Exploring Career Pathways in

Building Energy Modeling

A fast, practical tour of what BEM is, why it matters,
and how people actually use it on real projects.

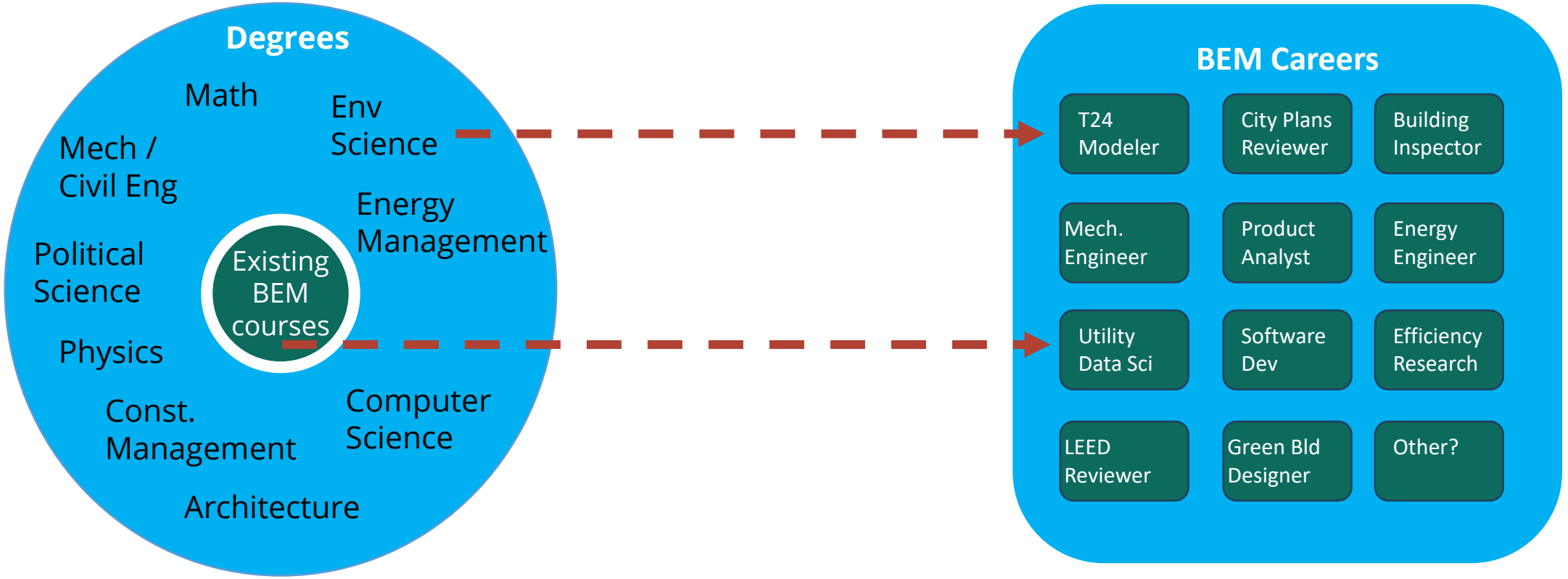
***CalBEM**, a collaborative initiative sponsored by Southern California Edison, brings together California's building energy modeling (BEM) community to advance solutions for high-performance buildings.*

A Career Pathway Exposure into BEM

1. Connecting Professionals with Students
2. Connecting University Teachers with Local Leaders
3. Build excitement for how BEM careers can lead to many opportunities
4. Share resources on professional job boards, certifications, resources for students

Overarching Goal of Project Engagement

To accelerate the process of people finding building energy modeling.



Today: what we'll do

Why buildings matter

Why energy + carbon in buildings are a big deal

Why we need BEM

A "virtual test drive" of a building:
inputs → simulation → outputs → decisions.

How to get into it

Career paths, real projects, and where to learn more without drowning in software training.

The Plan

1	**Why buildings matter and what building modeling is**	Energy, money, comfort, climate
2	**Why do we use BEM**	The virtual test drive
3	**What goes into a building energy model**	Core concepts brought together
4	**Codes & standards**	CA codes and the rules of the game
5	**Project case studies**	Real projects, real lessons
6	**Tools & software**	Free tools to try today + pro landscape
7	**Career pathways**	Roles, salaries, what employers want
8	**Certifications & closing**	Certs, resources, next steps

Acknowledgments

Project Facilitation Team:

A2 EFFICIENCY

west monroe

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Energy for What's Ahead®

CalBEM

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BEM
(add company logo here)

Jordan Silva

Building Energy Modeler
A2 Efficiency

B.S. Mechanical Engineering
LEED Accredited Professional
BEMP Certified
8 years in practice

Why I'm here today

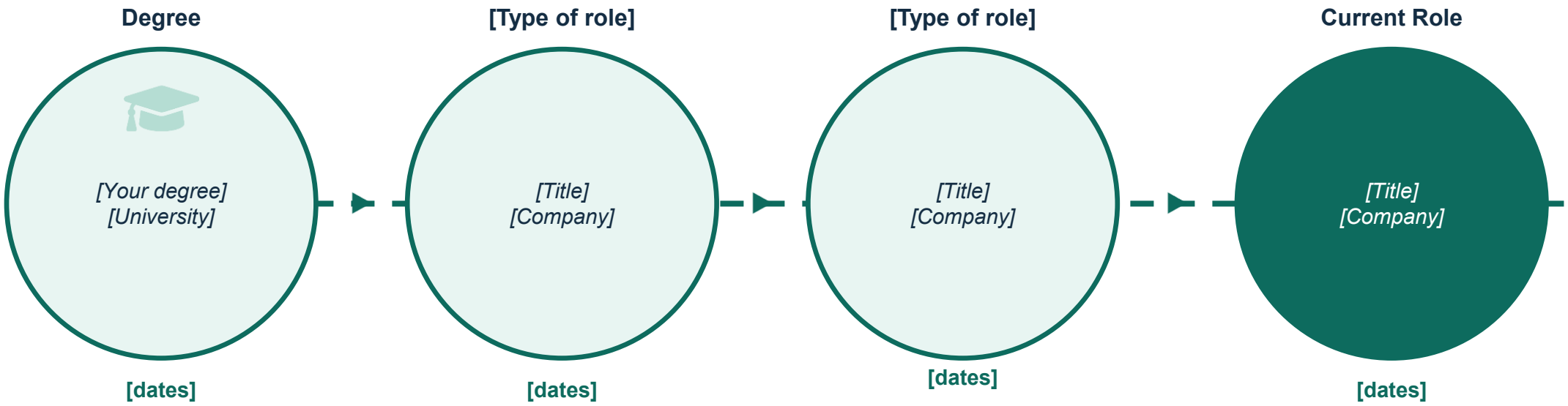
I didn't know this career existed when I was in school , nobody told me engineers could spend their days simulating buildings and shaping how they use energy.

I'm here because someone should have told me this was an option. So today, I'm telling you.

(guest speaker to update)

My pathway to BEM

From [degree] to building energy modeling



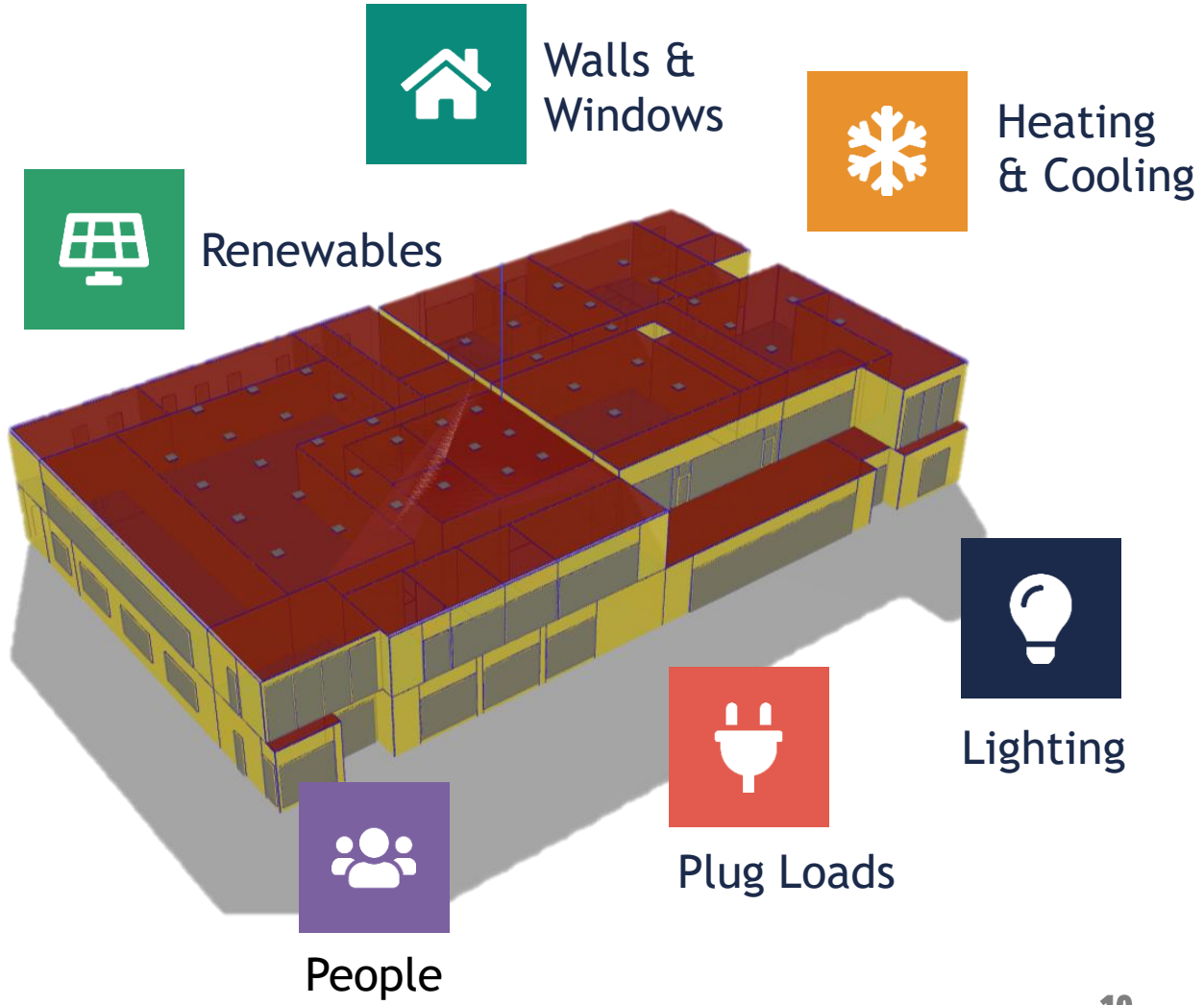
The moment I knew: *[Describe a specific project, task, or realization that confirmed BEM was your career path.]*

1) Why buildings matter and what building modeling is

Energy, money, comfort, and climate, all tied together.

What Is Building Energy Modeling?

A **virtual building** that simulates **how everything,** the climate, the walls, the windows, the lights, the AC, and the people inside, **adds up to energy use** across a whole year.



Why Buildings Matter

≈ 40%
of total U.S. **energy** use in buildings

≈ 75%
of U.S. **electricity** is from **buildings**

≈ 35%
of U.S. **CO_2 emissions**

So what? -> If you can predict energy you can optimize a design, reducing waste, saving cost and carbon

BEM helps teams answer questions like:
Should we spend budget on windows, insulation, or HVAC? · Will occupants actually be comfortable? · How do we comply with energy codes keeping flexibility?

Why Buildings Matter in California

California has a 2045 target: 85% GHG reduction + carbon neutrality.

