Reimagine Summer Labs Insight Briefs

Reimagine Buildings Collective–SUMMER 2025

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Introduction

This summer, fifty members of the Reimagine Buildings Collective organized themselves into eight Reimagine Summer Labs—small, self-directed "think and do tanks" that each explored a key challenge or opportunity in building decarbonization and climate resilience. Over the course of several meetings, each Lab engaged in a process of collaborative inquiry, uncovering insights and distilling them into concise written briefs.

This volume brings those Insight Briefs together in one place. I hope you enjoy!

I'm so proud of what the Labs accomplished—the ideas they developed, the conversations they initiated, and the momentum they generated in a short time. It's been exciting to see the connections that formed among Lab members and to know that each group has chosen to continue its inquiry this fall. Look for a new set of Insight Briefs soon.

Many thanks to my colleague Alain Bao for his support of the Labs and their work.

Please read on!

– Zack Semke, Host of Reimagine Buildings Collective (October 2025)

Selling Passive House Lab

Lab Members:

- *Lloyd Alter (editor, adjunct professor, and author of Carbon Upfront!)*
- *Trey Farmer (architect and partner at Forge Craft Architecture)*
- *Bo Green (architect and chapter lead for Passive House DC, a chapter of Passive House Network)*
- *Paul Herron (principal and founding member of Sage Craftsmen, LLC),*
- *Silas Patlove (PA in emergency medicine and CPHC)*
- *James Turner (marketing consultant and host of the Marketing Passivhaus podcast)*

The best way to sell Passive House? Don't!

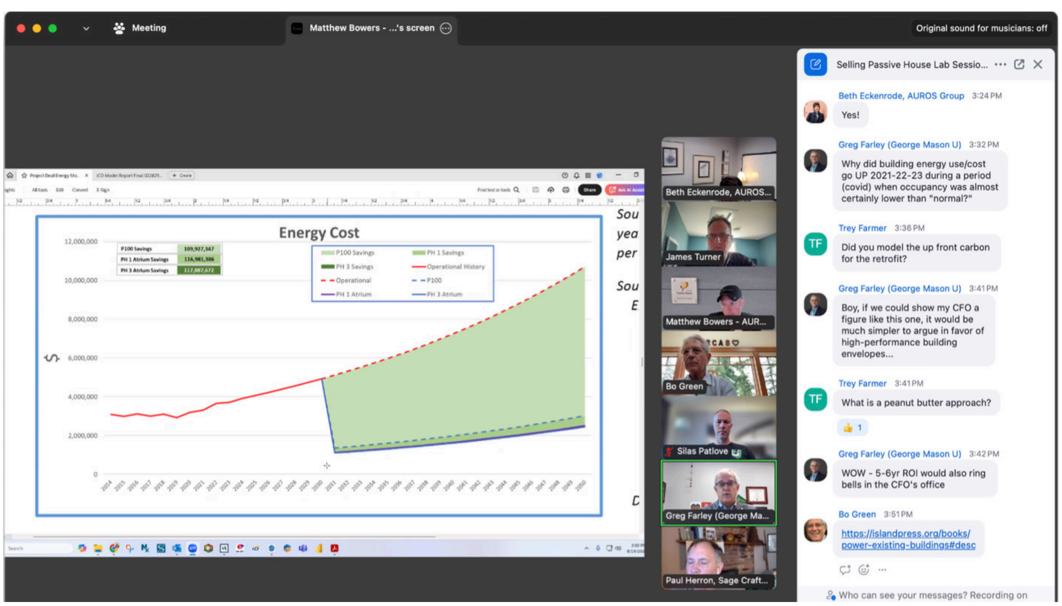
The Challenge

Forget your PHPP, don't mention thermal bridging, keep your airtightness rating in your back pocket. As the great sales leader Zig Ziglar said, "People don't buy for logical reasons. They buy for emotional reasons." And that's as true with Passive House as it is with cars, phones, and toasters.

