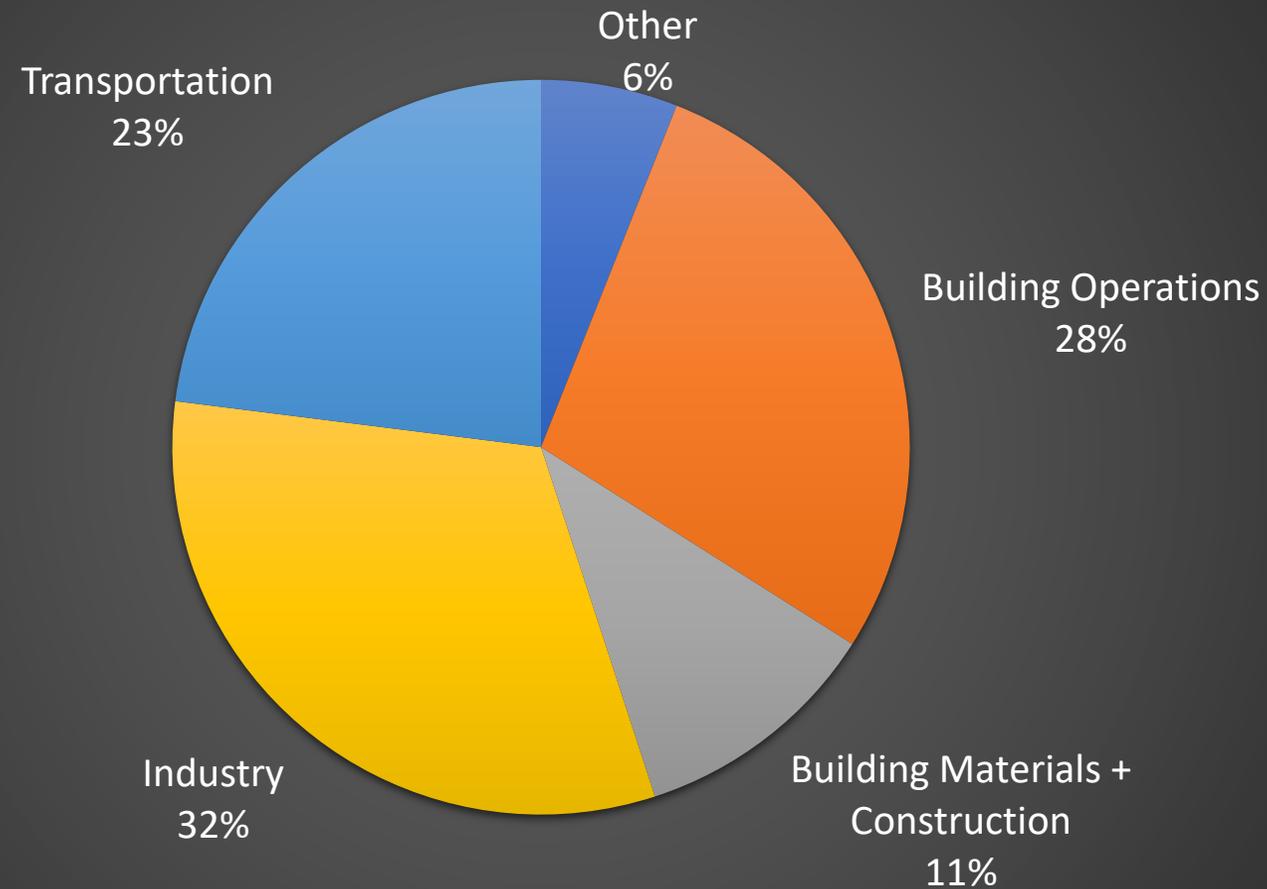


Pretty Good House 2.0:
Practical, Low-Carbon, High-
Performance Construction

We must reduce greenhouse gas emissions by 45% before 2030 and 100% before 2050 to avoid irreversible climate disruption.

UN IPCC 2018

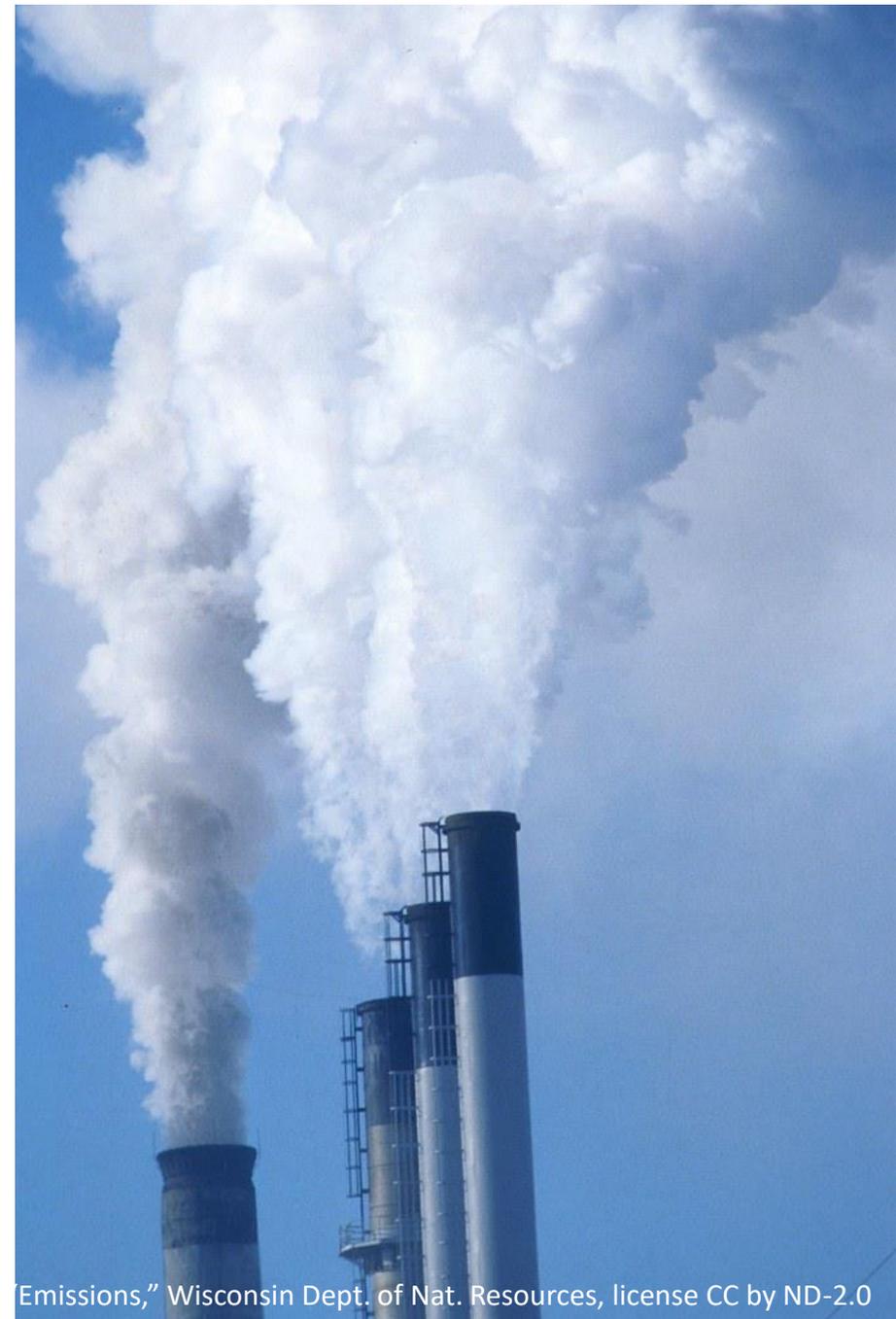
Global CO2e Emissions by Sector



Data source: Global Alliance for Buildings and Construction 2018 Global Status Report + Architecture2030.org

Operational Carbon Emissions

The greenhouse gas emissions resulting from heating, cooling, ventilation, appliances, and other plug loads



What is embodied carbon?

CO²e: a measure of carbon footprint--the global warming emissions created over a product's life cycle.



The Ore Mine of Sishen by rogiro, license CC by NC-ND 2.0

What is embodied carbon?



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What is embodied carbon?



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What is embodied carbon?



Henri de Fox, license CC



Construction is everywhere, JamieSanford, license CC by NC 2.0



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What is embodied carbon?



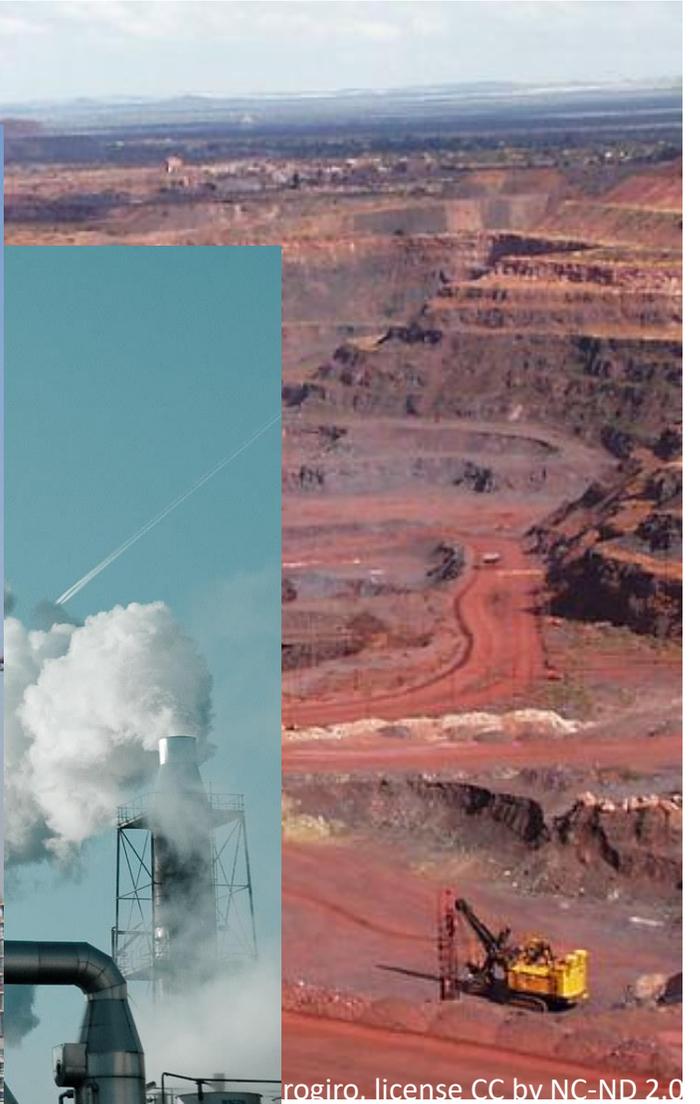
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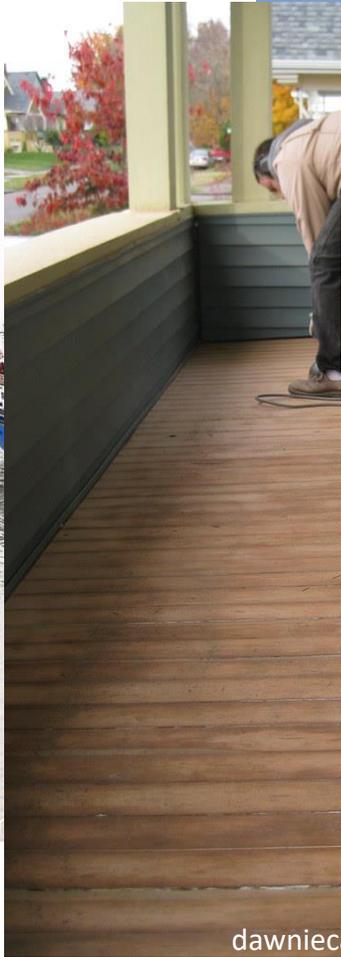


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What is embodied carbon?



