

Lab Benchmarking Symposium

Where do we go from here?



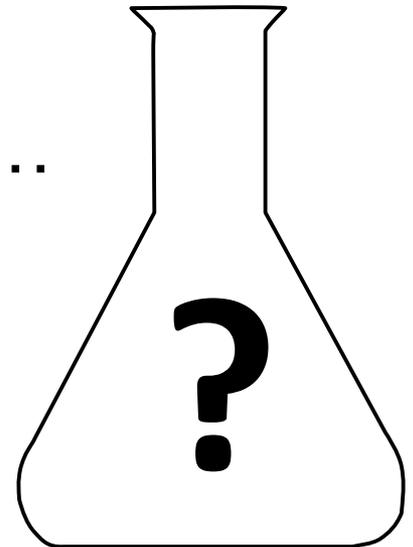
Alison Farmer

Learning Objectives

- Describe other cutting-edge lab benchmarking work and how lessons learned could be incorporated into the Labs21 tool.
- Contribute to an open discussion on proposed future enhancements to the Labs21 tool.
- Offer suggested improvements to be incorporated in the next round of upgrades to the Labs21 tool.
- Understand how to get involved with the work of the I²SL Benchmarking Working Group.

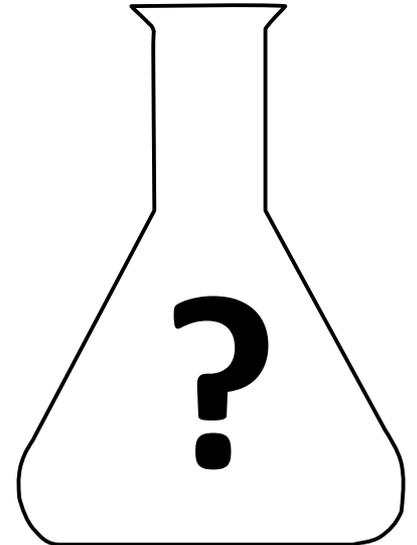
Where Do We Go From Here?

- Lab benchmarking is important and valued
- Labs21 tool contains an unparalleled dataset of lab building energy usage and properties
- Recent upgrades improved data quality, tool usability, and tool longevity
- **But there's more to do**
- Reaching the limits of volunteer efforts...



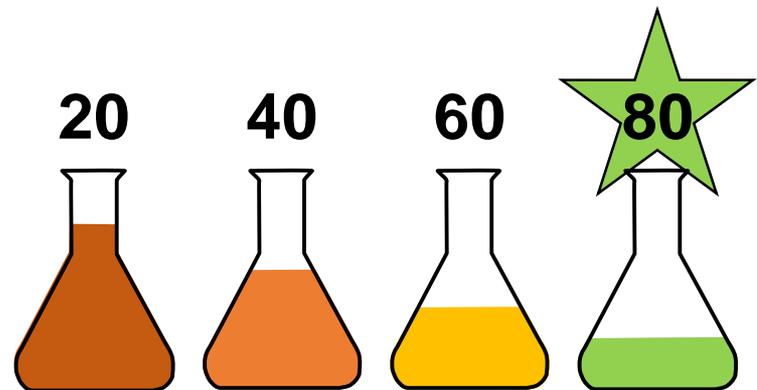
Outline

- Possible directions
 - Energy score for labs
 - Other possibilities
- Open discussion



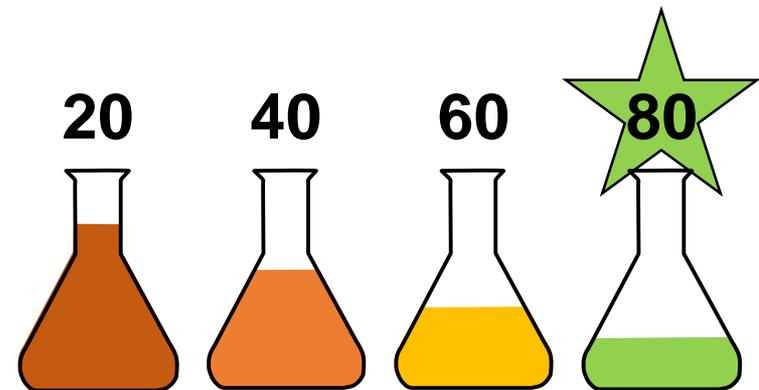
One Possibility: An Energy Score

- Survey: useful to most
- Simplifies benchmarking process
- Energy disclosure: comparison is inevitable
- Could there be an official ranking for labs?
- Could it be fair?



