

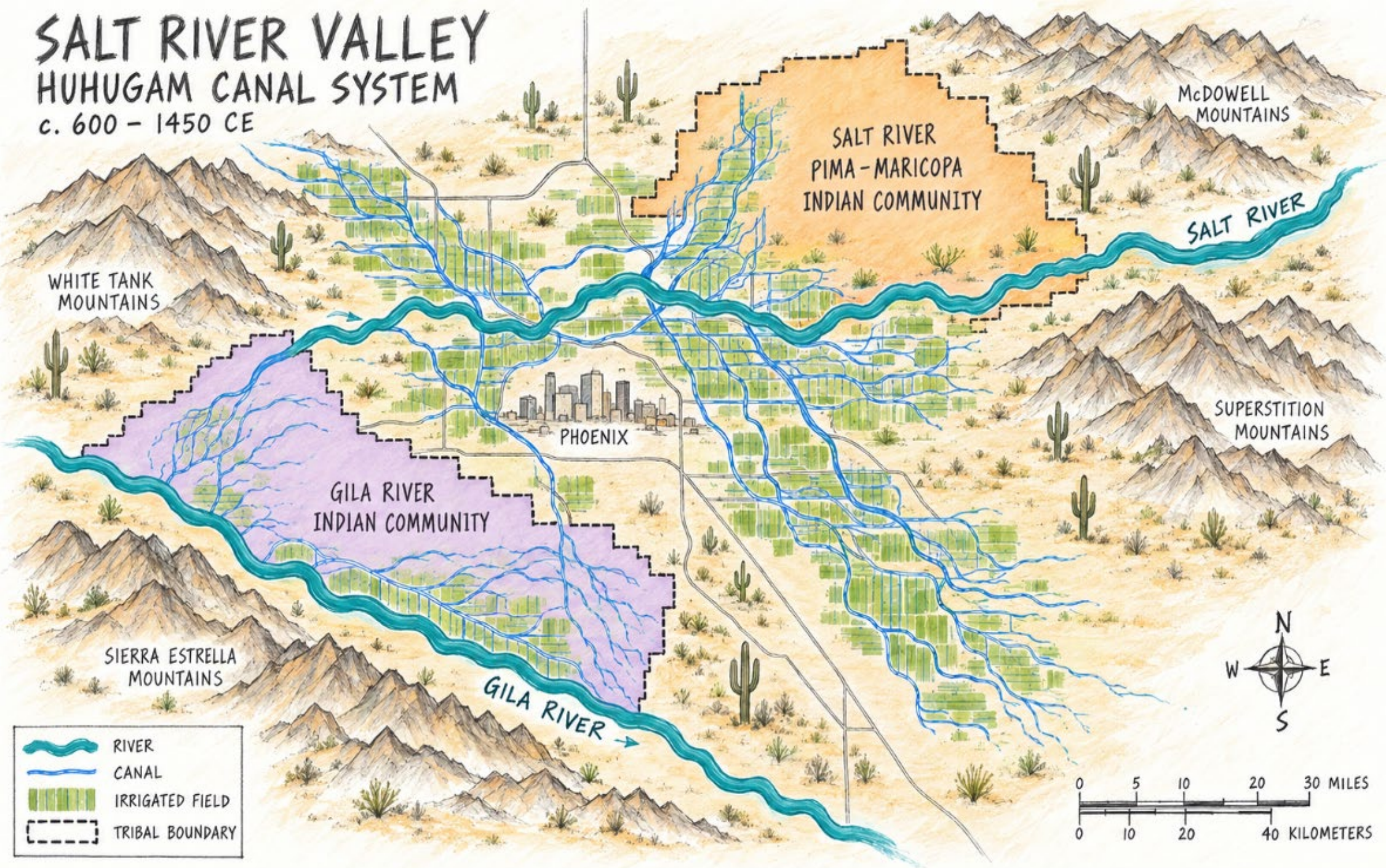
Passive Survivability

A Phius Case Study for Pueblos, Tribes, and Rural Communities of the Southwest

Presented by: Xavier Obando + Christopher Mancuso



SALT RIVER VALLEY HUHUGAM CANAL SYSTEM c. 600 - 1450 CE

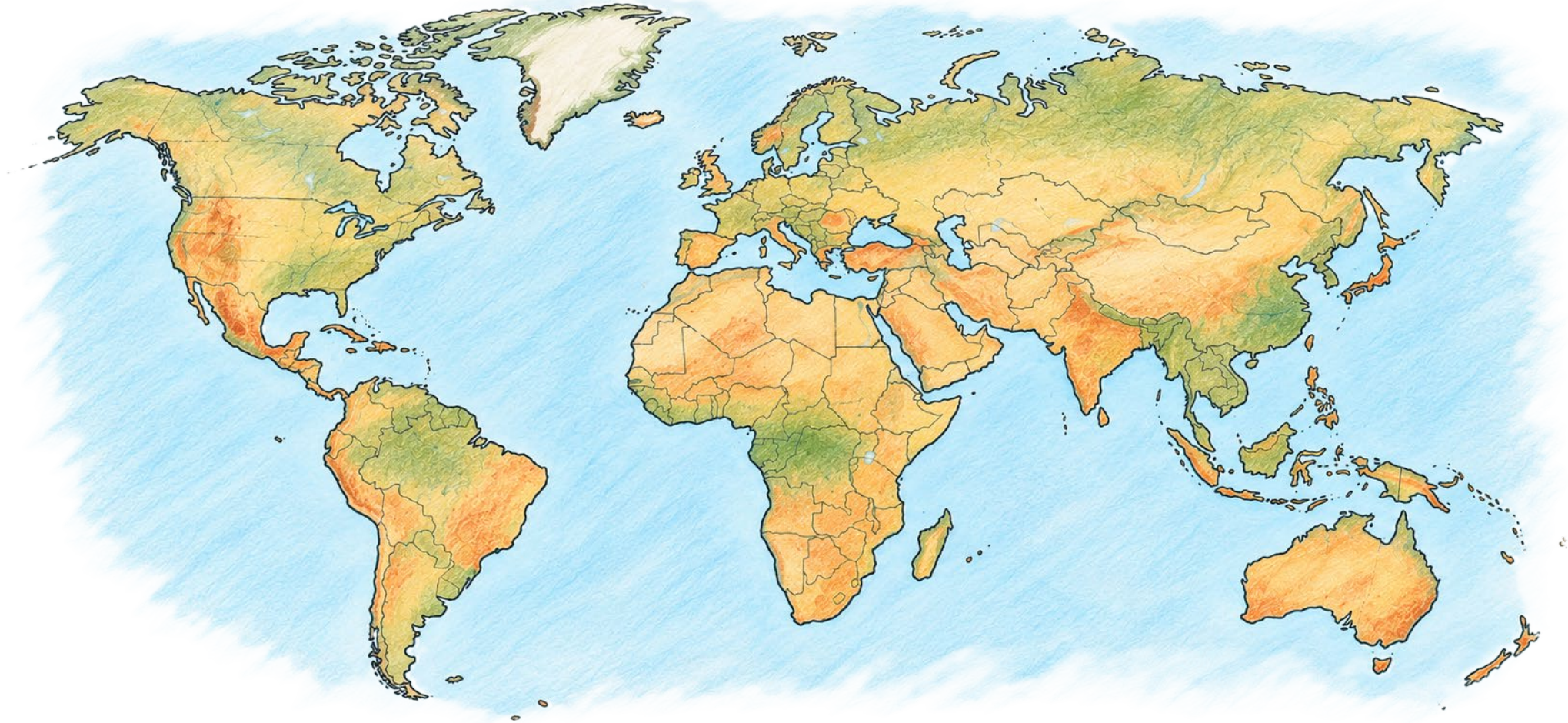




Phoenix Today: 127 days $\geq$ 100°F

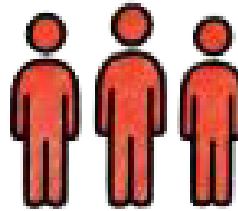
The Climate Toll

Heat kills. Every Year. Everywhere.



Heat-related deaths **have risen by 63%** since the 1990s,
