BUILDINGENERGY BOSTON

Pretty Good Reno:
The Greenest House Is an Existing House

Christopher Briley (BRIBURN)
Dan Kolbert (Kolbert Building)
Emily Mottram (Mottram Architecture)

Curated by Kurt Carlson (Websterbrook Energy)

Northeast Sustainable Energy Association (NESEA) | March 19, 2024

In the Northeast, climate's a fright

Heat waves and floods, day and night.

With buildings we fiddle,

But the truth's rather brittle,

As the planet succumbs to its plight.

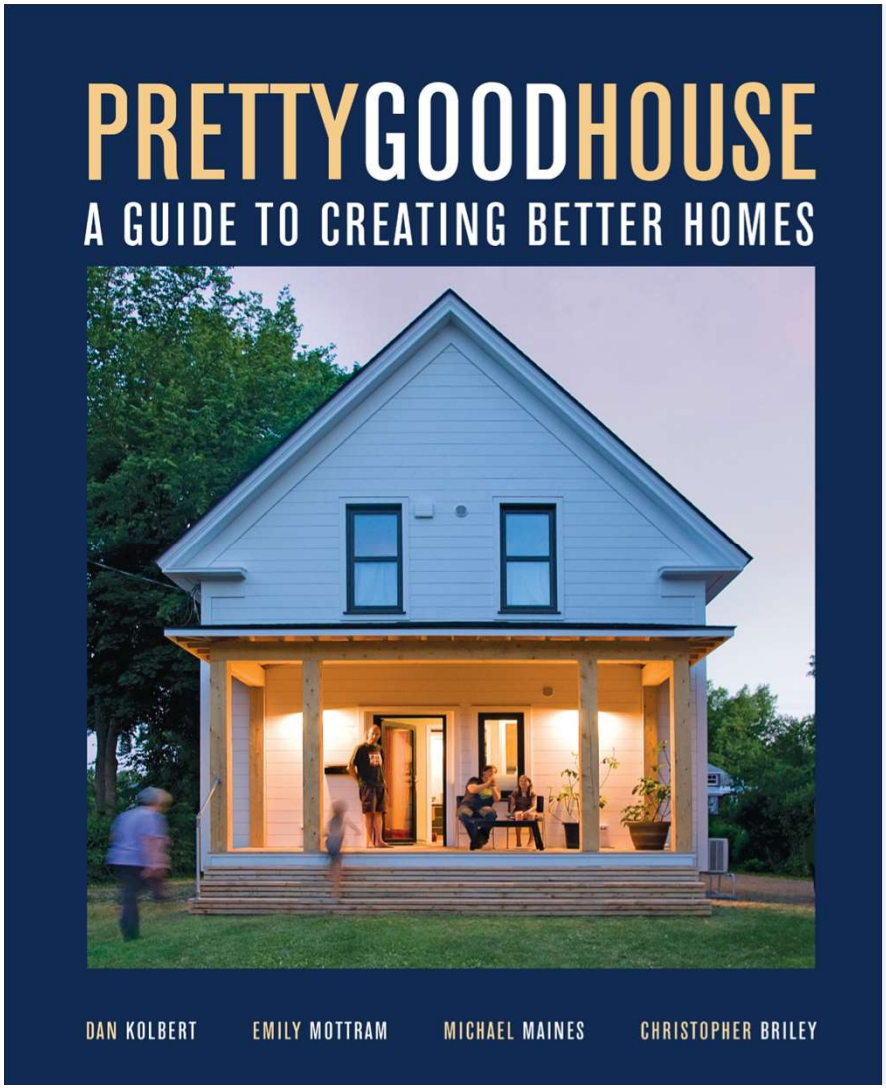
$500K Sand Dune Designed to Protect Coastal Homes Washes Away in Just 3 Days

| CRUMBLED |

Dan Ladden-Hall News Correspondent

Published Mar. 11, 2024 8:06AM EDT

WCVB Channel 5 Boston/YouTube



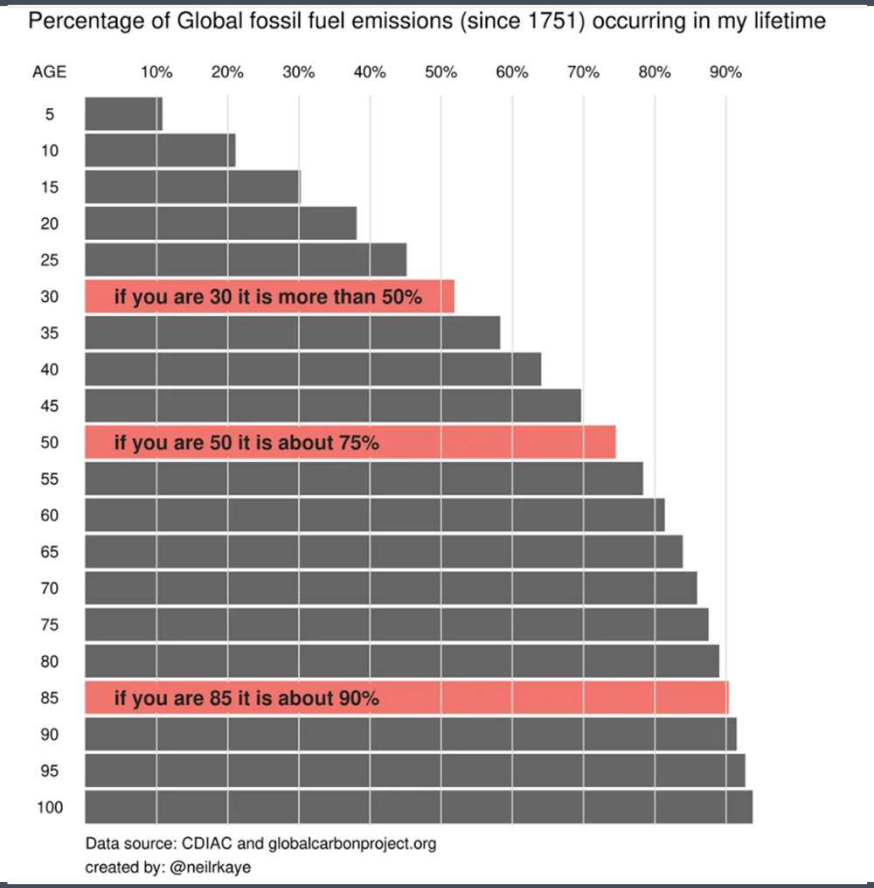
★☆☆☆☆ **Not good**

Reviewed in the United States on September 14, 2022

Verified Purchase

I'm surprised how highly this book is rating. In the opener they lament that most people buy existing homes and how environmentally unfriendly home-building is but punt because "it's hard to describe rules of renovation." This might be forgiven if the rest of the content were stout, but the designs and built pictures all look pretty childish with superlative writing about how pretty good they are.

So why isn't this book Pretty Good Reno?