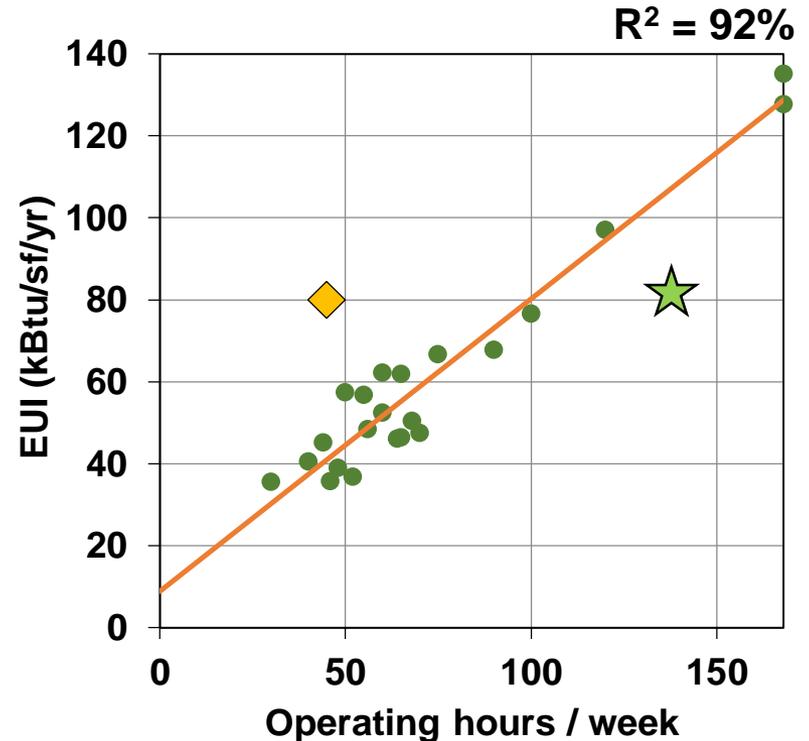
Regression Analysis: Approach

1. Identify functional requirements impacting energy use
2. Collect large dataset of buildings
3. Correlate energy use with requirements
4. Develop formula for energy use of “typical” building
5. Rank buildings against “typical”



A Simple (Fake) Example

1. Operating hours should affect EUI
2. Collect sample of office buildings
3. Correlate EUI with operating hours
4. Score other buildings against best fit line
5. Diamond gets low score; star gets high score



