Growing the Pipeline for Building Performance Simulation in the Age of AI

CalBEM 2025

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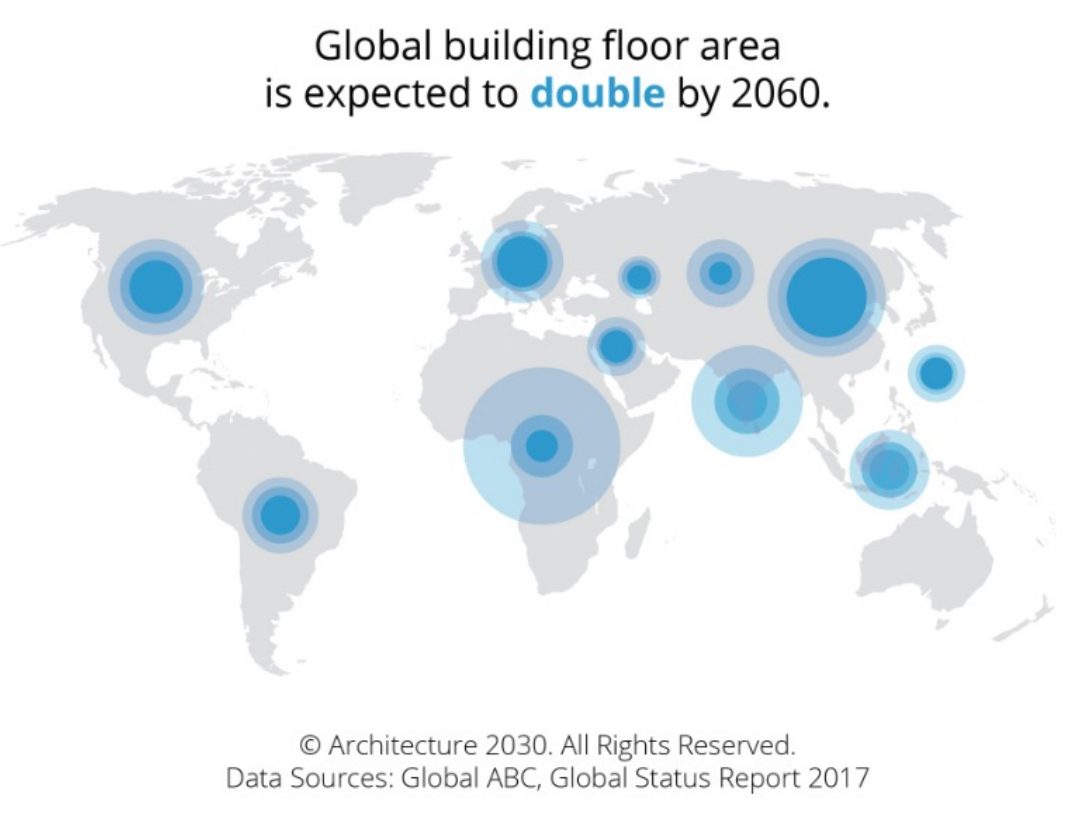
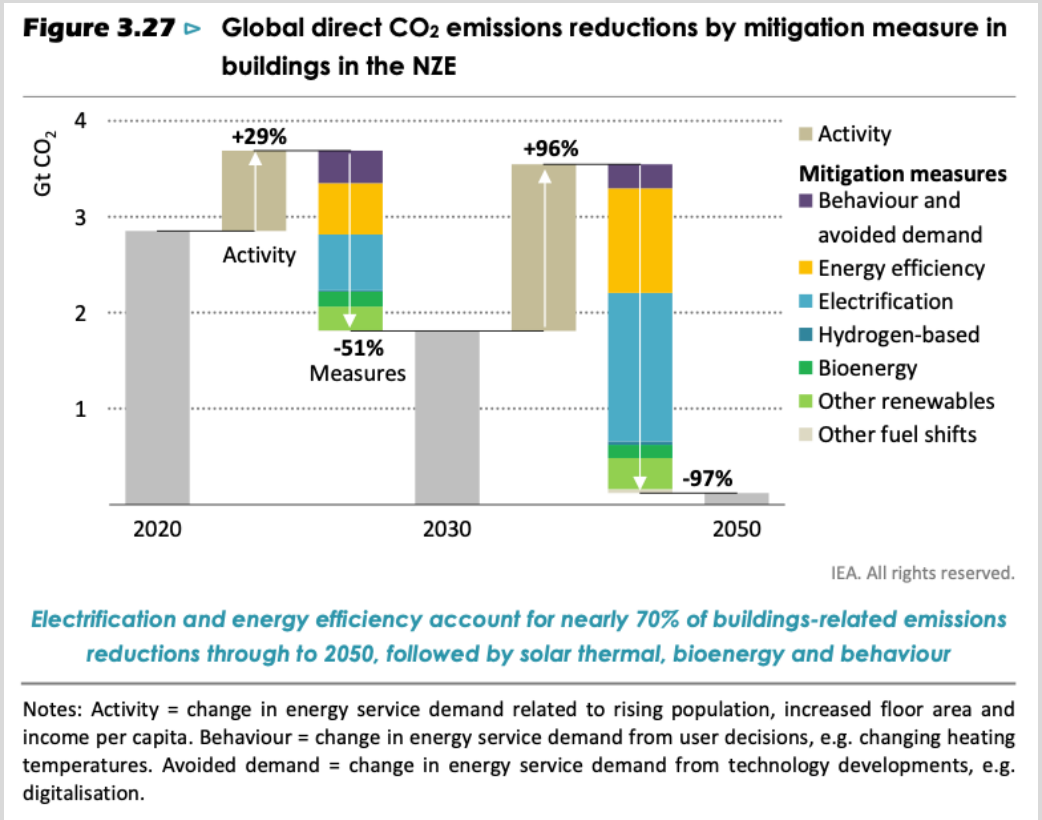
WHAT DOES THE FUTURE LOOK LIKE?