now **averaging 546,000** deaths per year (2012–2021)

Source: <https://heathealth.info/resources/the-2025-report-of-the-lancet-countdown-on-health-and-climate-change/>



990

Heat related deaths
Highest of any state.



10.95

Per 100,000
Highest of any state.



"Heat deaths in Arizona rose 77 percent from 2021 to 2023."

Phoenix

July 2006 Heat Wave

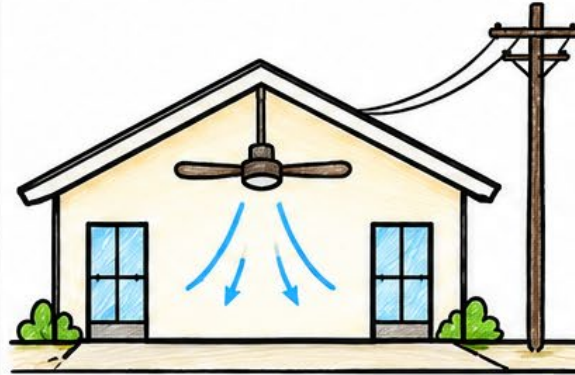
90°-113°F



With Power

19

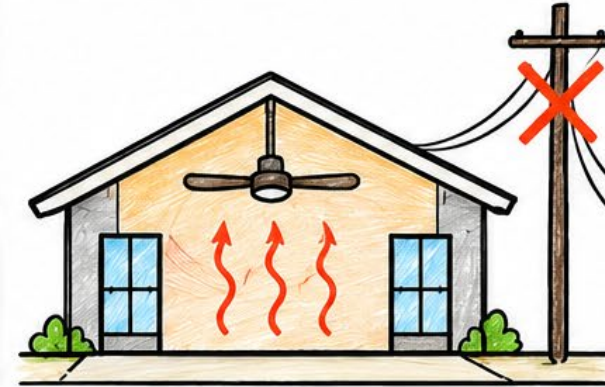
Modeled Deaths



Without Power

13,250

Modeled Deaths
(917 per 100,000)



