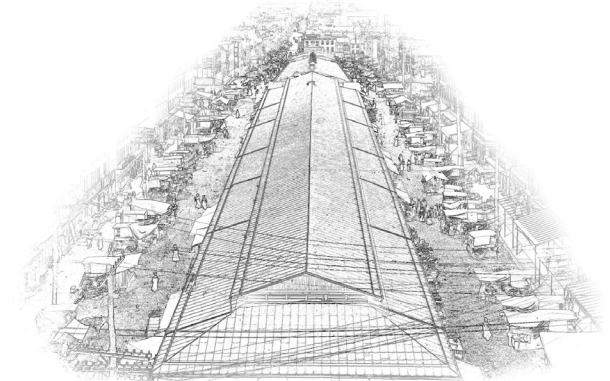


Construction Challenges in Retrofitting of Residential Buildings with Decarbonization Strategies (the Baltimore Case)

LBNL Seminar #3

5/15/2024

Schreiber Brothers Development



SCHREIBER
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DEVELOPMENT

Our work, and understanding the context

Schreiber Brothers is an anti-racist affordable housing company focused on bringing the greatest number of Baltimore's vacant buildings back into productive use as possible, along the lowest possible carbon pathway.

Context:

- 15,000 – 20,000 vacant buildings in Baltimore; massive mismatch of housing market economics, with outsized adverse public health outcomes
- Approx 80% of single-family housing stock is historic masonry (pre-1920), presenting a somewhat unique but critical decarbonization challenge
- The value of the finished product is well below the cost to build, especially since 2022-2023

Why vacant rowhouses?

Vacant, collapsing rowhouses are the #1 determinant of all economic, public health, demographic, and policy outcomes in Baltimore. It is the most urgent need facing the City, metastasizing throughout the entire human ecosystem. Homeownership is by far the highest priority, but rentals are a necessary “evil”.

Climate change, decarbonization, and environmental resilience are treated as an afterthought, even if it receives lip service.

The best we can do right now is try to lead the way and provide proof of concept (or, at least case studies).

Example: Historic Masonry Retrofits in Baltimore

2000 gross sf masonry retrofit:

- Minimum code-built hard cost to renovate a long-vacant rowhouse: \$250,000
- Additional financing and soft costs: \$50,000
- Profit margin (15-20%): \$45,000-60,000
- All-in cost: \$345,000-360,000
- After-renovation value: \$250,000-300,000 depending on the neighborhood
- Subsidy required to pencil out: \$60,000-95,000
- Maximum readily-available subsidy: \$50,000-60,000 per house at best
- Added cost to get to Zero-Energy-Ready: \$25,000-35,000 (meaning existing energy/environment subsidy is insufficient, and lenders won't count it as a source)

Example pt II: So how is it even possible?

- 1) Scale: spread increased costs across 10-20 houses (long lead time)
- 2) Single-Family Rentals: spread costs across 5+ years (necessary, but subsidy usually targets homeownership developments, and/or current homeowners)
- 3) Mixed-use: requires assembly of contiguous rowhouses (long lead time; difficult in the current legal landscape, but progress is being made)
- 4) Non-profit partnerships and/or very patient equity are critical
- 5) Bring down costs by developing experienced small- and mid-size GCs (there are maybe 3 or 4 in Baltimore who have any ZE familiarity)

The reality: Baltimore is not ready. But the need is urgent. We're in the fake it 'til you make it phase.

Zero-Energy Example: Multifamily Conversion



Zero-Energy Example: Multifamily Conversion

- 7 long-vacant rowhouses with no roofs; only front and two side walls in place
- Pursuing Passive House Certification and zero-energy; fully electric
- Minimized petroleum products (e.g., perlite for sub-slab insulation, dense-pack blown-in cellulose, reclaimed XPS insulation, sourcing locally if possible, etc)
- Early 2021 hard cost gross per sf estimate: \$200; 2024 Cost: \$300/sf+
- Important note: Only possible because our architect, energy modeler/CPHC, and MEP engineer are extremely experienced in primarily out-of-state projects.
- More than 1/3 of the capital stack is subsidy

Single-Family Retrofit: What if we scale down?