Percentage of Global fossil fuel emissions (since 1751) occurring in my lifetime
AGE
10%
20%
30%
40%
50%
60%
70%
80%
90%
5
10
15
20
25
30
if you are 30 it is more than 50%
35
40
45
50
if you are 50 it is about 75%
55
60
65
70
75
80
85
if you are 85 it is about 90%
90
95
100
Data source: CDIAC and globalcarbonproject.org
created by: @neilrkaye

Forget downsizing: Canadian seniors staying in large houses well into their 80s, due in part to lack of options

SAIRA PEESKER
SPECIAL TO THE GLOBE AND MAIL
PUBLISHED FEBRUARY 11, 2024
UPDATED FEBRUARY 12, 2024

The population in the 40-80 yr age bracket generally has the money and ambition to do renovation work prior to moving on to assisted living.

Inflation Reduction Act/Bipartisan Infrastructure Law

$3.5B for Weatherization Assistance Program

$7B for EV battery supply chain

$21B for "climate smart farming" including increased soil carbon storage

tax credits for heat pumps, rooftop solar, EV's

$3 billion Environmental and Climate Justice Block Grants

$27 billion Greenhouse Gas Reduction Fund

Clean energy workforce development tax credits

Source: US DOE - *The Inflation Reduction Act Drives Significant Emissions Reductions and Positions America to Reach Our Climate Goals*

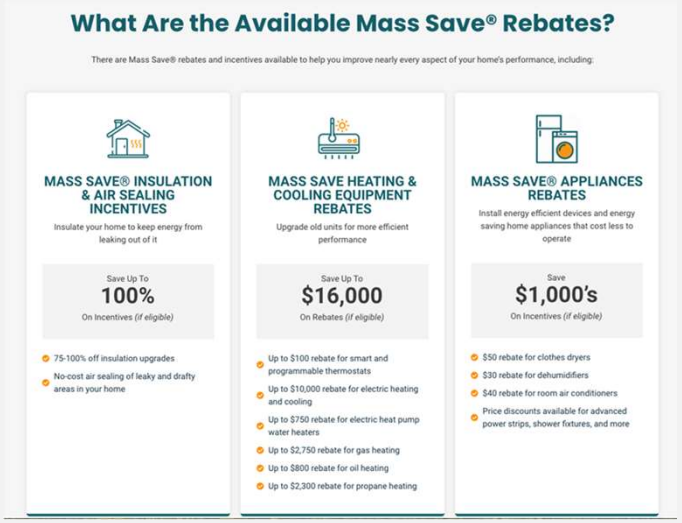
Efficiency Maine

- Low interest home energy loans
- Weatherization rebates
- Switching heating / DHW equipment

	Upgrade	Federal Tax Credit	Efficiency Maine Low Income Incentives	Efficiency Maine Moderate Income Incentives	Efficiency Maine Any Income Incentives
Water Heaters	**Heat Pump Water Heater**	**$2,000****	**free**	**$1,050**	**$1,050**
Water Heaters	200+ amp circuit panel upgrade	**$600***			
Heat Pumps	**Heat Pumps**	**$2,000****	**$8,000**	**$6,000**	**$4,000**
Heat Pumps	200+ amp circuit panel upgrade	**$600***			
Weatherization	**Insulation**	**$1,200***	**$8,000**	**$6,000**	**$4,000**
Weatherization	Energy Audit	**$150***			
Weatherization	Windows	**$600***			
Weatherization	Exterior Doors	**$250/door, $500 total***			
Electric Vehicles	**EVs**	**$7,500**	**$7,500**	**$3,500**	**$2,000**
Electric Vehicles	Installation of EV charger	**$1,000**			
Demand Management	**Managed Charging for EVs**		**$50/yr**	**$50/yr**	**$50/yr**
Demand Management	**Managed Charging/Use of Home Batteries**		**$100/kW/yr**	**$100/kW/yr**	**$100/kW/yr**
Appliances	**Clothes Washers**		**$50**	**$50**	**$50**
Pellet / Wood	**Boiler/Furnace**	**$2,000****	**$6,000**	**$6,000**	**$6,000**
Pellet / Wood	**Stove**	**$2,000****			
Other	**ECM Circulator Pumps**		**$75-$250**	**$75-$250**	**$75-$250**
Other	**Geothermal**	**30% no cap**	**$3,000**	**$3,000**	**$3,000**
Other	Installation of Battery	**30% no cap**			
Other	**Solar**	**30% no cap**			

* 30% of net cost after rebate up to $1,200/year shared maximum. **Click here for details.**

** 30% of net cost after rebate up to $2,000/year shared maximum. **Click here for details.**



Mass Saves

- Insulation and Air Sealing Incentives
- Switching heating / cooling equipment
- Switching appliances

Preliminary data release date: March 2022
Final data release date: March 2023

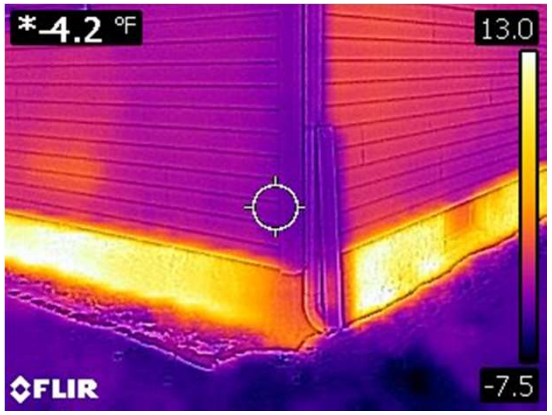
Table HC2.3 Structural and geographic characteristics of U.S. homes, by year of construction, 2020

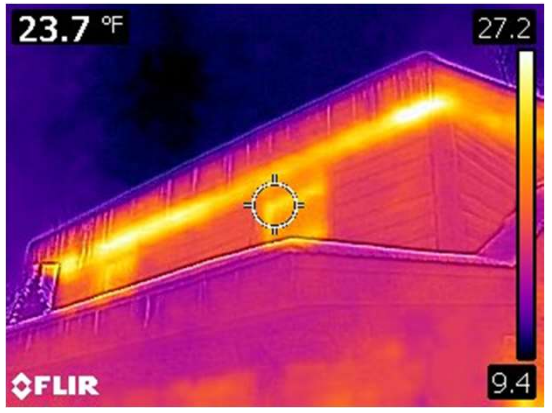
	Number of housing units (million)									
		Year of construction								
	Total U.S.[a]	Before 1950	1950 to 1959	1960 to 1969	1970 to 1979	1980 to 1989	1990 to 1999	2000 to 2009	2010 to 2015	2016 to 2020
All homes	123.53	16%	10%	10%	15%	13%	14%	13%	4%	4%
Census region and division										
Northeast	21.92	33%	14%	12%	12%	10%	8%	7%	3%	2%
Midwest	27.04	23%	12%	11%	15%	10%	13%	11%	3%	3%
South	46.84	8%	8%	9%	15%	16%	17%	17%	6%	5%
West	27.72	12%	10%	11%	17%	14%	15%	14%	4%	4%

Northeast has the oldest percentage of housing stock

SOURCE: *US ENERGY INFORMATION ADMINISTRATION*

New construction requires the arrogance to think you know everything in advance





RENO REQUIRES THE HUMILITY TO KNOW THAT THE HOUSE HAS SURVIVED JUST FINE WITHOUT YOU.