Top Takeaways

- Whether you're selling the passive house idea at the single-family residential, multifamily, mixed-use, commercial, institutional, or legislative level, it's important to remember that each person you're dealing with has their own emotional, often irrational, version of success for their project. Your job is to ask about their pains and listen. More often than not, the solution to their pains will lead back to passive house, but that doesn't need to be part of the discussion.

- Trey has found that advertising Passive House often attracts people who can't or think they can't afford it. (The people who have the money aren't as interested/aren't doing it.) In general, if they don't have the budget to build a passive house, they probably just don't have the budget to build a house, period.
- In Lloyd's 2019 article, *How Do You Sell the Idea of Passive House?,* he shared another Zig Ziglar quote: "People are basically the same the world over. Everybody wants the same things – to be happy, to be healthy, to be reasonably prosperous, and to be secure. " He then listed the selling points of Passive House (in order of judged importance at that time): Comfort, Air Quality, Quiet, Security (aka energy security/resilience/ passive habitability), Luxury, and Health. Now, based on what he's seeing, reading, and hearing, he'd change the order to put Security closer to the start.
- Bo, who has his eyes set on large-scale projects, following the thinking that they are the quickest way to convert the largest square footage to Passive House, talks of moving from the S word (Sustainability) to the C word (Cash) in his messaging. In a guest session with Beth Eckenrode and Matthew Bowers, both from AUROS Group, and Greg Farley, Director of University Sustainability at George Mason U, the following slide, showing the projected energy cost savings of making different sections of a large project Passive House wowed the crowd with it's 5-6 year ROI, causing Greg to say "If we could show my CFO a figure like this one, it would be much simpler to argue in favor of high-performance building envelopes."



- Paul (and Bo) attended the PHIUS Marketing Webinar on September 9, and he shared that "many of the participants were hung up trying to figure out how to sell the data points and Passive House itself (by name) rather than identifying and solving the client's problem. " In a chat he shared, many commented how this isn't really working, and someone pointed out that several different entities are trying to sell consumers "lowered energy bills, " making that, also, not a point of differentiation for Passive House. In this case, most were talking about single-family residential builds, and so were not dealing with the massive savings discussed in the point above.

What's Next?

The benefits and amenities sell. That it is the Passive House standard that brings those benefits is an afterthought, an interesting footnote. Whether it's the large-scale developer looking for the best possible ROI, the multi-family builder looking for sound-isolated, high-end units to attract better buyers, or the single-family owner looking to build a home that will keep their family safe and secure, the key to helping them get what they are looking for is to listen to them talk about their pains and desires. Figure out what those are and sell them solutions that address those needs, without requiring them to care that it's Passive House that makes it happen.

Nature-Based Performance Lab

Lab Members: *Greg Bishop, Tom Hootman, Chris Magwood, Buck Moorhead, Rainger Pinney, and Nidhi Shah*

Can Bio-Based Materials Be Successfully Incorporated in High-Performance Design?

Challenge

We asked: Can bio-based materials such as straw, hemp, cellulose, and wood fiber not only meet but enhance the goals of high-performance building design?

High-performance design aims to deliver buildings that are: **healthy, comfortable, safe, durable, and regenerative.** Achieving this requires airtight and water-tight construction, vapor-open assemblies for drying, adequate insulation for comfort, and ventilation for clean air. It also means using fire-safe materials that minimize flame spread and toxic smoke.

Top Takeaways

1. **Bio-Based Materials Align with Performance Goals.**
   Materials like straw, hemp, cellulose, and wood fiber are vapor-open, hygroscopic, heat-buffering, and can improve airtightness when dense-packed. They also store carbon, come from renewable sources, and char predictably under fire exposure without producing large amounts of toxic smoke. Bio-based material performance is a synergistic match with low-energy and Passive House buildings, and many of these materials are inherently regenerative.

