Leveraging simulations to reduce building carbon footprints

BUILDING ENERGY MODELING AS AN ACTIONABLE TOOL FOR REAL-WORLD DECARBONIZATION

Dr. **Ladan Ghobad**, Ph.D., CEA
ENERlite Consulting Inc.

PROBLEM

- **Decarbonization has become a major goal but there is:**

  Gap between regulation and implementation

  Lack of clear pathway for owners

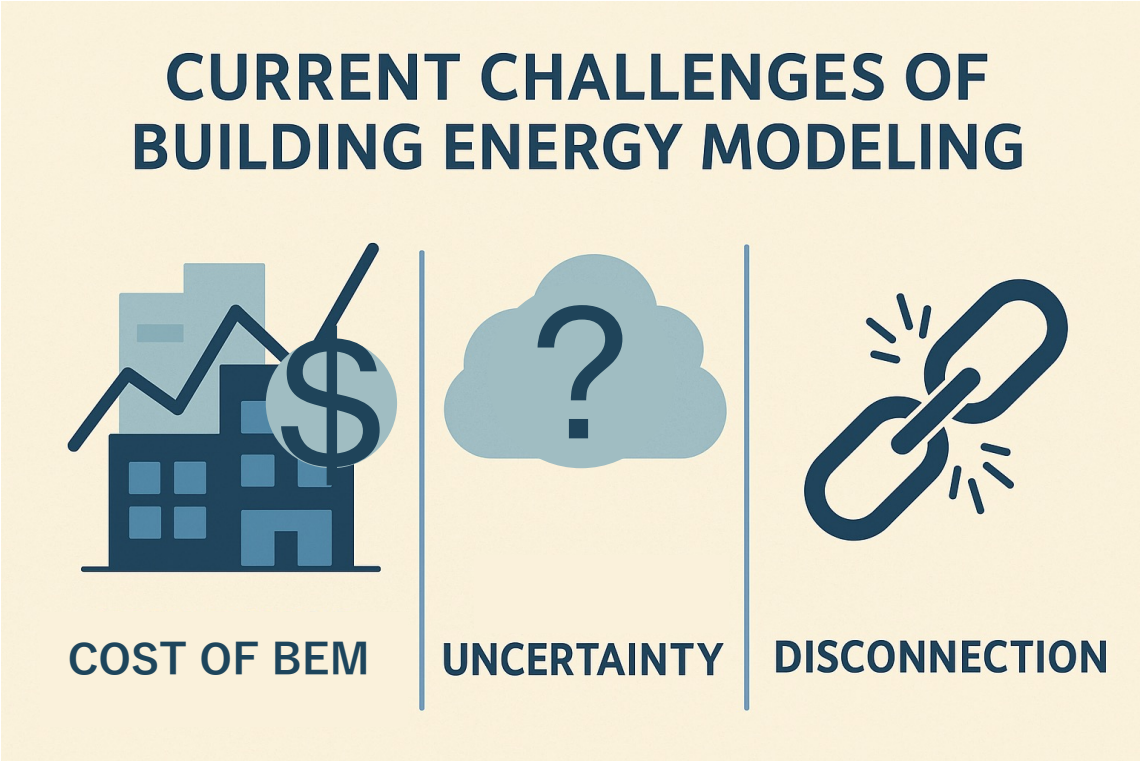
  AND Every building is **unique**

- **To make progress, we need to:**

  Translate goals into measurable, verifiable results – grounded in actual building performance.

  Provide real-word case studies.

CHALLENGES



High Costs of BEMs

Building Energy Modeling often requires significant initial investment, restricting widespread adoption.

Modeling Uncertainties

Assumptions in models can lead to inaccuracies, reducing reliability of energy predictions.