Existing 1970's 2,400 SF single floor home – 148 MBtu's/yr heating vs

New 2022 PGH, 2,400SF single floor home – 10 MBtu's/yr heating

BEAM BUILDING EMISSIONS ACCOUNTING FOR MATERIALS

BUILDERS FOR CLIMATE ACTION

Input Units:	Input Legend:
Imperial	Required for saving projects
	Used for materials calculations
	Non-essential
	Read-only

Project Information

Project Name	PGR
Designer	
Engineer	
Builder / Developer	
Development Project	
Address	
City	Anytown
Province / State (Can./US only)	
Country	United States
Building Type	Single Detached House
Construction Type	New Construction
Project Development Stage	Construction Complete

Construction Year	2024	
Number of Bedrooms	3	
Stories Above Grade	2	
Total Floor Area	2000	ft²
Above Grade Conditioned Area	2000	ft²
Below Grade Conditioned Area		ft²

Basic Instructions

1. Fill in this sheet according to the Input Legend above.

Tip: If your plans are PDFs, you might like to use this free tool to help take measurements from them:

PDFTron

2. Specify materials in the section sheets listed along the bottom of the window, from "Footings & Slabs" to "Garage." The sequence is not important.

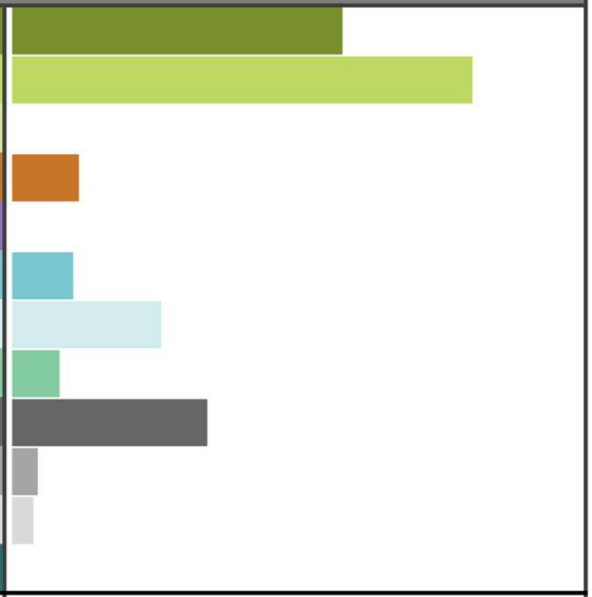
3. Review material selections in the REVIEW sheet.

4. View material carbon results in the RESULTS sheet.

For full instructions and more, see the
BEAM User's Guide

MATERIAL CARBON EMISSIONS BY SECTION

Footings & Slabs	5,834 kg CO_2e
Foundation Walls	8,129 kg CO_2e
Structural Elements	0 kg CO_2e
Exterior Walls	1,180 kg CO_2e
Party Walls	0 kg CO_2e
Exterior Wall Cladding	1,080 kg CO_2e
Windows	2,638 kg CO_2e
Interior Walls	839 kg CO_2e
Floors	3,447 kg CO_2e
Ceilings	453 kg CO_2e
Roof	377 kg CO_2e
Garage	0 kg CO_2e
NET TOTAL	**23,977** kg CO_2e

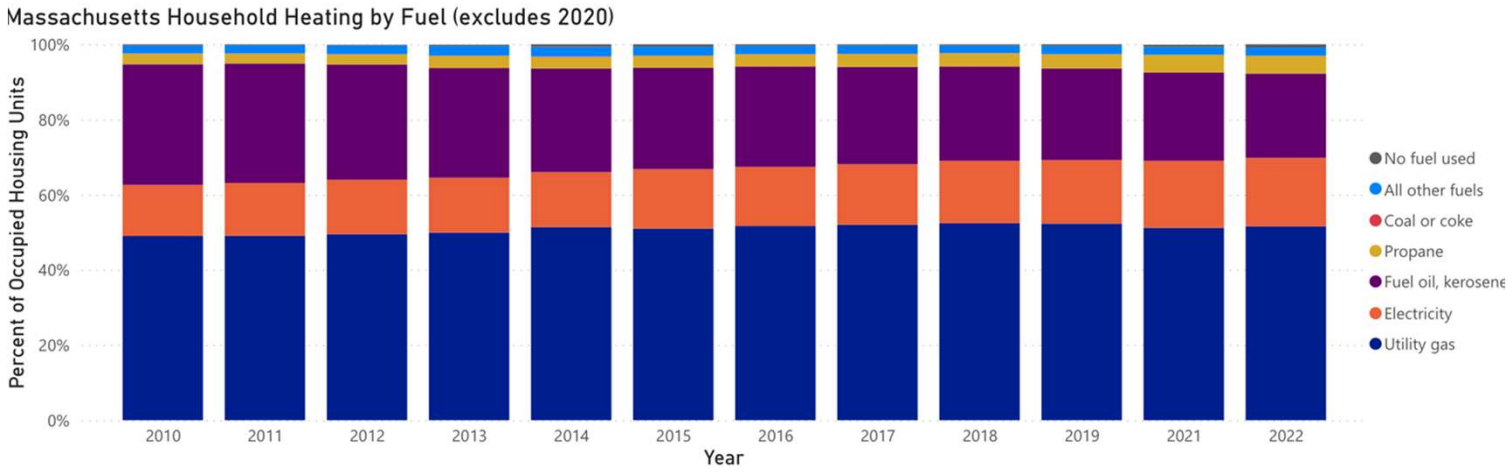


HIGHEST CARBON MATERIAL APPLICATIONS

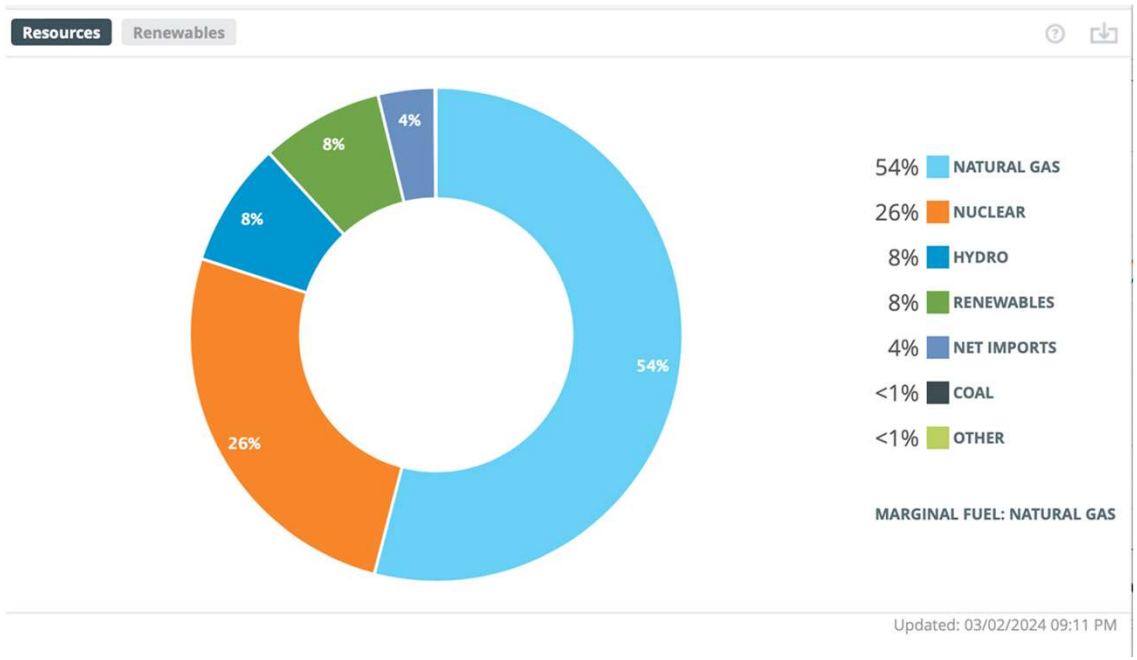
SECTION	kg CO_2e	% Total	MATERIAL
Foundation Walls	6,079	25%	Concrete - 0-2500 psi, Standard mix / NRMCA [In
Footings & Slabs	2,923	12%	Concrete - 0-2500 psi, Standard mix / NRMCA [In
Windows	2,638	11%	Window - double-glazed / Wood frame, aluminun
Floors	1,754	7%	Hardwood flooring / Action Floor Systems / 3/4"
Foundation Walls	1,626	7%	EPS foam board / R 4.0/inch avg [BEAM Avg | US
Footings & Slabs	1,013	4%	Concrete - 0-2500 psi, Standard mix / NRMCA [In
Floors	859	4%	OSB sheathing / 3/4" / AWC & CWC [Industry Avg
Footings & Slabs	782	3%	EPS foam board / R 4.0/inch avg [BEAM Avg | US
Roof	663	3%	Asphalt Shingles [Industry Avg | US & CA]
Interior Walls	652	3%	Drywall 1/2" [BEAM Avg | US & CA]