2. **They Outperform and Have Proven Precedent.**
   Compared to many petroleum-based options, bio-based insulation offers better moisture management, resilience against mold and rot, and improved thermal comfort in climates with wide temperature swings, especially when paired with modern detailing and membranes. Cellulose insulation is a strong precedent: dense-packed, vapor-open, hygroscopic, and already trusted and widely used in North America. Highlighting cellulose alongside new demonstration projects shows that bio-based materials are not risky novelties, but logical extensions of a proven approach. *Note: Properties like hygroscopic buffering are only beneficial when assemblies are designed to dry properly. If drying is restricted, such as by non-permeable finishes, these same materials can retain excess moisture. Considering the whole assembly and real-world occupant behavior is essential to manage this risk.*

3. **Research, Testing, and Code Adoption Are Crucial.**
   Designers and builders may hesitate until insurers and code officials are convinced. The challenge is less about material performance and more about validation and advocacy. Important testing is already underway, but its impact would grow with stronger coordination, funding, and visibility. Building on existing efforts through shared research, demonstration projects, and advocacy for code updates will be key.

4. **Policy and Market Drivers Can Accelerate Adoption.**
   The UK and Europe are ahead of the USA in adopting bio-based materials, partly due to whole-life carbon assessments and targets. Establishing similar frameworks in the USA could drive stronger market demand. At the same time, the rapid growth of mass timber construction in the USA offers a platform to leverage this interest and growth to promote a wider range of biomass-based material options.

What's Next?

To make bio-based materials a standard part of high-performance design in North America, the next steps are clear:

Expand Research & Testing – Strengthen the evidence base for durability, fire safety, and long-term performance. Aggregate information from completed projects—both recent builds and older examples—to give confidence in long-term outcomes. Work with the Bio-based Materials Collective to encourage researchers, testing groups, designers, and builders to collect and share data in accessible formats, ensuring that anyone exploring these materials can easily find reliable, trustworthy information.

Advance Code Adoption – Translate these results into recognized pathways for approval in regional and national codes. Demonstrating proven compliance helps remove regulatory barriers and provides design teams with clear, repeatable routes to approval.

Showcase Success – Map recently completed and in-progress demonstration projects using cellulose, straw, wood fiber, and other bio-based materials. Standardize data monitoring and testing protocols for these projects, and create a shared portal (potentially stewarded by the Bio-based Materials Collective) to collect and publish this information, including options for anonymous contribution. By making this knowledge accessible and searchable, we can normalize bio-based solutions, highlight successful precedents, and accelerate adoption across the industry.

The question we leave with: *How can we collectively accelerate the research, code adoption, and storytelling needed to make bio-based materials a trusted default in North American high-performance construction?*

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Passive Survivability Lab

Lab Members: *Lloyd Alter, Mike Fowler, Chloe Hellerman, David Komet, Valerie J. Amor, Tapani Talo, and Al Mitchell*

Passive Survivability: No power, no problem?

1. **Resilience means more than efficiency** — Passive survivability is about maintaining habitable, safe indoor conditions during power outages or environmental extremes, not just saving energy.
2. **Heat is the bigger threat** — Over the past 30 years, extreme heat has caused more deaths than any other weather event, making summer overheating and humidity control critical priorities.
3. **Passive only goes so far** — Superior insulation and airtightness help, but without ventilation, dehumidification, or backup power, survivability in heat, smoke, or long outages is limited.
4. **Optimization strengthens resilience** — Smart passive design (shading, form, fire-safe detailing, low embodied carbon) paired with right-sized, all-electric systems and backup energy makes buildings both survivable and part of the climate solution.

1. What do we mean by Passive Survivability?

When considering passive survivability, or building resilience, it is important to define the terms used as well as the specific hazards that a building is resilient to. In general, resilience can be defined as a building's ability to maintain or return to habitable conditions following a loss of power or a change in the environment. Whether this relates to thermal extremes, wildfire, or other natural disasters, passive building practices promote buildings that are able to weather these events and protect the health and safety of the occupants.

For some time now, Passivhaus, Passive House, Passivehouse, or Passive Buildings has been promoted as a "thermal battery," most prominently after the 2014 polar vortex (JLC: Cold Snap Tests High-Performance Homes). However, there are other challenges beyond keeping the cold at bay; we must view survivability within the context of local climate conditions and technical risks.

