

Wired for the Future: How all-Electric Labs make Cents

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Learning Objectives

- **Explore** new approaches to evaluating - and communicating - the cost/benefit of going all-electric.
- **Understand** how geographical location and lab program make compelling cases for electrification.
- **Learn** how to incorporate data available through financial markets to enhance lifecycle analysis, influencing key decisions.
- **Address** commonly held perceptions and misconceptions about the cost and complexity of decarbonization and lab electrification.

Agenda

Why go all Electric?

There are the typical reasons (regulatory, client requirements, sustainability).

Can it be justified on a practical basis (cost, maintenance, operations)?

***Real World Example:**
Confidential Multi-Tenant Life Science Developer

Develop a Plan

Going all-electric touches almost every aspect of a lab project.

What are the important aspects to consider in working to facilitate an all-electric approach?

***Real World Example:**
Northeastern University. Plug Load Demand Reduction

Justify the Approach

There are reasonable misconceptions about going all-electric.

How can they be addressed in terms that a key stakeholders can understand?

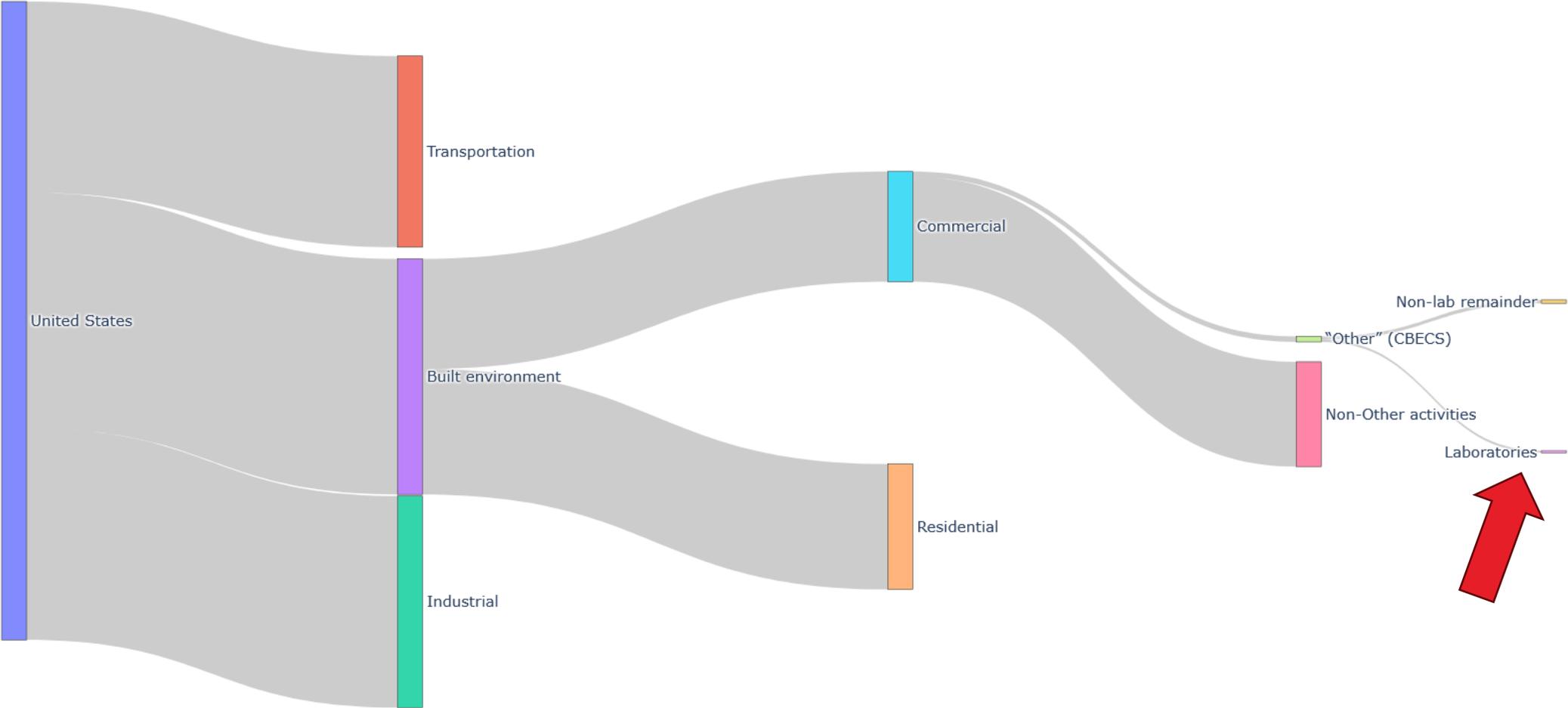
***Real World Example:**
UCSD Viterbi Vision Research Center

Why go All-Electric?

“Why is it worth the trouble?”

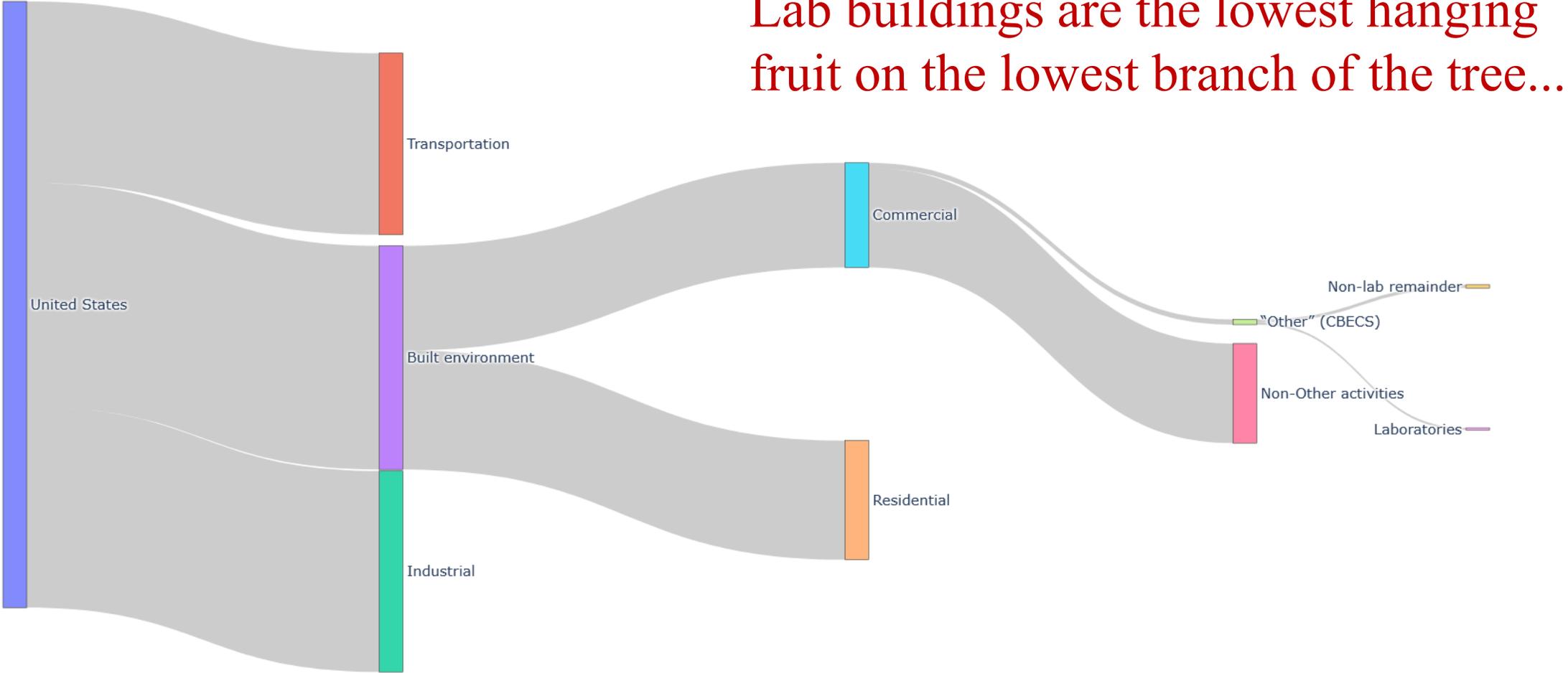
Why go all Electric?