LOWEST CARBON MATERIAL APPLICATIONS

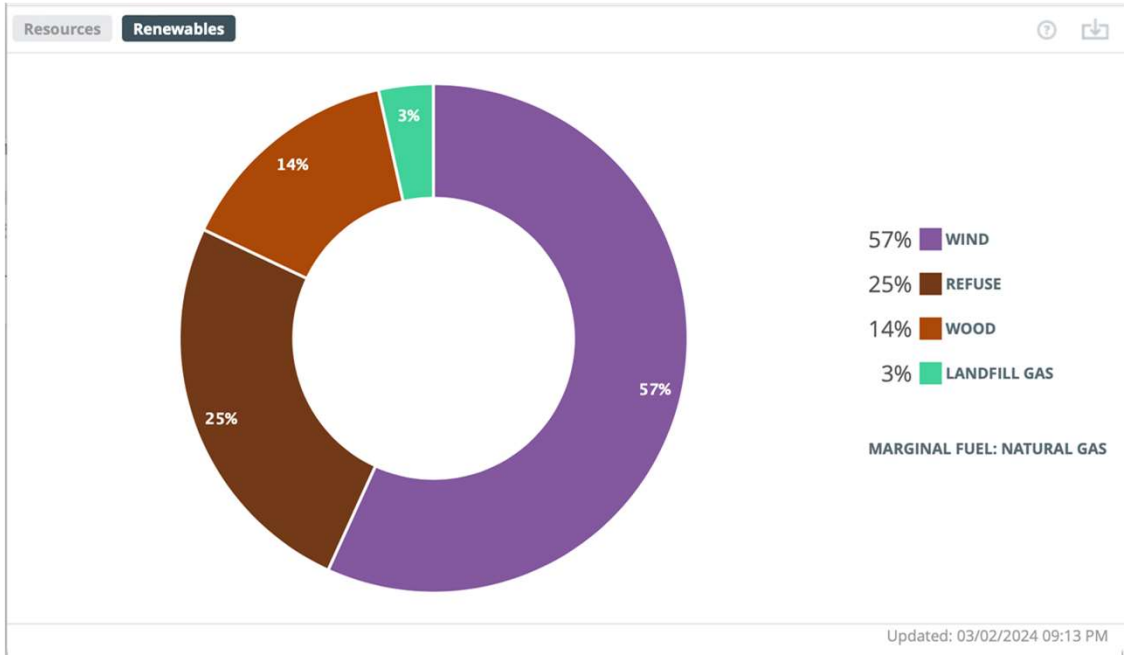
SECTION	kg CO_2e	MATERIAL
Roof	-1,029	Cellulose / loose fill / R 3.7/inch / CIMA [Industr
Structural Elements	0	Wood / SPF / Lumber by volume / AWC & CWC [I
Exterior Walls	0	Fiberglass batt / CertainTeed / Sustainable Insul



https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-metrics

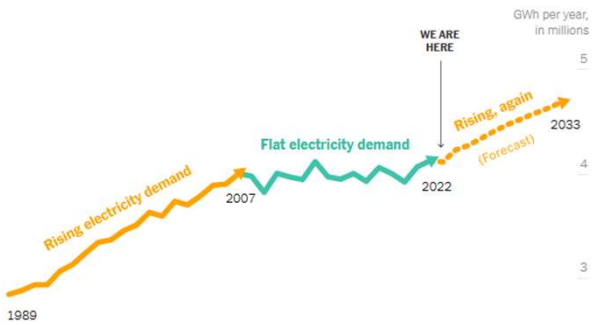


Source: ISO New England website



Source: ISO New England website

The New York Times



A New Surge in Power Use Is Threatening U.S. Climate Goals

A boom in data centers and factories is straining electric grids and propping up fossil fuels.

By Brad Plumer and Nadja Popovich March 14, 2024

BUSINESS

Amid explosive demand, America is running out of power

AI and the boom in clean-tech manufacturing are pushing America's power grid to the brink. Utilities can't keep up.