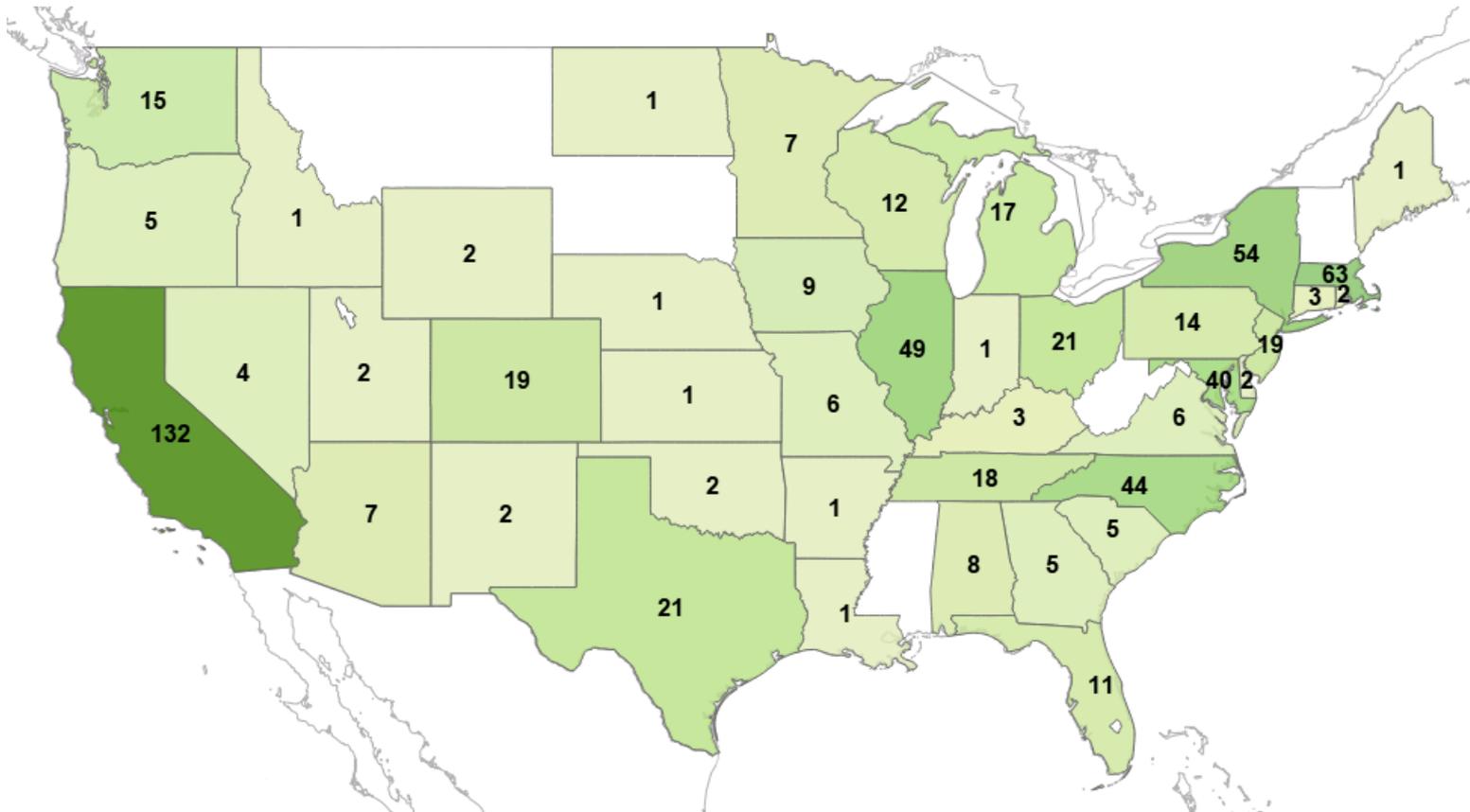
1. Functional Requirements for Labs

Functional requirements impacting EUI include:

- Lab type
- Lab % area
- # fume hoods
- Operating hours
- Weather and climate
- Lab use
- Ventilation requirements
- Space conditioning requirements
- Specialized equipment
- And others...

2. Collect Large Dataset of Labs

- Labs21 dataset contains 639 buildings
- Equals or exceeds typical Energy Star dataset