Sustainability



Why go all Electric?

Sustainability

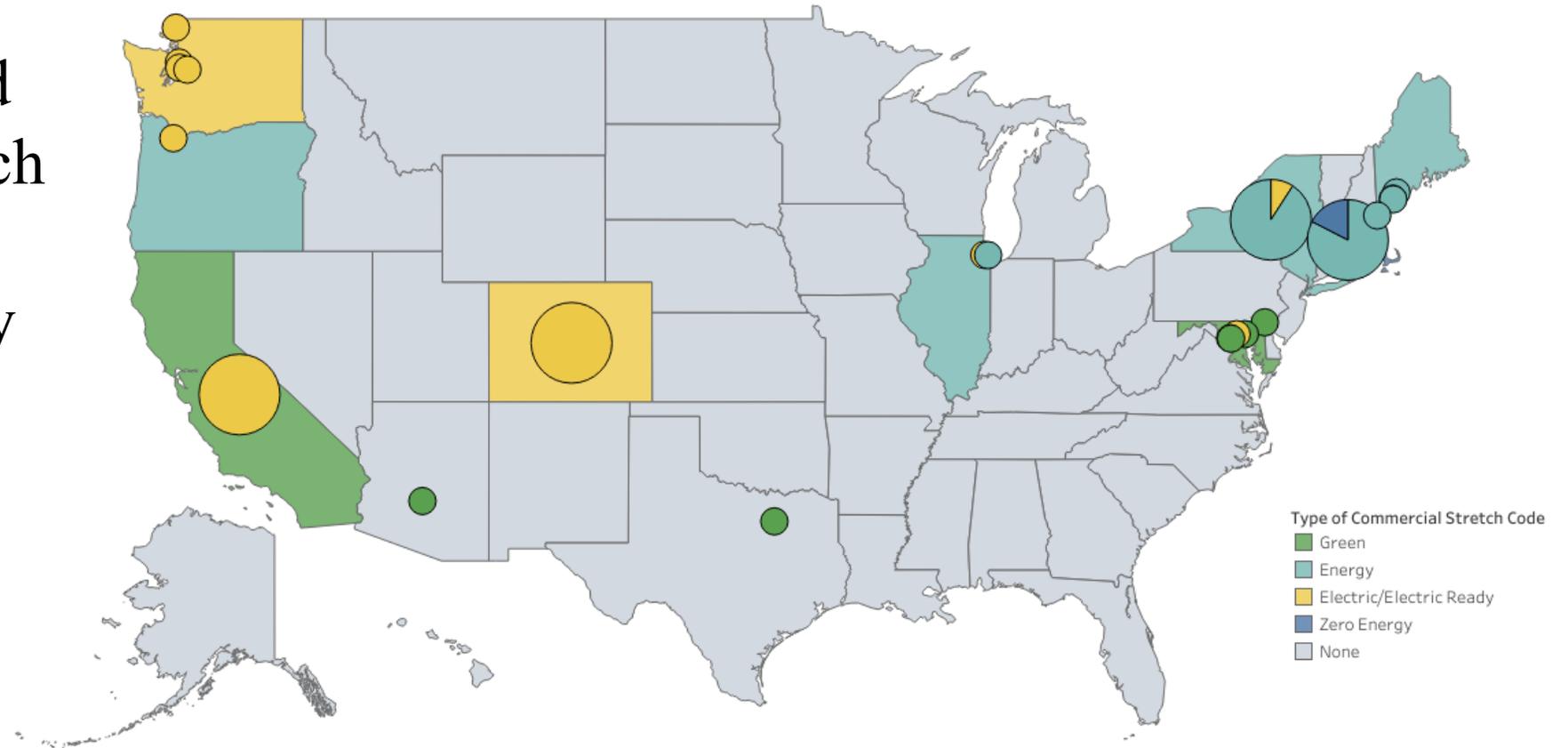


Lab buildings are the lowest hanging fruit on the lowest branch of the tree...

Why go all Electric?

Regulatory

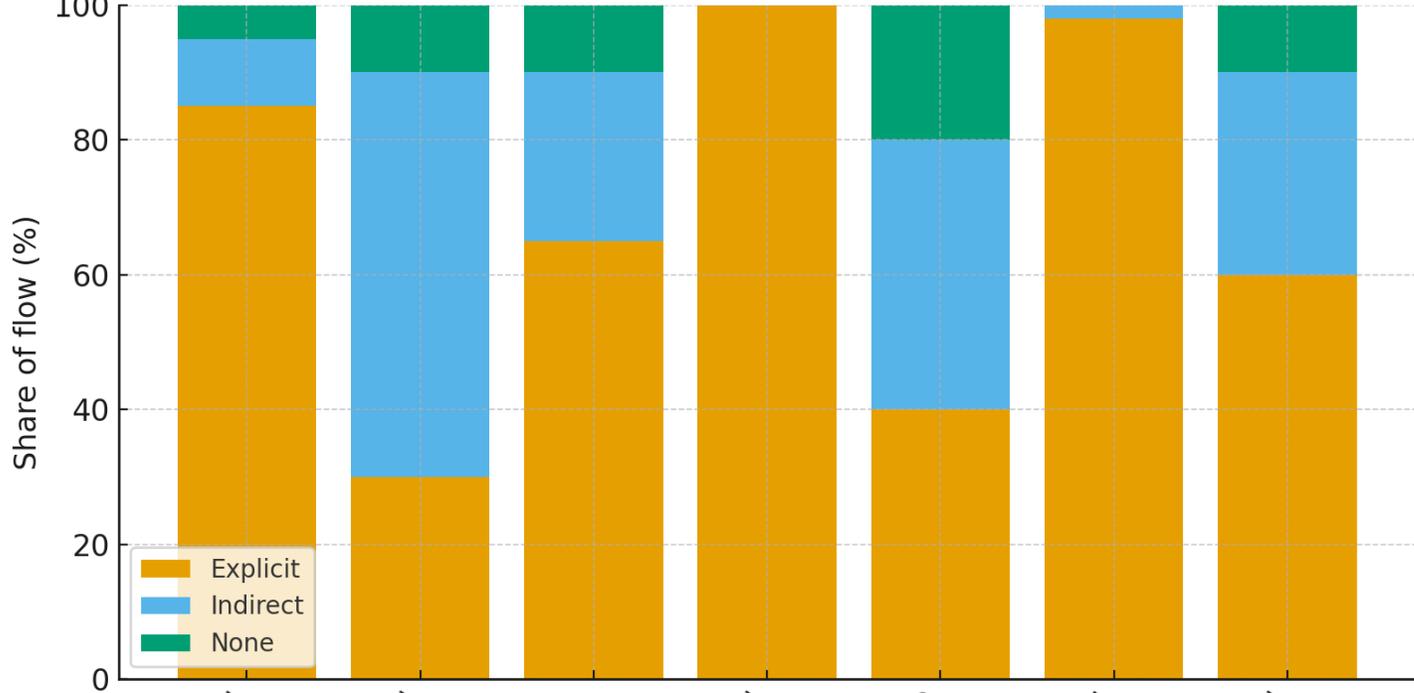
Gas restrictions and electrification stretch goals continue to advance, with many directly impacting key Science Hubs.



Why go all Electric?

Future Proof: All-Electric as an investment standard

Mandate coverage by financing vehicle (lower-bound illustrative shares)



Construction/perm loans (banks/insurers)
Federal facilities grants (NIH)
Institutional capital & philanthropy
JV equity (pensions/sovereigns)
Other / P3
Sponsor equity (REIT/private)
State conduit bonds (HE/health)

Why go all-electric?