Henr

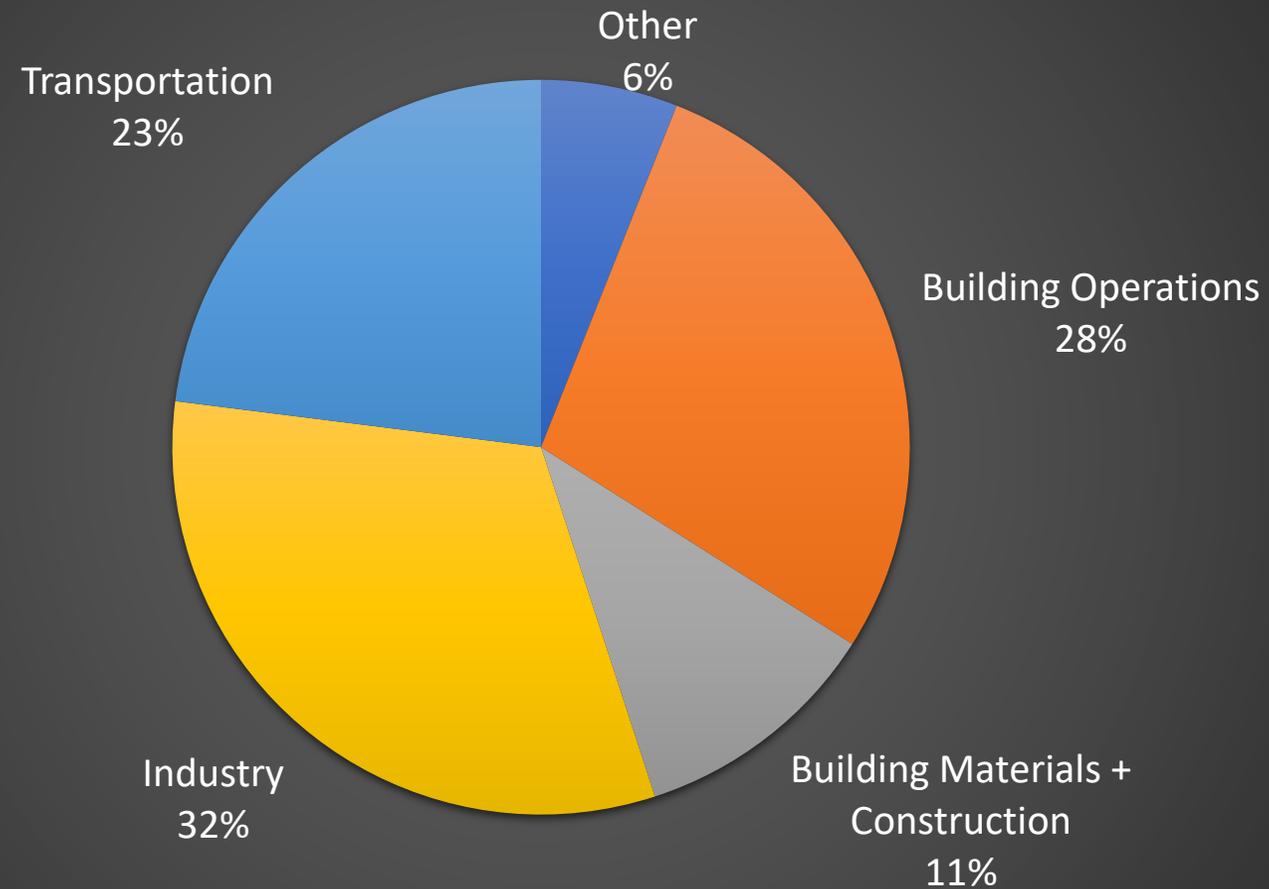
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A 2.0

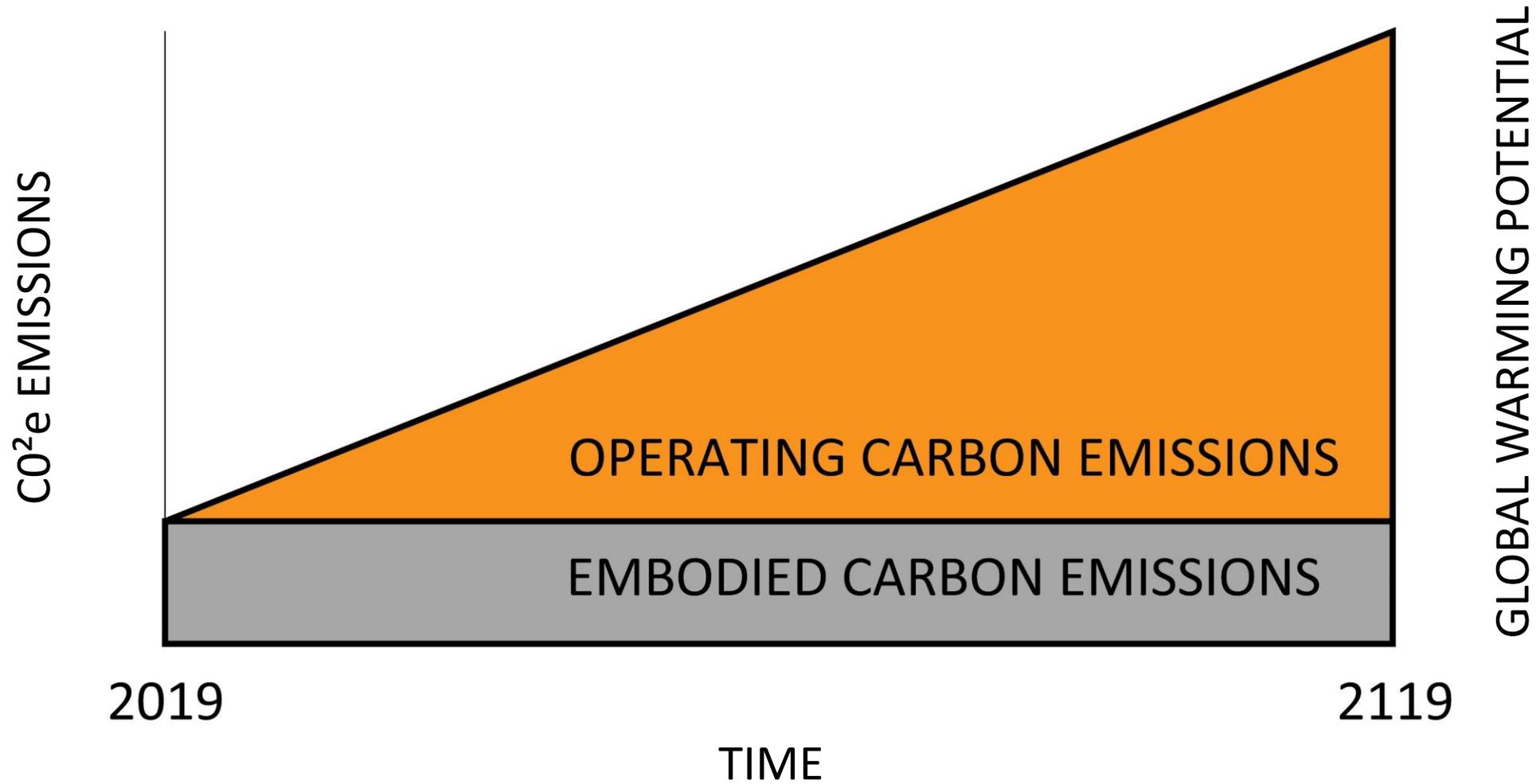
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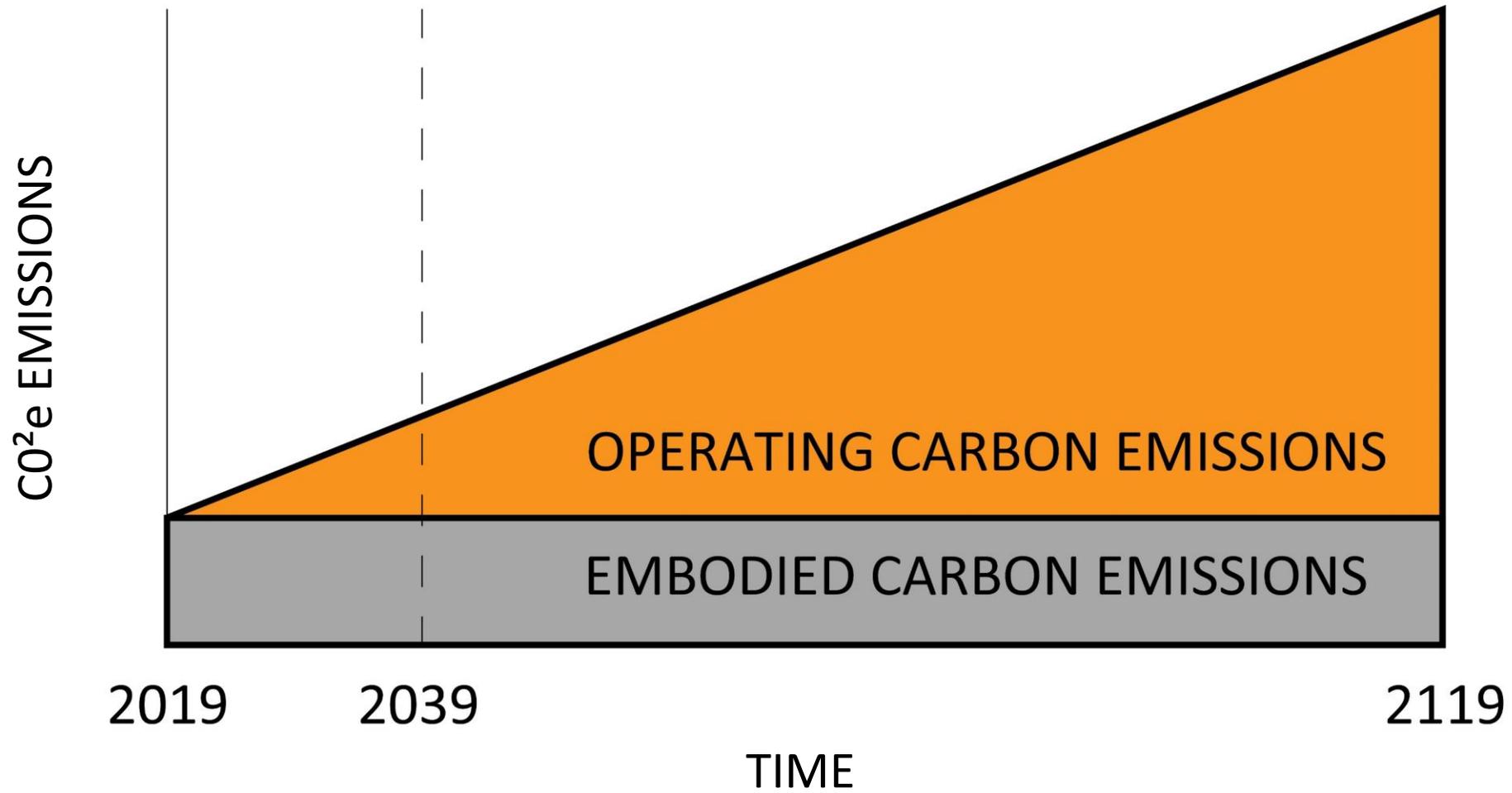
2011 Vancouver Landfill, SqueakyMarmot, license CC by SA 2.0