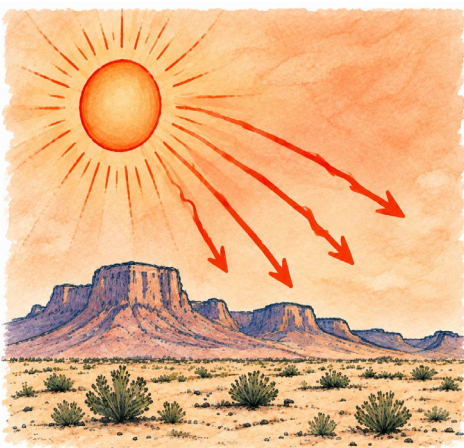
99%

of Phoenix homes
depend on one system.

When that system fails, the only thing between
people + extreme heat is the building itself.

Source: Stone et al., Environmental Science and Technology, 2023.

EXTREME HEAT



- On March 18, 2026, Phoenix hit **100°F**.
- So far this year PHX, **127** Days above **100°F**

WILDFIRES+SMOKE



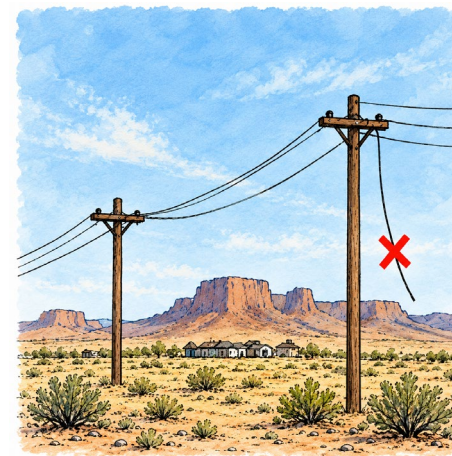
- Per year average:
- 2,840 Wildfires
 - 589,000 Acres
 - SWCC 2025 Annual Report

FLASH FLOODS



- 2025: A record 426 Flash Flood Warnings statewide (NM). 119, or 28%, from burn scars.
- On July 8, 2025, Rio Ruidoso rose from **1.43'** to a record **18.55'** in **35 minutes** after 3.29" of rain fell on the South Fork burn scar.

POWER OUTAGES



- Utilities in the SW cut power on purpose during fire weather.
- Wind, lightning and dust damage poles and lines
- The Navajo Nation contains **75% of all unelectrified** homes in the U.S.

From Vernacular Wisdom to Passive Survivability



Mesa Verde, 1100 CE

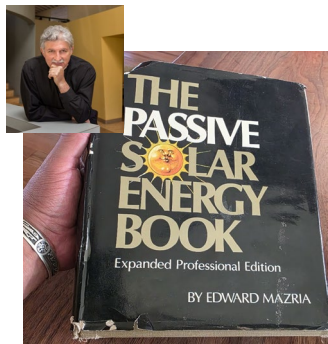


Taos Pueblo, 1450 CE



The railroad brought metal for pitched roof, 1880

Over 1000 Years of Passive Design in the Southwest



1979



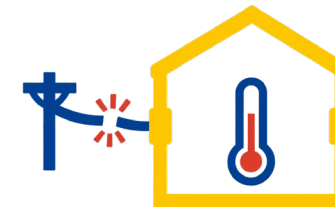
Earth Ship



2002



Phius Zero



Survivability and Resilience

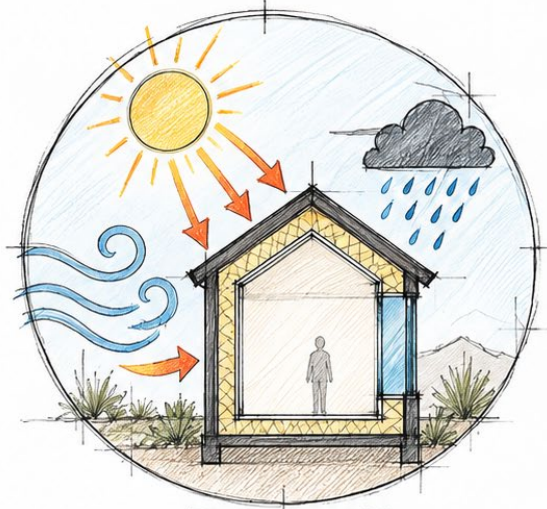
Passive Survivability



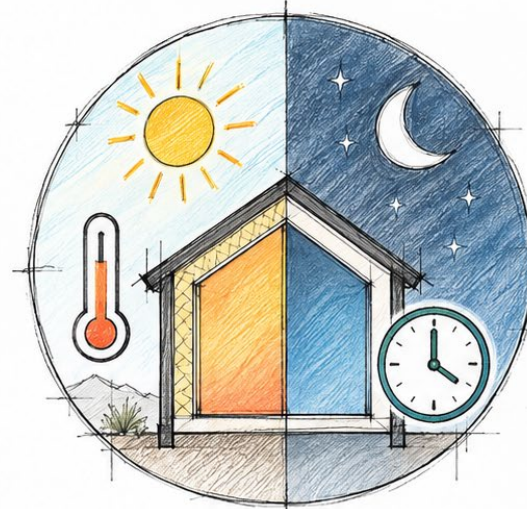
Working Definition:

A building's inherent ability to maintain **safe and habitable** indoor conditions during extreme climate events and utility disruptions without relying solely on mechanical or electrically powered systems. Through a **high-performance building envelope**, a resilient building can slow the deterioration of indoor conditions, reduce occupant exposure, and **provide a safe period of refuge** until building systems or community infrastructure are restored.

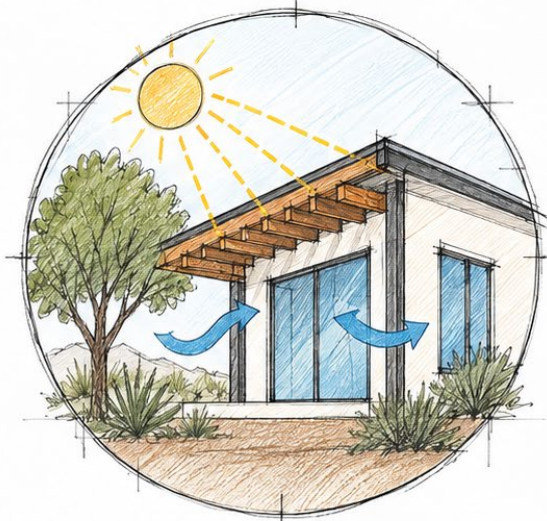
Measurable Layers:



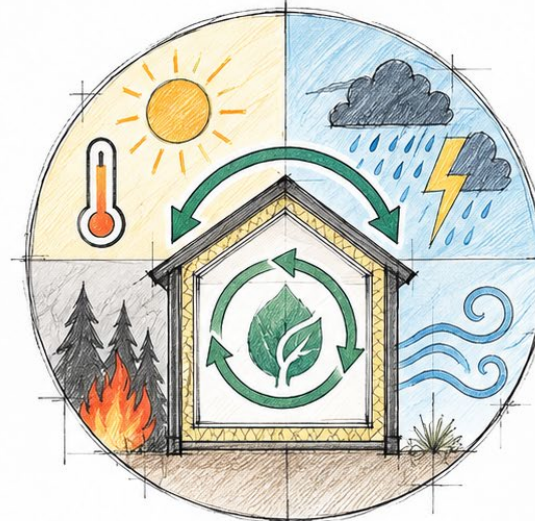
RESIST
Keep the stress out



DELAY
Buy time



MODERATE
Balance with the environment



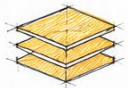
ADAPT
Respond to change



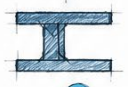
RESIST

Keep the stress out

The building enclosure first needs to reduce the amount of environmental stress entering the building.



High performance insulation



Minimized thermal bridging



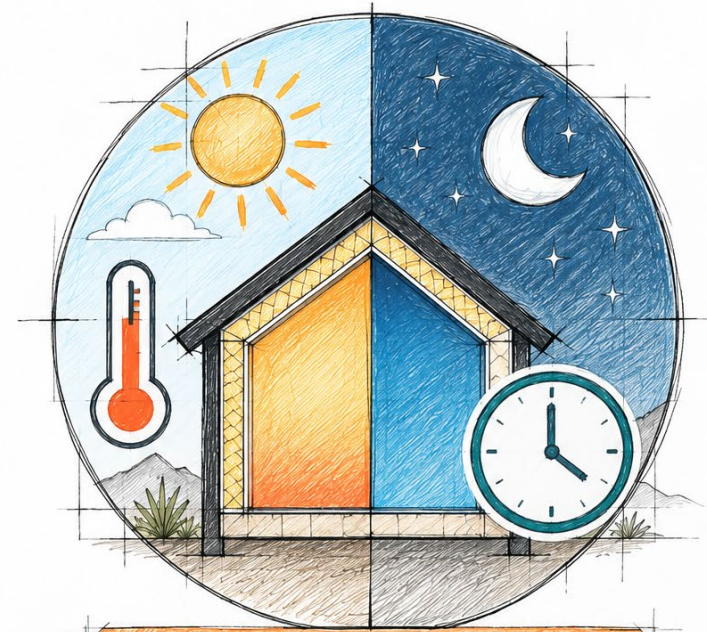
Airtightness



Robust protection from water intrusion



Calculated and verified through PHIUS certification.