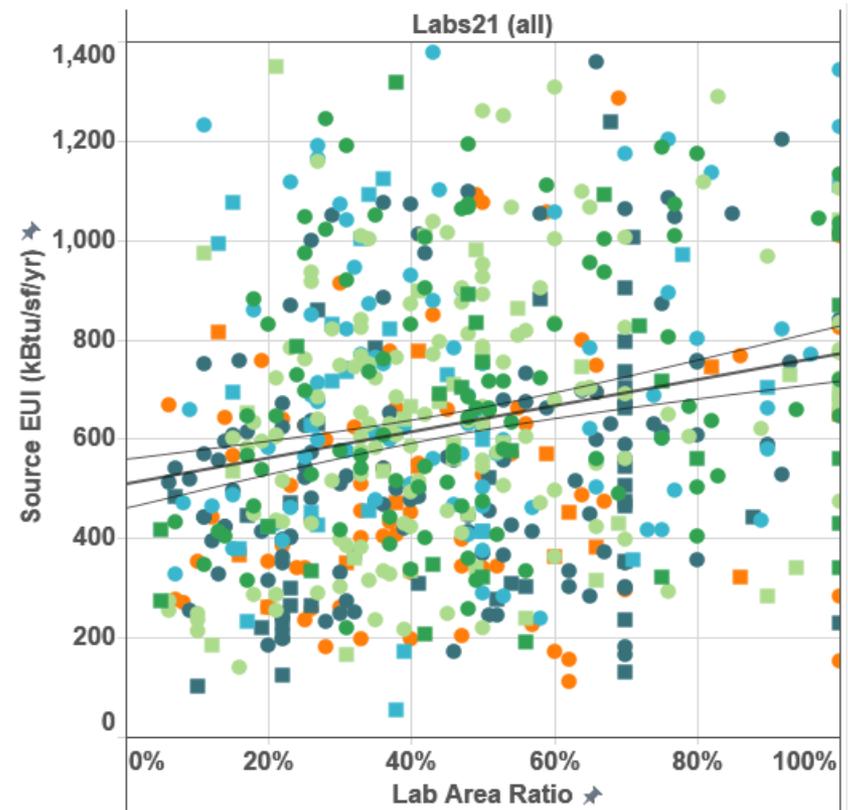


3. Correlate Energy Use with Requirements

Done twice for Labs21 dataset:

- ACEEE 2010 (LBNL): 82 buildings
- BMWG 2016 (Tim Deak): ~500 buildings

- Expected correlations are seen
- But so is **a lot of scatter**

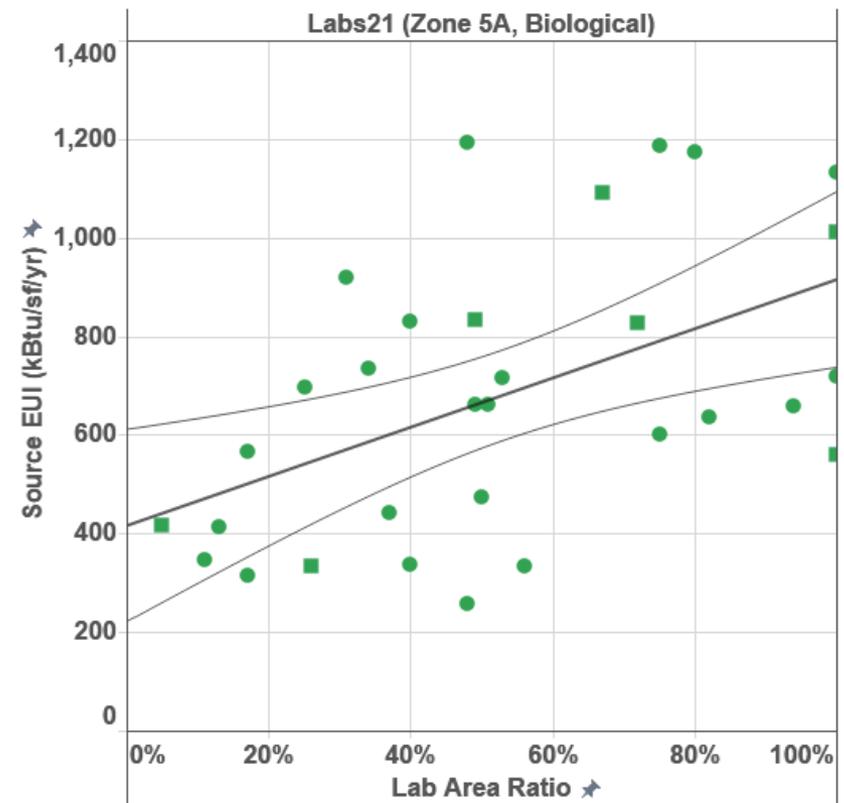


Why So Much Scatter?