Single-Family Retrofit: What if we scale down?

Scale up, but not too much:

- Four 1,100 gross contiguous rowhouses
- Site selection: one completely collapsed inside; two have no roof but otherwise stable; one already framed
- Strategy: Experiment. Focus entirely on airtightness at a code-built level. Focus on the individual targets to set a baseline. Don't go for zero-energy.
- **Achieved 5 CFM with the following:**
 - Fully electric
 - Builder-grade vinyl double-hung windows; no high-performance doors
 - Fiberglass batt insulation to code (IECC 2018); didn't chase any leaks
 - Ductless minisplits, standard water heater; energy star appliances
- **What did we learn?** The baseline isn't as bad as it seems. We can optimize.

Current Project: 20 houses for homeownership



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Given our massive constraints in the face of a huge imminent need, we shifted our strategy:

- 1) Scale up to 20 houses to attract more subsidy due to greater impact (approximately 1/3 of the total capital stack)
- 2) Focus on optimization: nothing is sacred. We know our likely maximum sale price, and the amount of subsidy available. Build up to the maximum we can afford and squeeze in everything we can, rather than starting high and scaling back
- 3) Incorporate a “lease-purchase” model (formerly “lease-to-own”, but partner with nonprofit homeownership counseling org to support tenants as they build to homeownership). This can get about 5% closer to the 15-20% IRR target. Nonprofit partner can stomach a 5-10% IRR if absolutely necessary.

(CURRENTLY UNDER CONSTRUCTION)

Current Project: 20 houses for homeownership

Where did we land? Zero-Energy-Ready certification only

- 1) Optimized for airtightness above all else. Plus, the geometry wouldn't allow for deeper than 2x6 exterior walls. Could not avoid spray foam, despite trying for parge coat with blown-in cellulose. Had to optimize by making the primary air barrier closed-cell spray foam. Sub-optimal, but unavoidable in this case.
- 2) Central high-efficiency heat pump HVAC in lieu of minisplits
- 3) Heat pump water heater; Energy Star appliances/WaterSense fixtures
- 4) High-performance windows and doors; basement outside of therm. envelope
- 5) Roof geometry only allows for max 4 kW solar array; provided as an option for buyers who want to get closer to zero-energy

The result...

Current Project: 20 houses for homeownership

Modeled outcomes: (Assumes 1.0 ACH50 target, which has been achieved in recent similar projects)

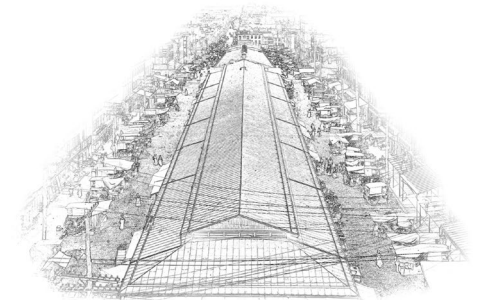
- 1) Approx 57% energy reduction over code-built
- 2) With solar, approximately 80% reduction over code-built
- 3) ZERH certification
- 4) 10% IRR, which is acceptable to non-profit partner for proof-of-concept effort

Resulting energy-related subsidy: jury is still out. State, City, and utility options are minimal or still coming together.

End result: we're not there yet, but we are starting to crack the code

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passivhausMAINE + retrofitMAINE

an open-source, collaborative project to monitor, document and analyze high-performance residential typologies, using passive house principles.