Massive Construction Activity and Massive Mitigation Efforts

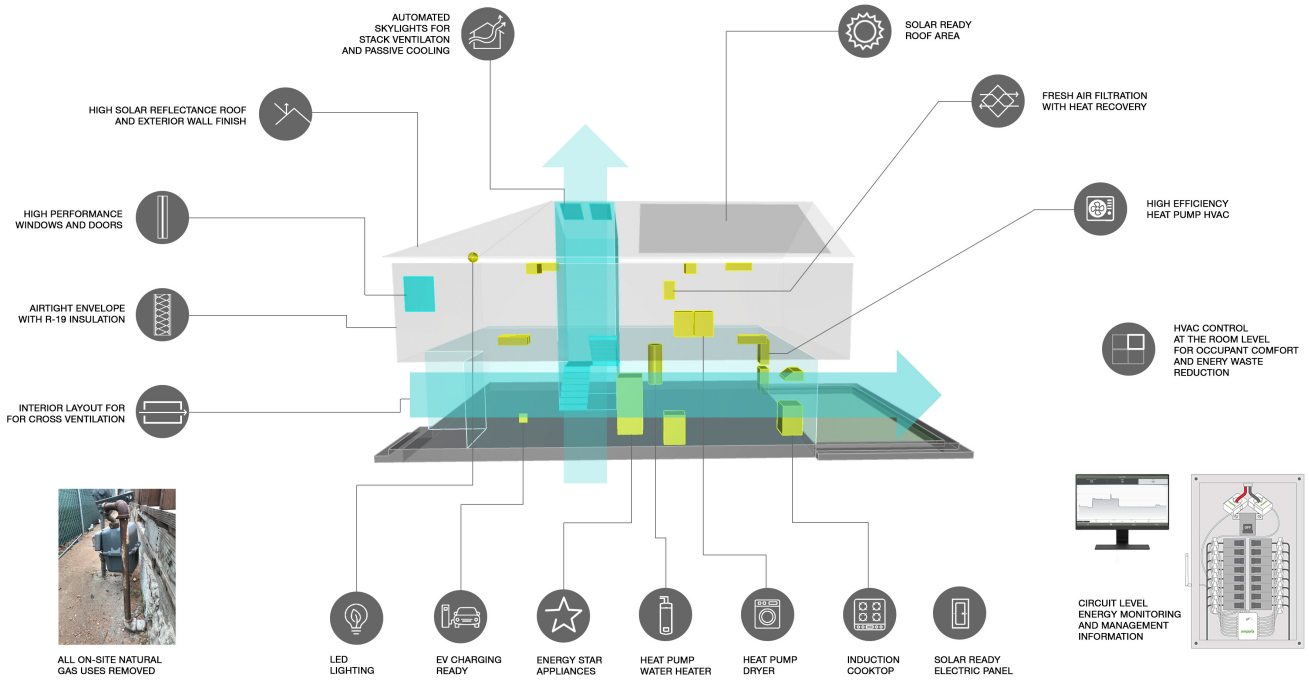


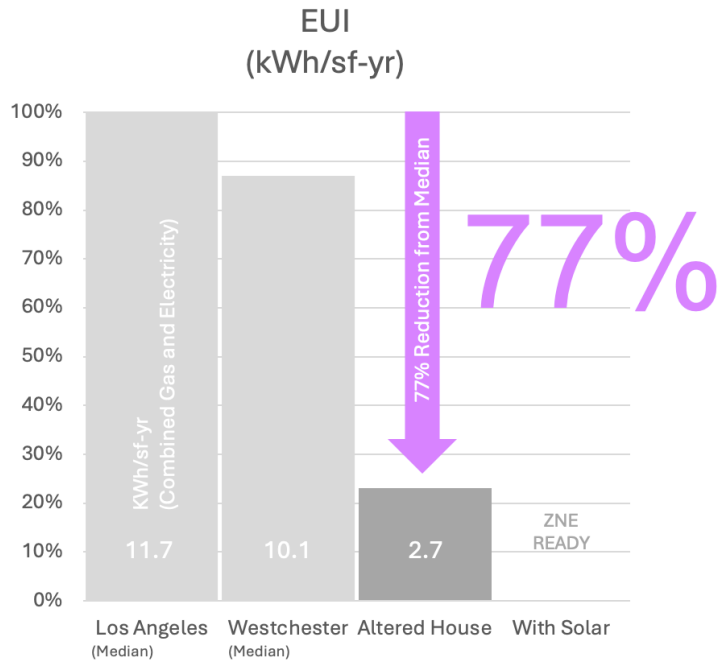
The IEA projects an increase of about 2.6 trillion ft^2 (241 billion m^2) of new floor area to the global building stock by 2060.



International Energy Agency. (2021). Net zero by 2050: A roadmap for the global energy sector (Revised version). International Energy Agency

THE FUTURE IS ALL-ELECTRIC...





High-efficiency all-electric deep energy retrofit + Feedback (Bridge the Gap)

After 1 year of measured data, the *project* results in 77% less energy use per square foot than the median home in Los Angeles and 73% less than the median home in the neighborhood. The home can achieve ZNE by adding photovoltaic panels to the solar ready roof zones.

WE (HUMANS) NEED TO RETHINK BAU DESIGN

Los Angeles, 837 CDD

Crank It Up

Cooling degree days — an oddly named index that measures (but not in actual days) the need for air-conditioning — in some of the world's largest urban areas. Developing regions are in **bold**.