Justifying it on a practical basis



Space Take

Impact on building GSF, site, or opportunity cost



Capital Cost

Offsetting the additional electrical infrastructure



Maintenance & Operations

Improving system utilization & reducing overhead

Real World Example

Confidential Multi-Tenant Life Science Development



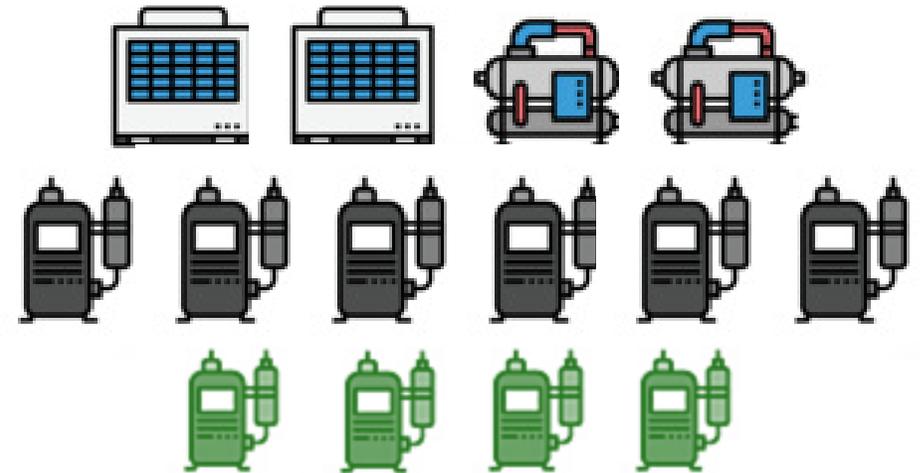
Impact on equipment & operations

Comparison between Hybrid Gas/Electric and All Electric Configuration

HVAC and Plumbing Equipment

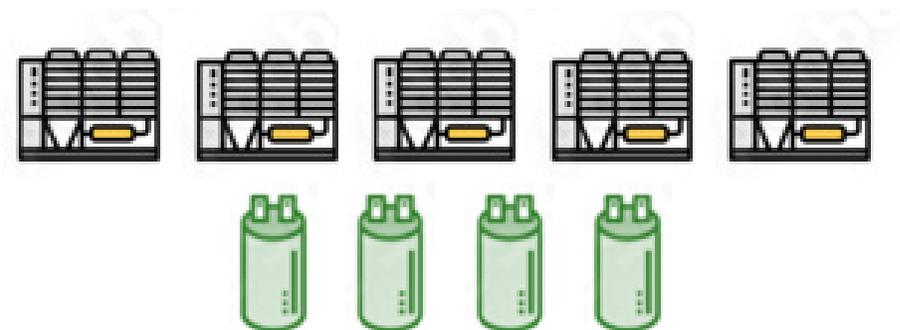
“Business as Usual” configuration

- (2) Centrifugal Chillers (600 Ton ea.)
- (2) Cooling Towers
- (6) Condensing Gas Boilers (3,000 MBH)
- (4) AHU's Air Handling Units (110,000 CFM)
- Natural Gas Domestic Hot Water Heaters



All-Electric Configuration

- (5) Air cooled heat pumps
(370 Ton Cooling ; 3775 MBH Heating)
- (4) AHU's Air Handling Units (110,000 CFM)
with heat recovery coil
- Heat Pump Domestic/Lab Hot Water Heaters



Why go all-electric?

Justifying it on a practical basis



Space Take

~50% reduction in SF required for mech equip.



Capital Cost

~4% savings on primary mechanical equipment



Maintenance & Operations

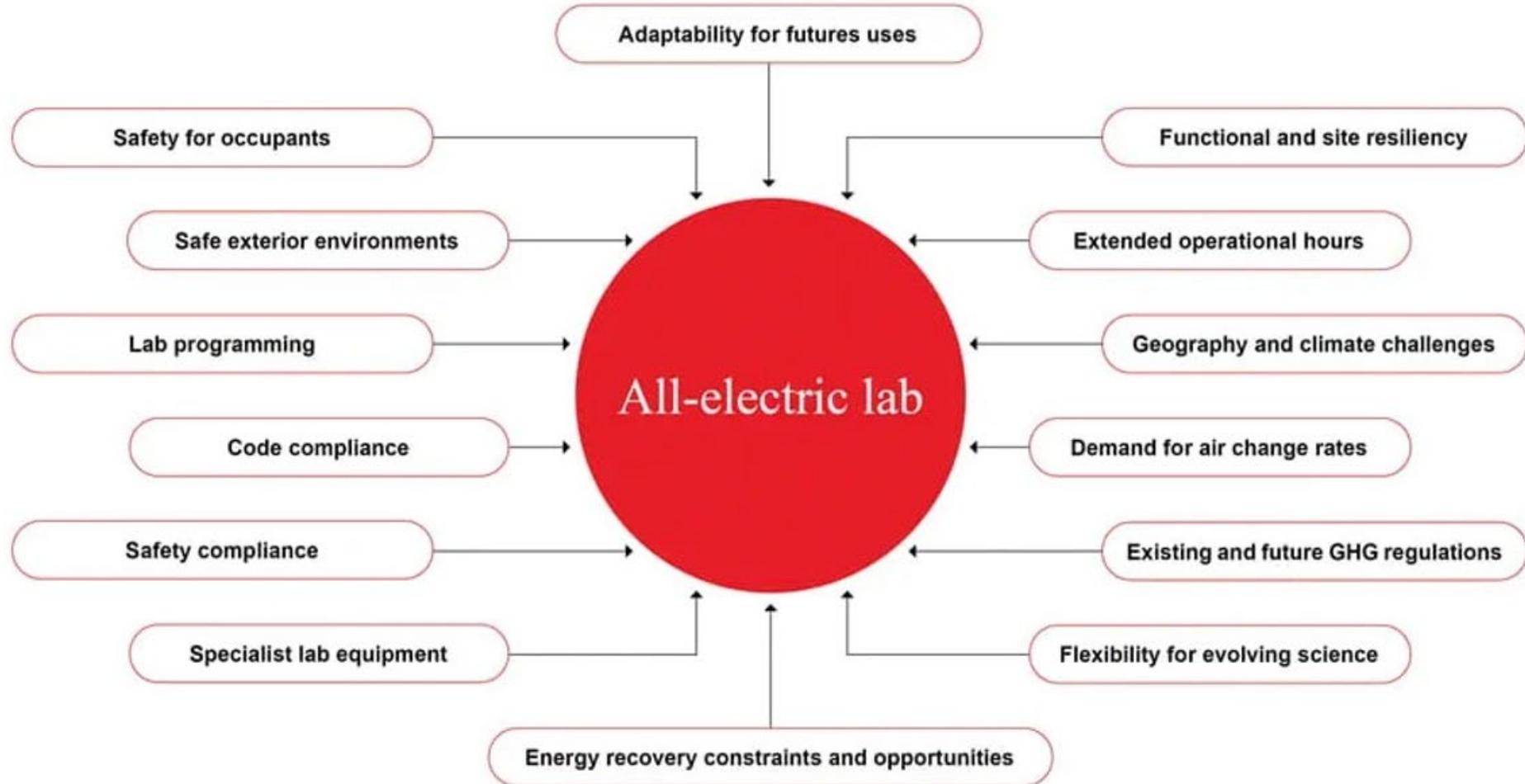
Fewer systems, equipment, service contracts

Develop a Plan

“How do I convince myself that I can make this work?”