14.5M+
Housing units statewide

160M square feet
New Non-residential built per year

170K
New homes per year

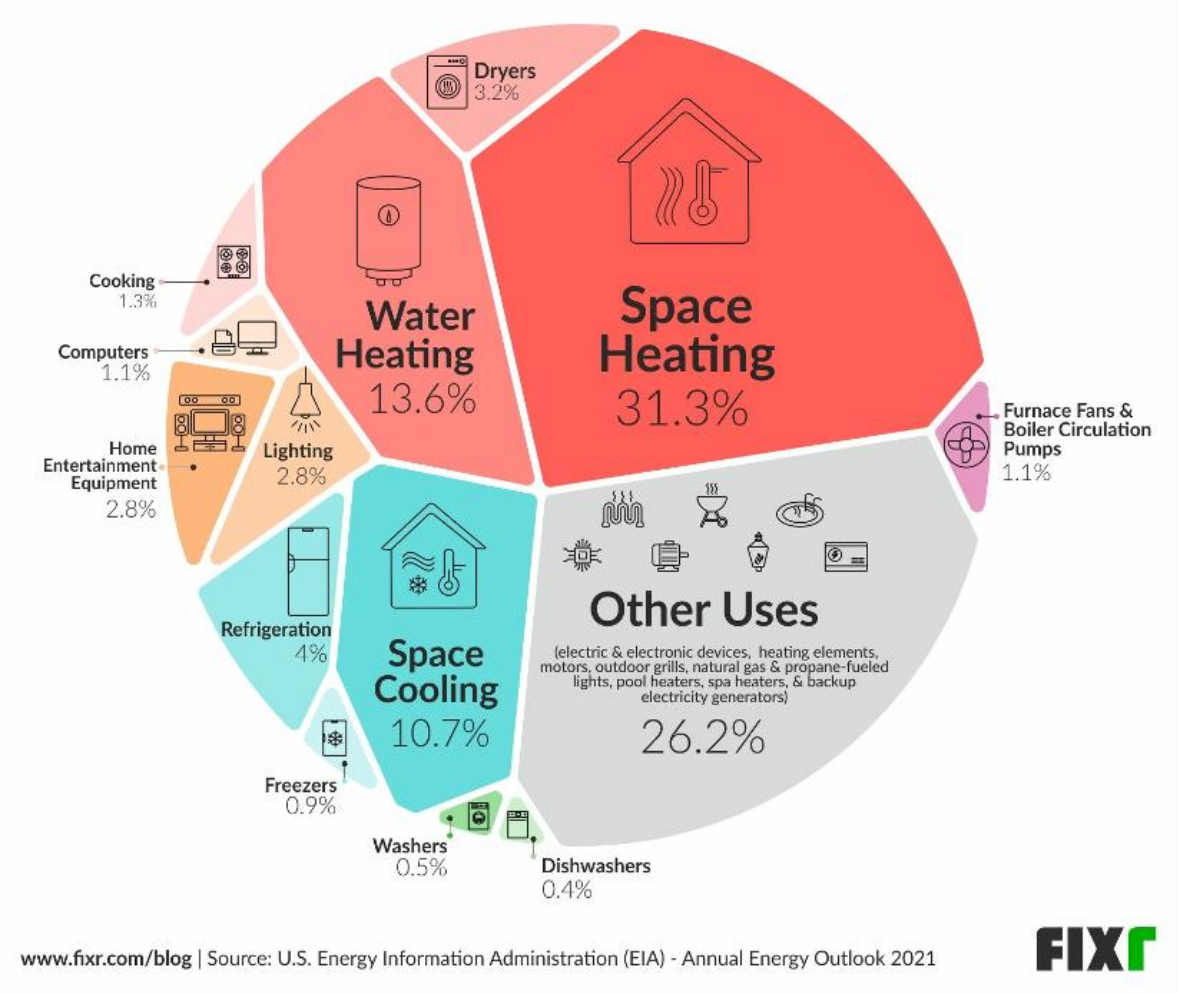
Energy Detective

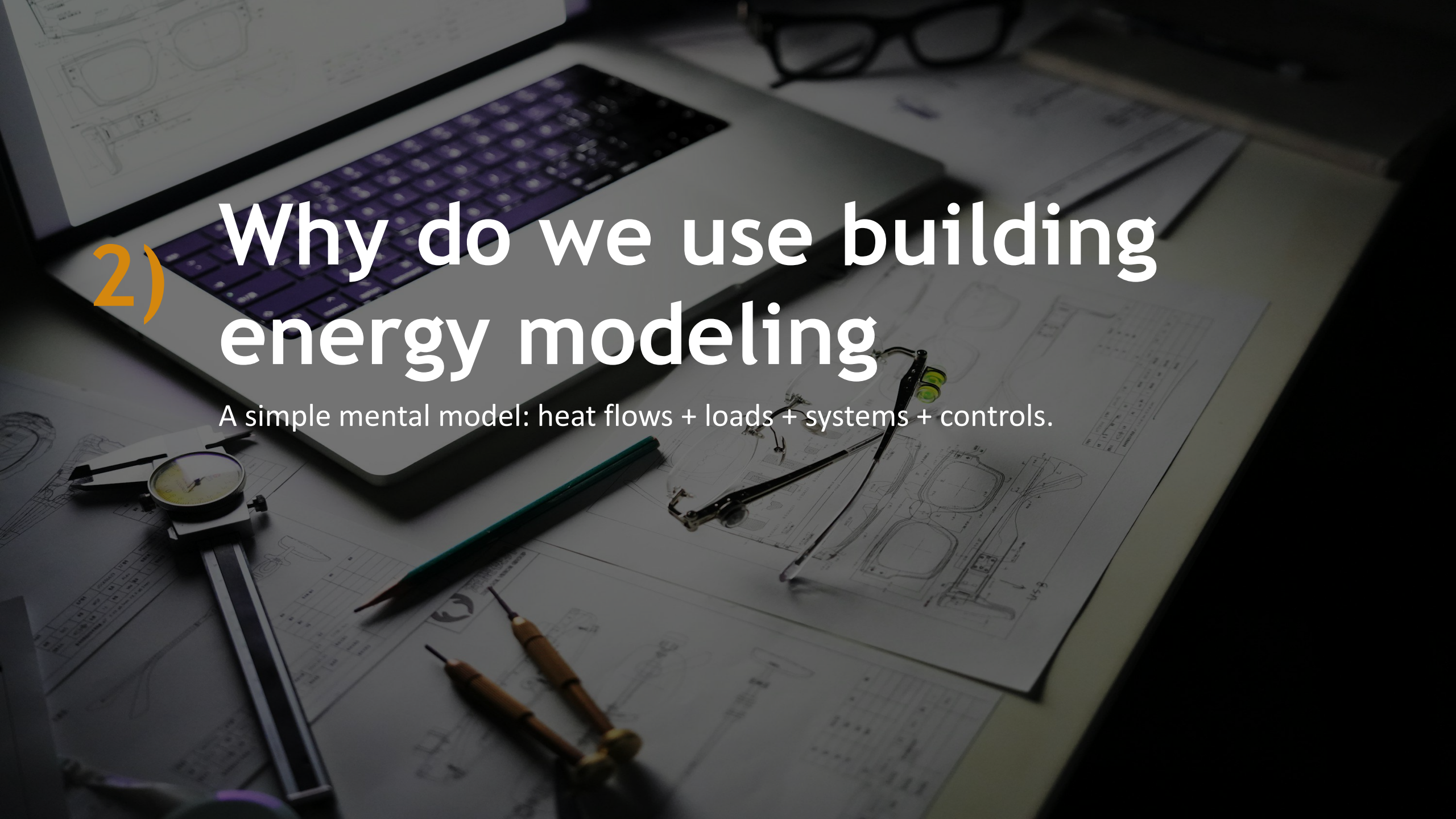
In a typical building, where does most energy go?

- Heating
- Cooling
- Hot water
- Lighting
- Plug loads

Where Does Energy Actually Go?

In most homes, space heating is #1. And "lots of small stuff" adds up.





2) Why do we use building energy modeling

A simple mental model: heat flows + loads + systems + controls.

Why BEM is Needed

Design Optimization

Can we compare design alternatives to identify the lowest operating costs, best comfort outcomes, and greatest resilience before decisions are locked in?

Building Code Compliance

Can we demonstrate that a building meets California's minimum efficiency standards to obtain a permit while still allowing design flexibility?

Green Building Certifications

Can we quantify improvements in air quality, daylighting, and energy performance to differentiate a building and attract tenants, buyers, and renters?

Energy Forecasting

Can we forecast how shifts in construction, electrification, and equipment will affect grid load to help utilities and state agencies plan smarter investments?

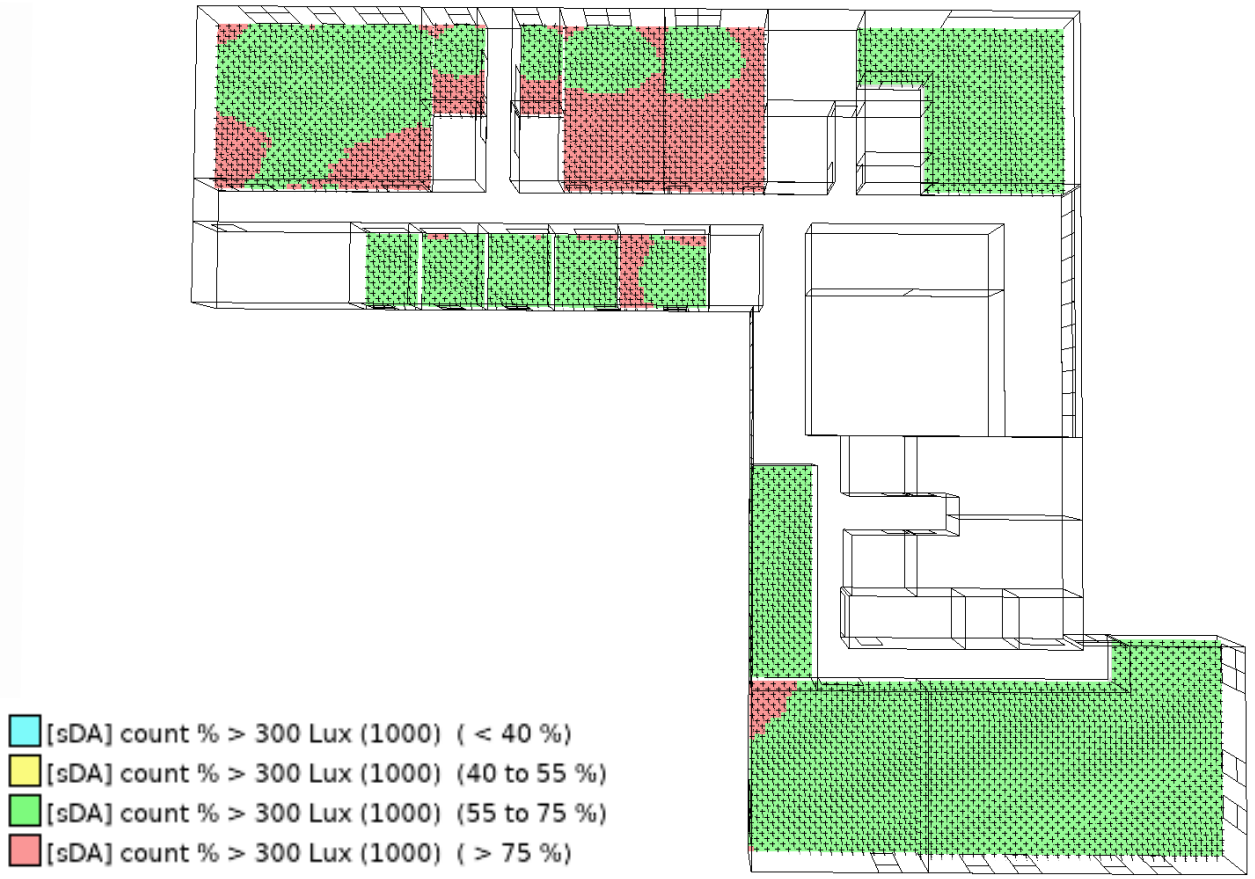
Green Building Certification, LEED

A voluntary way for buildings to show their commitment to sustainability, health and wellness.

Example LEED Credit Daylight Quality

Design: Higher Glazing No Shading

Enhanced: Reduced Glass with Shading



Energy Code Compliance for a Building Permit

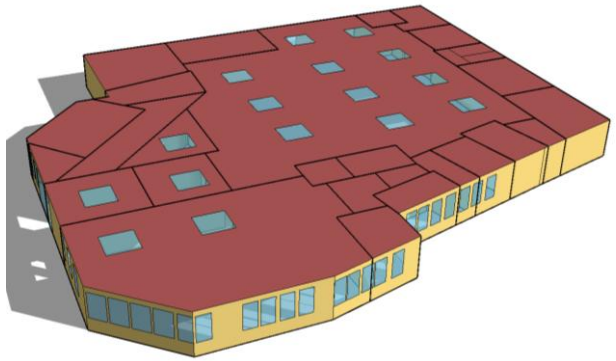
A Compliance Metrics — The 3 Tests That Determine Pass/Fail

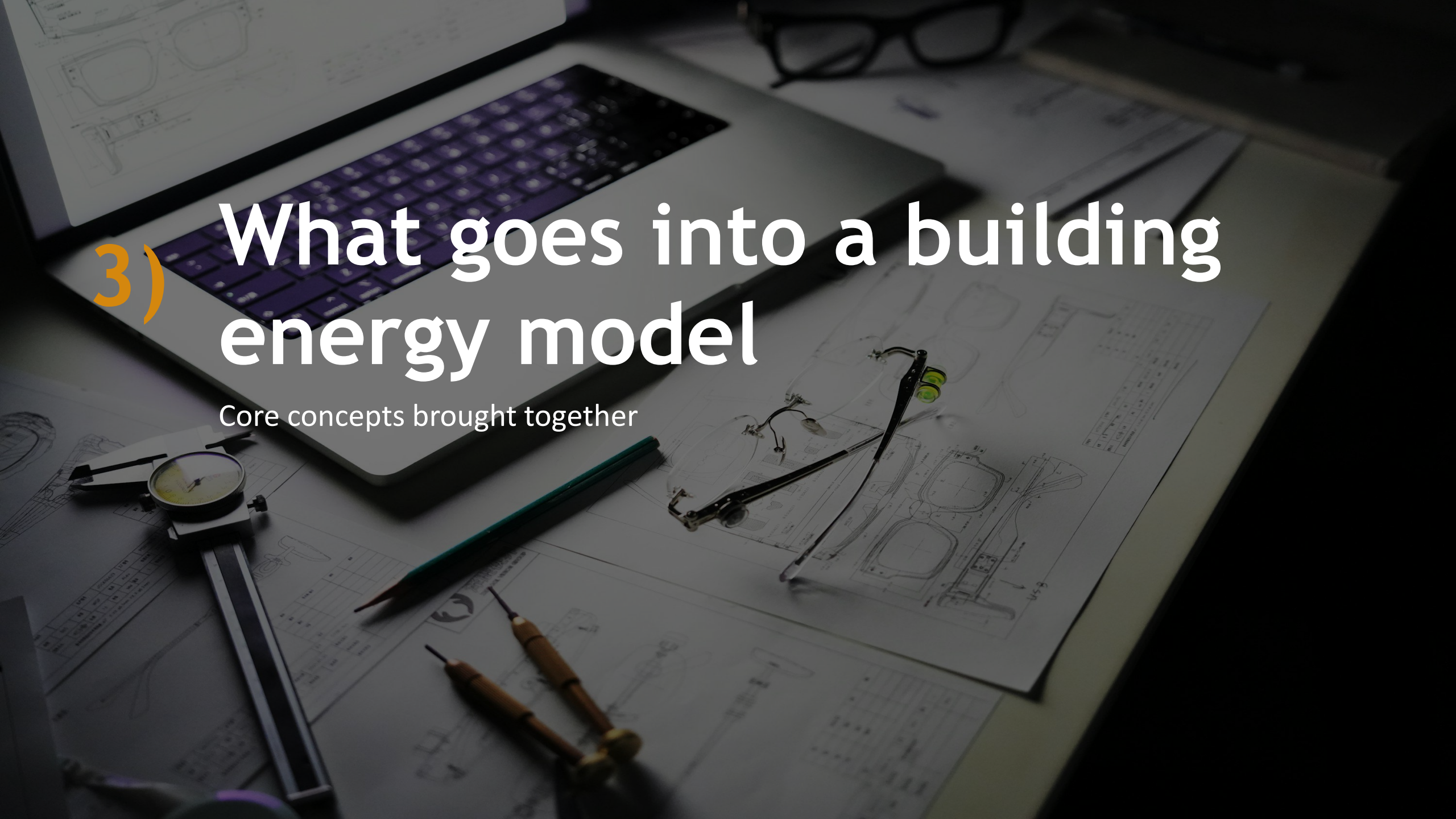
Metric	Standard (kBtu/sf·yr)	Proposed (kBtu/sf·yr)	Margin	% vs Std	Result
Efficiency (excl. PV/Battery) Core building performance — the primary compliance test	37.58	35.19	−2.39	**−6.4%**	✓ PASS
Total (incl. PV/Battery) Includes on-site generation benefit	19.14	16.74	−2.40	**−12.5%**	✓ PASS
Source Energy Accounts for upstream grid generation losses	46.53	40.70	−5.83	**−12.5%**	✓ PASS

B End-Use Energy Breakdown — Where the Savings (and Trade-offs) Come From

End Use	Standard (kBtu/sf)	Proposed (kBtu/sf)	Margin	Why It Matters for Students
Heating (Elec)	1.34	0.48	**−0.87**	*DOAS heat pump COP 3.7 + VRF vs. baseline COP 3.2–3.3*
Cooling	6.37	7.33	**+0.96**	*VRF zone cooling slightly less efficient than baseline DX — acceptable trade-off*
Fans	11.82	9.11	**−2.70**	*Largest single saving — DOAS + VRF fans vs. full-system supply fans*
PV (offset)	−18.44	−18.45	**~0**	*Matched PV generation — neither side advantages here*

Area: 13,895 sf · Both fully electric (0 kBtu gas) · Proposed: 143,300 kWh elec + 75,135 kWh PV · Standard: 153,034 kWh elec + 75,089 kWh PV · CBECC 2025





3) What goes into a building energy model

Core concepts brought together

The 6 systems an energy modeler integrates

Buildings are complicated. That's why they need someone to make all the parts talk to each other.