By Evan Halper

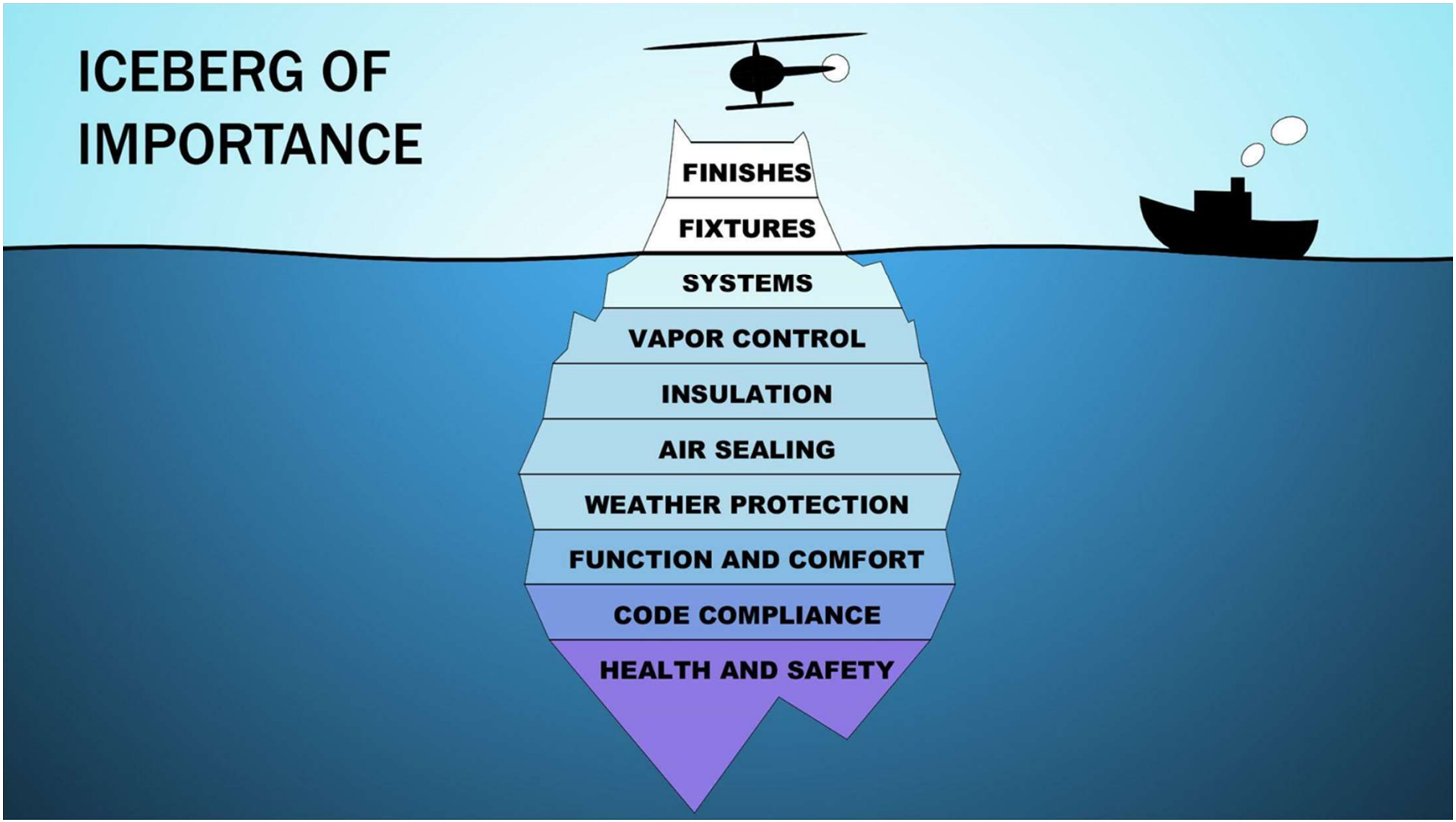
March 7, 2024 at 6:06 a.m. EST

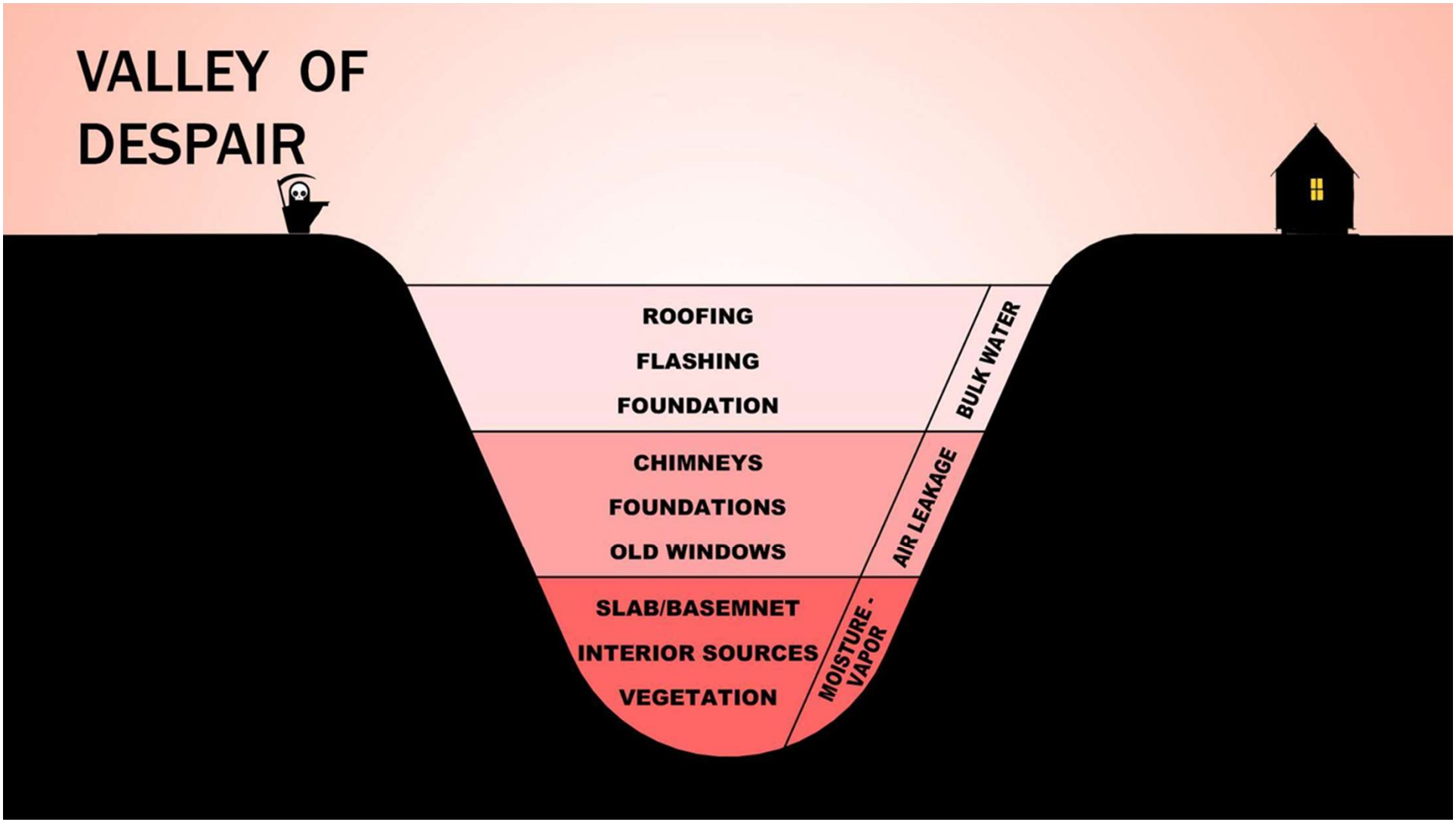
A major factor behind the skyrocketing demand is the rapid innovation in artificial intelligence, which is driving the construction of large warehouses of computing infrastructure that require exponentially more power than traditional data centers. AI is also part of a huge scale-up of cloud computing. Tech firms like Amazon, Apple, Google, Meta and Microsoft are scouring the nation for sites for new data centers, and many lesser-known firms are also on the hunt.

The proliferation of crypto-mining, in which currencies like bitcoin are transacted and minted, is also driving data center growth. It is all putting new pressures on an overtaxed grid — the network of transmission lines and power stations that move electricity around the country. Bottlenecks are mounting, leaving both new generators of energy, particularly clean energy, and large consumers facing growing wait times for hookups.