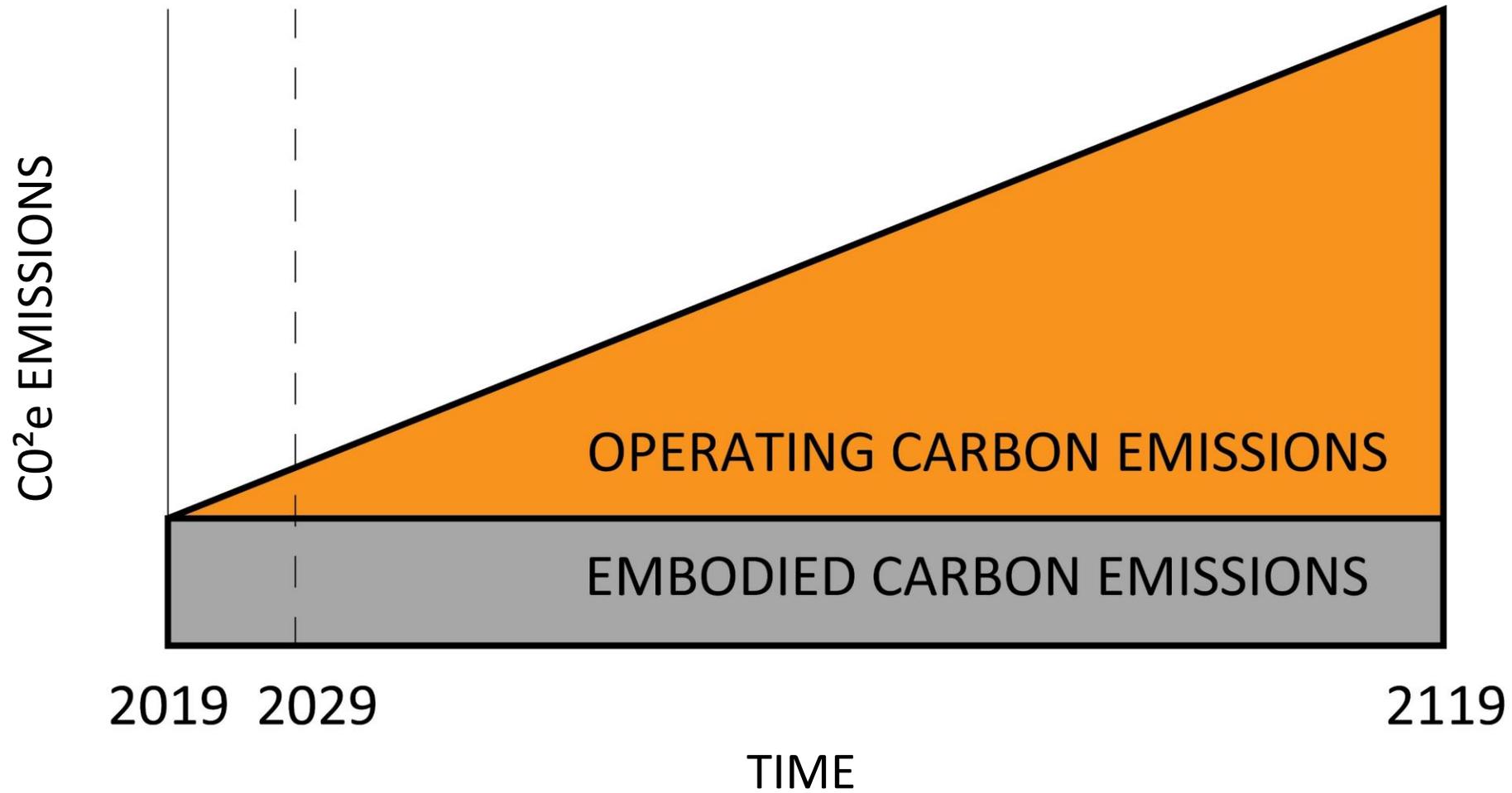
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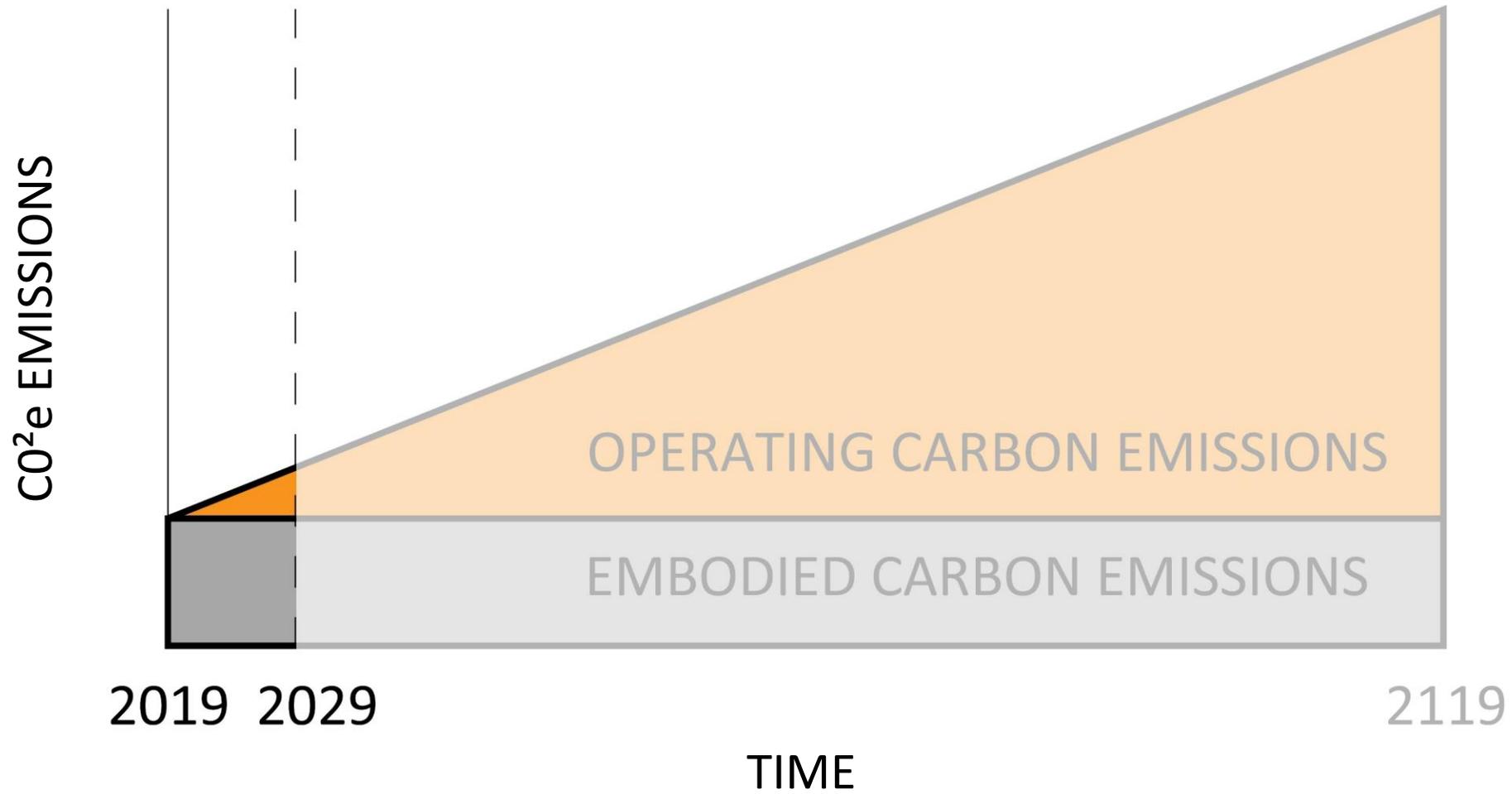