Threats to occupant health and safety may include:

- Extreme heat or cold
- Fire and particulate matter pollution from smoke
- Flooding
- Electrical grid outages
- Energy shortages

In discussing survivability, the definition of resilience synonymous with security and comfort, anticipation of future escalating events and social impact, potential conflict of urban vs. rural issues, building and zoning codes that can create both barriers and opportunities, the need for redundancy, low tech vs. high tech solutions, the integration of food and energy systems, typical vs. Passive house construction capacity to withstand weather events.
Some questions to consider - Who defines resilience/security? How does it differ among different communities/demographics? How far into the future can we/should we plan for?

For purposes of this paper, passive survivability is defined as the ability of a building to maintain safe thermal conditions in the event of an extended power outage or loss of critical services like heating or cooling.

A reason passive survivability prioritizes summer overheating above winter cold is because heat and heat related deaths kill more people each year, and on average over the past 30 years, than from any other weather-related event. [source: National Weather Service: www.weather.gov/hazstat/] In passive designed buildings, due to its superior insulation and airtightness, once heat from air temperature or sunlight enters it stays inside until it can be flushed out with cooler nighttime air or mechanical cooling.

2. One size does not fit all

Too often we throw the same solutions at vastly different conditions and risks. Dealing with cold is almost easy compared to the problems of dealing with smoke, heat, and in particular, how climate change is driving dangerous "wet-bulb" temperatures.

Research published by Penn State University in the Journal of Applied Physiology in 2022 revealed that young, healthy adult subjects in a warm-humid environment begin to experience heat stress at a 31oC / 87oF wet-bulb temperature, at critical point where the body can no longer effectively regulate its core body temperature. Prolonged exposure at and above this level can potentially lead to heat stroke or death. For older and disadvantaged populations, who are more vulnerable to heat, that heat stress point is likely even lower. This wet-bulb temperature threshold corresponds closely to the NOAA Heat Index danger level which starts at 40°C/104°F.

Passive House can only go so far as a thermal battery for keeping cool if the wet-bulb temperaturesstay high; dehumidification will also be essential.

3. The need for active systems as well as passive

Building to passive building standards alone does not ensure survivability. It is assumed that a passive building can "coast" for a couple of days through a cold or smoke event because of its insulation or airtightness. Eventually, interior air quality begins to deteriorate due to buildup of CO2 and humidity, and Passive House does not provide ventilation when the power goes out.
Consideration should be given to installing small backup battery systems to keep HRV/ERV fans operating, as well as some emergency lighting. The backup battery system can be small and simple, as the ventilation fan power and lighting provided by high-efficacy lighting is a low power draw. With the increasing commonality of on-site renewable energy generation, the batteries can be recharged during the event without dependence on the broader grid.

In hot and humid climate zones, humidity is the dominant factor in thermal comfort during extreme heat. A 'heat index' is a measure of how hot it feels to the human body when both air temperature and relative humidity are considered together. At higher humidity levels, sweat evaporates less effectively, reducing the body's ability to cool itself, making it feel hotter than the actual temperature.

While passive enclosures can significantly lower indoor air temperatures compared to the outdoor temperature during extreme heat events, they are not able to address humidity control without dehumidification. In hot, humid climates, managing humidity is not only a matter of comfort, but also a fundamental need, making battery backup and other distributed energy resources a critical component to ensuring health, safety, and survivability.

4. Optimization of Passive Design

Andrew Michler writes from experience in Building Forward in the Face of Fires how simple forms eliminate corners and crevices where firebrands can grab hold. Eliminating vents, careful selection of materials, and a continuous wrap of non-combustible insulation can improve fire resilience.

In an increasingly hostile climate, additional forms of building optimization should be considered. Rather than contributing to the problem of climate change, we ought to reduce the use of materials with high embodied carbon. Plans should be optimized to reduce building area and the absolute demand for energy. Sean Armstrong of Redwood Energy has demonstrated that with careful optimization and with smart choices of appliances, an all-electric 2000 square foot home including an EV can be run on a 100 amp panel.

Where passive first design can excel is limiting summer heat gain with an optimized building enclosure and proper shading. Perhaps the most important metric in design is a low BTU-h/sf to minimize peak cooling. That single metric reduces mechanical equipment sizes that are grid friendly and creates the favorable conditions of survivability during periods of power outages and extreme heat events.