Possible causes of scatter:

- Differences in efficiency – **the signal we want!**
- Annual weather variations
- Functional requirements not captured
- Data quality issues

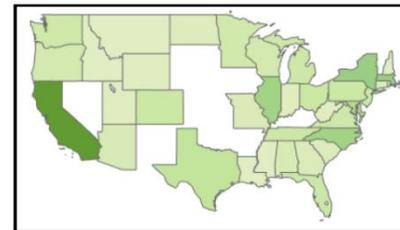
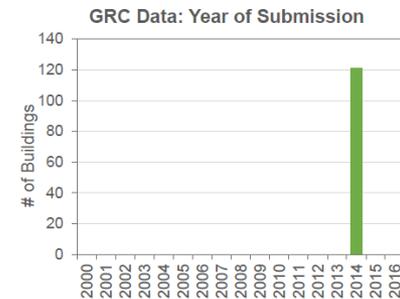
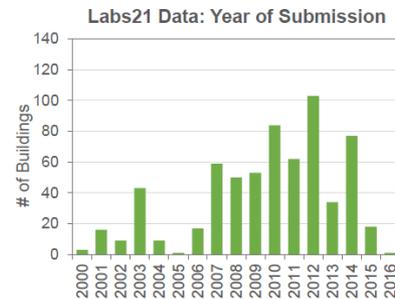
Can this work?



A Recent Study

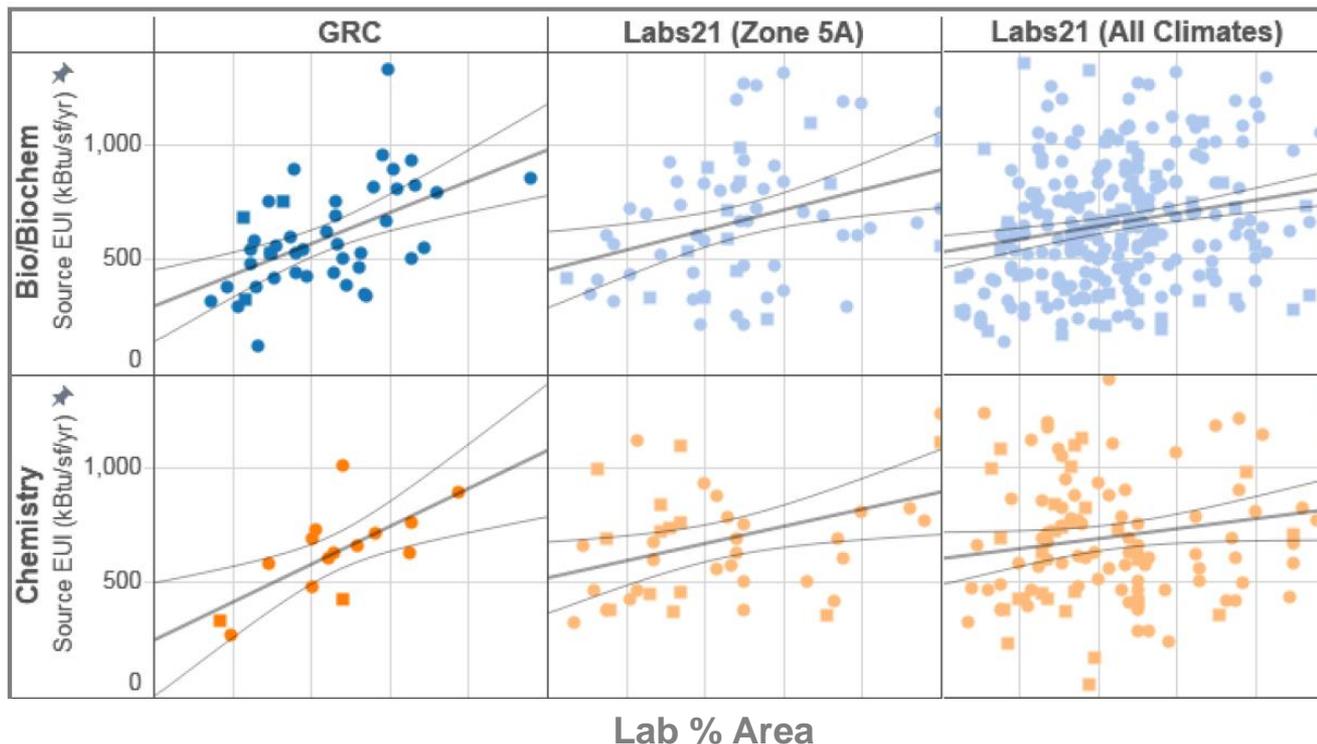


- Boston Green Ribbon Commission's Higher Education Working Group
- 122 academic lab buildings in Boston area
- 14 million sf
- Carefully controlled sample
 - Organized data collection
 - All same geographic area
 - All same year
- Eliminate many sources of scatter