Limited Feedback Loop

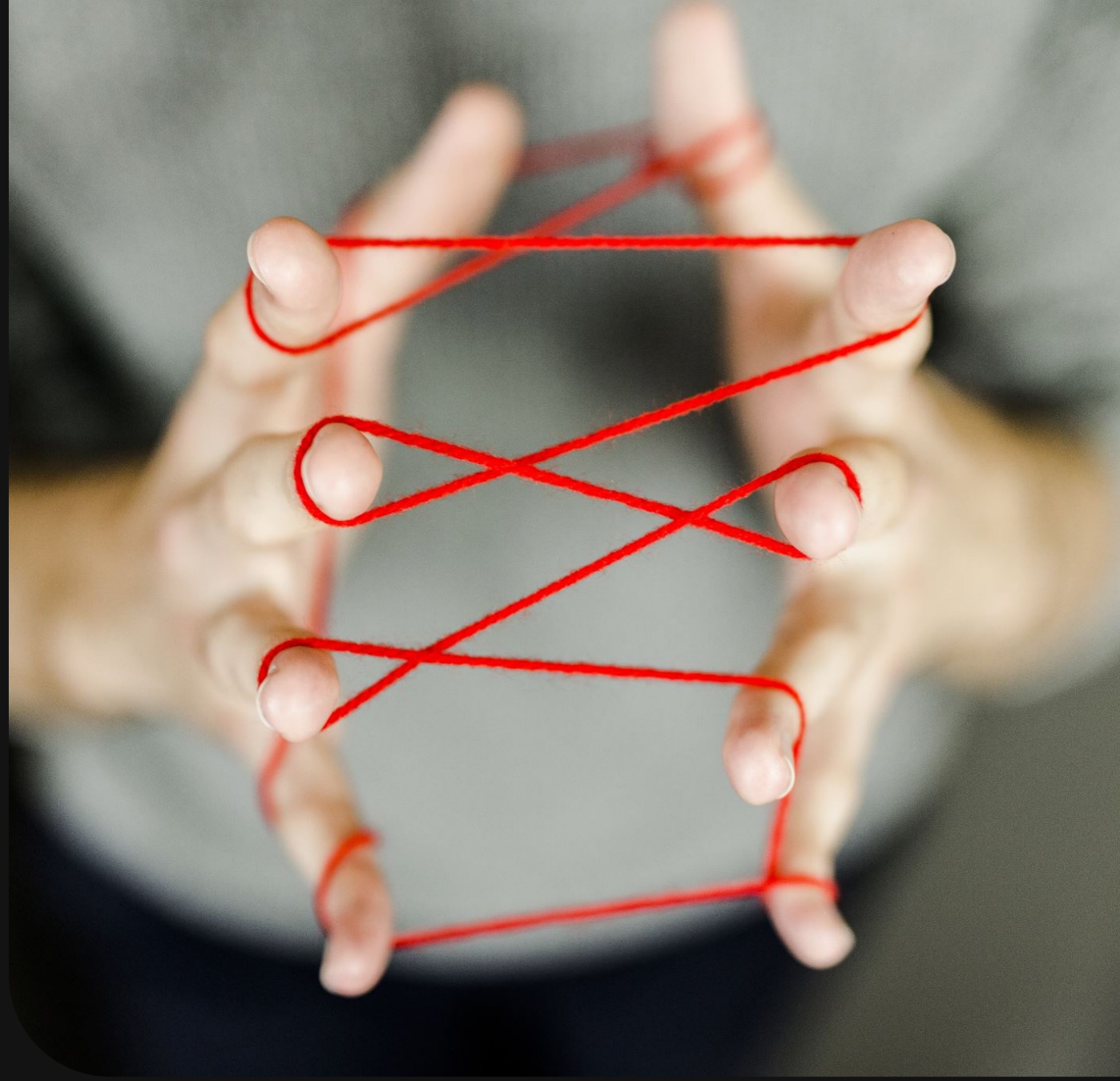
Lack of alignment between **BEM** and **actual building performance** limits decarbonization effectiveness.