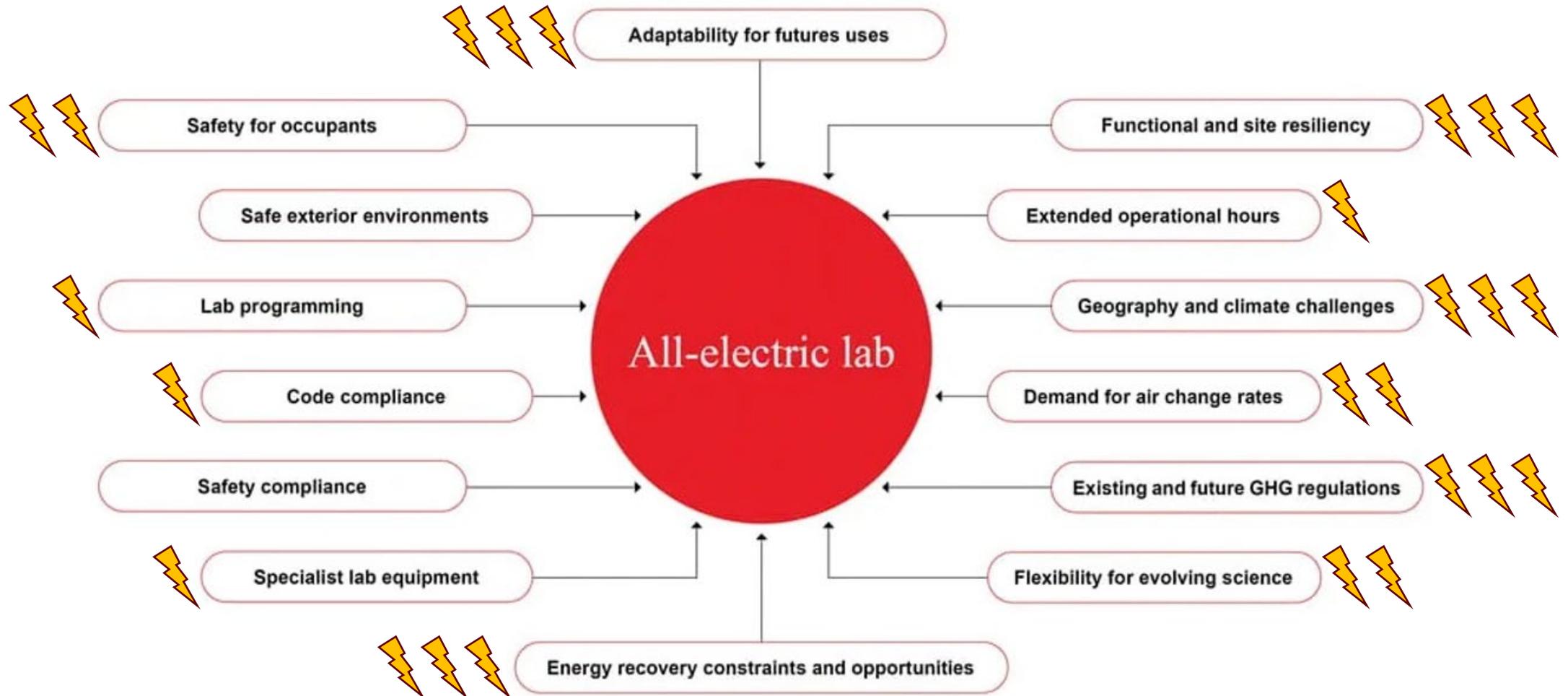
Balancing complexity

Lab design is already demanding



Balancing complexity

And going all-electric touches almost every aspect...



Develop a Plan



How to get over the challenge that All Electric Lab buildings need a lot more power?

Lower your baseline for electrical demands.

Utilize the best available technology for your climate.

Use Electrical Demand Metering to your advantage.

Coordinate early with the electrical utility.

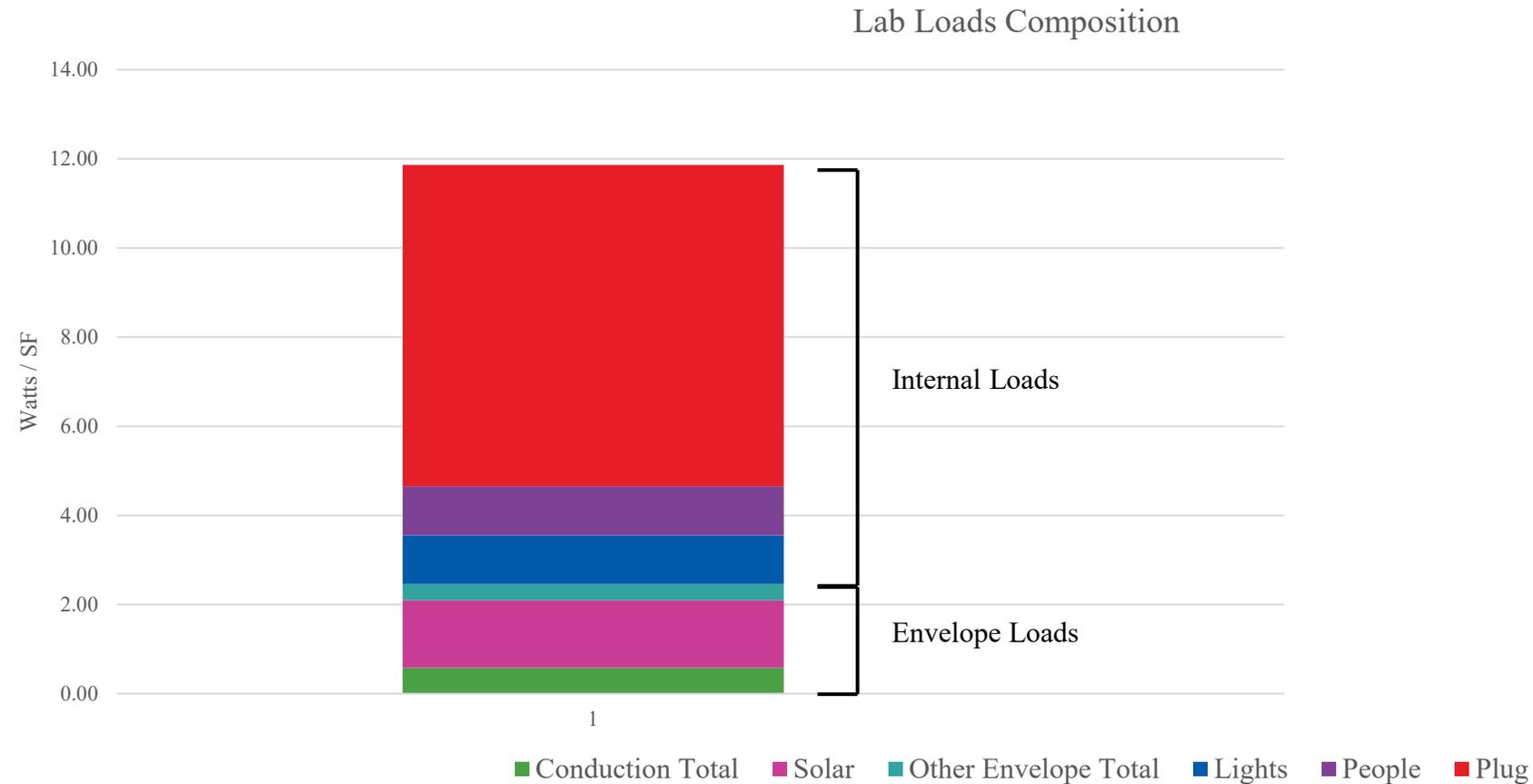
Real World Example

Northeastern University Interdisciplinary Science and Engineering Complex (ISEC) to EXP