DELAY

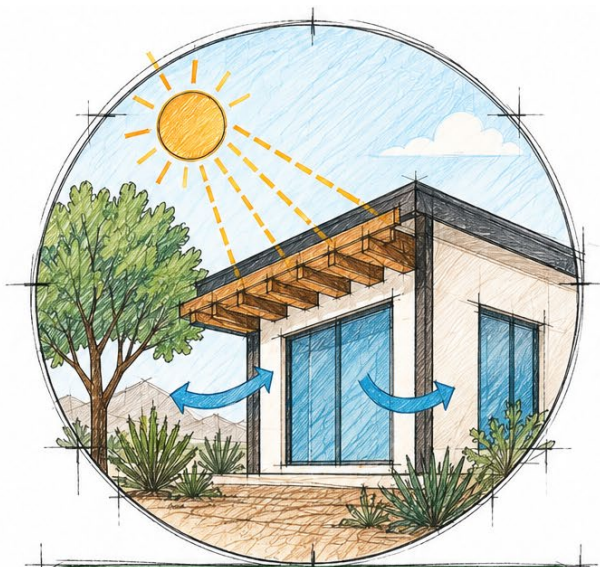
Buy time

Extend the amount of time a building remains within safe temperatures after the loss of active systems.



Measurable performance criteria that can be calculated given a building's actual building envelope.

Phius Revive 2024



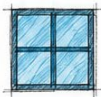
MODERATE

Balance with the environment

Review how the building envelope and design react to the environment to maintain safe temperatures.



Minimize solar heat gain



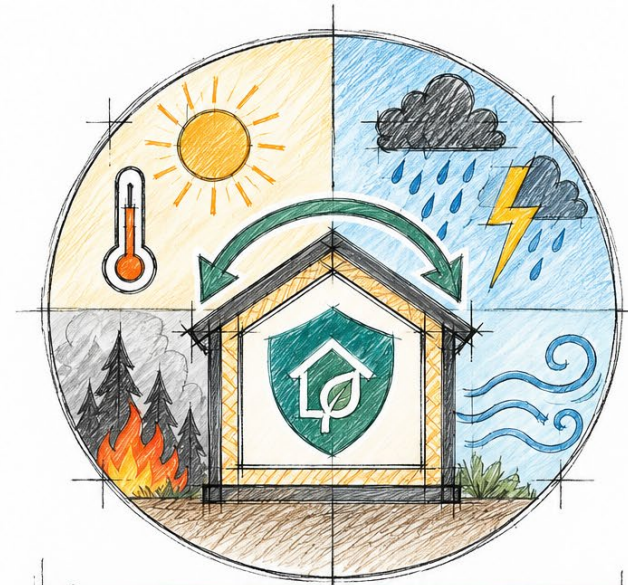
Limit east/west glazing



Enable natural ventilation when outdoor conditions permit



Provide exterior shading



ADAPT

Respond to change

How can the building react to changing environmental conditions?



Normal vs. High-Heat Operation

How does HVAC operate efficiently with the building envelope?



Power Outages (Day vs. Night)

Reduce solar heat gain and close the building, or open for passive ventilation during cooler periods.



Monsoon Events

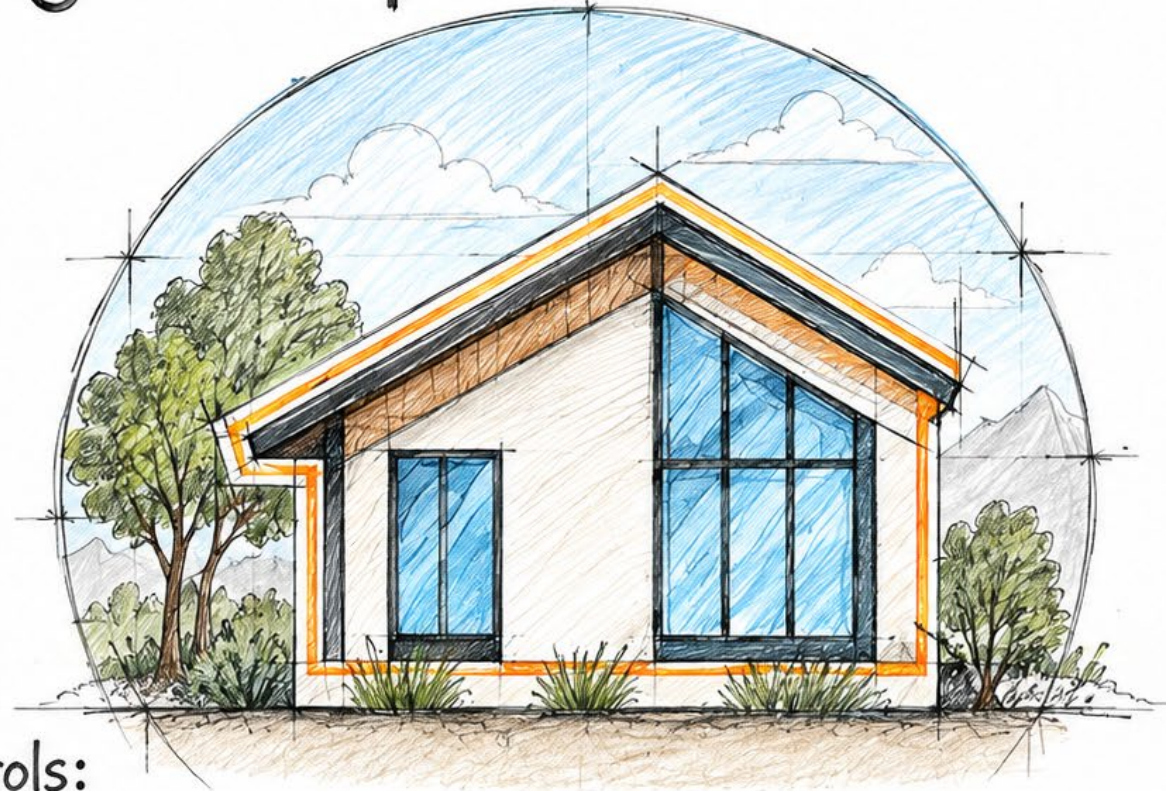
Shift to a protected mode to control wind driven rain and moisture.