Envelope

Insulation, windows, air sealing

HVAC

Heating, cooling, ventilation

Lighting

Daylighting, fixtures, controls

Plug Loads

Computers, appliances, equipment

Renewables

PV, storage, grid interaction

Occupancy

People, schedules, sensors

An energy modeler is the integrator, the person who makes all six talk to each other.

The thermal envelope — a building's jacket

Think of it like a winter coat: insulation is the fill, air sealing is the zipper, windows are the pockets you forgot to close.

Insulation (R-value)

Higher R = less heat transfer.

Walls R-13 to R-31, roofs R-30 to R-60.

Windows (U/SHGC)

U-factor = heat loss. SHGC = solar gain.

Low-e coatings reduce both.

Air Sealing (ACH50)

Code ~5 ACH50; Passive House <0.6.

Every crack is an energy leak.

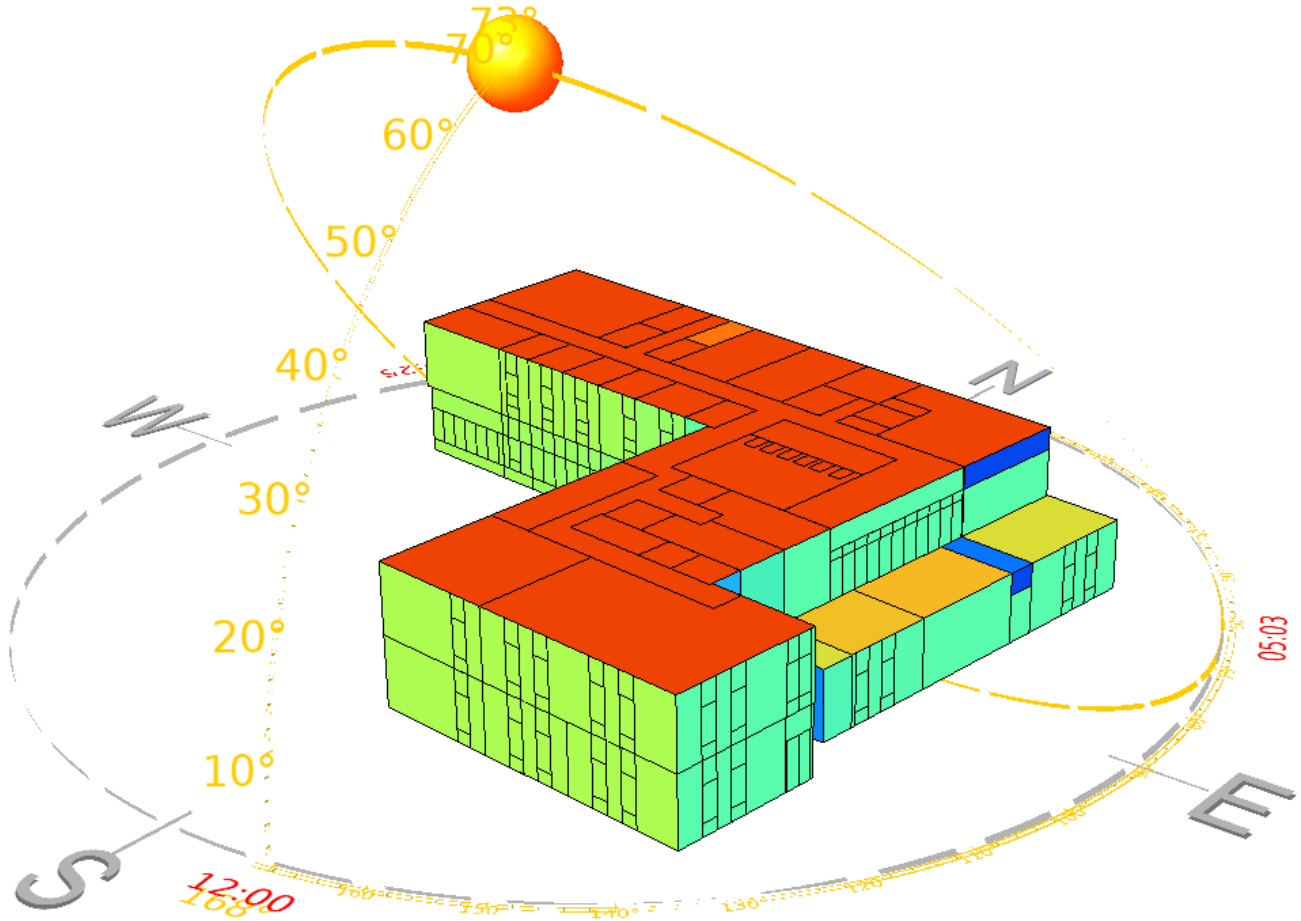
Thermal Bridging

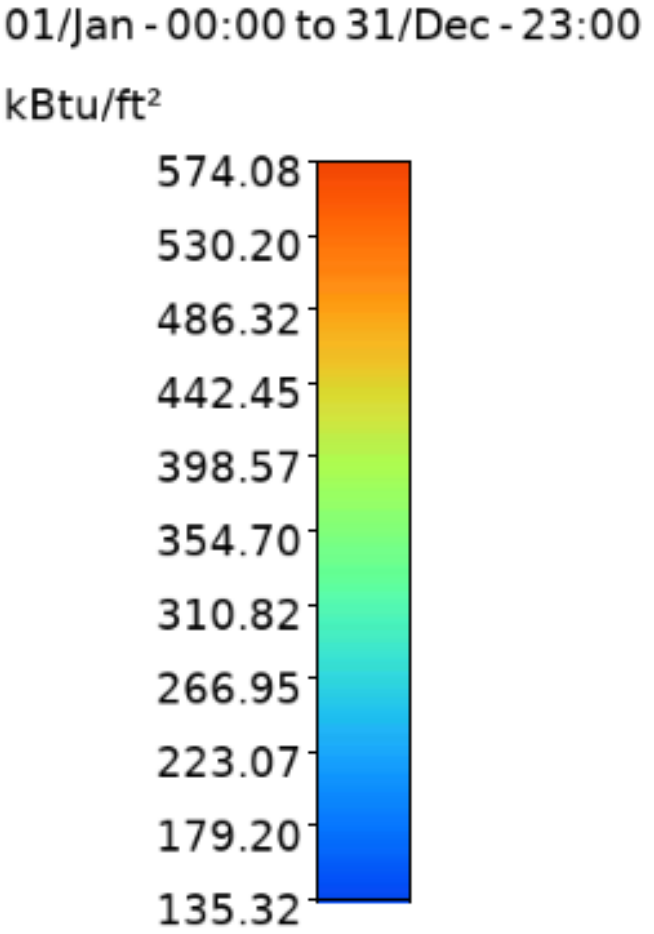
Metal studs conduct heat through insulation.

Can reduce R-value by 30–50%.

Sun + orientation and use of shading

Question: which side of the building gets the worst summer sun in CA?





The 5 levers you can pull

Most modeling questions map to one of these.

Envelope

Insulation, windows, air sealing

"What R-value is worth the cost?"

Loads

People, plug loads, process, schedules

"How much heat do occupants add?"

Systems

HVAC, water heating, ventilation

"VRF vs VAV, which wins here?"

Controls

Setpoints, sensors, sequences

"Can night-flush cut cooling by 30%?"

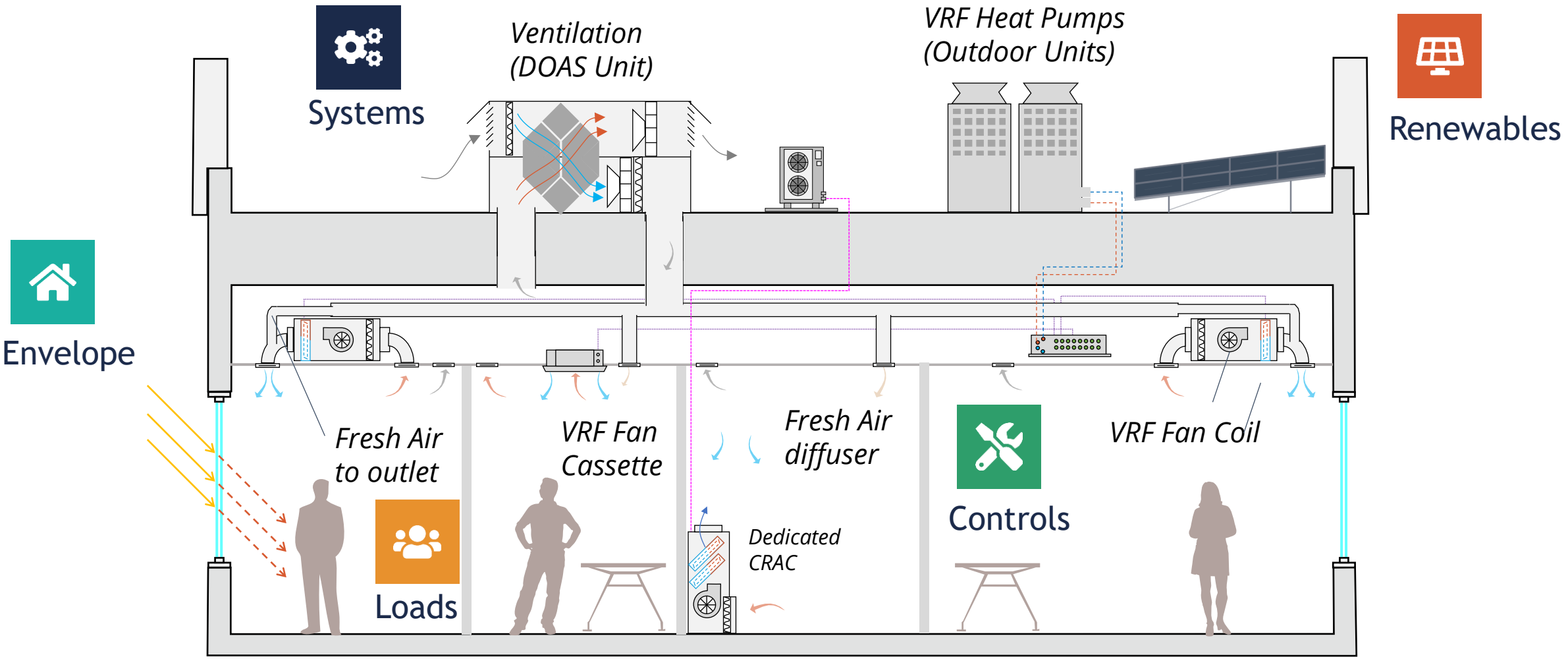
Renewables

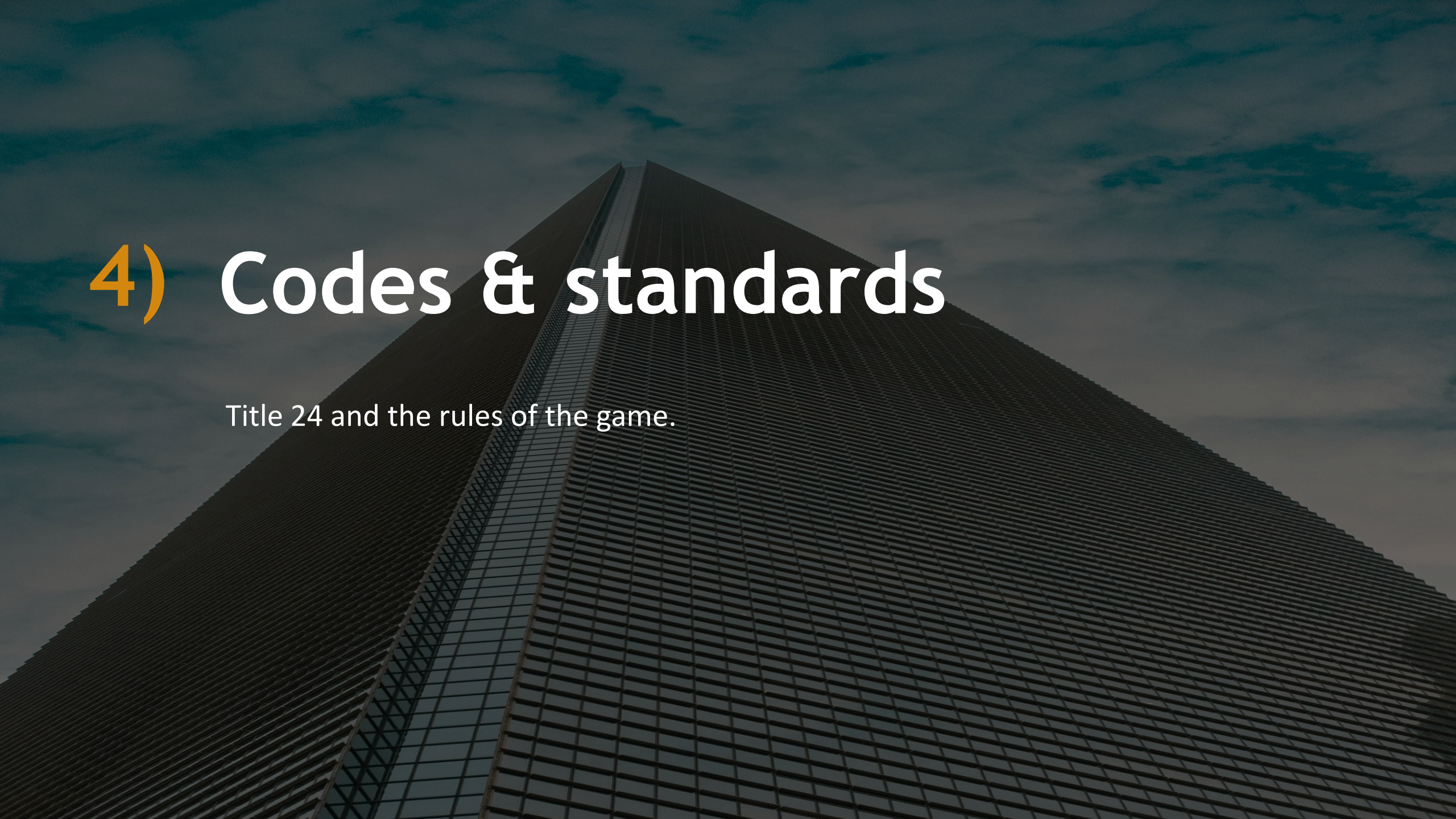
PV, storage, demand flexibility

"How much PV to hit net zero?"