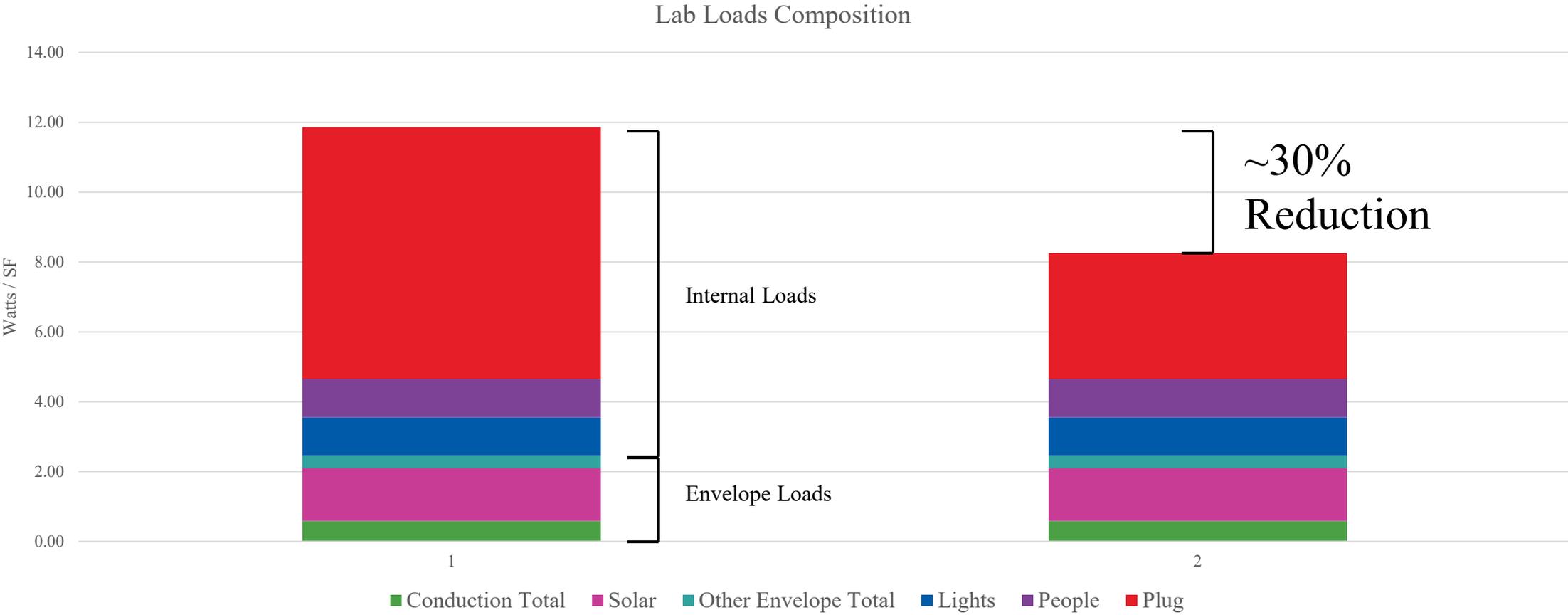
Exemplifying the Impact of Design Criteria

The contribution of lab assumptions to demand calculations



Exemplifying the Impact of Design Criteria

The contribution of lab assumptions to demand calculations



Wet Lab

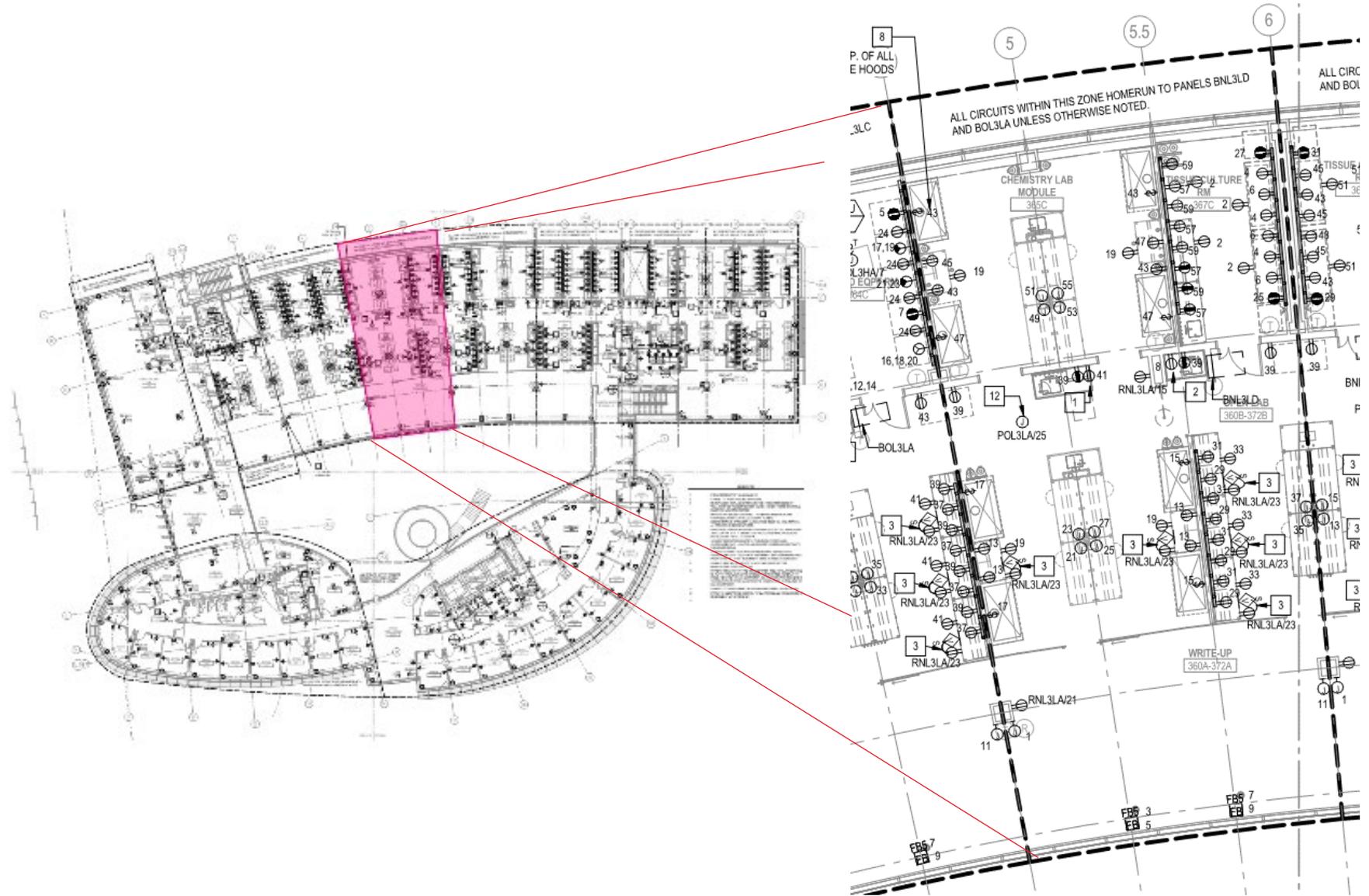
Design, 2,175sf

Support – 16W/sf
Open Lab – 8W/sf
Write Up – 2W/sf
Peak – 18kW (8.3W/sf)