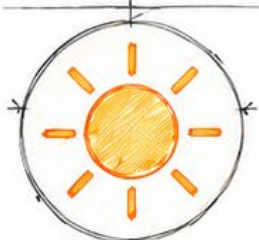
Wildfire Smoke / Poor Air Quality

Close the building and provide healthy indoor air for extended periods.

Building Envelope = 1st Line of Defense



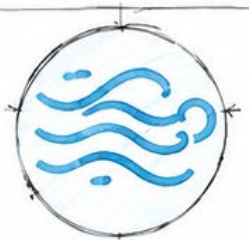
The envelope controls:



Heat



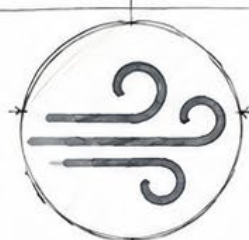
Solar
radiation



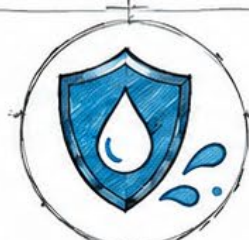
Air



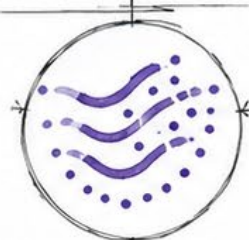
Moisture



Wind

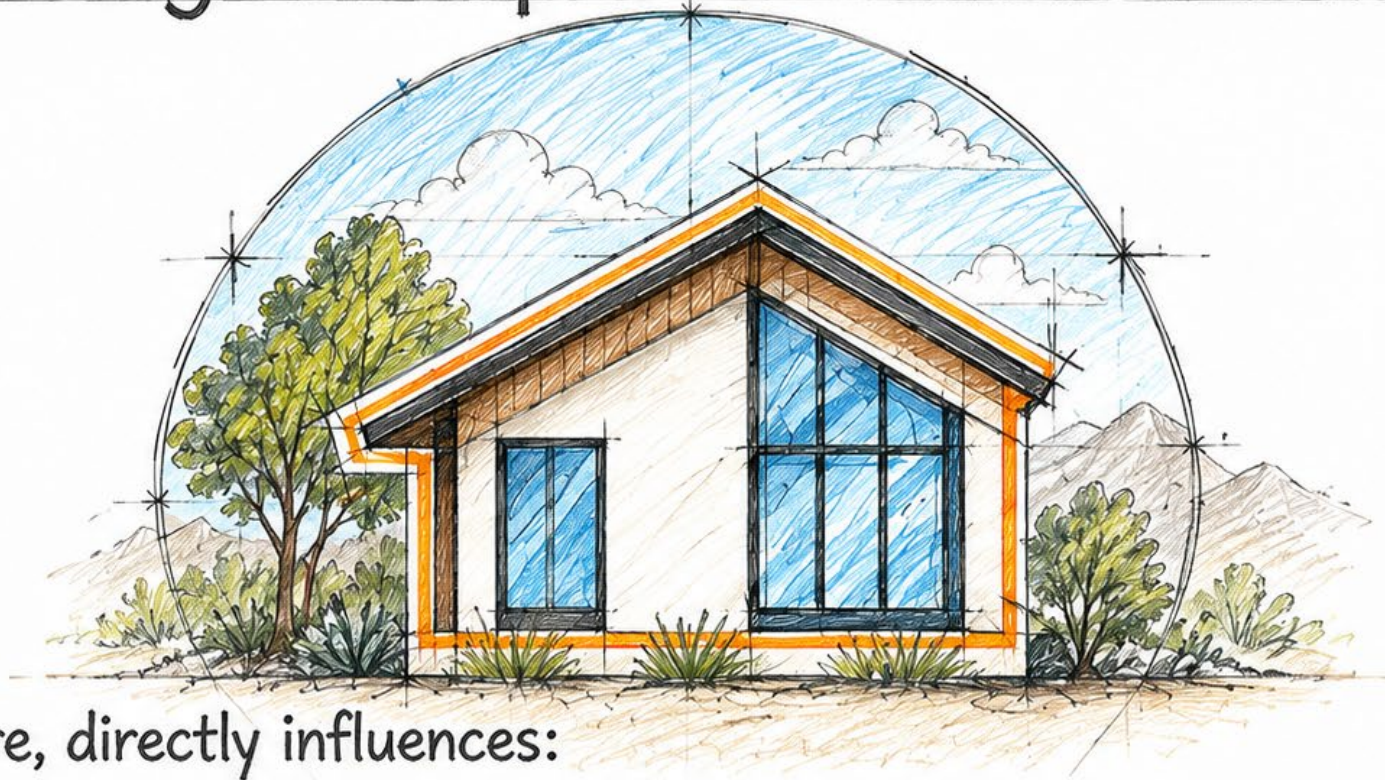


Water



Radiation

Building Envelope = 1st Line of Defense



And therefore, directly influences:





Passive Building Principles/Strategies

Start with **Compact form** then....

1

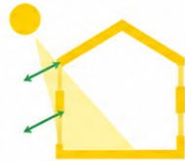