Different Heating, Ventilation, Air Conditioning

Efficient Fans, Cooling, Heating, Fresh Air choices





4) Codes & standards

Title 24 and the rules of the game.

What are Building Energy Codes?

Code cycle timeline

- **2016** First all-electric-ready
- **2019** Mandatory rooftop solar (res)
- **2022** Heat pump baseline, battery-ready
- **2025** Current — updated envelope, electric-preferred

Part 6 – California Energy Code

California's Energy Efficiency Standards for Residential and Nonresidential Buildings. It establishes energy efficiency requirements for new construction and alterations to existing buildings.

Primary Goals

- → Reduce energy consumption
- → Lower greenhouse gas emissions
- → Improve building performance
- → Reduce utility costs for occupants

Who Must Comply

Building Types

- → New residential construction (single & multifamily)
- → New nonresidential buildings
- → Additions and alterations to existing buildings
- → Tenant improvements

Key Stakeholders

- → Architects & Engineers
- → Builders & Contractors
- → Building Officials & Inspectors
- → Energy Consultants

Building Envelope
Insulation, windows, air sealing

HVAC Systems
Heating, cooling, ventilation

Water Heating
Efficient water heaters & systems

Lighting
Indoor & outdoor efficiency

Solar PV
Photovoltaic requirements

Electric Ready
EV charging, electrification

Two paths to prove code compliance

Prescriptive = follow a checklist.

Performance = use a model.

Prescriptive Path

- Follow a checklist of mandatory measures
- No energy modeling required
- No trade-offs between systems
- Simpler but less flexible

Best for: simple buildings, tight budgets

Performance Path

- Use a model to prove total energy ≤ code budget
- Trade-offs allowed (better HVAC offsets weaker envelope)
- Requires approved software (CBECC, EnergyPro, IES-VE)
- This is where energy modelers are essential

Best for: complex buildings, innovative designs

Performance Path: 4 steps to a permit

1

Build Geometry

Import or build 3D zones from arch plans

2

Assign Systems

Envelope, HVAC, lighting, schedules

3

Run Simulations

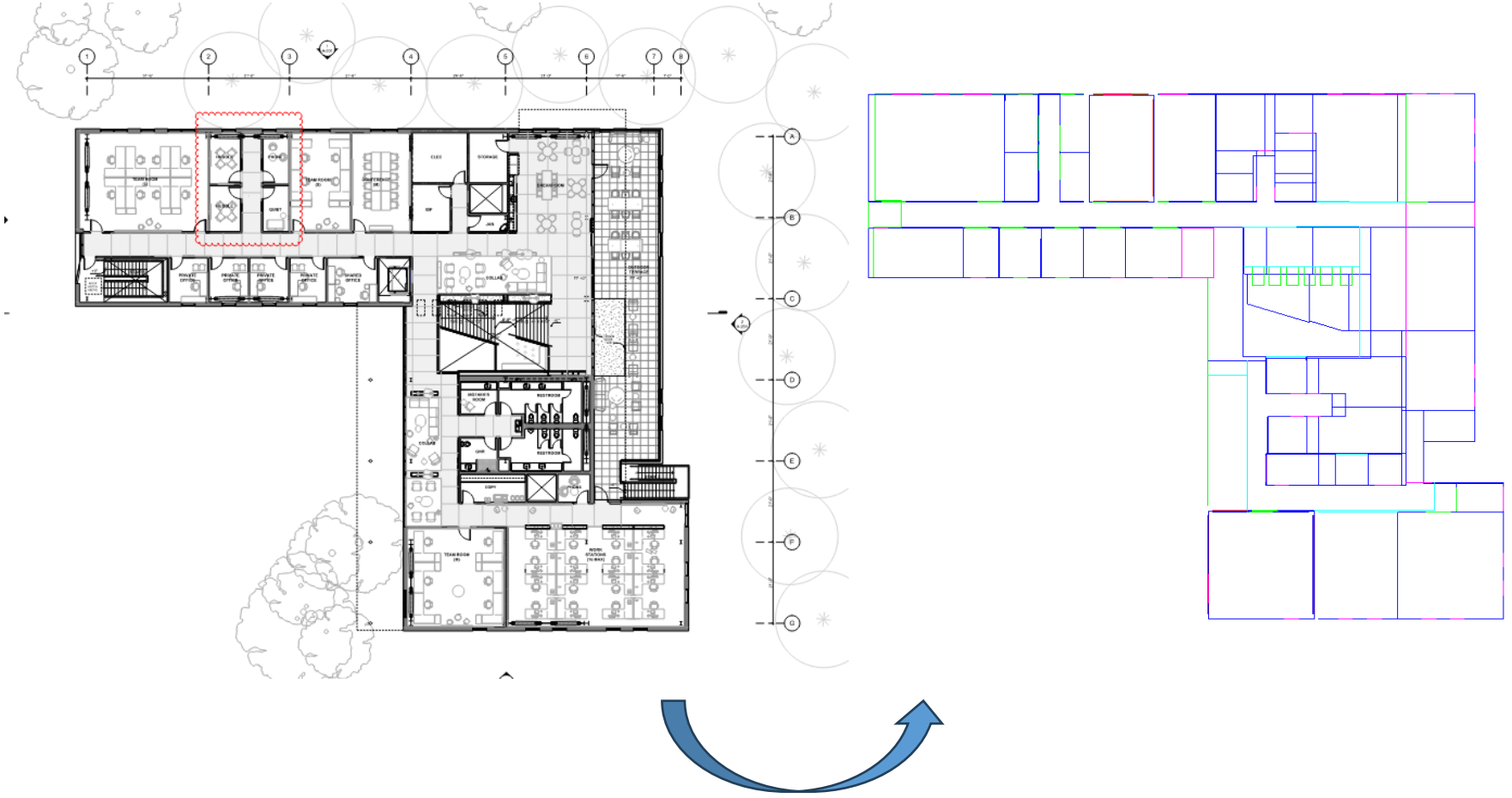
Standard vs. proposed, iterate to optimize

4

Document

CF-1R/CF-NR forms for plan check

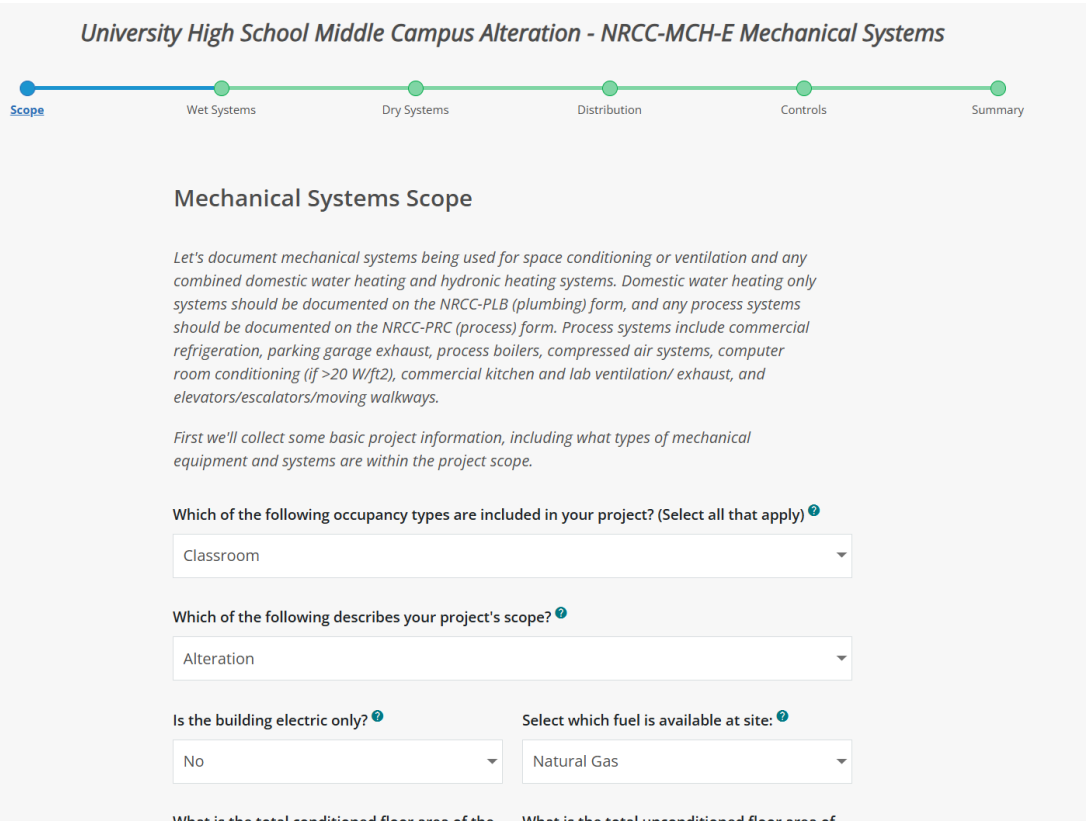
Performance Path

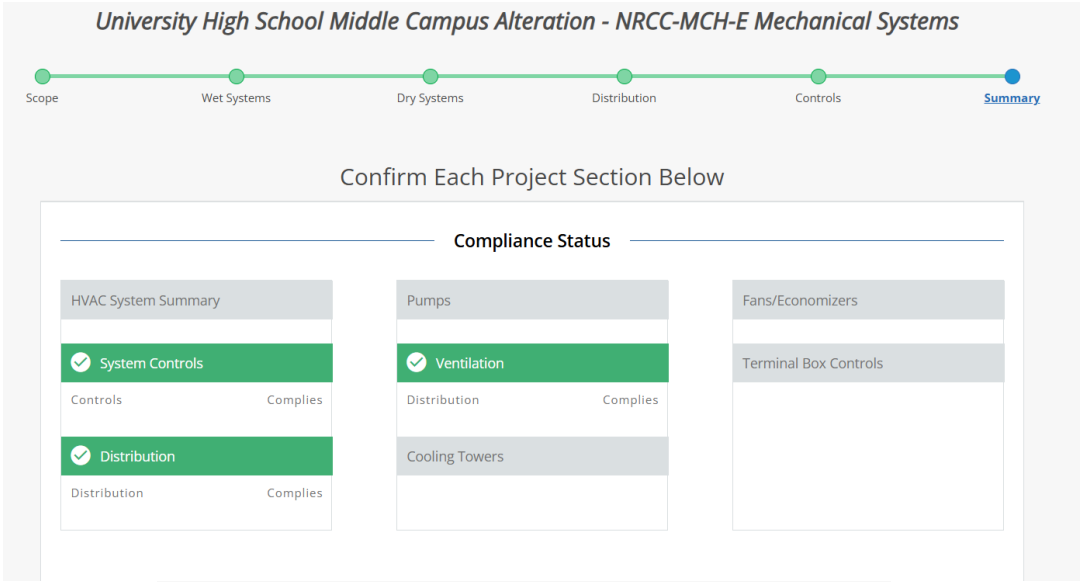


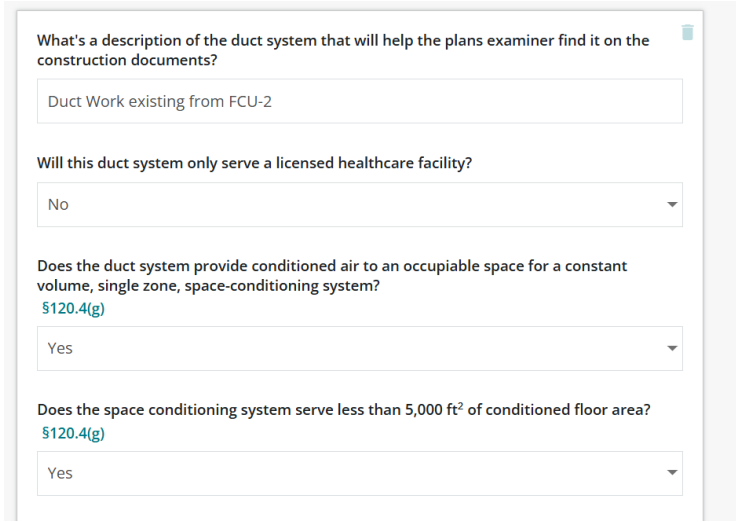
Building out geometry based on floorplans

Prescriptive Path

Energy Code Ace Online Forms







CALGreen + the code philosophy

Part 11 of the CCR, California's green building code.