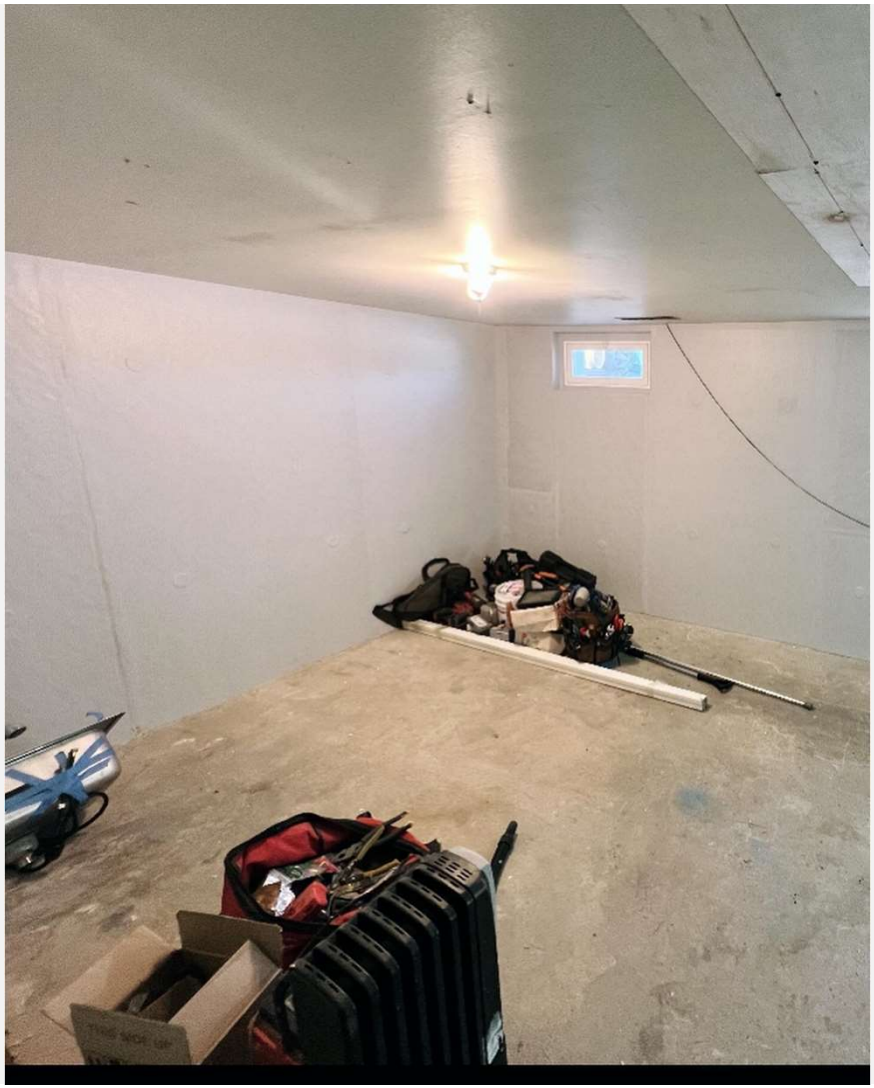
THE GRID IS ALREADY STRESSED

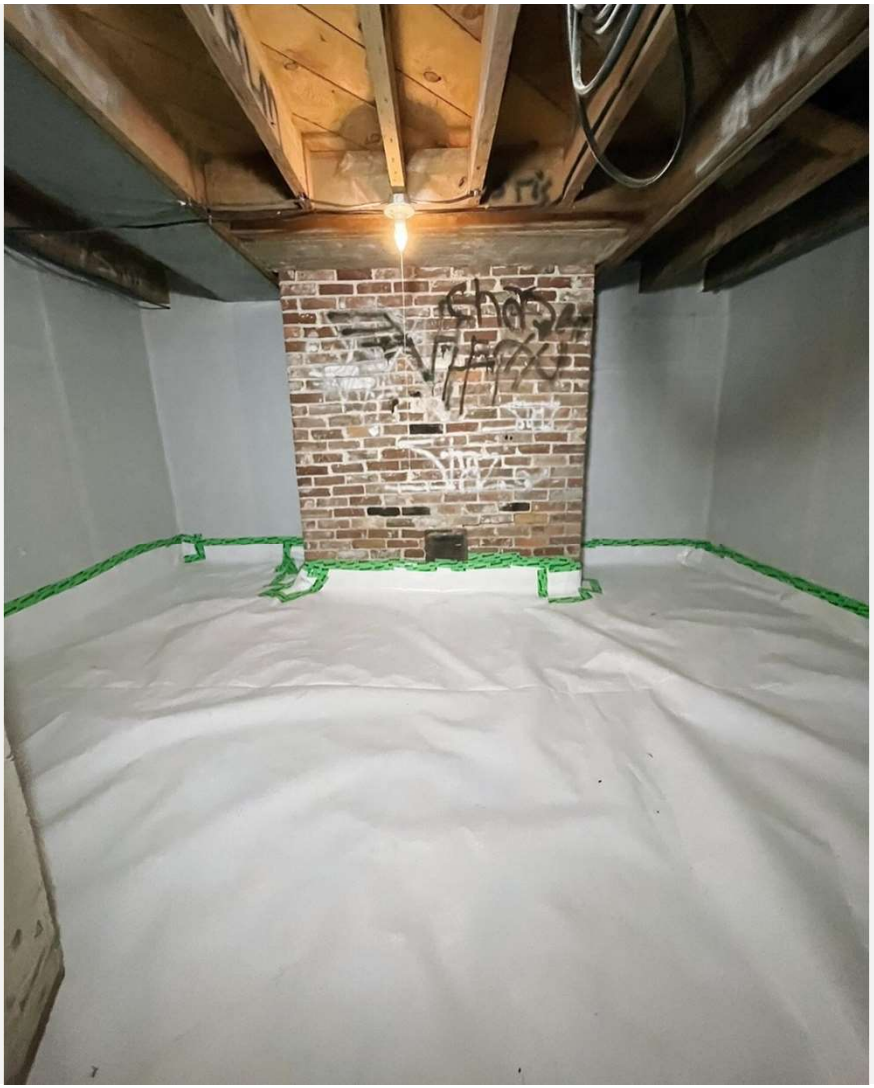
PYRAMID OF IMPORTANCE


ICEBERG OF IMPORTANCE
FINISHES
FIXTURES
SYSTEMS
VAPOR CONTROL
INSULATION
AIR SEALING
WEATHER PROTECTION
FUNCTION AND COMFORT
CODE COMPLIANCE
HEALTH AND SAFETY

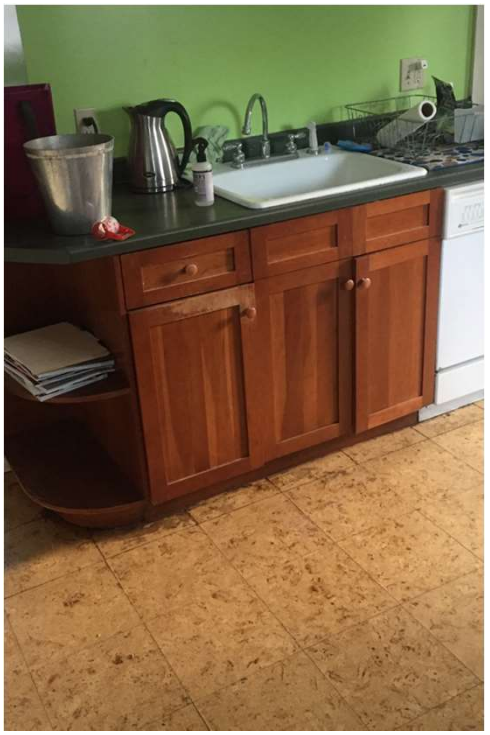

VALLEY OF DESPAIR
ROOFING
FLASHING
FOUNDATION
CHIMNEYS
FOUNDATIONS
OLD WINDOWS
SLAB/BASEMNET
INTERIOR SOURCES
VEGETATION
BULK WATER
AIR LEAKAGE
MOISTURE - VAPOR