Passive buildings should not just be a well-equipped lifeboat riding out the storm; from first principles it should be part of the solution, reducing demand and perhaps even giving back.

Fire-Resilient Design Lab

Lab Members: *Jim Bischoff, Carl Eklund, Edwin Fang, Rayan Ghazal, Graham Irwin, Lauren Shadid, Ken Levenson, and James Kupferschmid*

Passive House For Fire Resiliency

Two fire-resilient desgn teams merged midway through the summer. Several team members are involved in fire-rebuild projects or are building in WUI zones.

Team one focused on fire resilient design features, materials systems and best practices that are supported by Passive House design. We discussed the integration of building codes and policy to help support the effort. We shared design resources and links (included below).

Team two focused a bit more on the insurability of homes in WUI areas and beyond, and how Passive House and Building codes might reduce the risk perceived by insurers.

Top Takeaways:

1. **Passive House Offers Inherent Fire-Resilience Features**

   - Elements such as airtightness, multi-glazed/tempered windows, reduced wall penetrations, and form factor contribute to natural fire resilience.
   - These design choices can help withstand fires – from both burning and smoke damage, as evidenced by real-world Passive House examples surviving wildfires.

2. **Insurance Industry Is Not Yet Aligned with Fire-Resilient Design**

    - There is a knowledge gap among insurance underwriters regarding Passive House features and their potential for risk reduction.
    - Current underwriting tools like AI and geospatial analysis are used mostly for profit-driven risk assessment, not homeowner guidance.
    - Some insurers like "Stand Insurance Co" provide mitigation strategies, but these are limited and primarily benefit wealthier clients.

3. **Need for Integration of Building Codes, Insurance, and Design Standards**

    - There's potential to bridge Passive House standards with building codes to create fire-resilient structures, particularly in wildfire-prone areas (e.g., WUI zones).
    - A certification system that merges PH principles with fire-resilient design could help streamline insurance approval and policy pricing.
    - Legislation (e.g., Colorado HB 1182) is emerging that pushes insurers to consider mitigation efforts in risk assessments.

4. **Opportunity for Purpose-Driven Insurance Innovation**
    - If traditional insurance markets fail to recognize the resilience of Passive Houses, there may be space for a mutual insurance company owned by PH homeowners.
    - This could mirror firms like Stand Insurance, but with a focus on equitable access, policyholder support, and purposeful profit.
    - A pre-emptive AI/geospatial tool for homeowners to assess and optimize their design for future insurability could also be part of this solution.

Resources

WUI Compliance Checklist: https://nevadacountyca.gov/DocumentCenter/View/25877/WUI-Homeowner-Checklist-PDF

Designing Homes for Fire Resilience: https://www.passivehousecanada.com/when-wildfire-risk-becomes-routine-designing-homes-for-climate-resilience/

https://passivehousenetwork.org/wp-content/uploads/2025/01/5-Ways-Passive-House-Supports-Fire-Resilience.pdf

https://passivehousenetwork.org/wp-content/uploads/2025/08/5-Takeaways-Climate-Action-and-Fire-Safe-Recovery.pdf

The Blue Ribbon Commission vouching for Passive House Training and Design:
https://passivehousenetwork.org/wp-content/uploads/2025/07/BRC_FinalReport_Digital_FullResolution_061825_compressed.pdf

Blog post from PHN that references NYT article on wildfire smoke infiltration and PH benefits:
https://passivehousenetwork.org/featured/wildfire-smoke-infiltration-a-new-love-canal/

https://arcfirestop.com/about-us Fire Stop at joints of walls and floors

https://www.firefree.com/resources

https://zs2technologies.com Magnesium - improving cement https://www.zolawindows.com/firewall

Phased Retrofits–Multifamily + Large Buildings Lab

Lab Members: *Debbie Chambers, Sandra Lester, Buck Moorhead, Marin Nagle, Dori Renelus, Nidhi Shah, and Kurt Waldenberg*

Futureproof Phased Retrofits
Conscientiously going beyond Passive House

Challenge

Every building is different and we don't know what will work until we do a deep dive. We can take the customer through a process, but we have to go through customized renovation.