URBAN AREA	POPULATION (MILLIONS)	ANNUAL COOLING DEGREE DAYS
Chennai, India	**6.9**	**3,954**
Bangkok	**6.6**	**3,884**
Ho Chi Minh City, Vietnam	**5.1**	**3,745**
Ahmedabad, India	**5.1**	**3,514**
Manila	**10.7**	**3,438**
Jakarta, Indonesia	**13.2**	**3,390**
Mumbai, India	**18.2**	**3,386**
Hyderabad, India	**6.1**	**3,221**
Kolkata, India	**14.3**	**3,211**
Karachi	**11.6**	**3,136**
New Delhi	**15.0**	**2,881**
Lagos, Nigeria	**10.9**	**2,653**
Dhaka, Bangladesh	**12.4**	**2,560**
Miami	5.4	2,423
Rio de Janeiro	**11.5**	**2,401**
Bangalore, India	**6.5**	**2,280**
Baghdad	**5.9**	**2,142**
Hong Kong	**7.0**	**2,107**
Shenzhen, China	**7.2**	**2,107**
Kinshasa, D.R.C.	**6.0**	**2,098**
Guangzhou, China	**8.4**	**2,072**
Cairo	**11.1**	**1,833**
Belo Horizonte, Brazil	**5.3**	**1,654**
Lahore, Pakistan	**6.3**	**1,309**
Tehran	**7.3**	**1,282**
Wuhan, China	**7.1**	**1,277**
Chongqing, China	**6.4**	**1,189**
São Paulo, Brazil	**18.3**	**1,187**
Osaka, Japan	11.3	1,180
Shanghai	**14.5**	**1,129**
Tianjin, China	**7.0**	**965**
Tokyo	35.2	938
Lima, Peru	**7.2**	**906**
Beijing	**10.7**	**840**
Los Angeles	12.3	837

Source: Michael Sivak, University of Michigan / NYT
https://archive.nytimes.com/www.nytimes.com/interactive/2012/08/19/sunday-review/19rosenthal-ch-int.html

HUGE MARKET FOR BPS!

- 2.6 trillion ft^2 of new buildings
  - Performance outcomes are critical
  - Need to study alternative approaches (i.e. risk) in early stages of design
  - Need to close the feedback loop
- 4,700 IBPSA members
  - 545 BEMP-Certified Professionals
- 456 million ft^2 of projects /IBPSA member
- 13 million ft^2 / member each year
  - Or, 684 commercial buildings

HOW MANY BPS PROFESSIONALS DO WE NEED?

- 8.5 million total energy jobs in 2024
  - 5.4% of all U.S. jobs
  - 2.4 million jobs in energy efficiency
  - 116,000 Architects in the U.S. (+3606/yr)

- States with the most clean energy jobs:
  - California: 545,207
  - Texas: 261,934

- Clean energy jobs are growing faster than other jobs in the overall U.S. workforce

- 1 new BPS professional for every 20 new Architects leads to the need to educate 180 new BPS professionals/yr

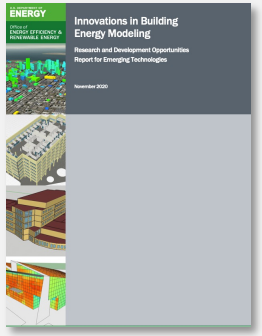
U.S. DEPARTMENT of ENERGY

2025 United States Energy & Employment Report

www.energy.gov/USEER

HUGE GROWTH OPPORTUNITY!

- AEC industry is one of the largest in the world
- One of the least digitized
- Productivity in decline (or stagnated)
- Slow to adopt new technologies and practices



> Despite progress in recent years, use of BEM is still far from saturated, especially in individual building applications. Stakeholders estimate that BEM is used to design only about 20% of new commercial and residential floor area.

Source: DOE https://www1.eere.energy.gov/buildings/pdfs/77835.pdf

THE LANDSCAPE IS RAPIDLY CHANGING

Source: NYT, June 24, 2025
https://www.nytimes.com/2025/06/24/technology/amazon-ai-data-centers.html

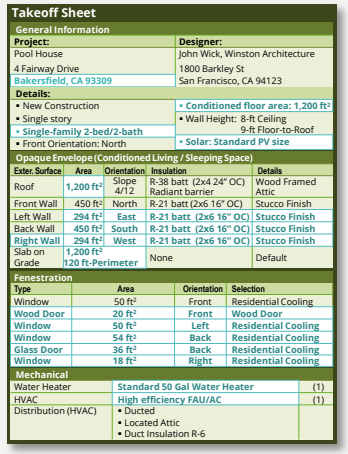
Los Angeles Times

Voices

Hossam Elsherbiny

If AirPods can instantly translate, why learn a language?