CALGreen (Part 11)

- Water efficiency & conservation
- Construction waste diversion (65% minimum)
- Material selection & indoor air quality
- EV charging readiness

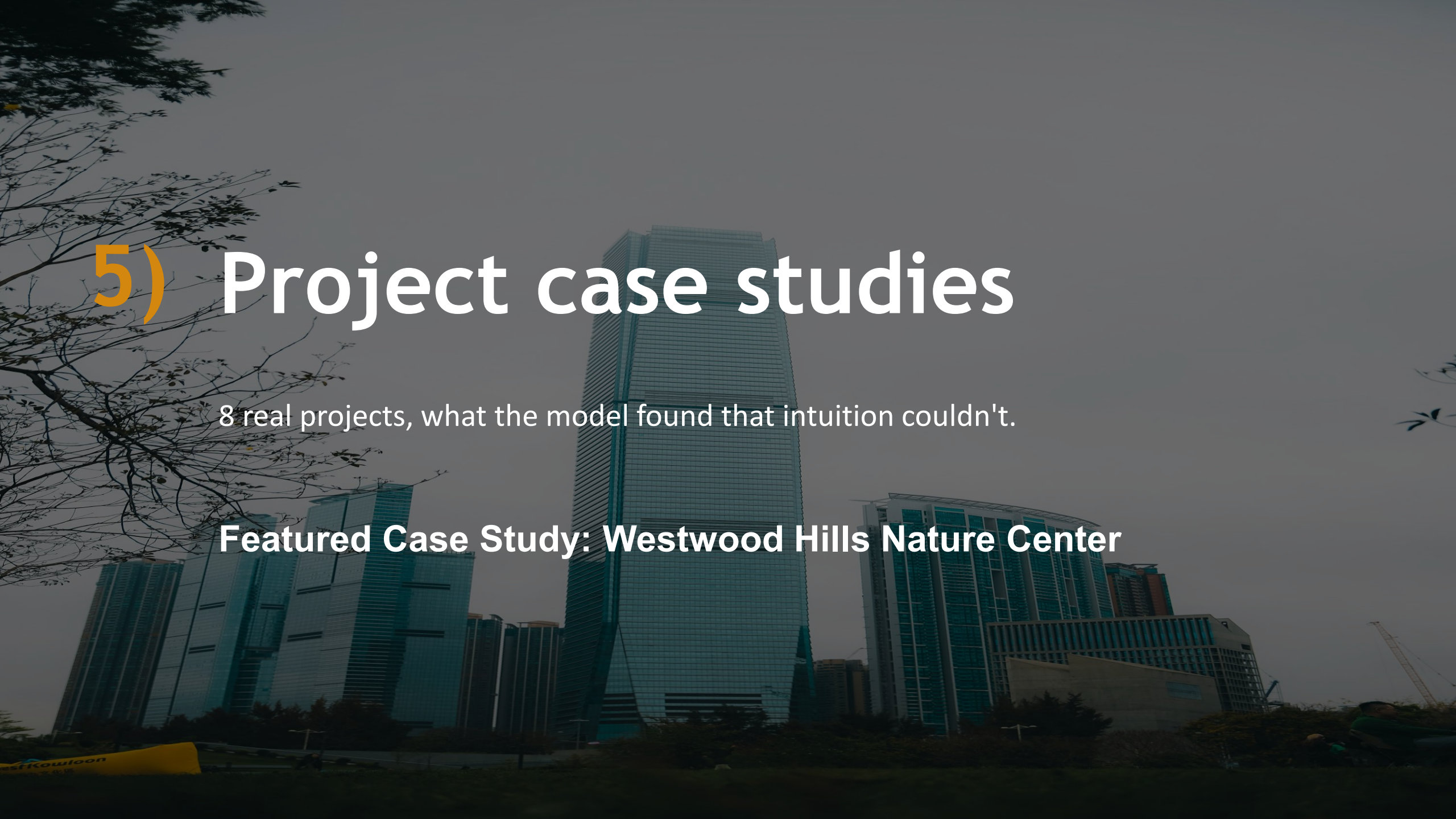
"Codes set the floor, not the ceiling."

Building codes establish the minimum. Great buildings, and great energy modelers, aim far beyond.

California Code of Regulations: all 12 parts

Energy = Part 6, Green Building = Part 11.

Part	Title
1	Administrative
2	Building Code
3	Electrical
4	Mechanical
5	Plumbing
6	**Energy (Title 24)**
7	Wildland-Urban Interface (WUI)
8	Historical Building
9	Fire Code
10	Existing Building
11	**CALGreen**
12	Referenced Standards



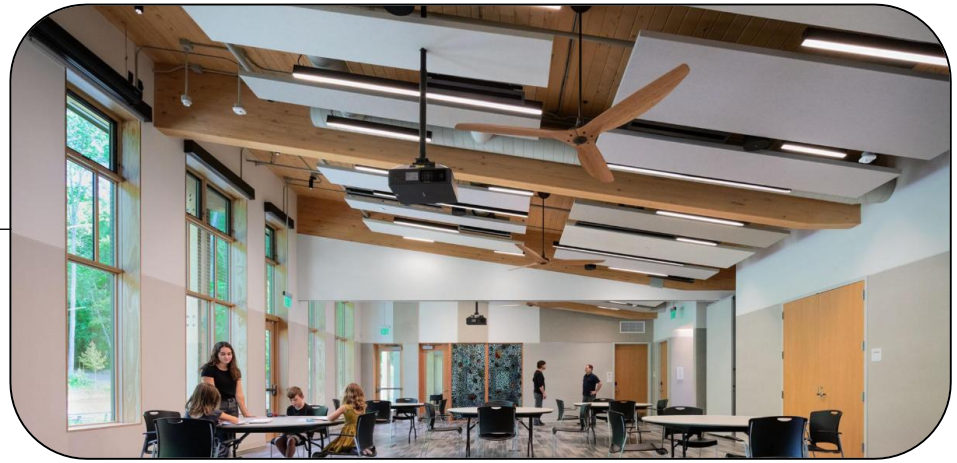
5) Project case studies

8 real projects, what the model found that intuition couldn't.

Featured Case Study: Westwood Hills Nature Center

Westwood Hills Nature Center

St. Louis Park, MN | Net Zero Energy | ILFI Zero Energy Certified | 160 Acres | Opened 2020



Project Overview

With increasing instances of extreme heat as well as historical extreme cold, the City of St. Louis Park, Minnesota, and the architecture firm HGA initiated a project to reimagine the Westwood Hills Nature Center

Building Overview

Building Type: Nature Center
Location: St. Louis Park, MN
Floor Area: 160 Acres
Occupancy Date: 2020

Energy Goal:

To achieve Net-Zero Energy and Net-Zero Positive status, culminating in the prestigious Zero Energy Certification from the International Living Future Institute

Multi-faceted Vision :

Transcended the simple replacement of an aging building; it was a long-term investment in community, education, and municipal leadership.

Pathway to Net Zero Energy

Set Energy Target

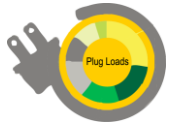
Design a Great Envelope

Maximize Light & Fresh Air

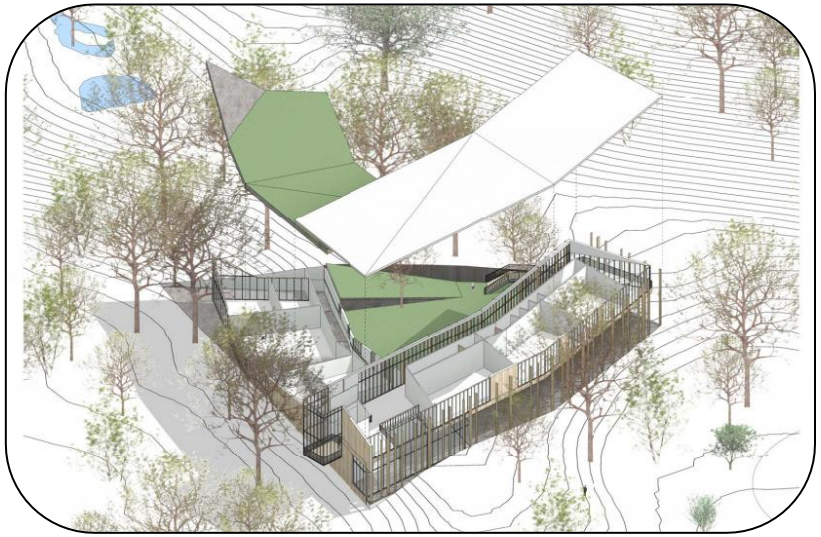
Expand Thermal Comfort

De-Couple Ventilation With Conditioning

Effectively Manage Equipment Energy



Project Floor Plans



Thermal Energy System + Solar PV

Geothermal Heat Pump System

Closed-loop system
using underground aquifer for heat exchange

32 vertical boreholes drilled 200–250 ft deep, located under parking lot and sidewalk to preserve native prairie

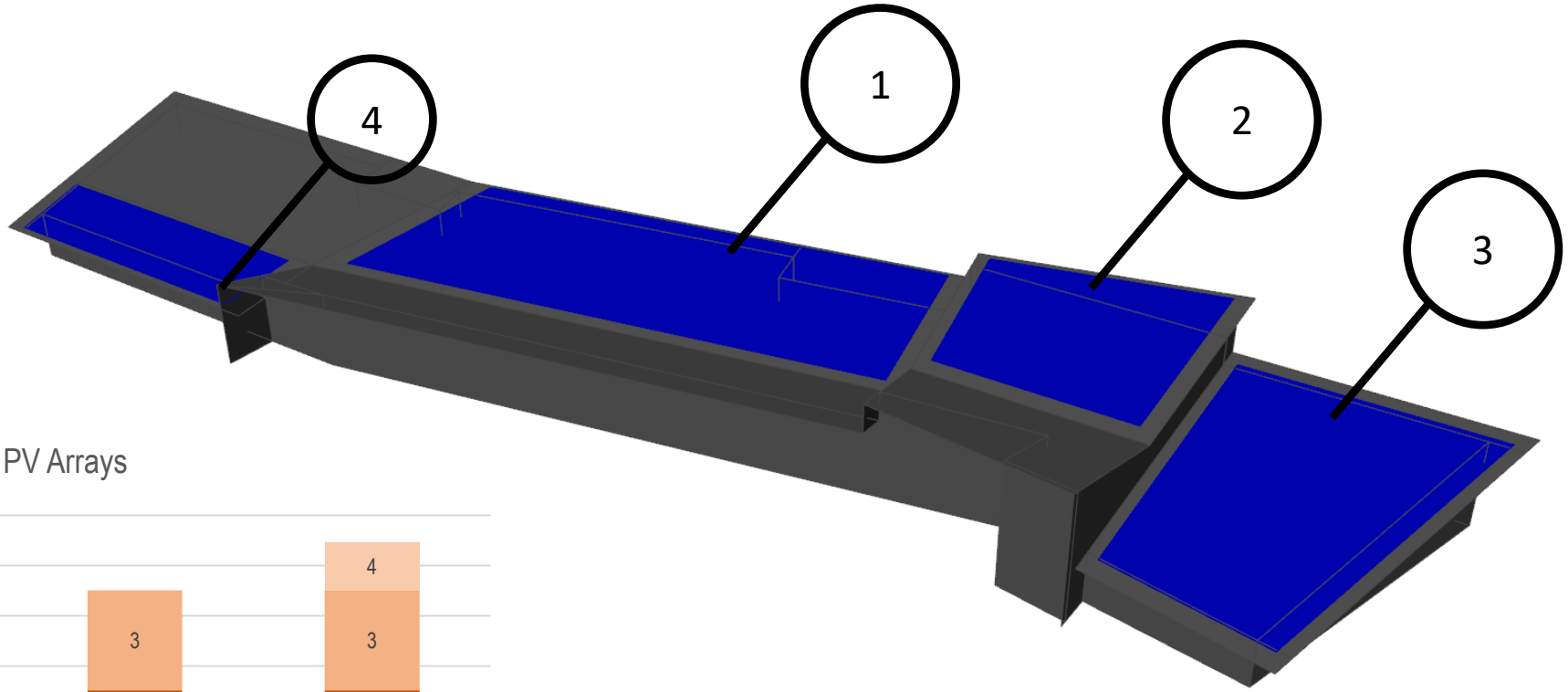
15 water-to-air heat pumps for heating and cooling + 1 water-to-water HP for radiant floor

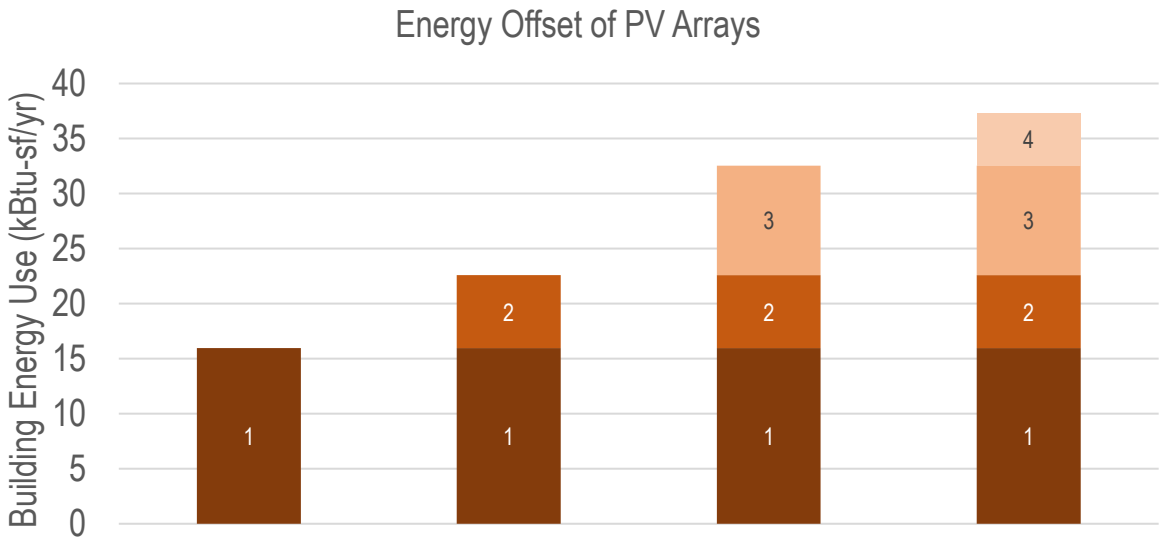
3,000 sq ft radiant floor system providing consistent, comfortable heat to key areas

122 kW Rooftop Solar PV

Generates enough electricity annually to balance total building consumption, making it a net-zero energy facility.

PV Generation Potential - Getting to Zero





Passive Design + Behavioral Nudging

Building Envelope

High-performance envelope reduces energy use by ~20% while improving occupant comfort.

Daylighting & Shading

Orientation optimizes natural daylight; solar shading prevents overheating.

Natural Ventilation

9 ceiling fans + operable windows for passive cooling when conditions are favorable.

