study
- Energy model for fenestration and HVAC
- Option: energy model to verify net zero performance

Ideal timing
- Concept phase: end-uses, fenestration and HVAC impact
- Early SD: fenestration alternatives and HVAC alternatives

Roles
- In-house: shading study, define fenestration alternatives
- HVAC designer: define HVAC alternatives, review models
- Energy modeler: concept and SD models

Budget, energy modeling
- $1,000 concept phase
- $3,000 SD phase
- Option: $5,000 net zero tracking

Working effectively with an energy modeler

Who do I engage?

How do I know they are qualified?

How much do I pay them?

How do I pay for it?

How do I sell this to my client?

What are some of the benefits I should expect?

What do I ask them to do? When?

How much time is reasonable?

What do they need from me?

What's my role in managing them?

What's the role of the owner? Other team members?

How do we all work together?

What design questions are appropriate?

Can they use my design 3D model?

What tools should they use?

How do I interpret their results?

How accurate are the model results?

How do I know that the results are reasonable?

Can they also do Title 24 compliance? LEED?

Can they calculate utility incentives?

How do I maximize the benefit from energy modeling?

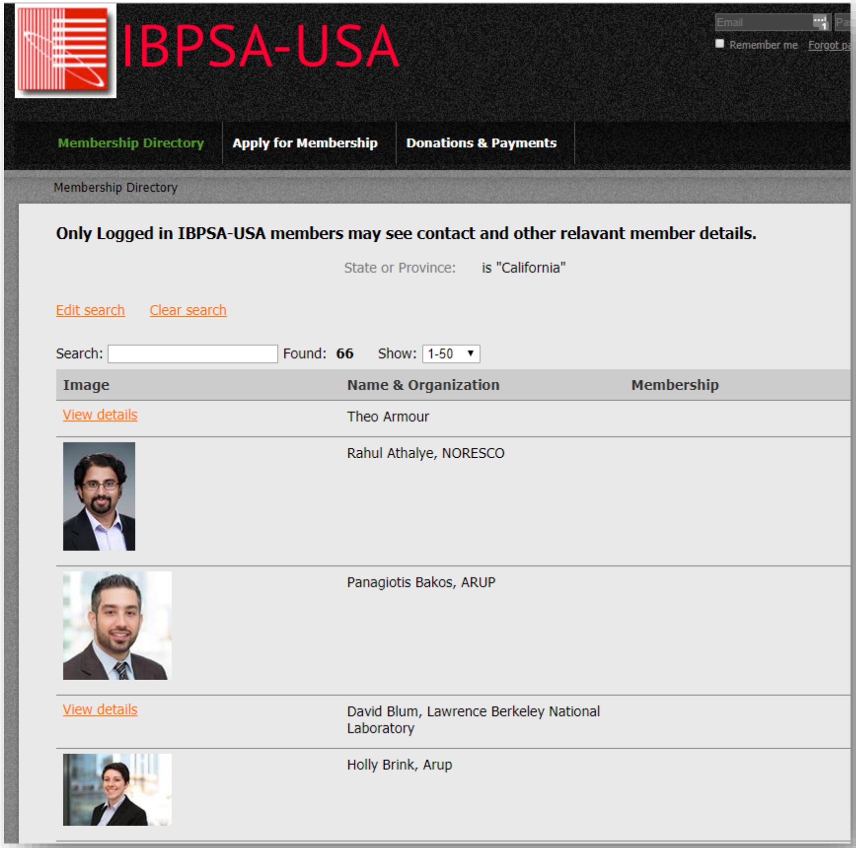
Working effectively with an energy modeler

Finding one

Exchanging information

Working effectively with an energy modeler

Finding one



International Building Performance Simulation Association IBPSA-USA Member Directory

http://ibpsausa.wildapricot.org/

Working effectively with an energy modeler

Finding one

ASHRAE
Building Energy Modeling Professional (BEMP) certification

http://certificants.ashrae.org/Search

ASHRAE Certified

Search

First Name

Last Name

Organization

Certification Type: Building Energy Modeling Professional

City: San Francisco

State/Province: California

Postal Code

Country

Search Reset

Name	Organization	Type	Exp.	State/ Prov.	Country
Charles Eley	Eley Consulting	BEMP	12/2019	CA	UNITED STATES
Brian Johnson	HOK	BEMP	12/2020	CA	UNITED STATES
Shruti Kasarekar	Atelier Ten	BEMP	12/2020	CA	UNITED STATES
Erik Kolderup	Kolderup Consulting	BEMP	12/2019	CA	UNITED STATES
Te Qi	Atelier Ten	BEMP	12/2020	CA	UNITED STATES