Source: https://www.latimes.com/opinion/story/2025-10-15/airpods-live-translation



Takeoff Sheet

General Information

Project:	Designer:
Pool House	John Wick, Winston Architecture
4 Fairway Drive	1800 Barkley St
Bakersfield, CA 93309	San Francisco, CA 94123

Details:

• New Construction	• Conditioned floor area: 1,200 ft²
• Single story	• Wall Height: 8-ft Ceiling 9-ft Floor-to-Roof
• Single-family 2-bed/2-bath	
• Front Orientation: North	• Solar: Standard PV size

Opaque Envelope (Conditioned Living / Sleeping Space)

Exter. Surface	Area	Orientation	Insulation	Details
Roof	1,200 ft²	Slope 4/12	R-38 batt (2x4 24" OC) Radiant barrier	Wood Framed Attic
Front Wall	450 ft²	North	R-21 batt (2x6 16" OC)	Stucco Finish
Left Wall	294 ft²	East	R-21 batt (2x6 16" OC)	Stucco Finish
Back Wall	450 ft²	South	R-21 batt (2x6 16" OC)	Stucco Finish
Right Wall	294 ft²	West	R-21 batt (2x6 16" OC)	Stucco Finish
Slab on Grade	1,200 ft² 120 ft-Perimeter		None	Default

Fenestration

Type	Area	Orientation	Selection
Window	50 ft²	Front	Residential Cooling
Wood Door	20 ft²	Front	Wood Door
Window	50 ft²	Left	Residential Cooling
Window	54 ft²	Back	Residential Cooling
Glass Door	36 ft²	Back	Residential Cooling
Window	18 ft²	Right	Residential Cooling

Mechanical

Water Heater	Standard 50 Gal Water Heater	(1)
HVAC	High efficiency FAU/AC	(1)
Distribution (HVAC)	• Ducted • Located Attic • Duct Insulation R-6	

Source: Energy Code Ace

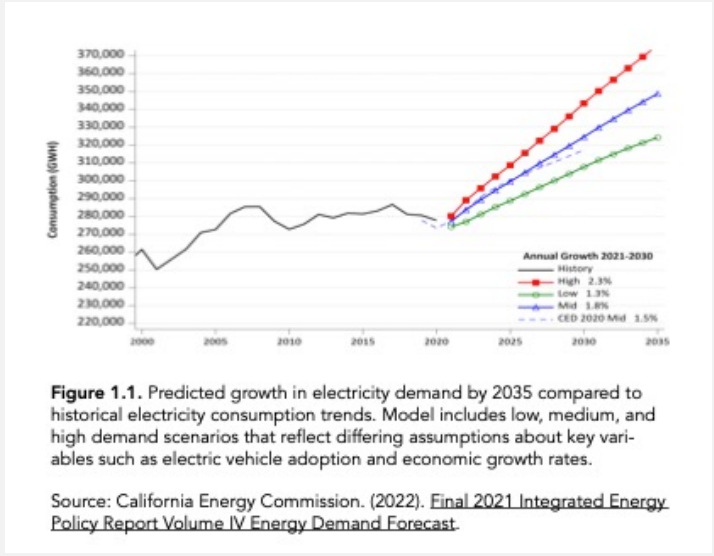


Figure 1.1. Predicted growth in electricity demand by 2035 compared to historical electricity consumption trends. Model includes low, medium, and high demand scenarios that reflect differing assumptions about key variables such as electric vehicle adoption and economic growth rates.