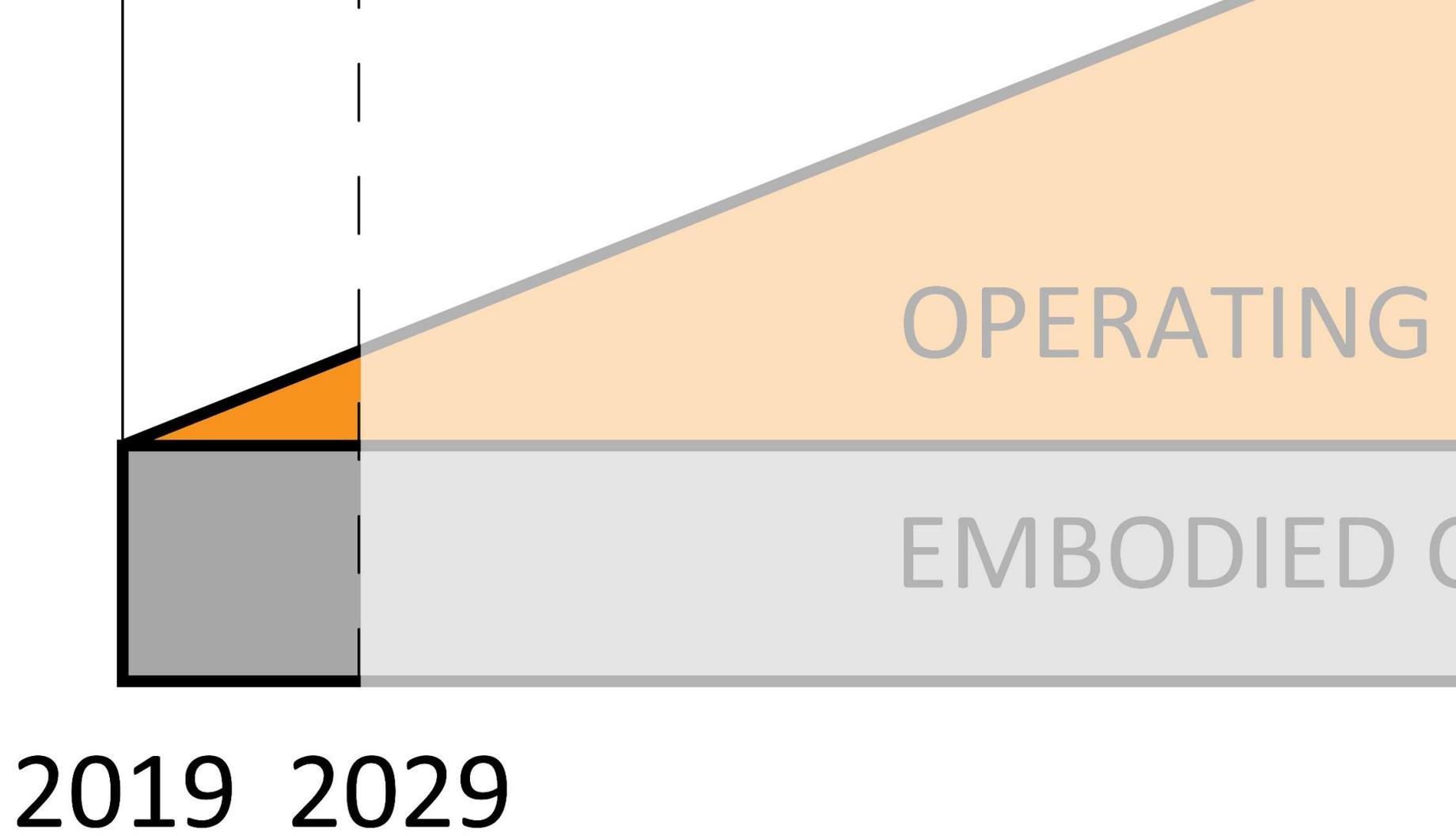
Data source: Global Alliance for Buildings and Construction 2018 Global Status Report + Architecture2030.org









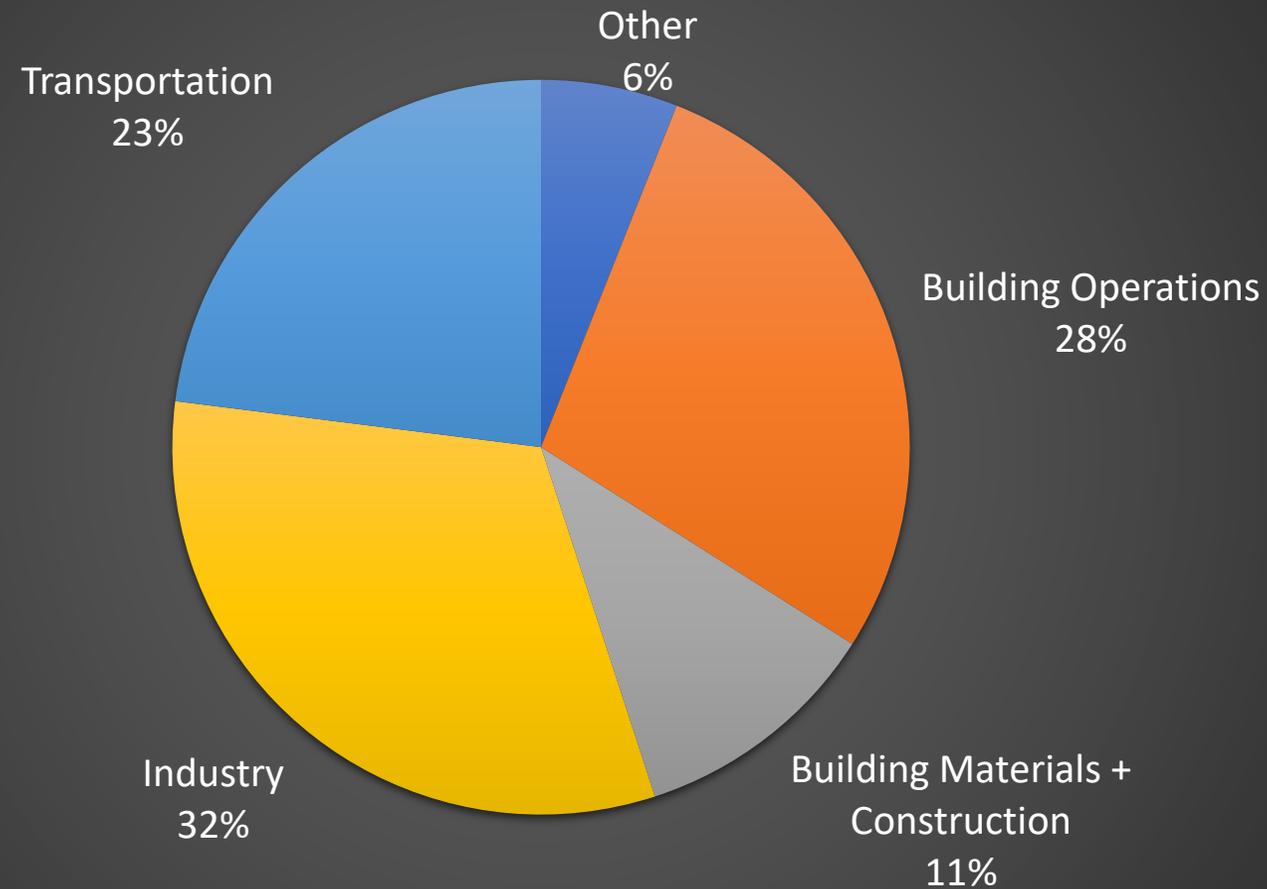


Over the next 40 years, the world is projected to add 2,500,000,000,000 square feet of buildings, doubling the existing building stock.

That is equivalent to building an entire New York City every 34 days. For the next 40 years.

(source: Bruce King, [The New Carbon Architecture](#), 2017, based on IEA 2016 report)

Global CO2e Emissions by Sector



Data source: Global Alliance for Buildings and Construction 2018 Global Status Report + Architecture2030.org