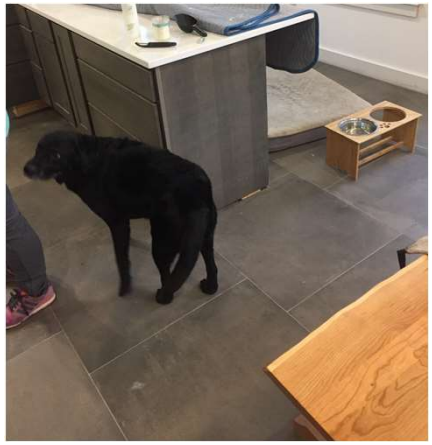
CASE STUDIES



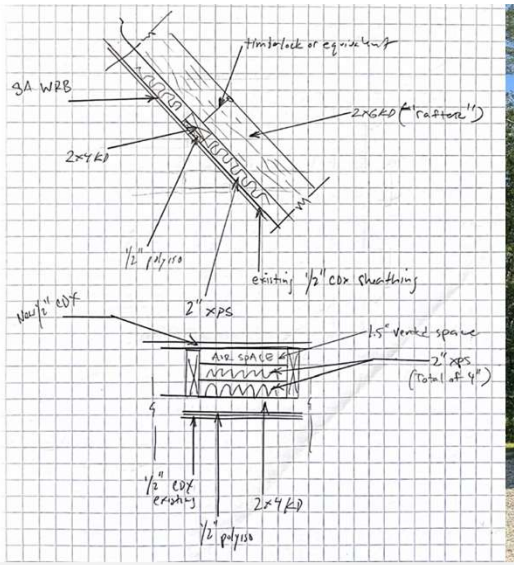



96-GRAY





OUTSULATION - APPROACHING FROM THE EXTERIOR WHEN THE ROOF NEEDS TO BE REPLACED



APPROACH IT FROM THE INTERIOR WHEN DOING OTHER RENOVATIONS

Pre-construction Air Infiltration: 5.5 ACH - Post-construction: 0.62 ACH

CASE STUDY - DER

Wet Basements + Kitchen Salvage

- Exterior WRB
- Exterior Insulation
- Rainscreen
- New Wood Siding
- Replace Heating with Heat Pumps
- Dense packed cellulose in most wall cavities
- Water management in basement
- Solar

CASE STUDY - Slow DER - Maintenance with Carbon in mind

EXISTING HOME OPERATIONAL CARBON IMPACT

1977 home – with minor renovations. Foil faced fiberglass in basement ceiling, exterior walls, and attic.