Measured

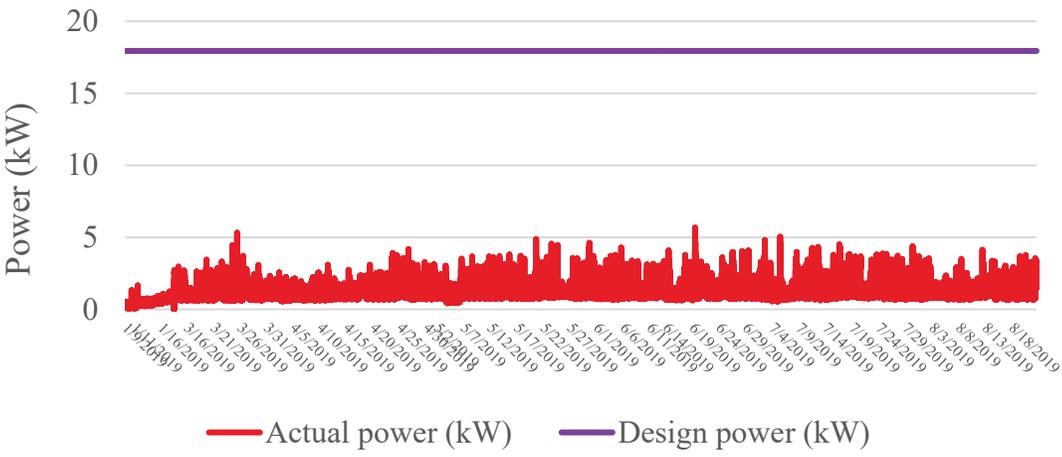
Peak – 5.7kW (32%)
2.6W/sf

Occupant: MCTE
Lab Designed as: Wet
Lab Utilized as: Wet
Lab Utilization: 100%

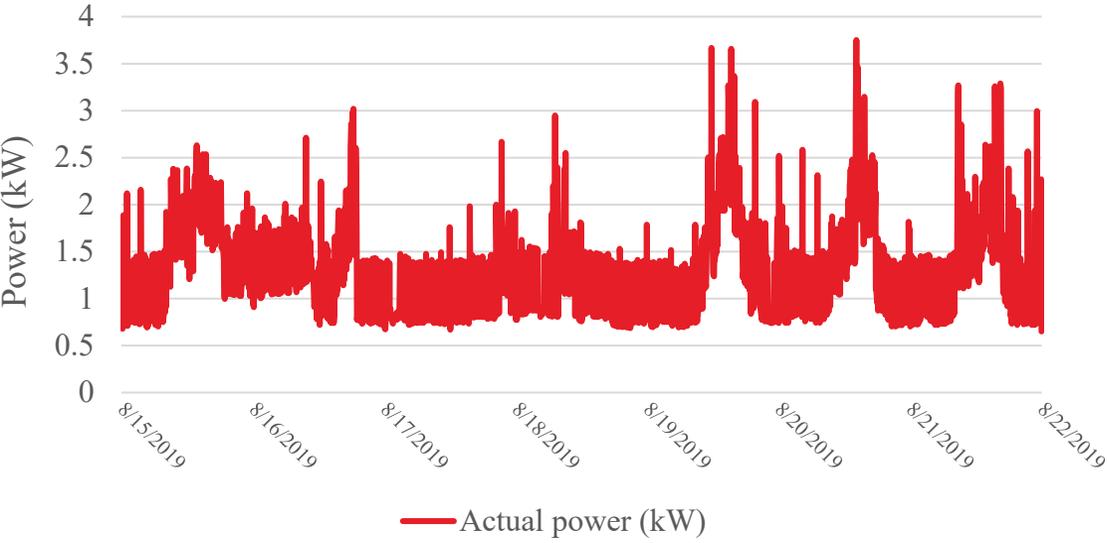


Wet Lab

Measured vs. Design power draw



Typical weekly profile



Helpful Upcoming Code Updates

Proposed / Likely Changes for the 2026 NEC Cycle

Reduced demand factors for heat pumps & electrification loads

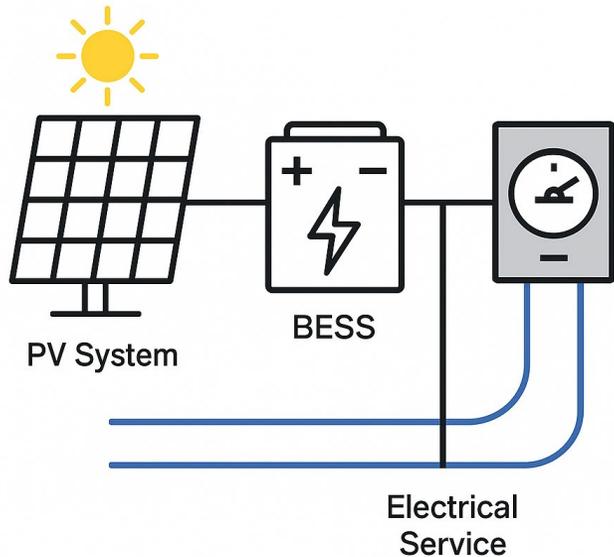
Expanded ability to take credit for controllable or load-managed loads

Rewrite / clarifications in the Metering Data Method (220.87)

More flexibility in **demand factor usage**, allowing for better **right-sizing** based on **anticipated demands** vs. prescriptive oversizing.

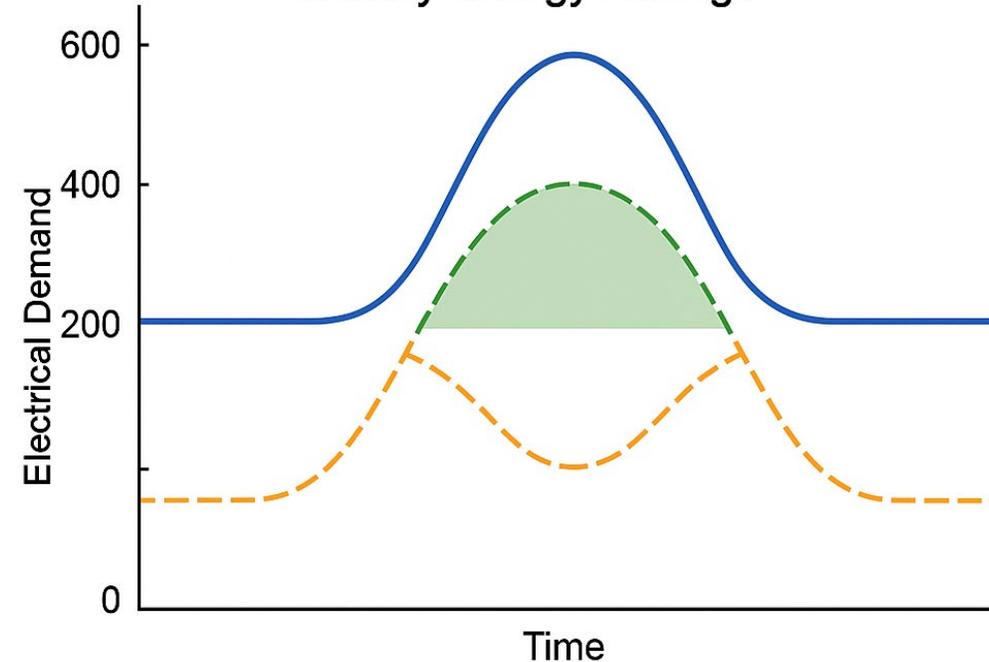
Complementary Technology

Using PV and BESS for peak load shaving



Using the PV and BESS system will allow you to “stretch” your available power to accommodate peak loads without exceeding available capacities.