<http://nesea.org/buildingenergy-boston-2019-keynote-session>

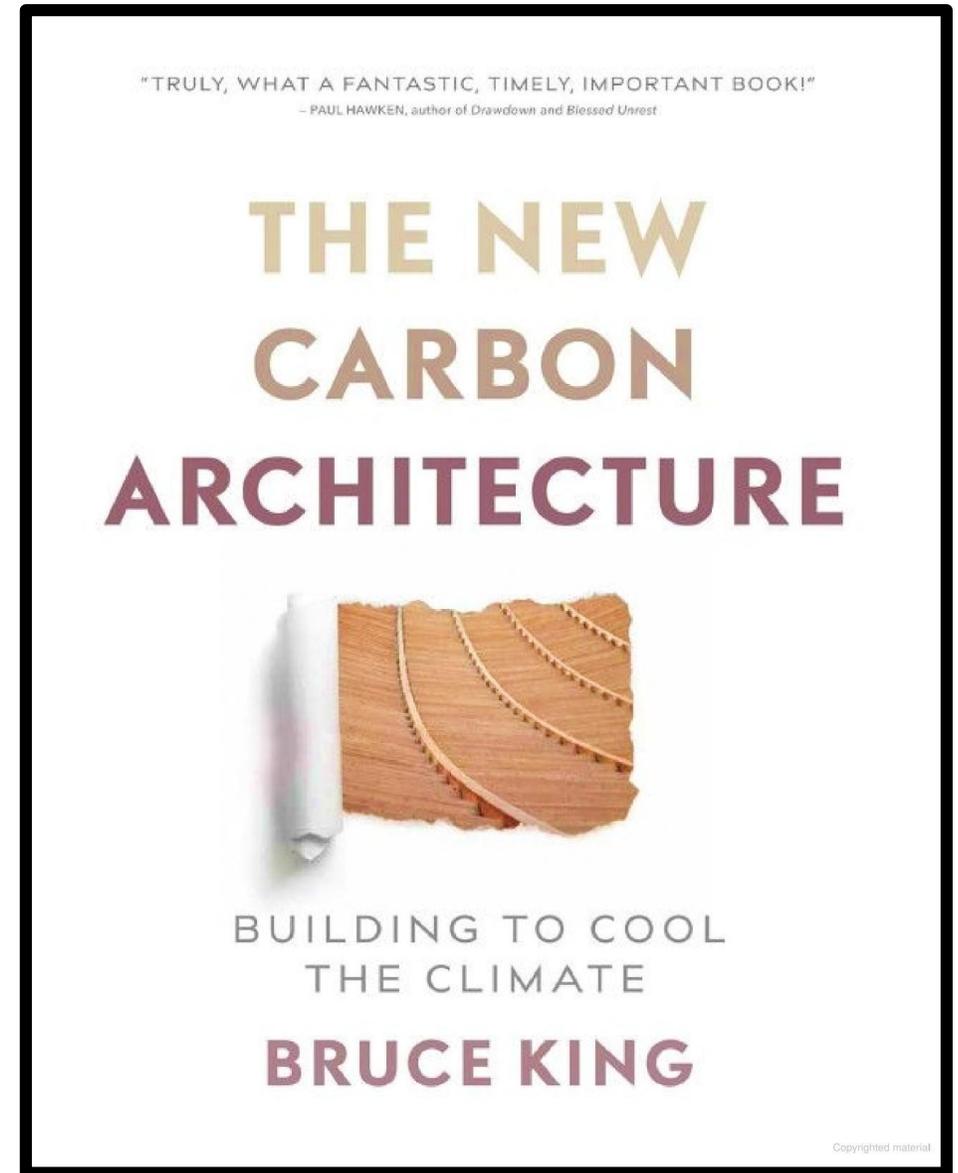
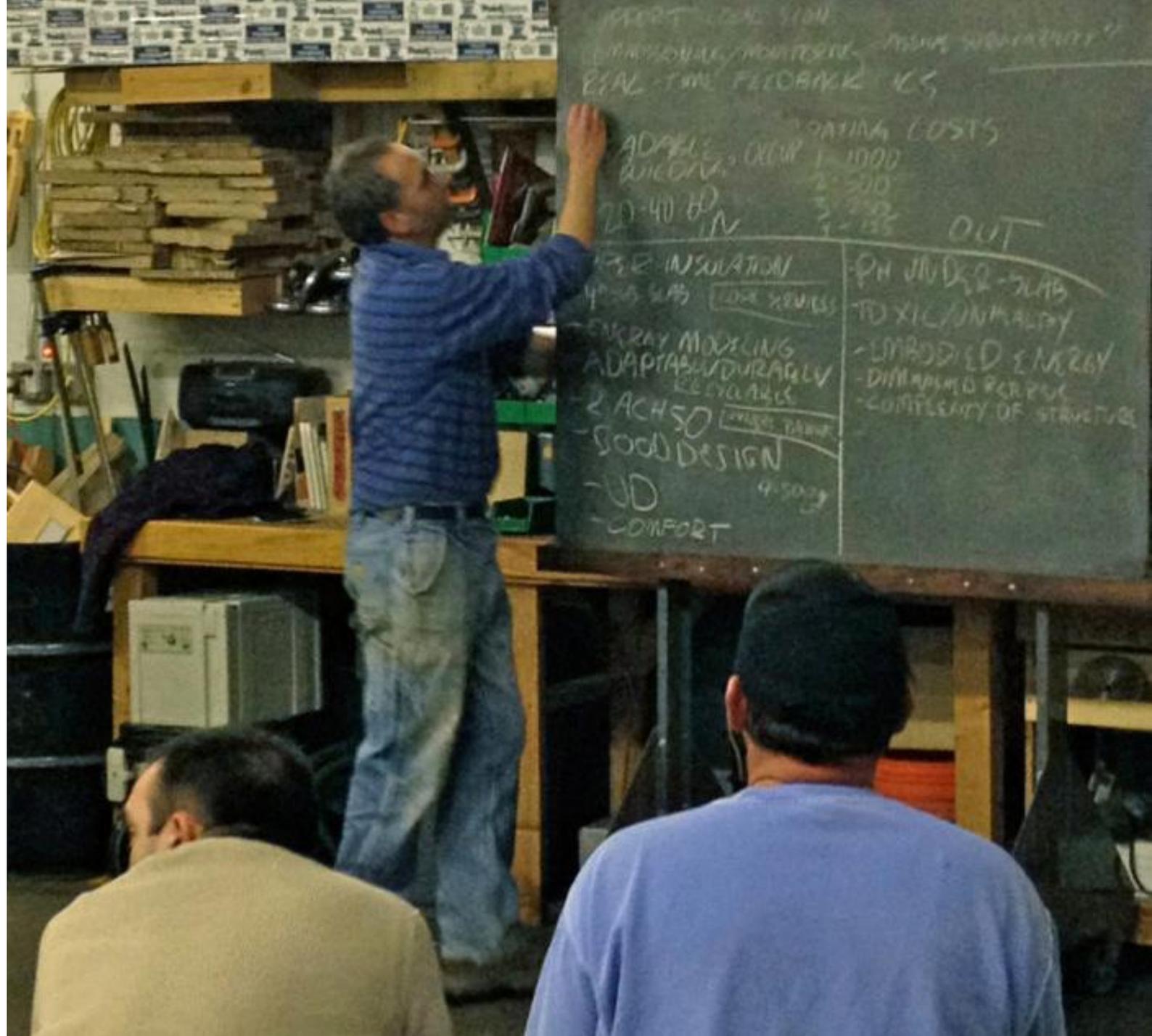


Image used with author's permission

The Pretty Good House



The Pretty Good House 2.0: Low Carbon Edition



The Pretty Good House

HOW TO DESIGN AND BUILD A PRETTY (DARN) GOOD HOUSE OR RENOVATION



What is a Pretty Good House?

prettygoodhouse.org



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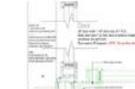
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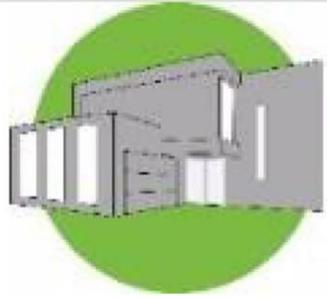


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[read more...](#)

(and prettygoodhouse.com)



PERFORMANCE BUILDING SUPPLY

presents:

Building Science Discussion Group

An informal discussion for building professionals to ask, learn, debate, knock around, support, agonize over, ridicule, flog, and answer the challenges and concepts of the best building practices.

Portland, Maine

Dan Kolbert, moderator

info@performancebuildingsupply.com



So What exactly is a
Pretty Good House?

We'll start with some of the key elements:

A Pretty Good House 2.0 should include these features:

- Be as small as possible.
 - 1 person: 1000 sq. ft.
 - 2 person: 1500 sq. ft.
 - 3 person: 1750 sq. ft.
 - 4+ person: 1875 sq. ft.



A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
- PV panels or PV-ready for net zero operation
 - Pay their carbon debt in 2-4 years
 - Produce energy for 30-40 years (lose 1% per year)



Photo: Emerald Builders

A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
- PV panels or PV-ready for net zero operation
- Be simple and durable
 - Easier to air seal and insulate
 - Perform better in harsh weather
 - Less materials, lower maintenance
 - Invest in the parts that are hard to change later



A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
- PV panels or PV-ready for net zero operation
- Be simple and durable
- Use wood and other renewable materials
 - More processing = larger carbon footprint



Photo: John Deans/Emerald Builders

A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
- PV panels or PV-ready for net zero operation
- Be simple and durable
- Use wood and other renewable materials
- Use air-source heat pumps
 - In a PGH, only 1-2 indoor units usually needed



A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
- PV panels or PV-ready for net zero operation
- Be simple and durable
- Use wood and other renewable materials
- Use air-source heat pumps
- Invest in the envelope
 - Enough insulation + air sealing that a small heating system is enough
 - 1.0 ACH50



A Pretty Good House 2.0 should include these features:

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- PV panels or PV-ready for net zero operation
- Be simple and durable
- Use wood and other renewable materials
- Use air-source heat pumps
- Invest in the envelope
- Good orientation, good windows, good doors
 - Easy to over-glaze in the name of architectural vanity



A Pretty Good House 2.0 should include these features:

- Be as small as possible (1000-1500-1750-1875)
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- Be simple and durable
- Use wood and other renewable materials
- Use air-source heat pumps
- Invest in the envelope
- Good orientation, good windows, good doors
- KISS: Keep It Simple + Safe
 - Make it easy to understand and operate, with owner-proof systems

A Pretty Good House 2.0 should include these features:

- Be part of a sustainable community
 - Use local labor and materials
 - Have access to community solar, jobs and services that minimize driving and infrastructure costs

A Pretty Good House 2.0 should include these features:

- Be part of a sustainable community
- Renovate whenever possible
 - The embodied carbon is already sequestered
 - Aim for current International Residential Code performance
 - Apply money saved toward photovoltaics



A Pretty Good House 2.0 should AVOID these features:

- Don't be a one-hit wonder in the middle of the woods
 - Nothing green about a 4,000 sq. ft. third home with bamboo flooring.
 - Extreme levels of energy efficiency will eventually recoup investment, but carbon footprint may negate advantages

A Pretty Good House 2.0 should AVOID these features:

- Don't be a one-hit wonder in the middle of the woods
- Minimize use of concrete
 - Responsible for >8% of global carbon emissions

A Pretty Good House 2.0 should AVOID these features:

- Don't be a one-hit wonder in the middle of the woods
- Minimize use of concrete
- Foam, especially XPS + CCSF
 - Conventional closed cell spray foam blowing agent has a GWP of 1000+
 - XPS has a GWP of 1400+
 - HFO-blown foam is much better, GWP 1-4
 - EPS and Polyiso, GWP 7
 - Cellulose embodied carbon 0.003 kg•CO²/ft²•R (1/10 of best foam)
 - -> On new construction, no foam above grade

A Pretty Good House 2.0 should AVOID these features:

- Don't be a one-hit wonder in the middle of the woods
- Minimize use of concrete
- Foam, especially XPS + CCSF
- Combustion appliances
 - Especially ones that burn fossil fuels
 - High efficiency, low emission wood stoves only for supplemental heat

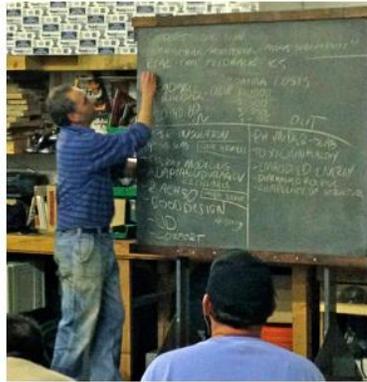
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- Minimize use of concrete
- Foam, especially XPS + CCSF
- Combustion appliances
- Toxic/unhealthy materials

These things may seem simple, but a house is a complicated assembly, and designing and building a high performance house requires a lot of knowledge and understanding of the process. The new Pretty Good House website includes a Guideline with Guideposts to help people understand everything that needs to be considered.