Blower door test: 8.5 ACH

Site EUI – 65.7 kBtu/ft2

2,400 SF

Coastal Maine

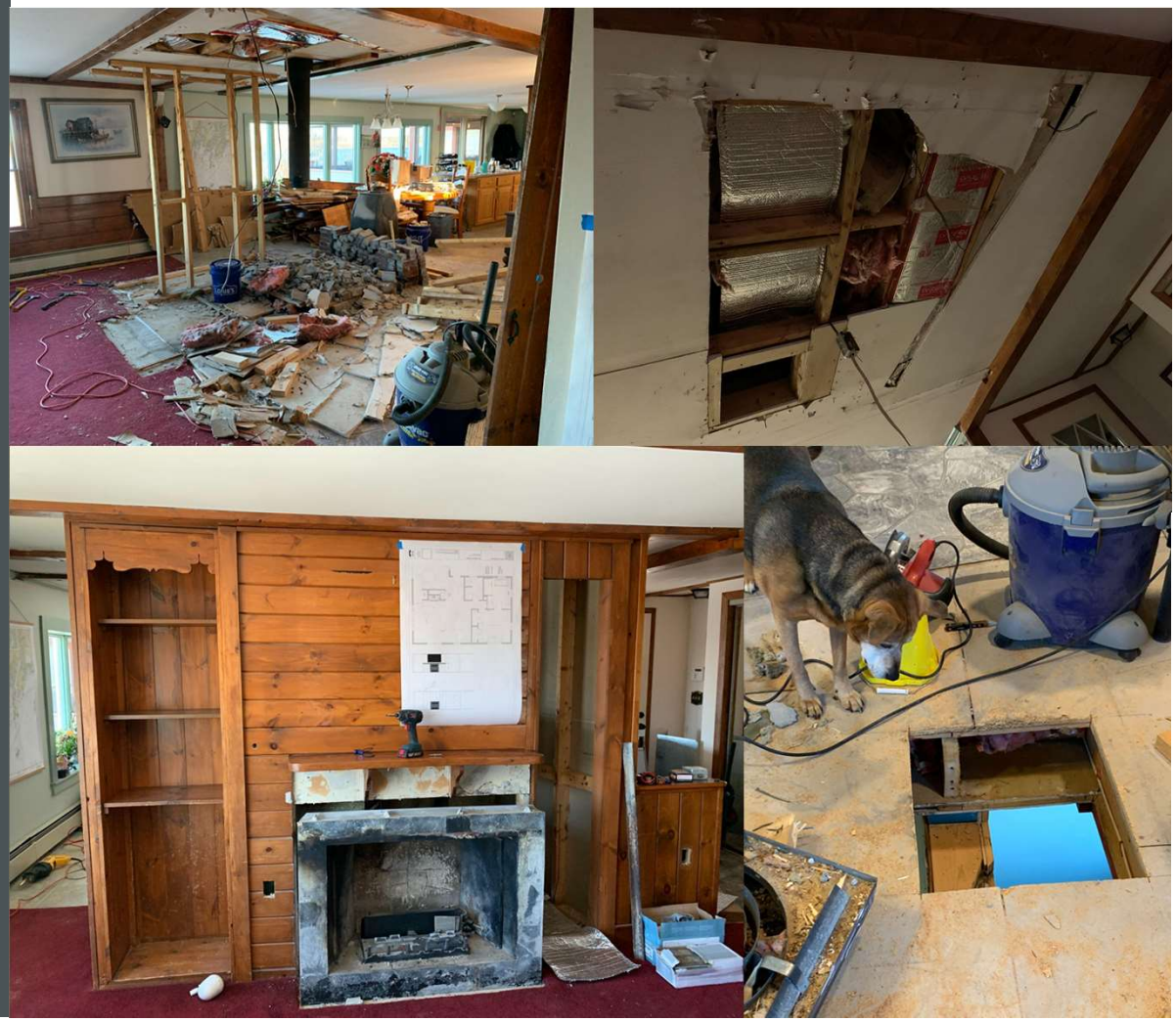
Single story with walkout basement

SWAP TO HEAT PUMPS AND Heat Pump DHW

Site EUI - 36.3 kBtu/ft2

AIR SEAL + EXTERIOR INSULATION

Site EUI 28.5 kBtu/ft2



ADD BASEMENT INSULATION + ATTIC INSULATION

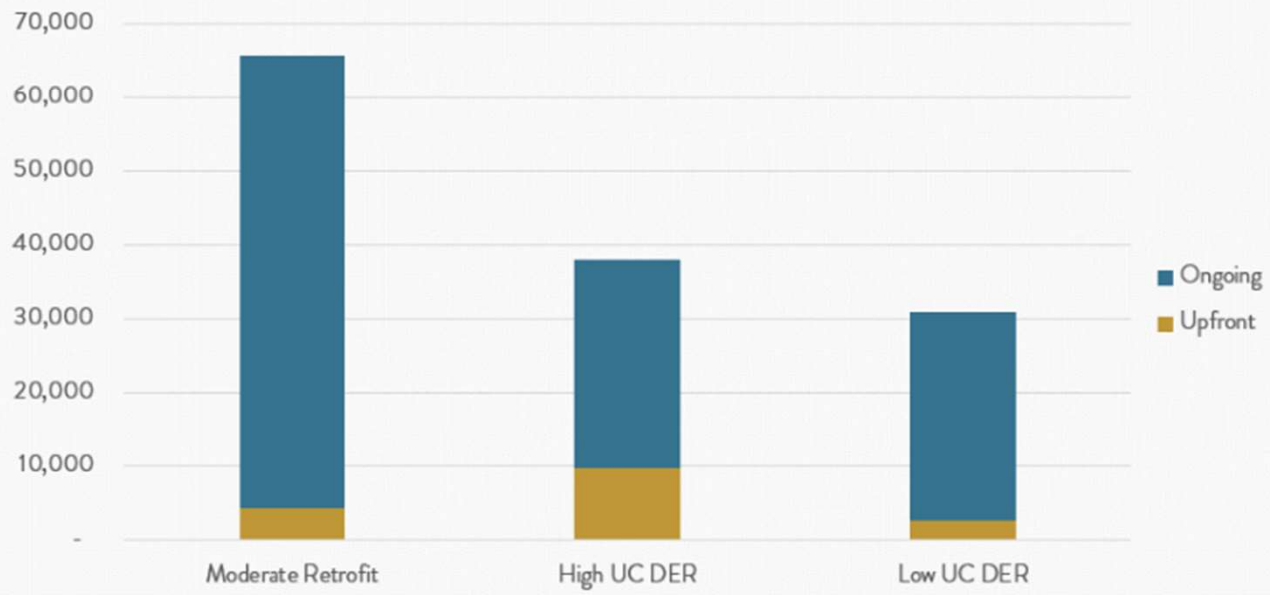
Site EUI - 23.3 kBtu/ft2

MER Performance Compared to Hypothetical DER Performance

	Pre-Project (Measured)	Post-Project (Measured)	Hypothetical DER (Modeled)
Air Leakage	13.5 ACH50	4.9 ACH50	1.0 ACH50
Heating Load	67 kbtu/hr	32 kbtu/hr	13 kbtu/hr
Annual Site Energy	195 MMBtu	42 MMBtu	18 MMBtu*
Energy Use Intensity	85 kBtu/sf	18 kBtu/sf	7.9 kBtu/sf*

**modeled energy use updated*

Carbon Emissions 2020-2050: MER Compared to DERs*



*DER operating emissions updated

BUILDINGENERGY BOSTON

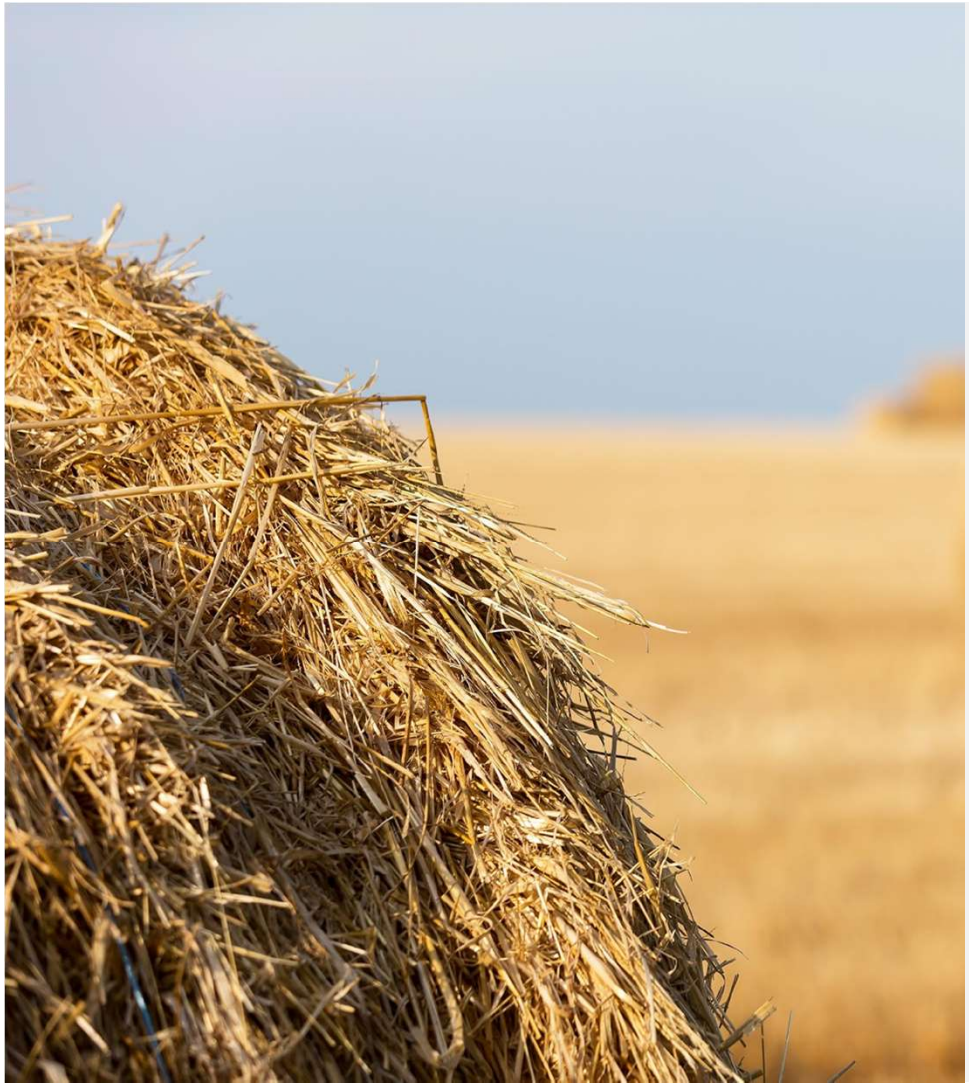
The Deep Energy Retrofit Controversy Revisited

Michael Hindle (Passive to Positive)
Rachel White (Byggmeister)

Curated by Meg Howard (MassCEC)

Northeast Sustainable Energy Association (NESEA) | March 19, 2024

Today, 4:00 PM, Harbor I



- Carbon storage with new materials
  - New materials
    - Blown in
    - Wood fiber exterior
    - FSC (local, etc)
- Retain Carbon in existing material (reuse, retain, salvage)
  - Re-use/retain materials
  - Salvage over replace
- Avoid high-carbon materials/solutions
- Use a Carbon Calculator (BEAM - flooring, cabinets, counters? Siding?)