Top Takeaways

We need to use a process to determine which upgrades need to be done when:

1. **Assess the goals, needs, facts and funding drivers.**

   Goals:
   - Determine the customer's top three to five drivers (energy is not usually the most important).

   Needs:
   - Determine the restrictions on the project (whether tenants can remain in place, what permits are required, which upgrades are necessary while renovating).
   - Determine which upgrades are necessary to make the building more

climate resilient (fire, earthquake, cold snaps and heat waves).

- Assess upgrades to allow for greater quality of life (thermal comfort, air quality, accessibility and ageing-in-place).
- Investigate restoration of the local ecosystem (wetlands, habitat for wildlife).

Facts:

- Assess the existing building condition including mechanical equipment, lighting, building envelope, electrical capacity, and list deferred maintenance issues.
- Gather utility data and benchmark the building.

Gather requirements for all funders:

- Operational savings
- Carbon footprint or Greenhouse Gas Intensity (GHGI):
- Passive survivability
- Other upgrade requirements (accessibility, fire etc.)

2. **Determine which products and technologies are available in your geographical area:**
    - PH-Certified building envelope components
    - Mechanical equipment
    - Heat Pumps
    - Ventilation equipment
    - Lighting

3. **Use energy modelling to determine the effectiveness of individual and bundled ECMs**

4. **Create a whole-building retrofit plan:**
    - Look for opportunities for carbon savings, energy savings and indoor air quality improvements that are low-hanging fruit first, then go deeper
    - Assess both the building owner's and the tenants' drivers:
        - How can we plan a better renovation?

    - Air quality issues:
        - indoor air contamination from cooking
        - infestation issues
        - high CO_2 levels
    - Operational costs (rarely)
    - Carbon impact (rarely)
    - Ageing building envelope or mechanicals (or both)
- Assess opportunities interventions for opportunities and issues:
    - Building code (fire dampers, fire ratings)
    - Maintenance issues (multiple equipment rather than centralized)
    - Building envelope performance (thermal bridging, air permeability)
    - Embodied carbon (biobased, local)
    - Climate resiliency
        - Wildfire
            - material flammability
            - filtering out <PM 2.5 contaminants
            - blocking embers
            - air sealing
        - Overland flooding
            - locating mechanicals above the 500-year flood levels
            - flood gates on underground parking garages
        - Drought (xeriscaping)
        - Powerful wind (mechanical fastening of PV panels instead of ballasted)
        - Increase risk of earthquakes (structural upgrades during building envelope renovations)
        - Cold snaps and heat waves (Passive House does well in this regard)
    - Accessibility, indoor air quality and ageing-in-place:
        - Engage with tenants to find out their needs
        - Go beyond code for accessibility, ageing-in-place and dementia
        - Bring in real samples before finalizing design (controls, operable window hardware, thermostats, HVAC system controls, exit door hardware)

        - Regenerative design (based on donut economics):
            - Restore a wetland (Henning Larson, Cøpenhagen; Effekt, Denmark)
            - Create habitat for wildlife (WWF Headquarters)
            - Create community spaces and assets
    - Assess which interventions can be done when (seasonal restrictions, occupancy, use of building, timing on leases etc.)
    - Assess interventions holistically and bundle them together conscientiously so that:
        - Building efficiency is upgraded:
            - Operational savings
            - Carbon savings
            - Water savings
        - Red flag issues are addressed (windows that won't open, surfaces covered in mould)
        - Upgrades address past issues and prevent damage from future climate events
        - Upgrades do not prevent future adaptive uses of building
        - Occupants also receive benefit (visible perks like upgrading common areas)

Top Takeaway

We need to understand the client, their drivers, the building, and risks associated with doing the upgrades. When we work with the client we need to develop a master plan that everyone can follow—this is crucial.