The Pretty Good House

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[read more...](#)



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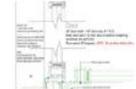
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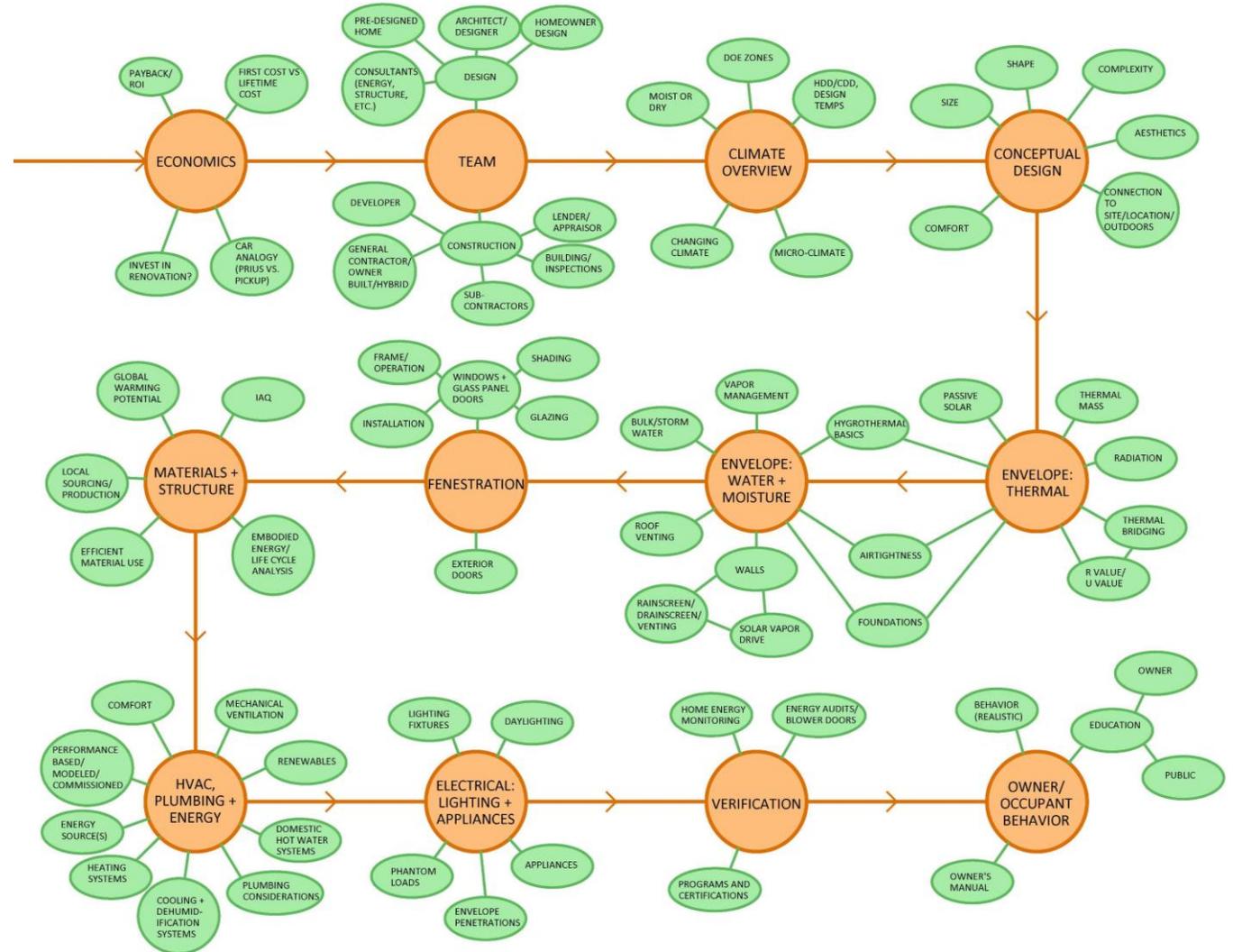
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(and prettygoodhouse.com)

Roadmap for Designing and Building a Pretty Good House



Roadmap for Designing and Building a Pretty Good House



1. Economics

Balance expenditures and gains
Consider ROI (return on investment)
Consider first costs vs. lifetime costs
Consider renovations vs. new construction

Roadmap for Designing and Building a Pretty Good House



2. Team

Design Team

Construction Team

Financing Team (including Owner)