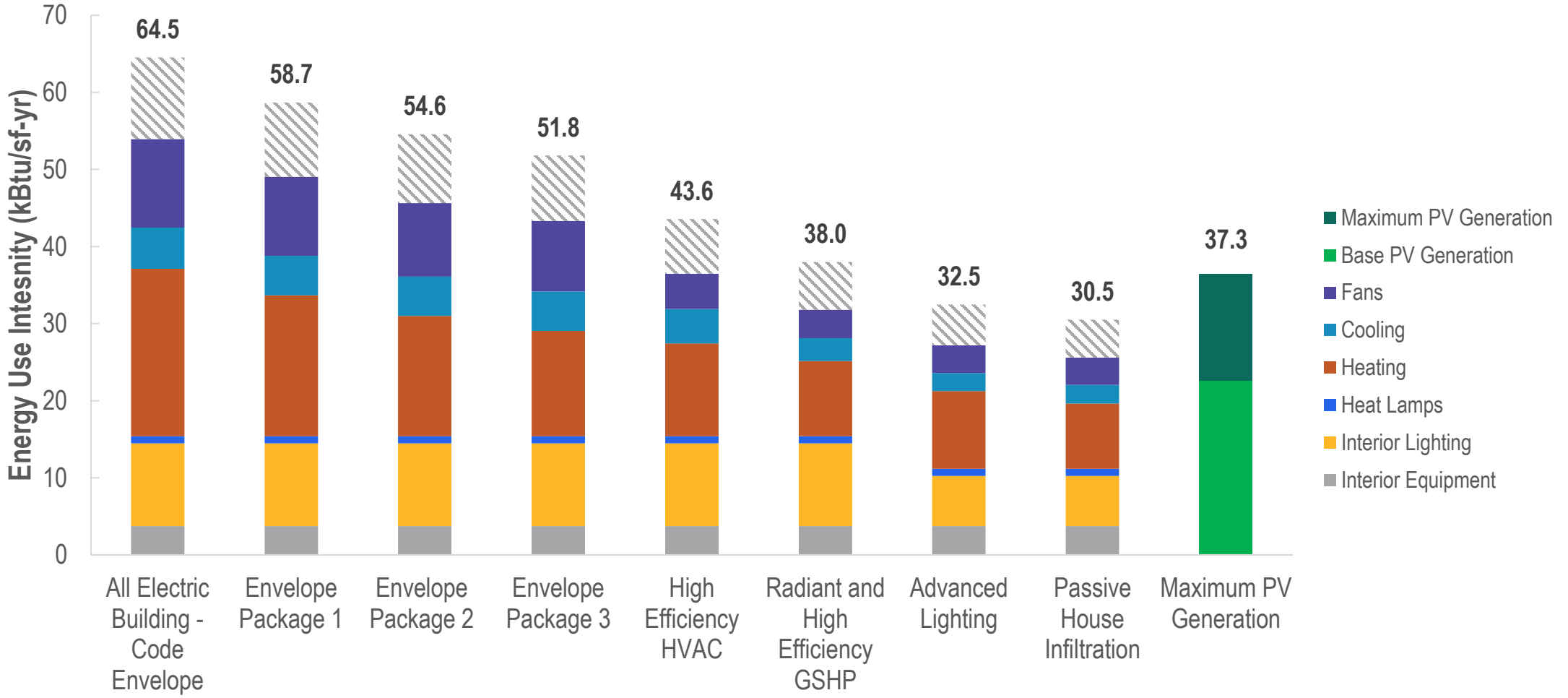
Thermal Mass

Mass absorbs and slowly releases heat, passively regulating indoor temperatures.

Key Insight: Behavioral Nudging

A simple "green light" indicator in the staff office illuminates when outdoor temperature and humidity are optimal for opening windows. This nudge significantly extended natural ventilation hours.

Net Zero Energy & Energy Efficiency Measures



Performance, Recognition, and User Experience

Annual Energy Cost Savings

$6,750

(a 35% reduction)

Projected 50-Year Operating Savings

$322,000

(from net-zero design)

The project has received numerous prestigious awards between 2020 and 2023 from organizations

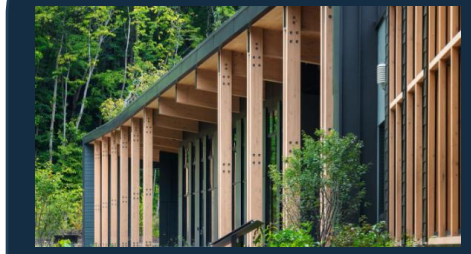
2023 Design Award - AIA California

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) – Technology Award

American Institute of Architects (AIA) San Francisco Chapter – Architecture Merit Award

International Living Future Institute (ILFI) Zero Energy Certification

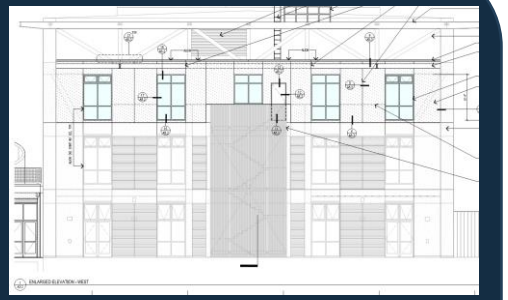
Case Studies



Nature Educational Center

Net Zero Office Retrofit

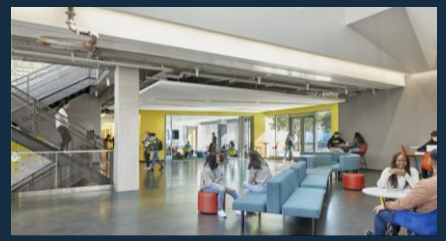
Vera Cruz Village – Multifamily Residential



High School T24 Addition

Silver Star Apartments

Robert Redford Conservancy Pitzer College



Lick Wilmerding HS Campus Expansion

Office Research, T24 Core and Shell Compliance

6) Tools & software

What you'll actually use on the job.

Match the tool to the question

Different questions call for different models and tools. ASHRAE Standard 209 maps these analyses across the design process.

SIMPLE BOX MODEL

Massing & orientation

Which form and orientation perform best?

DAYLIGHT MODEL

Daylight & glare

Where do we get daylight without glare?

WHOLE-BUILDING MODEL

Load reduction

Which measures cut the loads?

WHOLE-BUILDING MODEL

HVAC & controls

Which system and controls fit the loads?

COMPLIANCE MODEL

Code compliance

Does it pass Title 24?

CALIBRATED MODEL

Operational performance

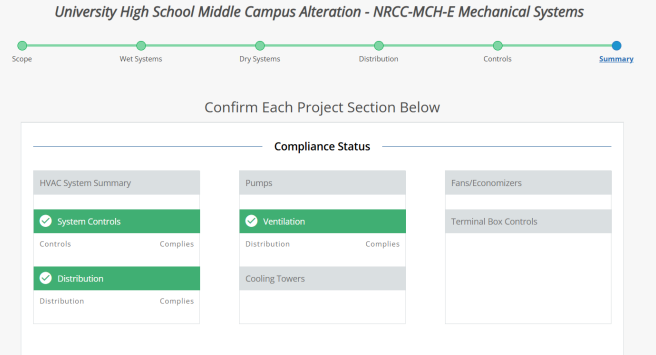
Does it match the meter?

Professional software landscape

Three categories of tools predominantly used by working energy modelers.

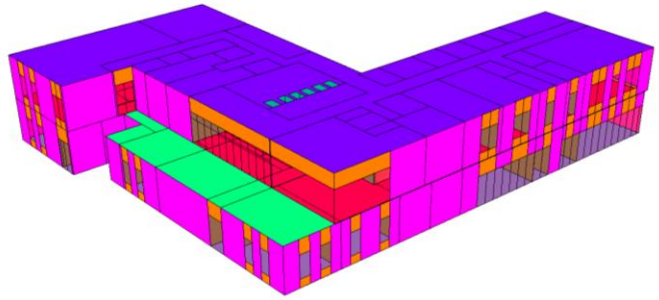
Code Compliance (CA)