It's crucial for sustainability and resilience to go beyond Passivhaus, and make sure that you are meeting the needs, while doing the work conscientiously, while planning for climate resiliency and create a healthy building that works to restore the ecosystems, create community and regenerate the environment.

What's Next

- We'd like to draft up a step-by-step process template for a retrofit design process
- Why are we designing buildings that have the same indoor environments

year round? This has a huge impact on our environment. Can there be a range instead? What would be the carbon savings?

- Why doesn't Passive House consider embodied carbon? This is super important.
- We need to be designing futureproof buildings that are adaptable, that will protect peoples' lives and won't get damaged as easily.

Resources

The Atmospheric Fund (TAF) Retrofit Accelerator for MURBs in the Greater Toronto Area: Sandra at affectingchange wrote the award-winning prototype competitive RFP process for the retrofit of seven buildings on four sites that formed the foundation of the MURB retrofit accelerator: https://retrofits.taf.ca/ (Case studies are also on this page.)

Phased Retrofits Multifamily/Large Building Lab's Collaborative Slide Deck - https://docs.google.com/presentation/d/1qOFV-6UaSwTBBR9Dk2InhkJ0Q4TzXPau45uhDnMe-vY/edit?usp=sharing

Phased Retrofits–Single Family Lab 1 Insight Brief

Reimagine Buildings Collective–SUMMER 2025

Phased Retrofits–Single Family Lab 1

Lab Members: *Mark Attard, Marcy Conrad Nutt, Melissa Furukawa, Greg Leskien, Jessica Piper, and Eric Zeise*

Guideline for Retrofitting Single Family Homes

Goal

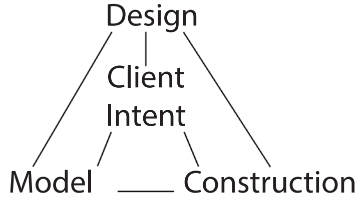
Cost-effective and accessible single-family home retrofitting

Challenge

How to make comprehensive retrofits achievable and understandable for homeowners.

The Integrative Design/Build Process

- **Key Principle:** This is NOT a linear process; all aspects are investigated early and revised iteratively.
- Establish a complete project plan scaffold
    - As the project progresses and different aspects (Items below in list) are investigated, the project plan is interactively updated and the appropriate sequence of investigation and of project execution are fleshed out
    - Comfort, Health, and Value driven
    - A semi continuous process



Core Interactive Steps

Step 1: Establish the client's priorities

- Client survey (comfort, acoustics, IAQ, mold) to define project goals.
- Helps establish what to tackle first.

Step 2: Putting together the team

- Contractor involvement from the start.
- Integrative Design Process: All team members (architect, builder, consultant) in communication.
- Project Representative for oversight.

Step 3: Establish a baseline

- Blower door test, thermal imaging, baseline air quality/comfort.
- Create a baseline model (DesignPH, WUFI Passive) for planning.

Step 4: Establish a timeline

- Consider component replacement, budget phasing, contractor sequencing, and lifestyle.

Step 5: Model in PHPP or WUFI Passive

- Set a target (EnerPHit/Passive House) and model variants to assess impact.

Note: Steps 4, 5, and 6 (which would be "Execute Retrofit" for completion) are highly interactive.

Takeaways & Next Steps

- An integrative approach is crucial for success.
- Continuous feedback loop between design, modeling, and construction.
- Next: Further develop team responsibilities and refine the project plan scaffold.

Phased Retrofits–Single Family Lab 2

Lab Members: *Snigdha Bera, Jennifer Childs, Allan Horvath, Michael Ingui, Fabrizio Maso, and Stephen Stuart*

Fabric-first vs. mechanical-first

- Consensus that fabric-first (airtightness, insulation, windows) remains critical.
- Heat pumps without grid decarbonization risk being “greenwashing.”

Incremental/phased retrofits

- Need to define what phased means: sequencing vs. partial measures.
- Must ensure each phase can stand alone if later phases never happen.
- Importance of planning (decision tree, pre-design study) so early moves don’t need undoing.

Certification = quality control

- Certification forces checklists, blower door tests, submittals, and photos.
- Without it, critical steps often get skipped.
- Even non-certified projects need structured verification processes.