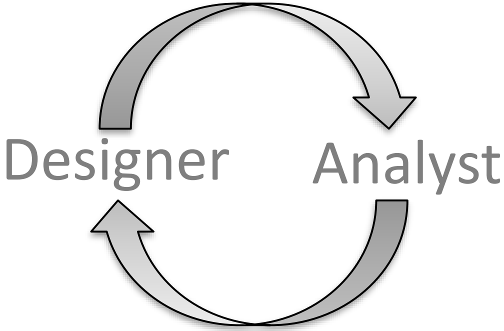
Showing 1 to 5 of 5 entries Previous Next

Working effectively with an energy modeler

Exchanging information

Communication challenges

- Understanding needs
- Uncertainty and unknowns
- Unclear responsibilities



Working effectively with an energy modeler

Exchanging information

Modeler wants…

- Floorplans
- Elevations
- Construction details
- Lighting schedule
- Lighting design
- Mechanical equipment schedule
- Owner provided equipment
- Operating schedule
- Occupant density
- Etc.

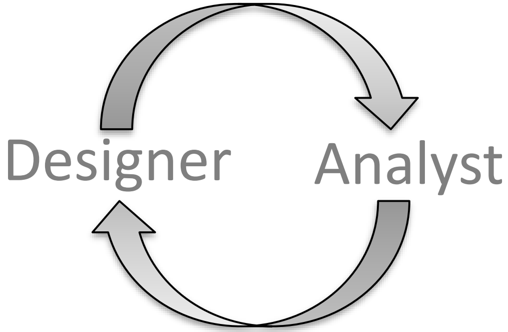
Typically not available in early design

Working effectively with an energy modeler

Exchanging information

Collaborate on design assumptions

- Identify known information
- Consensus on unknown information
- Update as detail develops
- Minimize use of default inputs

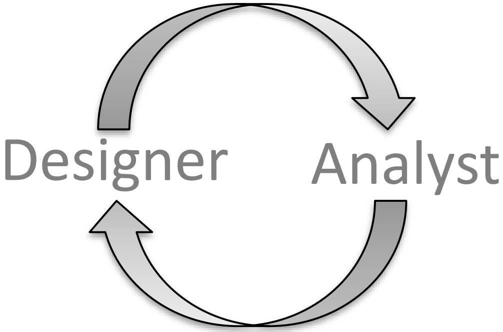


Working effectively with an energy modeler

Exchanging information

Collaborate on design questions

- Challenge them to be creative!



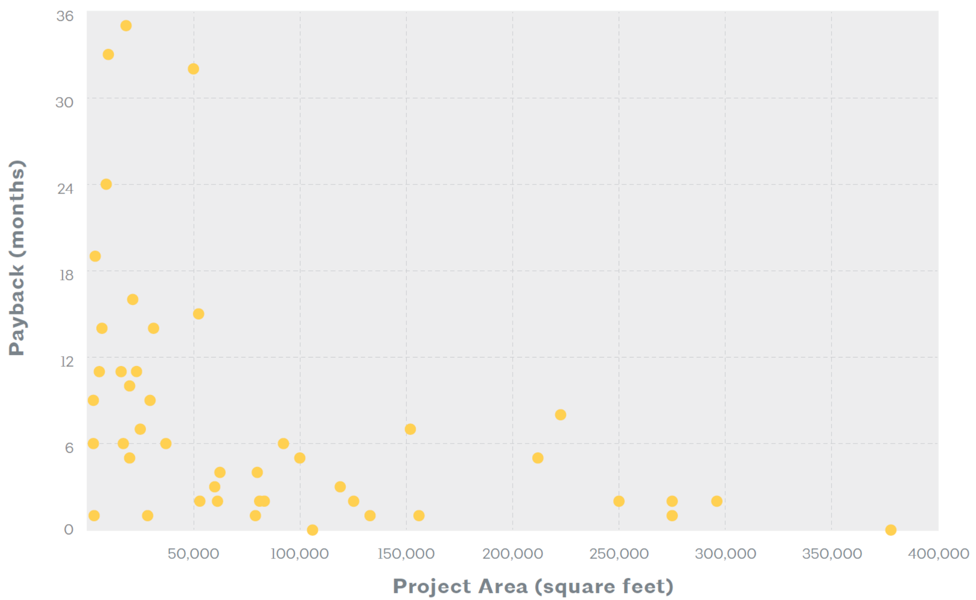
Making it work – Talking to a client

Cost-effective improvements

Optimized construction cost

Value-engineering

Energy modeling payback



Credit: HOK & TLC Engineering for Architecture
Source: Architect's Guide to Building Performance (AIA 2019)

Panel discussion

Panel

Mark Ayers, AIA, LEED AP

Associate/Senior Project Architect, Ferraro Choi

Charles Chaloeicheep, PE, LEED AP

Senior Associate, WSP

Kim Claucherty, AIA, BSME, LEED AP

Senior Project Manager, Ferraro Choi

Samantha Nakamura, PE, LEED AP

Mechanical Engineer, WSP

Lester Ng, LEED AP

Principal and Director of Design & Sustainability, AHL

Type your questions and comments using the Zoom Q&A feature

Thank you

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