Reduce Heating /Cooling Demands & Loads



Continuous
Insulation



Air Tight
Construction



Manage
Solar
Gains



Balanced
Ventilation
With Heat
Recovery

2

Reduce Energy Use



Minimal
Heating/
Cooling
System
(Heat Pump)



Efficient
Lighting &
Domestic
Hot Water
Systems

3

Offset Energy Use

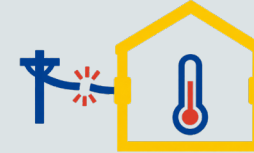


Offset
Site Energy
Use with
Renewables



4

Survive the Outage



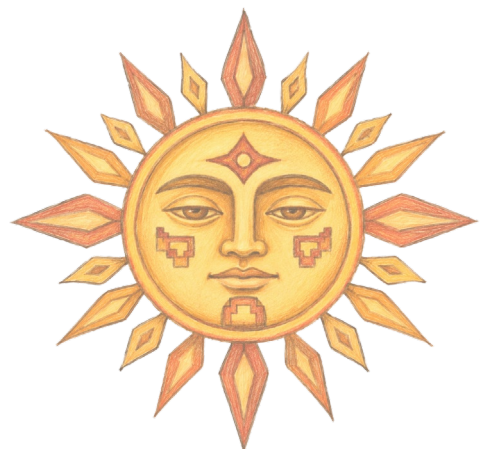
**7 day modeled outage, no grid.
Only critical loads are powered.**

Summer:

0 hours above 103 °F
Temperature setpoint at 80°F

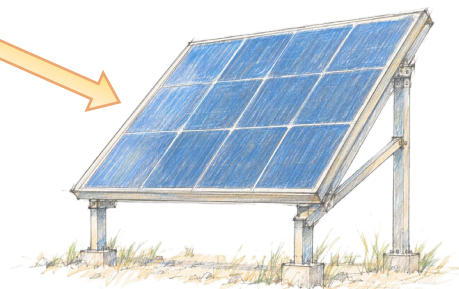
Winter:

0 hours below 36°F
Max 216 °F-hours < 54°F SET.