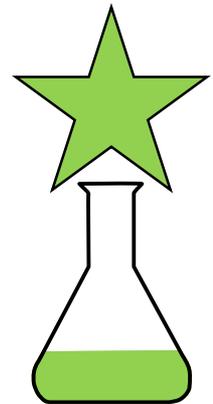
Study Results

- Much tighter correlation of EUI with functional requirements
- R^2 similar to Energy Star for offices or hospitals
- Draft energy score developed (for chem/bio)



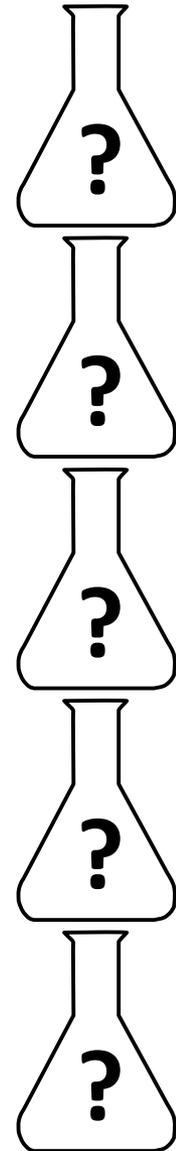
Lessons for Labs21 Tool

- Continue to improve data quality for new submissions
 - Outreach
 - Live data checks
 - Automatic data transfer from Portfolio Manager?
 - Other methods?
- Follow-up work on draft energy score
 - Correct for weather variations
 - Develop **I²SL Lab Energy Score**?
- Collect data on additional functional requirements?



Other Possibilities

- **Interface enhancements**
 - Interactive graphing interface
 - e.g. BPD, examples Jacob showed
- **New or expanded metrics**
 - Energy cost
 - Water use
 - System-level and submetering data
 - Too much to ask?
- **Integration with other tools and programs**
 - Live data import from Portfolio Manager
 - API for use by others
 - Incorporate use in incentive programs
- **Normalization**
 - Energy use per research paper published?
 - But many requirements are area-based



Possible Paths

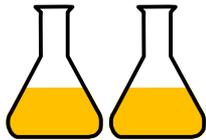
Levels of effort:

0: Not an option

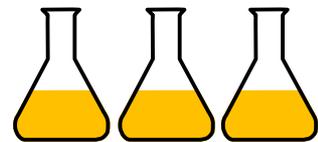
1: **Status quo:** maintain website, update database



2: **Continue with upgrades:** outreach for more data; interface upgrades; research on scores; provide new resources



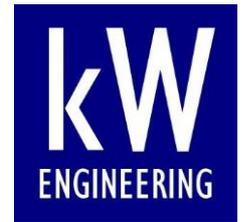
3: **Complete overhaul:** completely new tool; collect new data types; provide new metrics; link to Portfolio Manager



Discussion and Questions

- How do you use benchmarking data?
- Are you worried about energy disclosure ordinances? Will they lead to improved energy efficiency?
- Do you think we can get more out of benchmarking data than we currently do?
- Can predicted (modeled) performance be compared with actual?
- Would an I²SL Lab Energy Score make you nervous?
- Is it important that the tool be free of corporate sponsorship?
- Can lab benchmarking ever be fair?
- What do you think of the new upgrades?
- What should we upgrade next? Or should we scrap the tool and start over?
- What questions could the Labs21 dataset answer? What would you do with the dataset?
- Will you come to the working group meeting on Wednesday at 1pm?

Thank you!



Alison Farmer
afarmer@kw-engineering.com