Trade training & buy-in

- Trades often don’t grasp the value of continuous insulation/air sealing.
- Training, mockups, and checklists needed.
- Potential vision: national training/roadshow to normalize high-performance building.

Decision-making tools

- A decision tree or flow chart could help builders/clients choose retrofit priorities (roof, windows, mechanicals, etc.) based on project conditions.
- Pre-design studies (with modeling like Honeybee + Matterport scans ->Rhino/Revit) can guide sequencing.

Cost barriers & client communication

- Retrofits still often cost "like building a house on top of a house."
- Builders wrestle with balancing cosmetic desires vs. deeper performance improvements.
- Framing around comfort, health, and durability helps communicate value.

AI-Enhanced Practice Lab

Lab Members: *Randall Anway, Rayan Ghazal, James Kupferschmid, Galen Staengl, Mike Wong, Sandra Lester, Brendan W., Demian Rybock, and Erik Zeise*

What We Learned

There's a lot to absorb. LLMs are limited, especially for space utilization/spatial reasoning and design. Two realms where AI may be used (in the context of the PH community):

1. 'External' information sources used to explore available resources.

   Useful for:
   - getting ideas
   - starting a conversation, first drafts
   - finding resources
   - learning what you don't want
   - research
   - starting point for quick investigations (eg, new products, feasibility)

2. 'Internal' where information has been validated and legitimized within a circle of trust (eg, a team, organization, or community) and made available for an AI to use.

   For example, the Reimagine Buildings Collective could:
   - Sandra suggested that we may collect collective member - posted details and lessons learned in a database
   - Potentially could be made available through an AI interface to answer inquiries about products & materials, generate parameter-based

comparisons & identify relevant details, summarize product criteria (quality, cost, regional availability, etc) and lessons learned; a kind of specialized search engine
- Host would need to be indemnified
- Such resources would need to be thoroughly and transparently tested; questions of governance would need to be addressed, including but not limited to:
    - Thinking through procedures and processes
    - Monitoring and addressing issues as they arise
    - Identifying uses and usage limitations

**Caveat: Take generated information with a grain of salt, and validate. LLM use/usage in practice may be problematic for professionals due to liability concerns and responsibility for correct information, especially in the delivery of services and in regards to the need to maintain reputation and trust.*

Observations

Present pitfalls include:
- Transparency - data and training processes
- Cybersecurity - new issues such as hacking.
- Governance
- Insurability, liability, legal implications unclear in relation to data use/responsibility and ai utilization
- Hallucinations - LLM-generated information can be plausible and convincing but false and/or unattributable.
- Current LLMs poor at/incapable of spatial reasoning - inappropriate for design

We shared an example of an attempt at LLM advising on spatial layout. Use cases are valuable. Certification programs and standards are evolving and are something to keep an eye on. We talked mostly about LLMs; there's a lot we didn't have time to discuss that could also be relevant to the PH community.

Some Practical Notes:

- Can use on desktop to ethically help reduce energy use and carbon footprint. (*Caveat: hardware and software limitations, trade-offs to consider.)*
- Make design adjustments to enhance sustainability and performance monitoring
- Wish there was a generative design tool for modular construction
- This is the way of the future for affordability and sustainability
- Other ways to use AI include:
  - Data driven decision making at the design stage
  - More accurate predictive energy consumption using simulation
  - Optimizing material use
  - Non-service delivery tasks (where liability is less of a concern)

Actions to take:

- Take steps to be informed about the technology and its capabilities that may be relevant to you and your application(s) of it.
- Be aware that the technology is changing and improving. LLMs (eg, chat bots) are only the 'tip of the iceberg', and what we're seeing now is evolving.
- Be both curious and cautious; seek trustworthy & knowledgeable advisors and implementers to help manage risks.
- Consider participating in technology governance activities when/if they emerge & where appropriate for your needs.
- …

Questions:

Can we set up AI to cite its references? For example internally, may we see the places AI found its answers among the files that we internally loaded? This would be a good way to understand the effectiveness and limitations of AI.