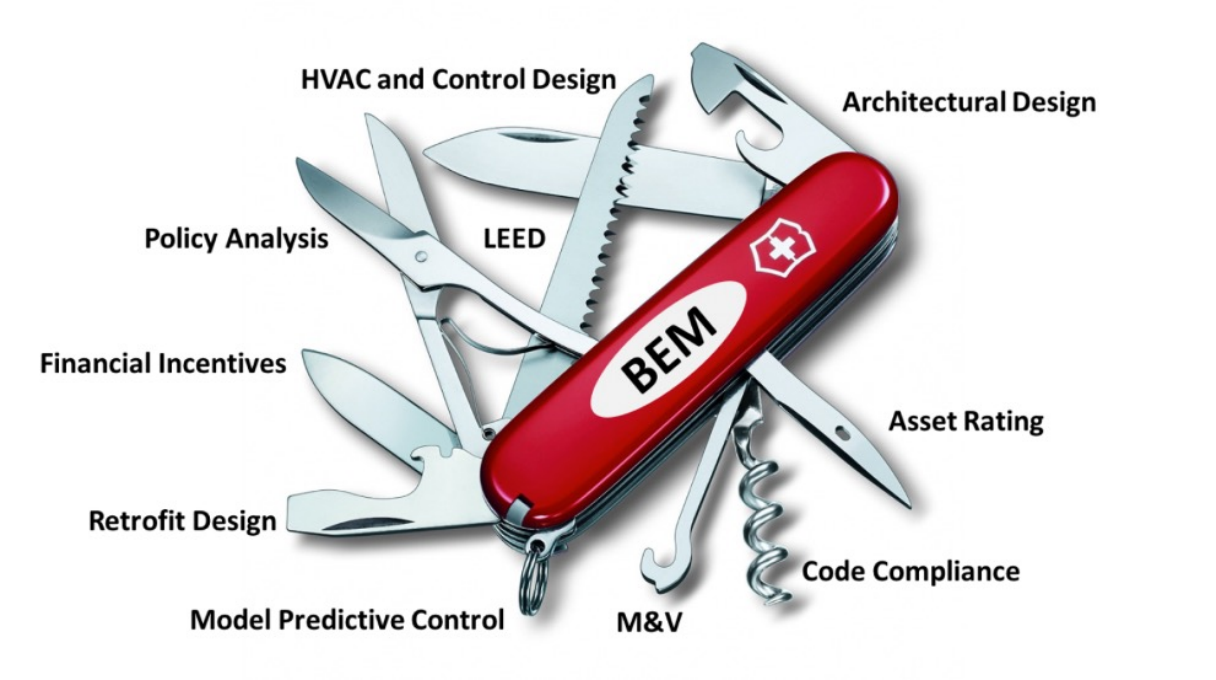
Source: California Energy Commission. (2022). Final 2021 Integrated Energy Policy Report Volume IV Energy Demand Forecast.

Source: California Council on Science and Technology

FIRST STEP: GROW MARKET

- **Expand** regional context
- **Demonstrate** value
- Model what matters (**humans**)
- **Validate** applicability
- **Leverage** AI + new data sources
- **Promote** new applications
- **And** … (to be discussed)

From BIM to BEM to…



Source: https://www.energy.gov/eere/buildings/about-building-energy-modeling

NEXT STEP: GROW PIPLINE

- **Stabilize**: the employment landscape (or be more agile!)
- Increase **Awareness** @ K-12
- Increase **Pathways** to a BEM career (e.g. CTE, Architecture progs.)
- **Streamline**/reduce cost of “certification soup”
- Expand BIM/BEM/etc. functionality as a **Collaborative** Tool
- **Consistency**: Progress ongoing standards efforts
- **Community**: improve communication and share best practices
- **Usability**: simplify tasks, improve capabilities and interoperability
- Grow engagement with modeling as a **Creative** instrument
- **Education**: Strengthen academic and professional support
- Promote successful models of **Project-Based Learning**
- **And…** (to be discussed)

THANK YOU

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