Electrical Demand with Peak Shaving by Battery Energy Storage



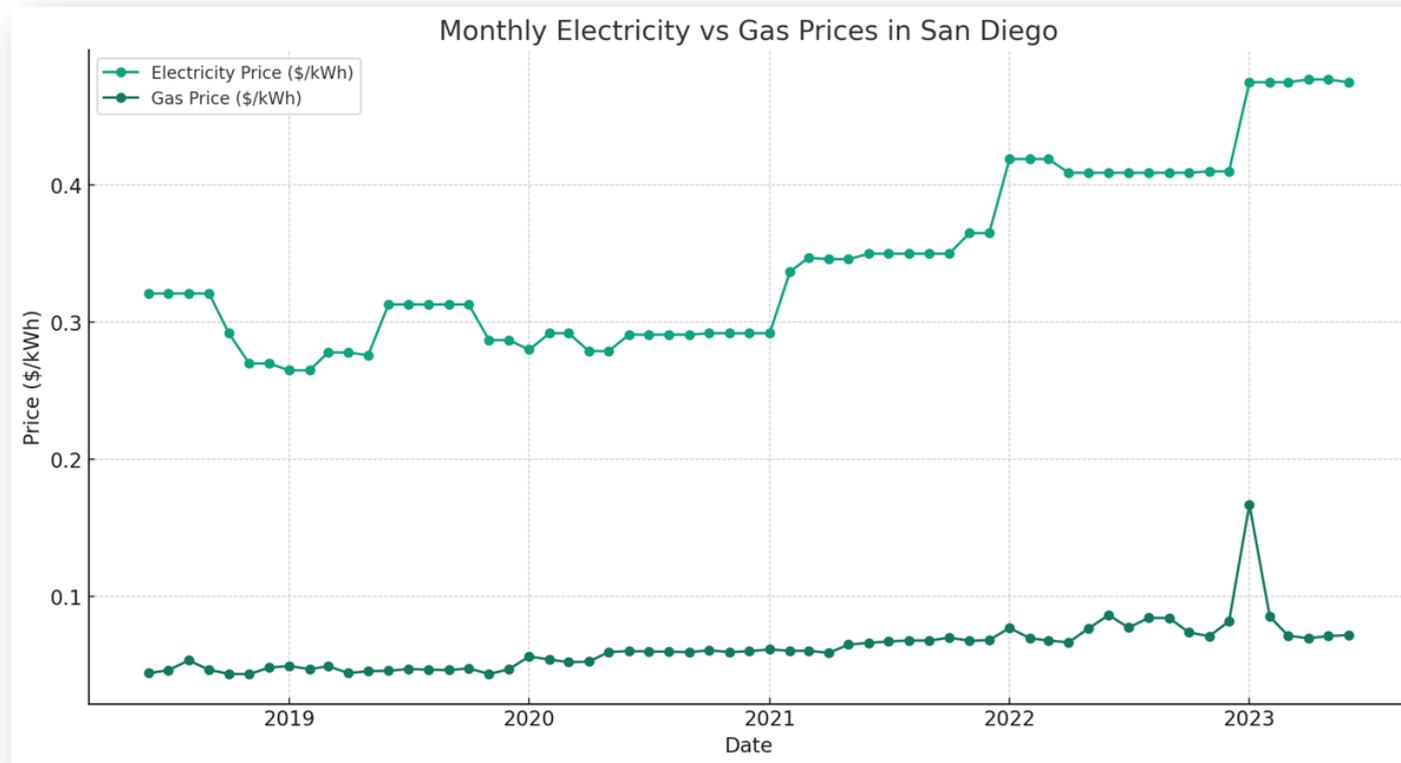
Justify the approach

“How do I convince others that all electric labs make cents”

What does it mean to operate an all-electric lab?

Levelized Cost of Energy Comparison

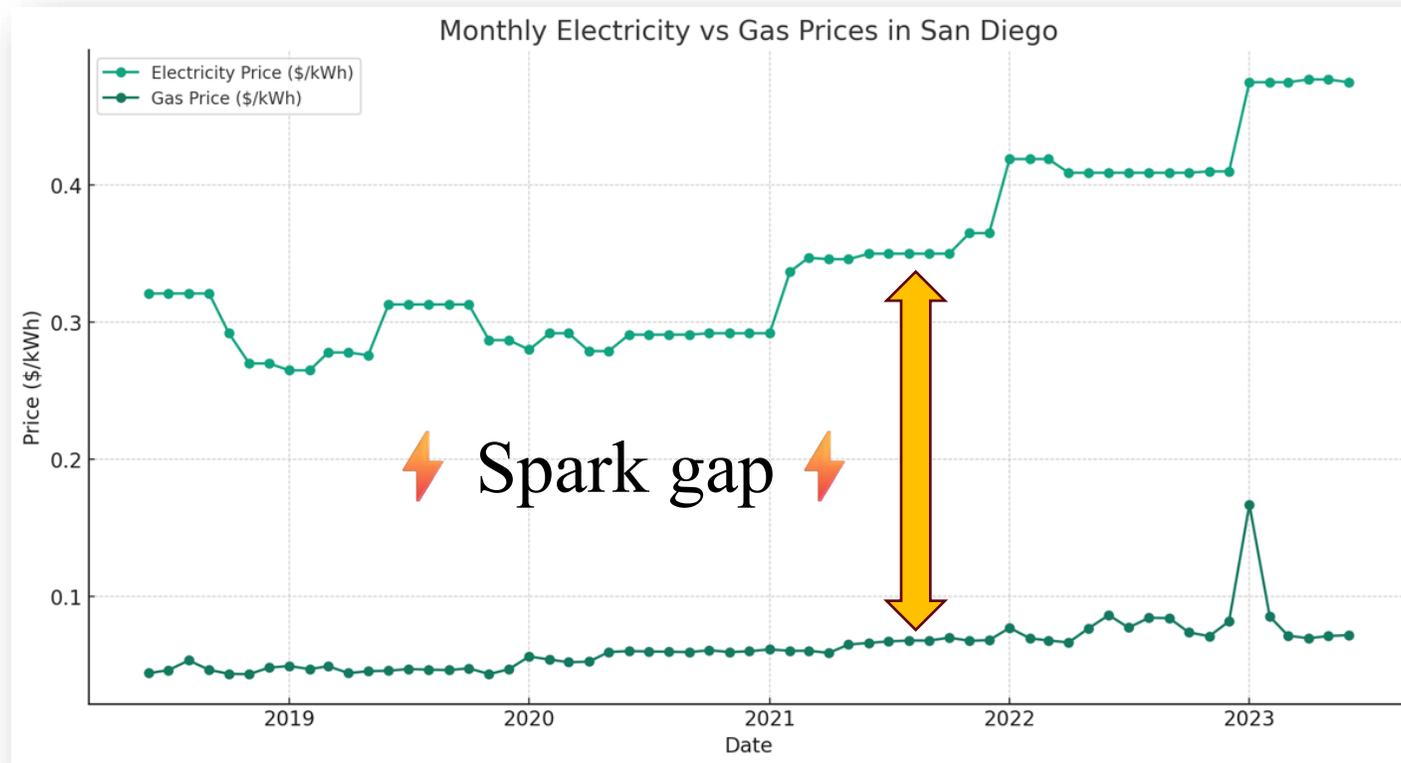
- Electricity costs 3-4x natural gas for the same unit of energy.
- **Common owner question:** Won't this mean my utility bills will be significantly higher?



What does it mean to operate an all-electric lab?

Levelized Cost of Energy Comparison

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Real World Example

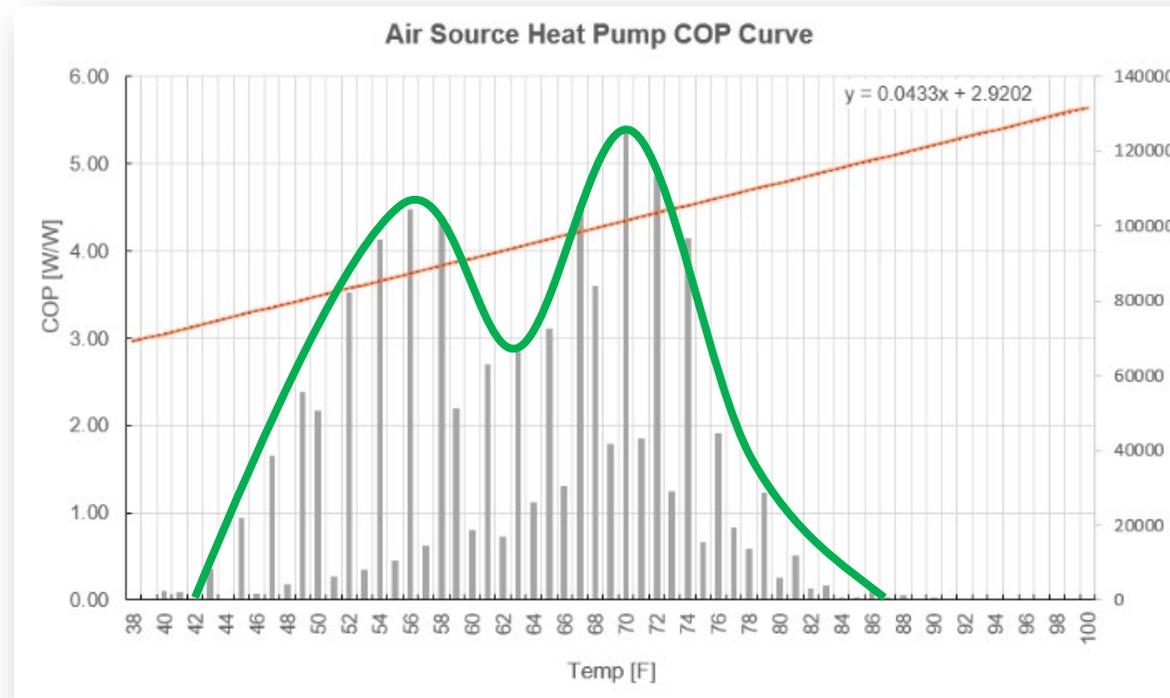
Viterbi Family Vision Research Center at UC San Diego's La Jolla campus



What does it mean to operate an all-electric lab?