Maintenance Team

Roadmap for Designing and Building a Pretty Good House



3. Climate

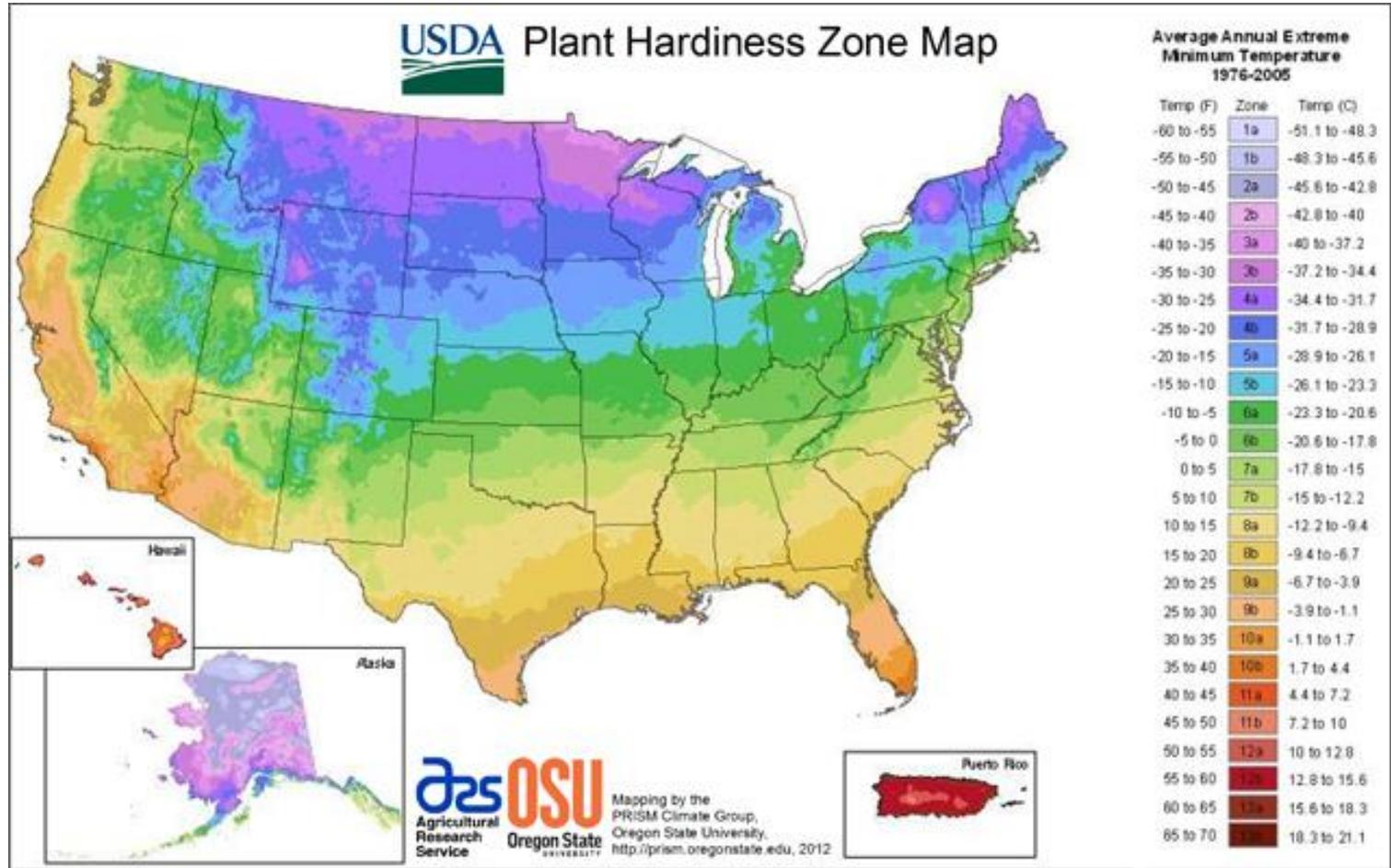
Hot/Warm/Cool/Cold

Wet/Dry

Macroclimate vs microclimate

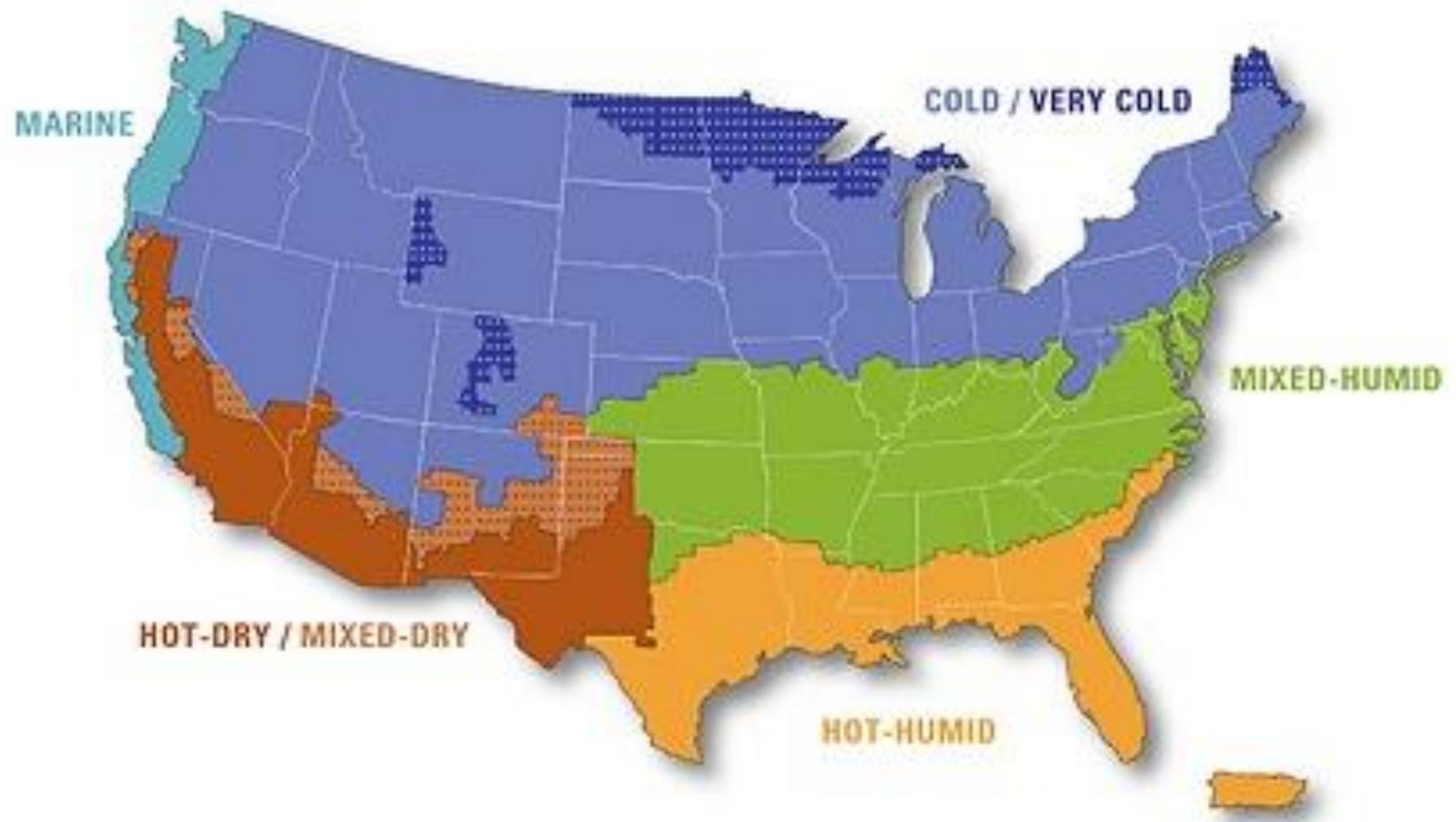
Climate zones are shifting

Climate Zone



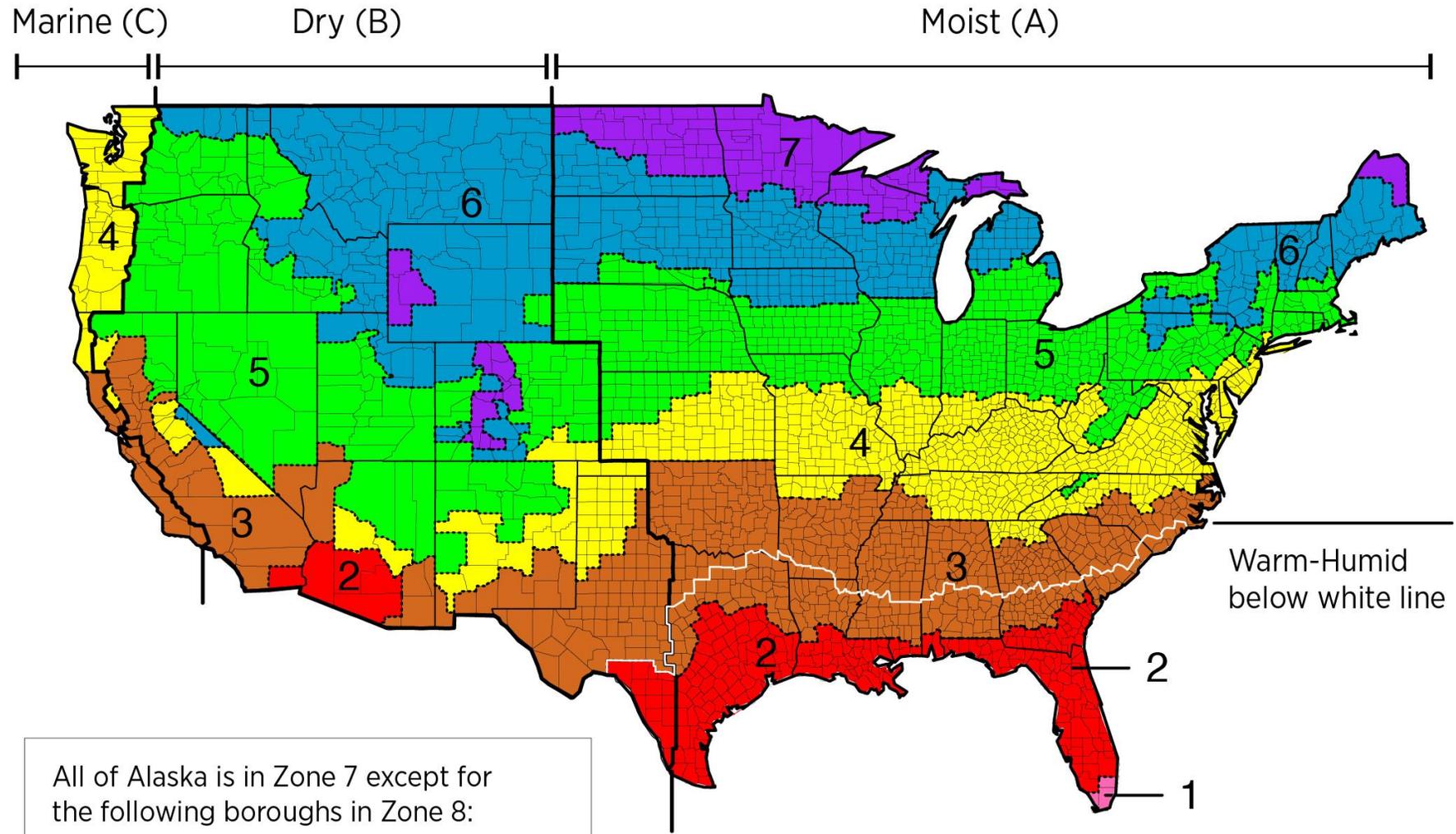
source: usda.gov

Climate Zone



source: energy.gov

Climate Zone



All of Alaska is in Zone 7 except for the following boroughs in Zone 8:
 Bethel, Northwest Arctic, Dellingham, Southeast Fairbanks, Fairbanks N. Star, Wade Hampton, Nome, Yukon-Koyukuk, North Slope

Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

Warm-Humid below white line

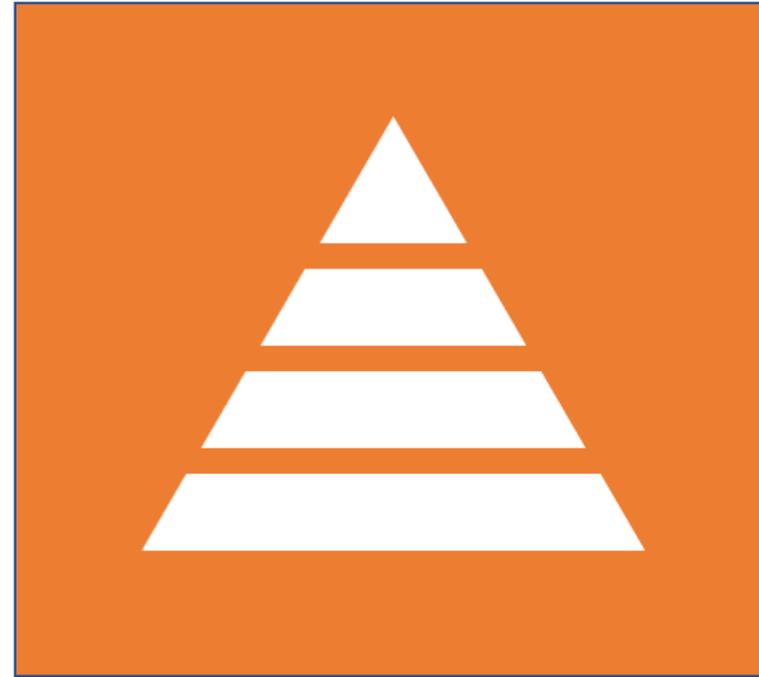
Roadmap for Designing and Building a Pretty Good House



4. Design

Location, Size and Orientation
Shape and Complexity
Comfort and Performance
BEAUTY

Roadmap for Designing and Building a Pretty Good House



5. Envelope Basics

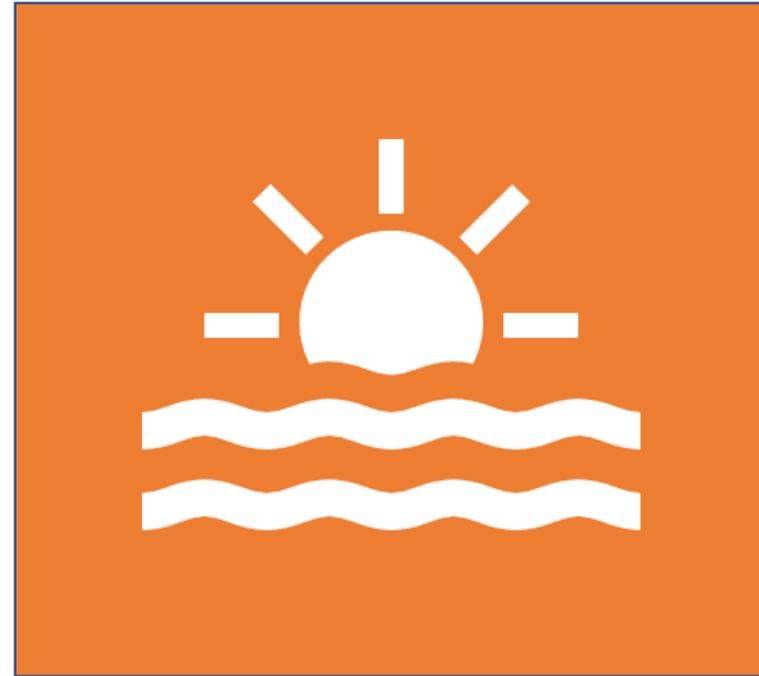
Rain control layer

Air control layer

Vapor control layer

Thermal control layer

Roadmap for Designing and Building a Pretty Good House



6. Envelope Details

Nitty Gritty of how the various envelope elements interact and how they are installed