Developing a Culture of Efficiency

MAINE

- Population
 - Housing stock
 - Fuel sources
-
- Quite challenging weather



Buildings UP

The Buildings Upgrade Prize

AMERICAN
MADE
U.S. DEPARTMENT OF ENERGY



Construction Challenges in Home Electrification and Decarbonization Lawrence Berkeley National Lab

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May 15, 2024 2:00pm EST

CHALLENGES:

1. CULTURAL/emotional/bandwidth
2. FUNDING/ disparate/siloed/restricted
3. WORKFORCE/aging/mostly men

CULTURAL

2. Years of ingenuity

People from Maine were upcycling before it was a Pinterest trend. We pickle watermelon rinds instead of composting them and turn junk into Etsy gems. This stems from our insatiable need for sufficient combined with the impressions from our thrifty forefathers who work hard and pride ourselves on our independence. Mainers are known to “git ‘er done” on any budget, in any situation — whether it’s gerry-rigging a car repair or improvising a home remodel prepared, usually with duct tape and vinegar.

3. Roughing it

Mainers take a masochistic pride in roughing it, working on a budget, and being forced to find an original way to tackle a problem. Sure, hiring someone to dig a well would make everyday life easier, but why not see how long we can make the rain cistern/hauling in water situation work? It’s not so much a matter of finance as it is a matter of pride. Even urban Mainers are well-trained in the art of survival, and we love showing it off. So much so that adversity actually makes us giddy. We perk up when a storm hits, or when the car breaks down.

4. Our heritage

Mainers can get weirdly hung up on the “How Maine are you?” competition. Questions such as, were you actually born in Maine? And what about your parents? Grandparents? These petty distinctions even come into play on the city/town level, with community bonds passing from generation to generation as people grow up with the grandkids of their grandparents’ friends. Things can get dicey when hometown loyalties are ruffled, and locals draw an invisible line to show outsiders their place.

Frugal Yankees Do Almost Anything To Save a Buck



Capitalise on

- Frugality,
- Tribalism,
- Territorialism,
- Independence,
- Self Sufficiency

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FUNDING

But what unconventional add ons might be available??

(suggestions gratefully accepted)

Funding Available in the State of Maine

Project Element	Funding Source(s)
Weatherization	Federal Weatherization Assistance Program
	Efficiency Maine Rebates
	Federal HOMES Program
	Federal 25C Tax Credit
HVAC	Federal HEEHR Program
	Federal HOMES Program
	Federal 25C Tax Credit
	Efficiency Maine Rebates
	Maine State Housing Authority Program
Electrical Rewiring	Federal HEEHR Program
Healthy Home Investments	USDA Housing Repair Loans and Grants
	Maine State Housing Authority Program (Lead Paint & Arsenic)
Solar Installation	Federal Residential Clean Energy Credit
	Efficiency Maine Rebates
Roof Repair	USDA Housing Repair Loans and Grants
	Maine State Housing Authority Program

FREEPORTERS

	<i>Fed tax credit 25c</i>	USDA GRANT	<i>State incentives</i>	<i>Town Incentives</i>	TOTAL INCENTIVES	LOANS	
health + safety		\$10,000			\$10,000	\$40,000	USDA
heatpumps	\$2,000		\$8,000	\$1,200	\$9,200		
electric panel	\$600				\$600		
insulation/airseal	\$1,200		\$8,000	\$2,300	\$10,300		
energy audit	\$150			\$300	\$450		
Heatpump water heater			free	\$400 (install)	400		
	\$3,950 tax credit				\$30,950 TOTAL	\$40,000 LOAN TOTAL	\$70,950 Potential total working budget

taxable income of about \$40k = \$4k

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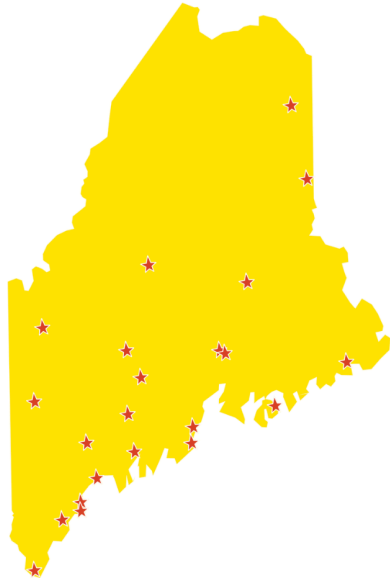
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WORKFORCE

Our state-wide training program is bringing passive house skills and knowledge to people all over Maine.