THE NEED FOR EVOLUTION:

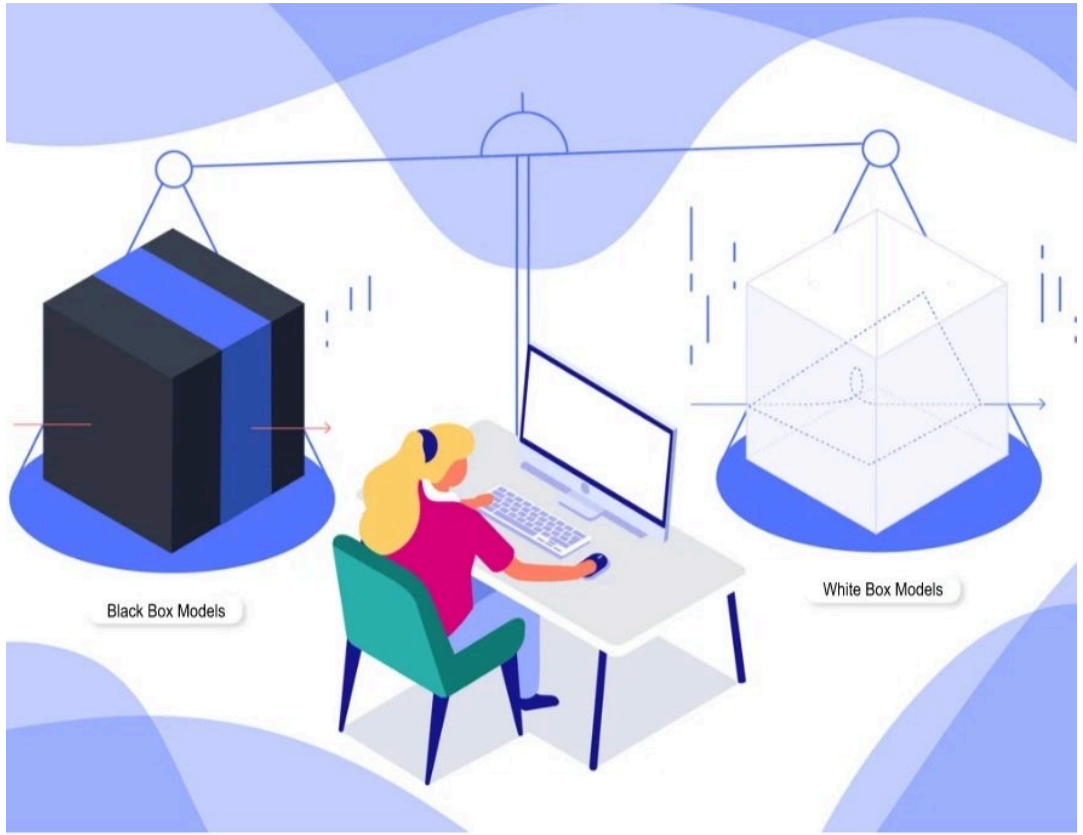
FROM **SIMULATION** TO **ACTIONABLE INSIGHT**

- Beyond Static Simulations
- Integration of Empirical Data
- Automated Tools for Insights

HYBRID MODELING: INTEGRATING **PHYSICS-BASED** AND **DATA-DRIVEN** MODLES



BLACK-BOX (AI/MACHINE LEARNING) Vs. WHITE-BOX (PHYSICS-BASED)



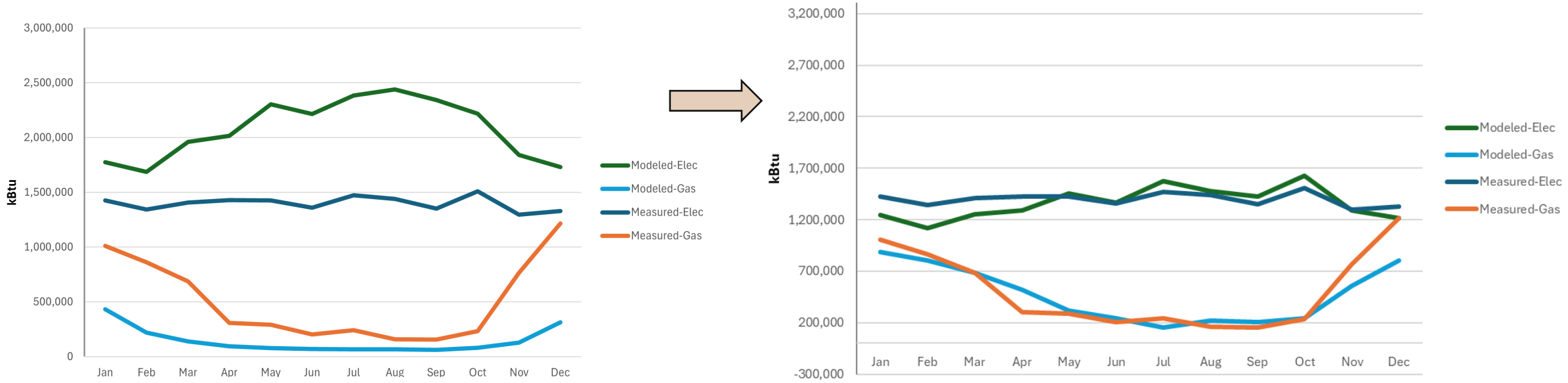
HYBRID MODELS:
ENERtune, our automated calibration tool