Roadmap for Designing and Building a Pretty Good House



7. Windows + Doors

Operation type: Tilt/turn, double hung,
casement, awning, fixed

Solar Heat Gain Coefficient

U-factor

Visible Transmission

Roadmap for Designing and Building a Pretty Good House



8. Materials

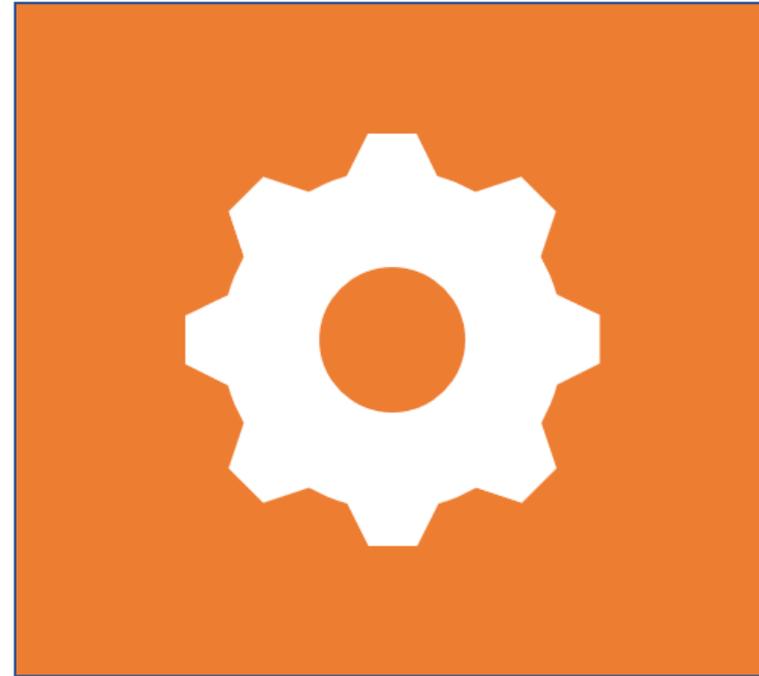
Local is good

Efficient Framing and Waste Reduction

Toxins and indoor air quality

Embodied carbon

Roadmap for Designing and Building a Pretty Good House



9. Mechanicals

Heating, cooling, humidity control
Ventilation
Plumbing systems/water use
Energy sources other than electric

Roadmap for Designing and Building a Pretty Good House



10. Electrical + Lighting

Lighting

Photovoltaic and other renewable generation

Equipment and appliances

Phantom loads

Roadmap for Designing and Building a Pretty Good House



11. Verification

Prescription vs. verification

Commissioning equipment

Blower door testing

Programs such as Passive House, Energy Star

Roadmap for Designing and Building a Pretty Good House

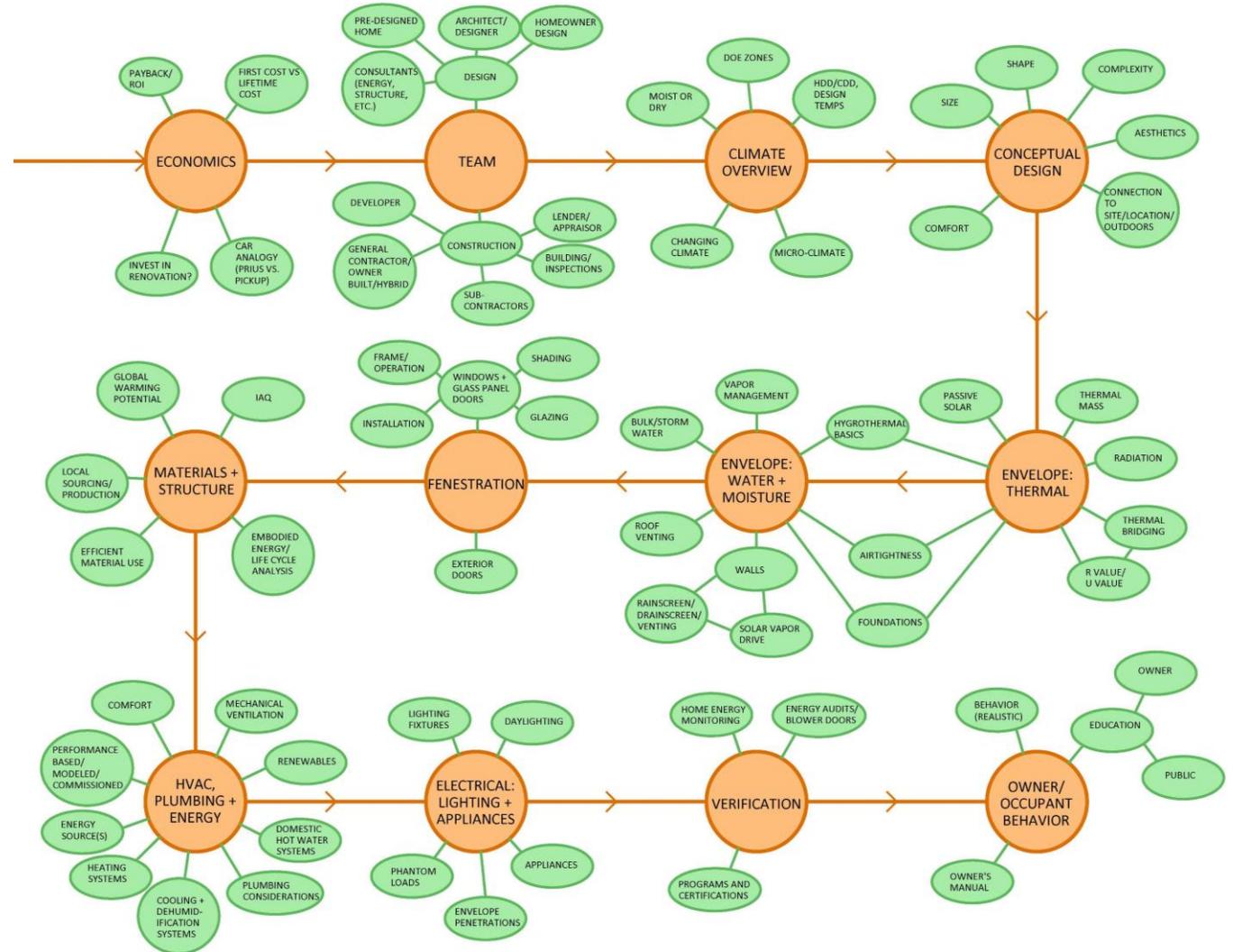


12. Owner/Occupant

Owner's manual

Energy consumption dashboards

Roadmap for Designing and Building a Pretty Good House



A **Pretty Good House** in Maine

This home's low energy bills speak louder than any certification system

BY STEPHEN SHEEHY

Like many people approaching retirement age, my wife and I decided that it was time to downsize. At more than 4000 sq. ft., our home of 22 years was much too big for us. We selected a building site alongside our existing house in Alna, Maine, a small town of 700 people near the coast, that offered views of a small pond and fields beyond.

I'd done a lot of research into modern building practices and materials, and I wanted our new house to be cheap to operate and easy to maintain—while also being nice to look at and to live in.

Lots of organizations will certify a house based on whether it meets particular standards for efficiency, including LEED, Energy Star, and Passive House. While these certification systems have aided in the development of technologies and construction processes and spurred



Photos: Debra Judge Silber,
courtesy of Fine Homebuilding



Photo courtesy of Mottram Architecture



Photos courtesy of Robert Swinburne
Bluetime Collaborative | Vermont Architect



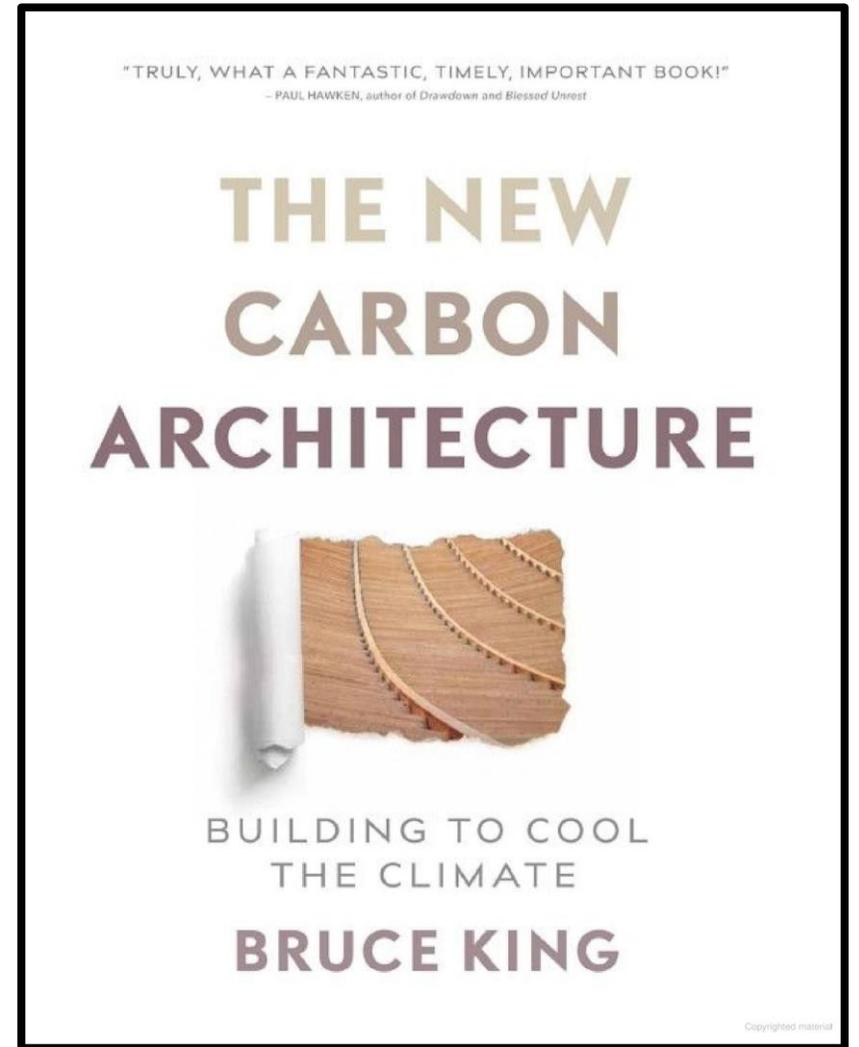
Photos: Nat Rae, courtesy of Fine Homebuilding



Photos by Kat Alves, courtesy of Green Building Advisor.
Design by Jeff Adams.



architecture2030.org



newsociety.com

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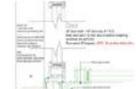
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