Levelized Cost of Energy Comparison

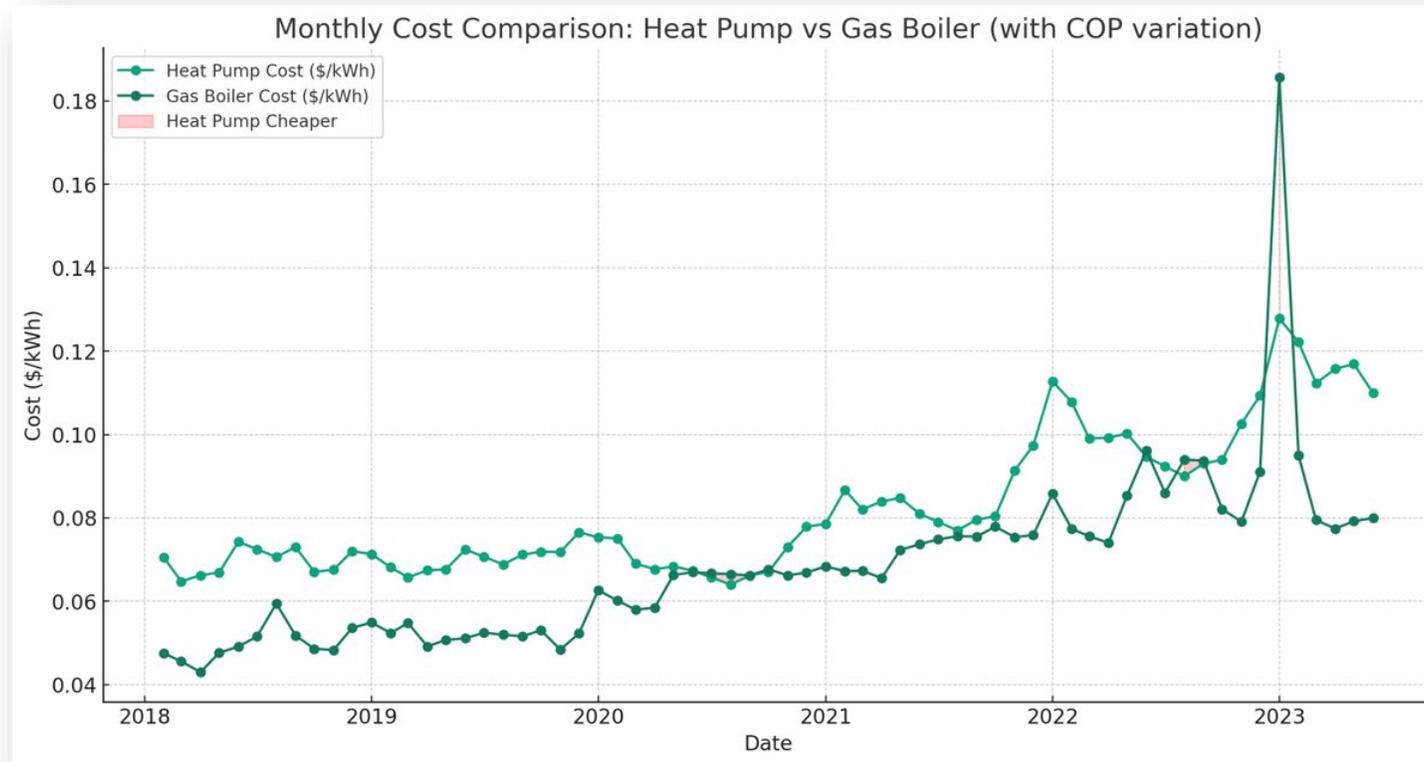
- Heat pumps “produce” more useful energy than they consume.
- Heat pump efficiency increases with a moderate climate & summer reheat demands.
- Heat pump COP for a lab in southern US: **>4.0!**



What does it mean to operate an all-electric lab?

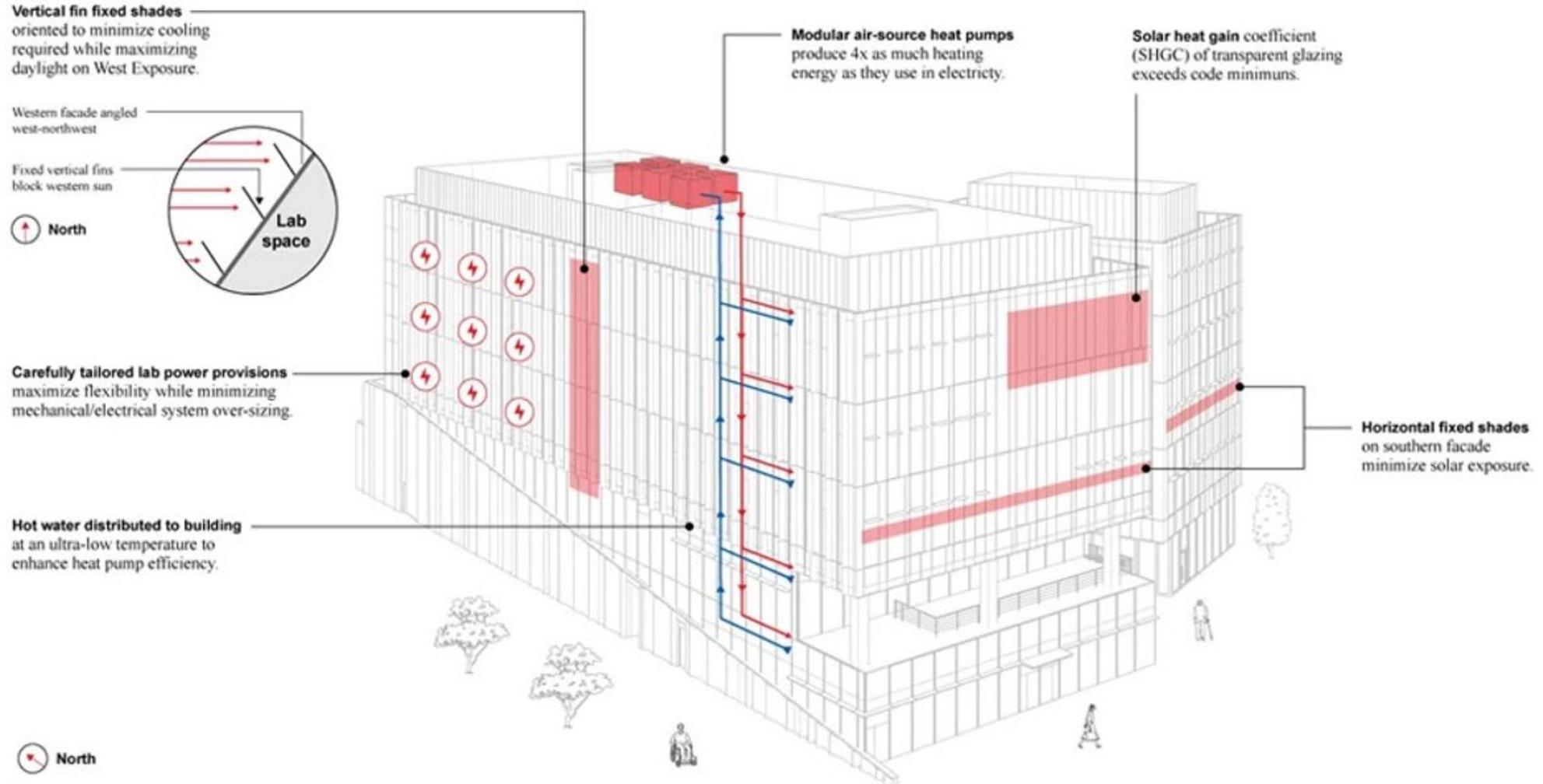
Levelized Cost of Energy Comparison

- Important to consider all factors in communicating impact.
- Important to speak in a language that **your client will understand**.



Bringing it all together

UC San Diego Viterbi Family Vision Research Center



Thank you and questions

ARUP