THE IMPORTANCE OF CALIBRATION FOR MODEL ACCURACY

Aligning Model Outputs and Reducing Uncertainty

- Adjusts model outputs to match observed data
- Improved reliability and reduced errors
- Higher confidence for decision-making.

Guiding Decarbonization



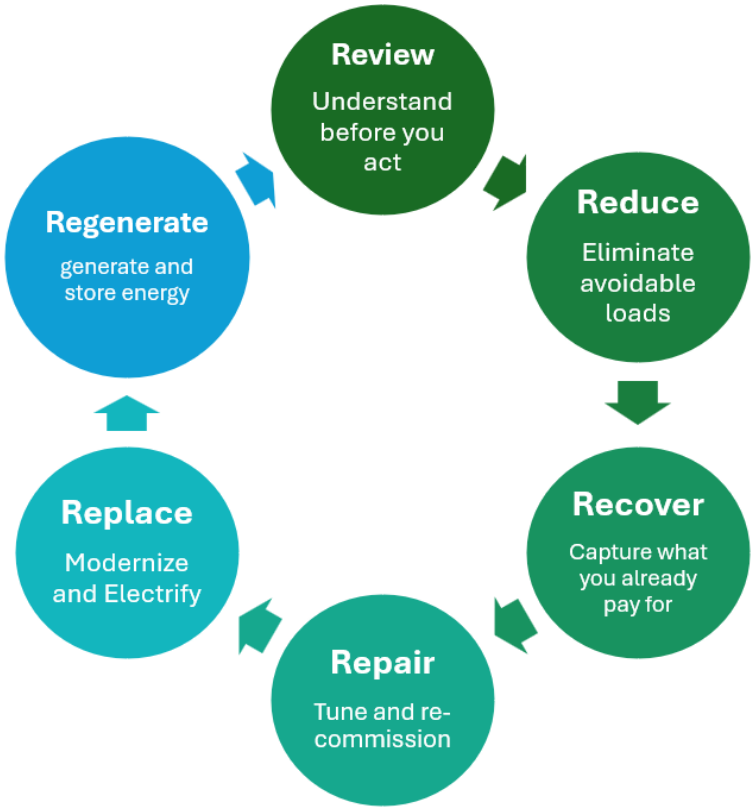
CASE STUDY:

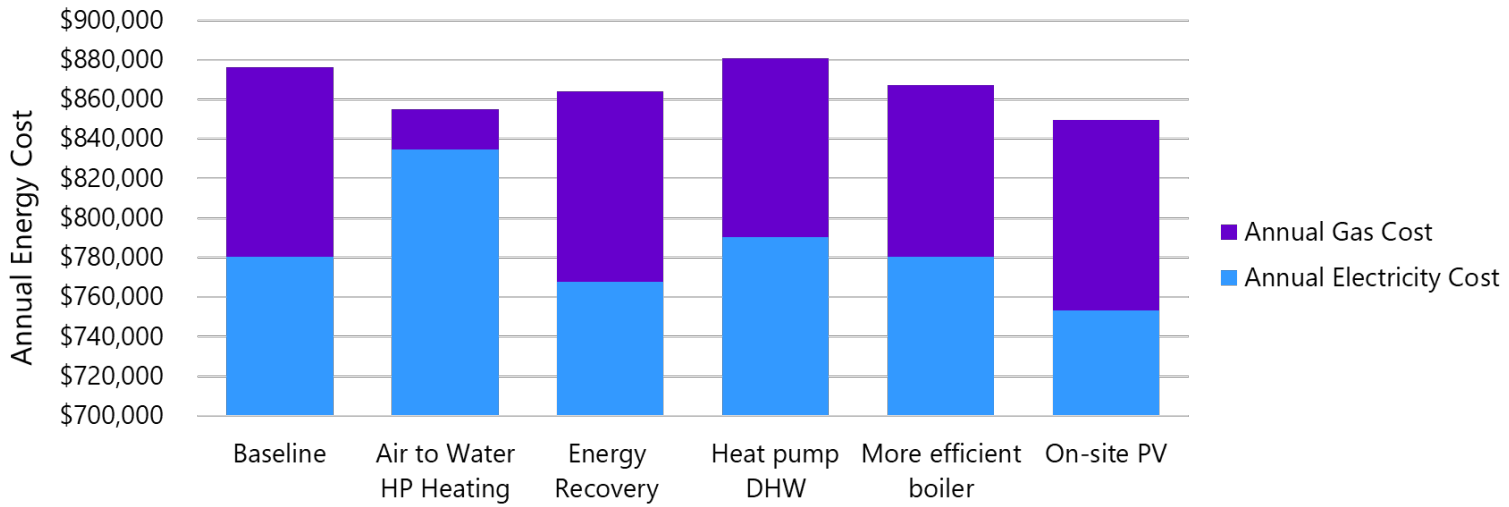
DECARBONIZING A LARGE COMMERCIAL OFFICE BUILDINGS

50 California St, San Francisco

STRATEGIES

6R RESILIENT RETROFIT FRAMEWORK

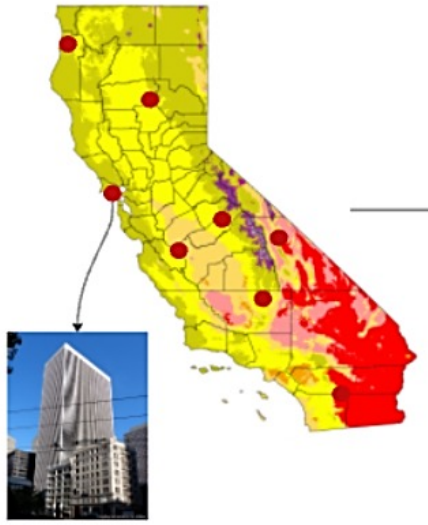




Name	Annual Electricity Cost	Annual Gas Cost	Total Annual Utility Cost	Cost Savings to Baseline	
Baseline	$ 780,220	$95,987	$ 876,207	-	
Air to Water HP Heating	$ 834,528	$20,359	$ 854,887	$ 21,320	
Energy Recovery	$ 767,862	$95,984	$ 863,846	$ 12,361	
Heat pump DHW	$ 790,547	$90,076	$ 880,623	- $ 4,416	Lowest
More Efficient boiler	$ 780,220	$87,039	$ 867,259	$ 8,948	
On-site PV	**$ 753,463**	**$95,987**	**$ 849,450**	**$ 31,199**	Highest

SCALABILITY

Clinical Trial



50 California St

Database

Accurate & Reliable Database. Reconciled from all Existing Datasets

Analytical Regenerative Engine

Extrapolation/ Prediction beyond the models in the database

Solution Application

VISION:
LIVING DATBASE OF BUILDING PERFORMANCE

- Facilitating AI to **scale** this process by handling large, complex datasets:
  - **Benchmarking data**
  - **Retrofit cost databases**
  - **Post-occupancy data**
  - **Model libraries**
- Continuously improvement of model accuracy **by connecting actual data**.
- A **living database** that evolves as more buildings decarbonize.

THANK YOU!

ENERlite Consulting