EnergyPro, CBECC, IES-VE



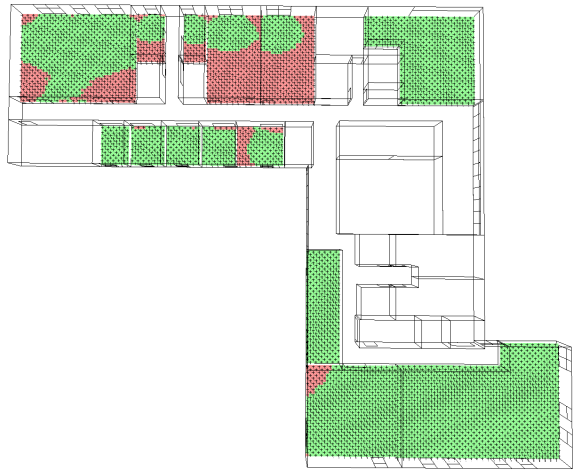
Whole-Building

EnergyPlus, OpenStudio, IES VE, DesignBuilder, …



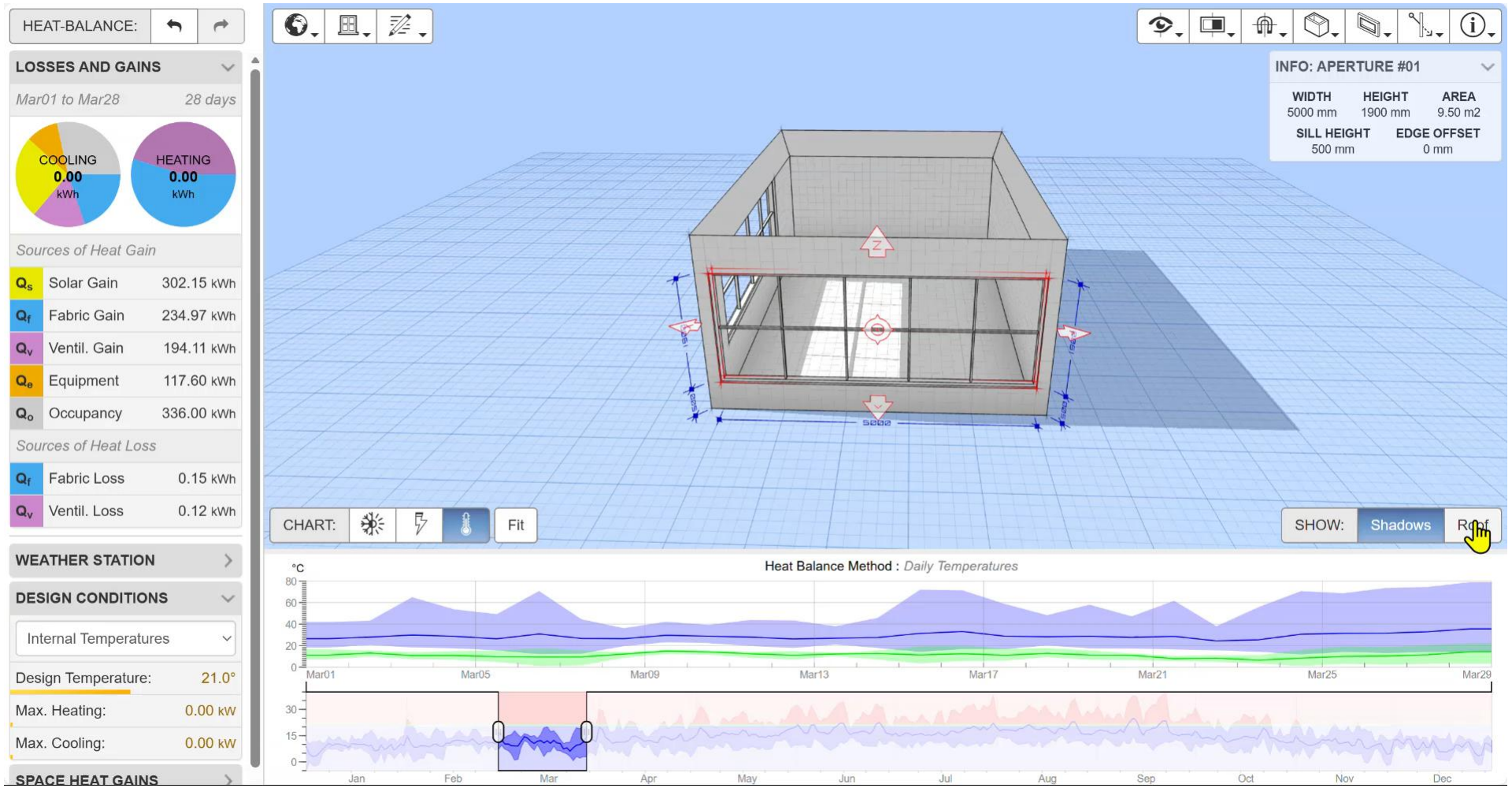
Daylight & Comfort

Radiance, ClimateStudio, Honeybee

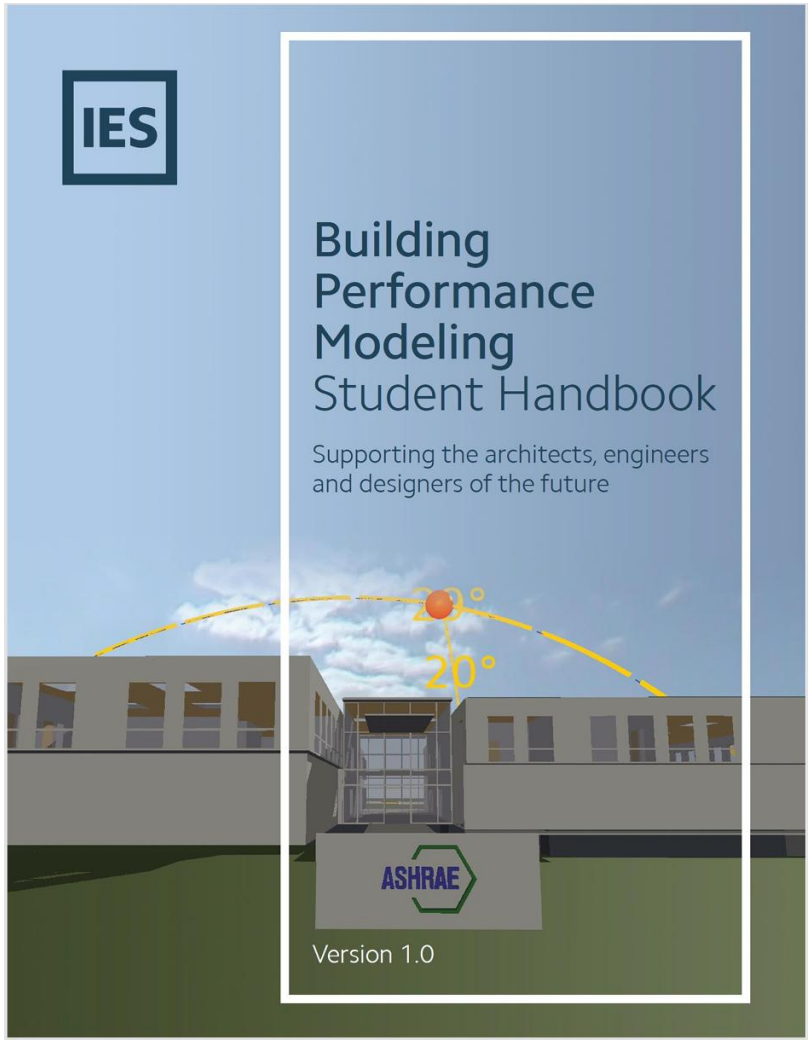


Shoe Box Heat Balance Tool

Andrew Marsh Tools: https://drajmarsh.bitbucket.io/

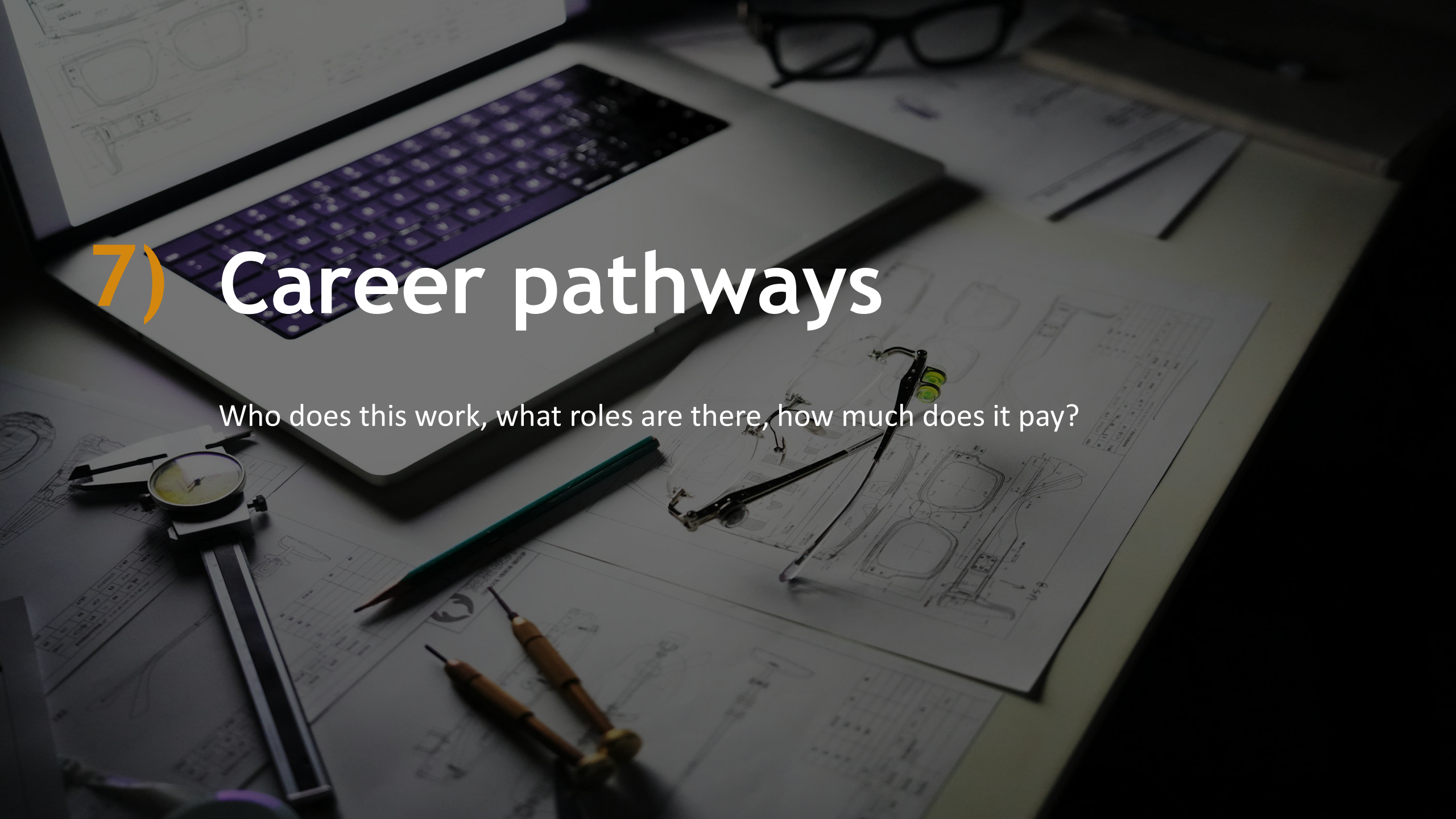


IES Modeling Handbook



[Building Performance Modeling Student Handbook]

[Introducing the Fundamentals of Building Performance Modelin]



7) Career pathways

Who does this work, what roles are there, how much does it pay?

Typical roles in energy modeling

Where modelers work and what they do.

Architecture Designer/Modeler

Layouts, facades, daylight

Mechanical Engineer

HVAC, loads, optimization

Energy Code Consultant

Title 24, compliance

Data Analyst & CS

Energy data, software

Facade/Enclosure Designer

Curtain walls, glazing

Utility Consultant

Incentives, grid planning

Building Perf. Engineer

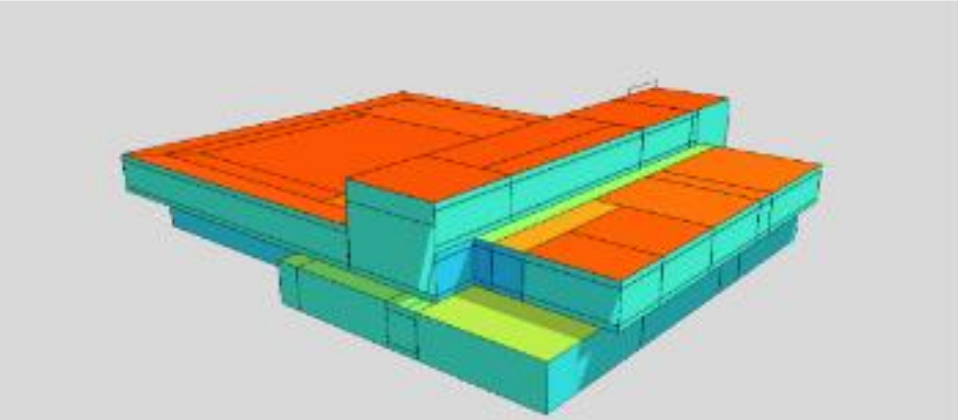
Commissioning, M&V

AI/ML Energy Analyst

ML, prediction, analytics

Job Benefits

Energy modelling is like professional MINECRAFT



A Day in the Life of an Energy Modeler

9:00 AM		Review updated architectural plans — check window-to-wall ratios and new floor plan layouts
10:30 AM		Update the energy model geometry in OpenStudio to reflect design changes from the architect
1:00 PM		Join a coordination call with the MEP engineer to discuss HVAC system options and efficiency targets
2:30 PM		Run simulations comparing two different glazing options to see which one reduces cooling loads more
4:00 PM		Prepare the Title 24 compliance report showing the building passes performance standards

Every day is different. One day you're deep in HVAC systems, the next you're analyzing solar shading. The variety is what keeps it fresh.

AI in practice for BEM

Where AI speeds up the work and where the modeler's judgment is irreplaceable.

The modeler	Workflow	AI assists
Scope the project	Drawings & specs arrive	Flag missing info in drawings
Draw thermal zones	**Build model inputs** Geometry, systems, schedules	Pre-fill inputs from specs
Select HVAC systems		Catch outlier inputs
Choose scenarios to test	**Run simulation** EnergyPlus, CBECC, IES VE	Run sanity checks and plot QA and QC data
Troubleshoot bad runs		
Sanity-check the physics	**Interpret results** Charts, compliance, trade-offs	Plot results automatically
Recommend design changes		
Present to the team	Deliver to design team	Draft reports & docs
Coordinate across disciplines		

= modeler (judgment, physics, communication)

= AI (tedious, repetitive, formatting)

What makes a great energy modeler?

Six traits that set top performers apart.

Building Science

Heat transfer, thermo, materials.

Critical Thinking

Question assumptions, validate inputs.

Communication

Translate results for non-technical audiences.

Software Fluency

EnergyPlus, IES VE, Revit, scripting.

Attention to Detail

One wrong input invalidates everything.

Big Picture Vision

Connect buildings to climate + equity.

Four main tracks into BEM

All roads lead to energy modeling, pick the one closest to your interests.

STEM/Eng

Major:

Mech or Civil Eng

Entry Role:

Energy analyst

First Cert:

ASHRAE BEMP

Architecture

Major:

Architecture, BldgSci

Entry Role:

Sustainability designer

First Cert:

LEED AP BD+C

Env Studies

Major:

Env Science/Policy

Entry Role:

Energy Code Consultant

First Cert:

LEED GA / CABEC CEA

Comp Sci

Major:

CS, Data Science

Entry Role:

Building data analyst

First Cert:

E+ certificate

Salary Ranges & Career Progression

What energy modelers earn - and where the career goes.

Level	Typical Titles	Experience	Salary Range	Source Basis
Entry	Energy Analyst Jr. Energy Modeler Title 24 Analyst	0 – 2 years	**$55,000 – $75,000**	BLS 17-2199, O*NET, Glassdoor
Mid	Energy Modeler Sustainability Consultant BEM Specialist	3 – 6 years	**$75,000 – $110,000**	BLS 17-2199, Glassdoor
Senior	Senior Energy Modeler Project Manager Associate Principal	7 – 12 years	**$100,000 – $145,000**	BLS 17-2199, Glassdoor
Principal	Principal / Director Studio Lead / Owner VP of Sustainability	12+ years	**$130,000 – $185,000+**	BLS 11-9041, Glassdoor

Ranges vary by region, organization size, and specialization.

Career doesn't just go up, it branches into specializations.

Code Consulting
Title 24 compliance firms

Sustainability Director
Corporate / institutional

Software Development
BEM tool companies

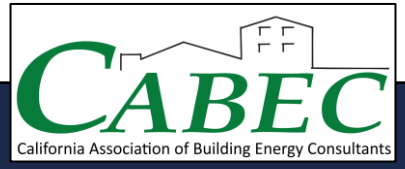
Utility Program Mgmt
IOU efficiency programs

Policy & Research
CEC, national labs, academia

Sources: O*NET 17-2199.03 — Energy Engineers, Except Wind and Solar. BLS Occupational Employment & Wages, 17-2199 (Engineers, All Other) and 11-9041 (Architectural & Engineering Managers), 2024 data. Glassdoor salary data for "Energy Modeler," "Sustainability Consultant," accessed March 2026. *Figures reflect national ranges*

What Resources Are Available

A statewide program providing training, tools, and resources to simplify compliance with California's building energy codes.
Energy Code Ace - Home Page



A professional organization supporting building energy consultants through certification, training, and industry standards.
CABEC Homepage - CABEC.org

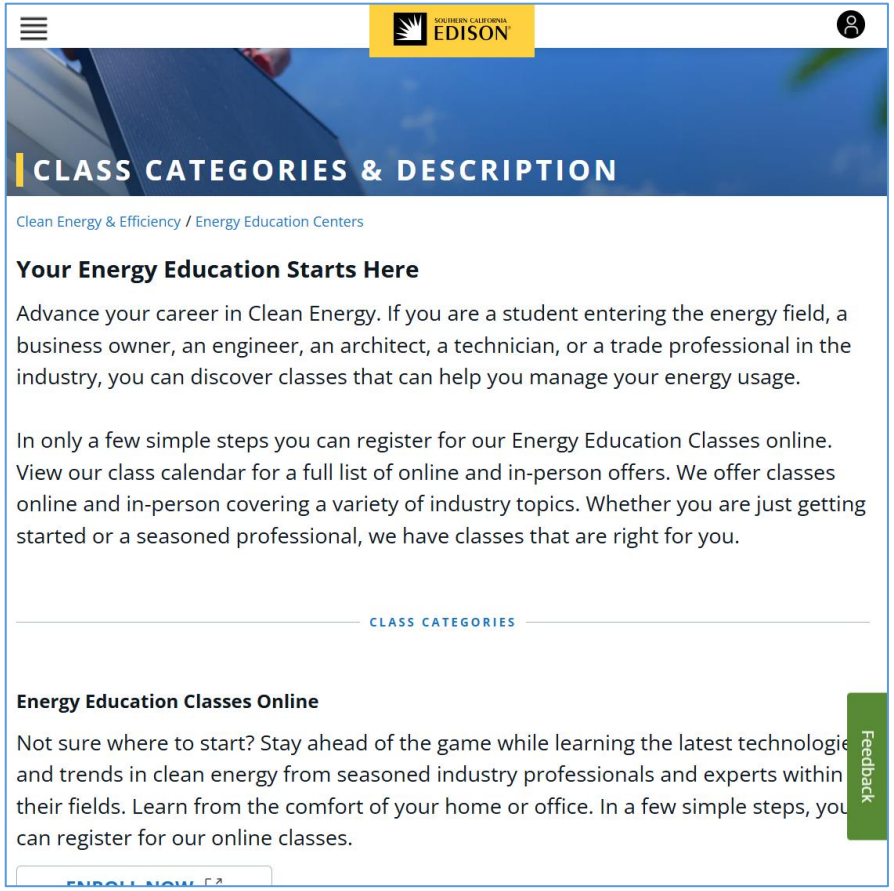
A regional network of the U.S. Green Building Council advancing sustainable building practices and green building education across California.
Sustainability Professionals Driving Change in California

Regional energy networks, delivering energy efficiency programs, building performance training, and decarbonization initiatives across three central California counties.
Homepage - 3C-REN

A statewide collaborative focused on advancing building energy modeling tools, standards, and workforce development.
Home - CalBEM