UPCOMING TRAININGS

- York
- Portland
- Bar Harbor
- Augusta
- Freeport
- Lincoln
- Freeport
- Wiscasset
- Saco
- Bethel
- Lewiston
- Freeport
- Camden
- Greenville
- Houlton
- Presque Isle

PAST TRAININGS

- Fairfield
- Portland
- Freeport
- Saco
- Camden
- South Portland
- Augusta
- Bangor
- Brewer
- Machias
- Bethel
- Rockland
- Lincoln



Our next \$25 training is in Machias
Full-day training on MUBEC and passive building principles
April 14 | 9a - 3p | UMaine Machias



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1. CULTURAL/emotional/bandwidth.....
2. FUNDING/ disparate/siloed/restricted
3. WORKFORCE/aging/mostly men



POLICY

Across New England the income disparities play out in disparate ways, but looking at energy poverty we see the case for Resilient Retrofits as a path for a just transition, as required by Federal programs IRA + BIL.

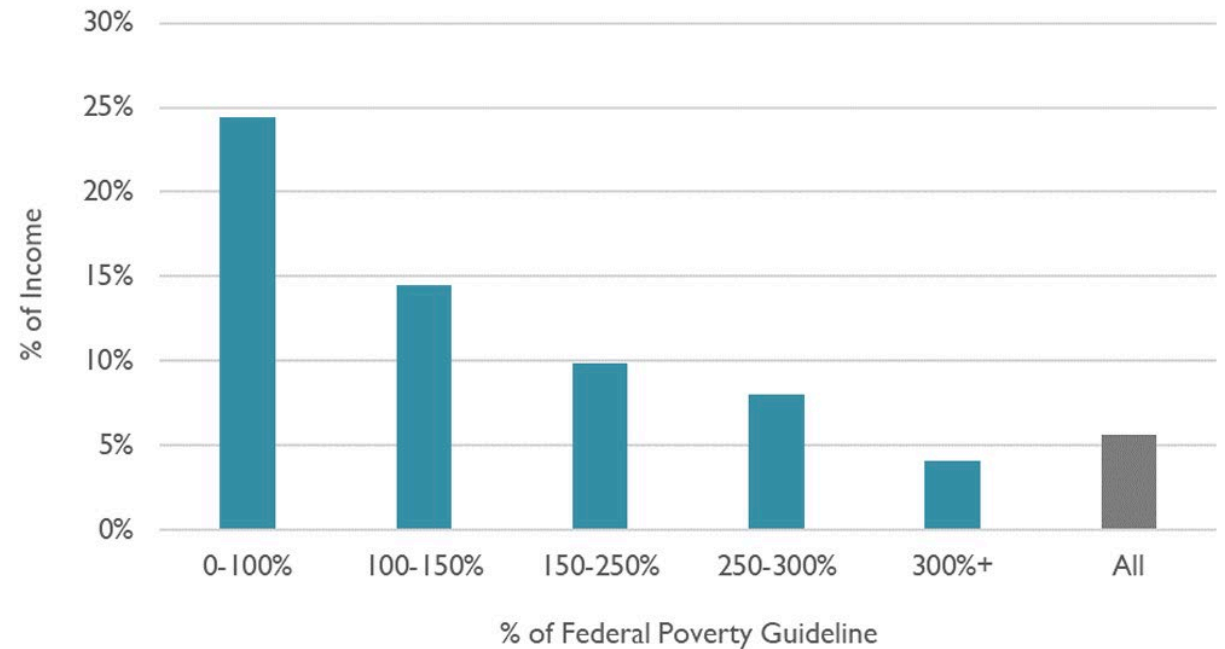
Income inequality : Resilience in extreme weather

Pushback: *“taking care of the poor will take too long, we are in a crisis.”*

followed by

“or don’t you care about Climate Crisis?”

Figure 6. Maine average household home energy burden by income level



Thank you!



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