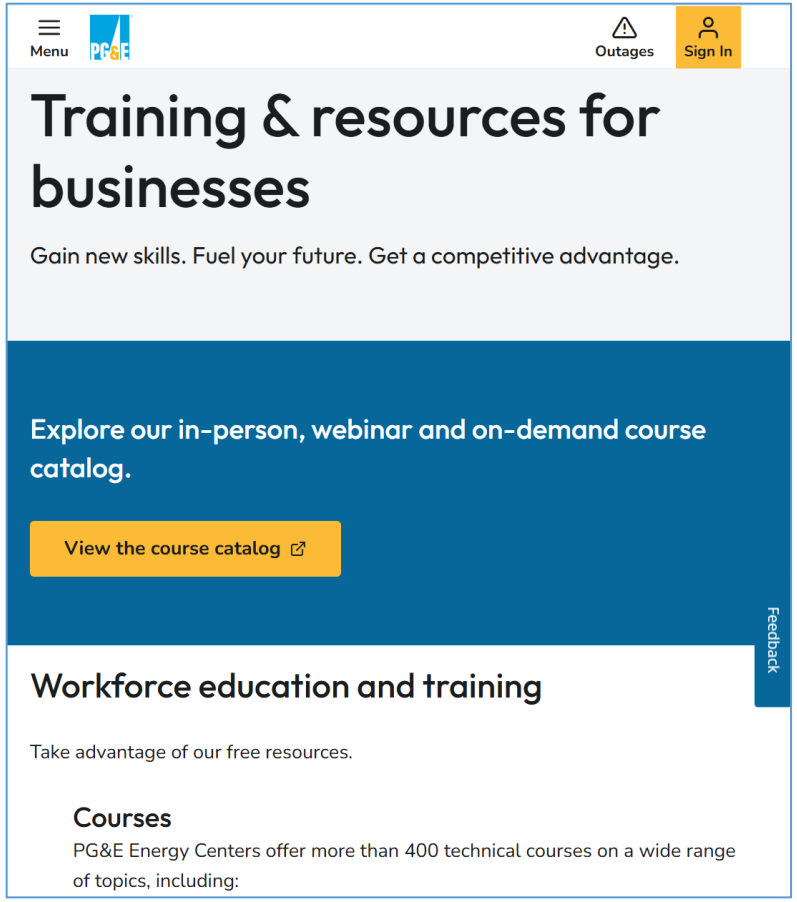
Professional group promote the science of building simulation in order to improve the design, construction, operation, and maintenance of new and existing buildings in the United States.
https://www.ibpsa.us/

Utility Education Centers (SCE and PG&E)



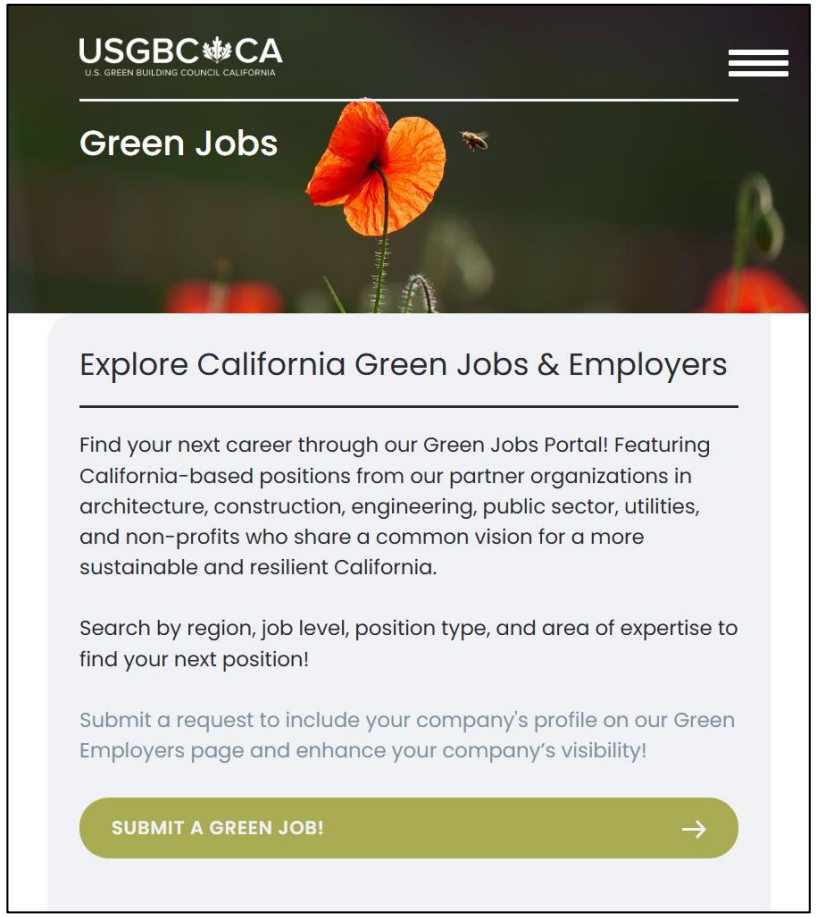
[Energy Education Class Categories & Descriptions | SCE]

[Workforce Development | SCE]

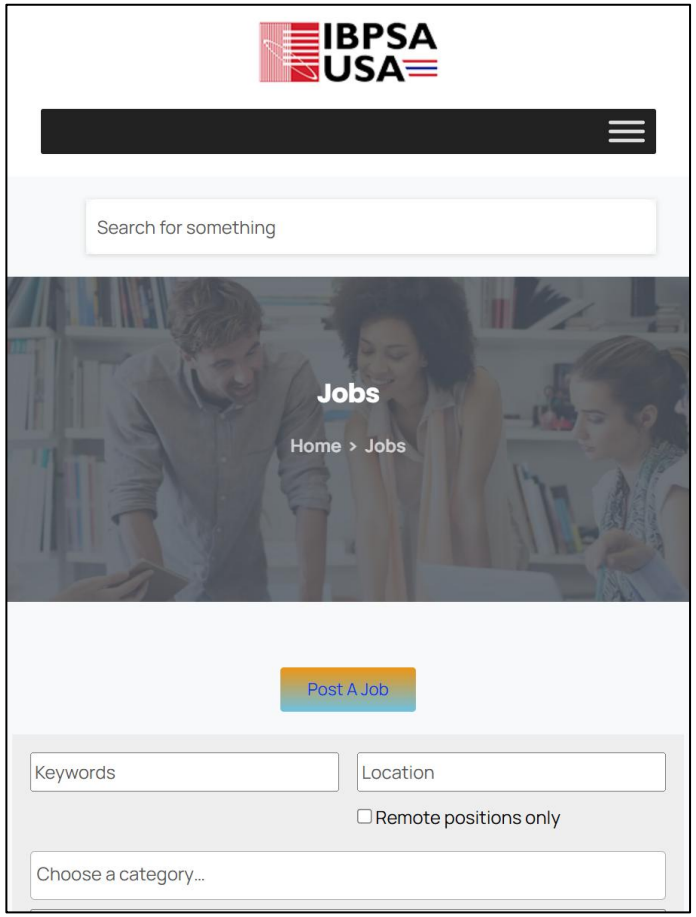


[Education & Tools | PG&E]

Job Boards

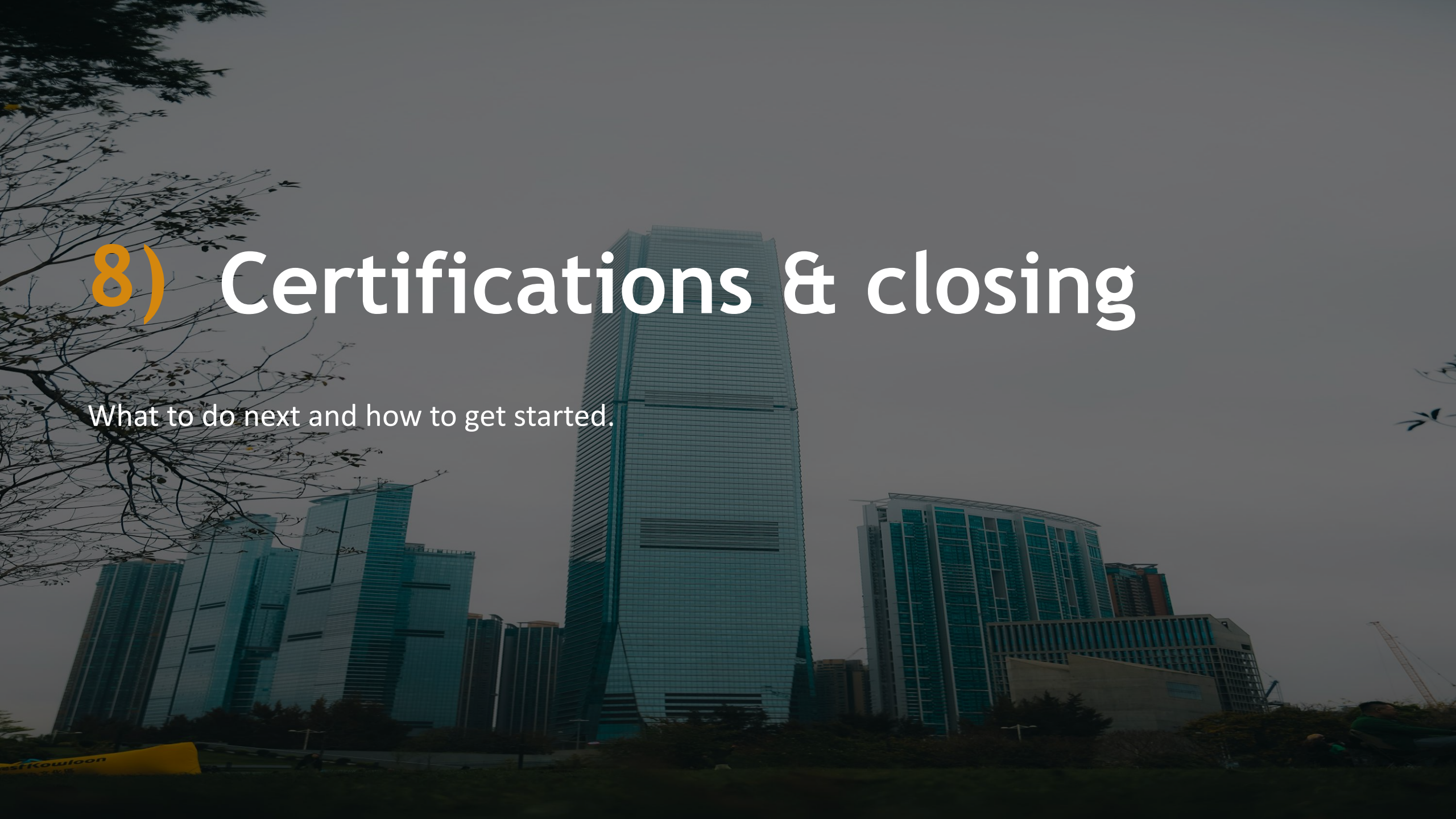


[Green Jobs in California - USGBC-CA]



[Jobs - IBPSA-USA]

[Mentorship Program - CABEC.org]



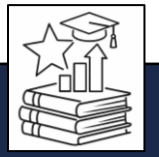
8) Certifications & closing

What to do next and how to get started.

Certifications

CABEC Certified Energy Analyst (CEA)

Certifies energy analysts who demonstrate expertise in the California Building Energy Efficiency Standards (Title 24, Part 6)



ASHRAE Building Energy Modeling Professional (BEMP)

Certifies proficiency in whole-building energy modeling to predict and optimize performance

LEED Green Associate (GA) / Advanced Professional (AP)

Denotes proficiency in today's sustainable design, construction and operations standards

Certified Passive House Consultant (CPHC)

Offered by PHIUS. Demonstrates expertise in Passive House energy modeling and performance-based building optimization.

AEE Certified Energy Manager (CEM)

Offered by the Association of Energy Engineers. Recognizes expertise in optimization of energy performance of facilities, buildings, or industrial plants.

Software Specific Training Certificates

IES VE – Training & Badges

Offers official software training and workshops (live and on-demand). Many sessions provide certificates of attendance or continuing education credits

Big Ladder / EnergyPlus Training

Big Ladder Software provides hands-on workshops for tools such as EnergyPlus, OpenStudio, Modelkit, and DesignBuilder typically ~2-day in-person or webinar workshops.

EnergyPro

The developer offers training and seminars on how to use EnergyPro for compliance and modeling reporting.

Energy-Models.com

Online training courses and tutorials for tools like eQUEST, TRACE 700, OpenStudio, etc.

TAS – Training Courses

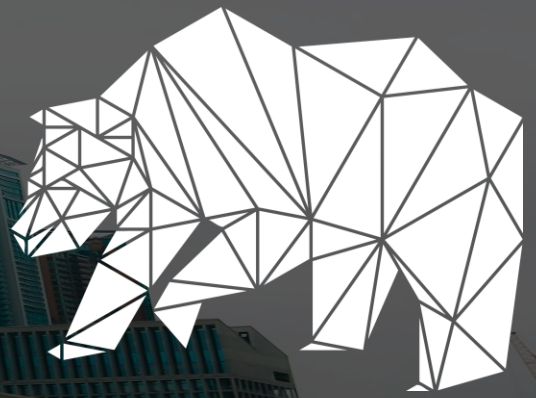
Offers official software training and on-demand e-training introduction courses with HVAC / systems-focused modules.

* Not a comprehensive list of software vendor training materials

BEM Education and Career Development

These slides and more available online:

https://calbem.ibpsa.us/bem-career-dev/



Appendix for Speakers

How to use this deck for you, the presenter

Instructions for the Presentation Deck

- We want the presentation to flow naturally for you and as such encourage people to re-configure and take what makes sense from this master deck. We have identified the minimum slides (see the next slide) we would like shared at some point during the presentation and supporting slides available for each.
- Guest Lecture Guide Document: *Link to be added*

Key Slides to Update:

- Slide 7 (and optional Slide 8) your bio, please tell the students who you are and why you are here
- Slide 5, update the agenda to match what your final presentation will be

Minimum Slides to Share:

What slides must be included? *CORE SLIDES* must be included at a minimum:

- Introduction and Project Sponsor 1-6, including script for slide 6.
- What is BEM: slide 10
- How BEM is Used: slide 16,
- What is Title 24: slides 28-30
- Roles in BEM: slide 52 & 53
- Resources: Slide 59 & 60
- Final Slide on project website and learn more: Slide 65

What slides are optional

- The depth of each topic is optional. The depth of materials and examples should be tailored to the class and student type.
- We would like at least one project example to connect the material to a real project. Use of ours or your own.
- We would like at least one engaging question and answer, like slide 13 and 14 where you engage student responses.

Where to put your information and share any examples

- slides 7-8 is a place for your bio and about you. Use of 1 or 2 slides here is best.
- Add any case / example where appropriate from your own work if desired.

Questions for Presenter Post Presentation

1. How many students approximately in the class?
2. What slides or section sparked the most questions and engagement from students?
3. Any notable questions raised by the students?
4. Any live feedback on the presentation from attendees?
5. Other observations about the presentation?
6. Any follow-up action items with students or class instructor?