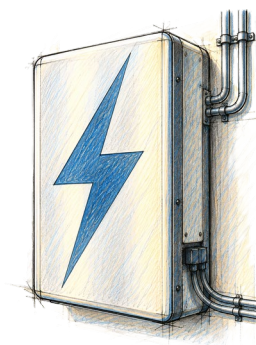
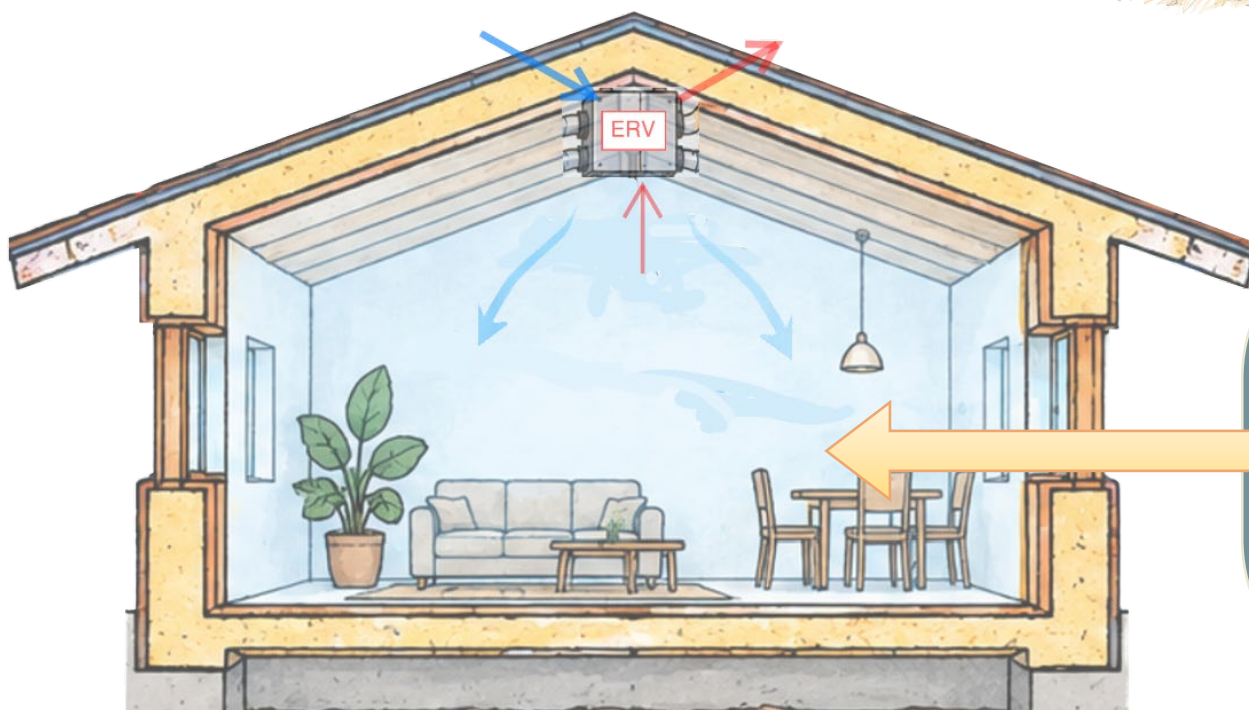
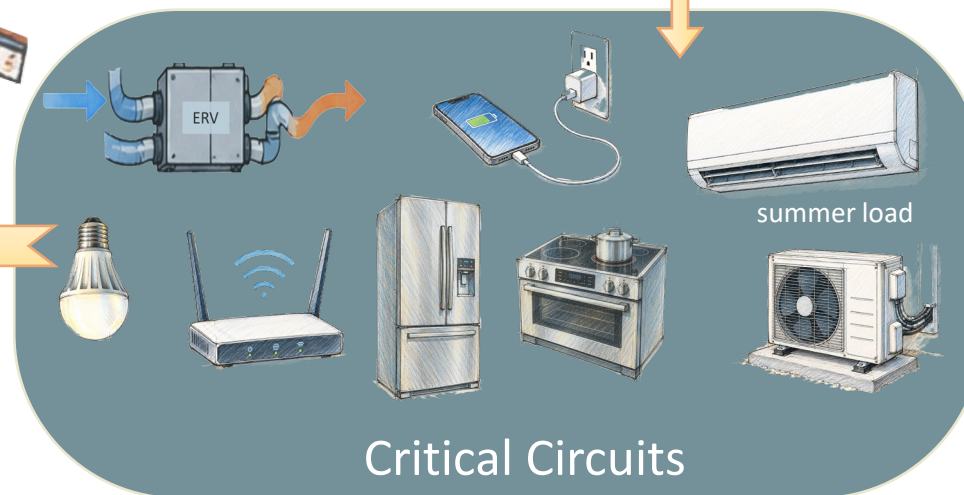


The sun refills the battery every day

2.6 kW DC
Solar Array



10 kWh battery



Passive Survivability

Sizing example: small family home, central New Mexico, 7 day summer outage, critical circuits only. Hand calculation, not a Phius model.

Extreme heat

'It's just cruel': US households hit by surge in electricity shutoffs amid record hot summer

Utility disconnections were up 28% in 10 states in July 2026
- the hottest month ever recorded in the US - compared
with July 2024, data shows



Oliver Milman, with data
visuals by Aliya Uteuova

Tue 29 Sep 2026 09.00 EDT

The sun rises over the New York City skyline during a heatwave on 2 July 2026. Photograph: Michael Nagle/Bloomberg via Getty Images

- **173,598 households** lost power in July 2026 for unpaid bills, across just 10 reporting states.
- Utility **disconnections rose 28%** when compared to July 2024.



Who Can't Wait?

Contrast Played Out

NATIONAL

Thousands in northwest Indiana still without power nearly two weeks after storm

AUGUST 23, 2026 · 12:55 PM ET

By Chandelis Duster



'Survival mode': Indiana residents endure a ninth day without power

AUGUST 21, 2026 · 2:40 AM ET

By The Associated Press

Workers from True Cut Tree Care of Farmington, N.J., topped during a recent storm on Aug. 20, 2026 in
Scott Olson/Getty Images

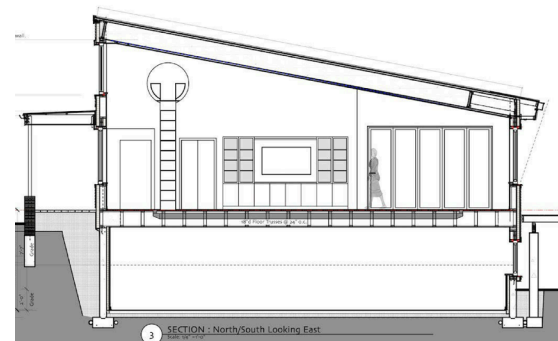
More than 20,000 people are still
severe storms rolled through the a



A person prays before receiving a free boxed lunch at City Life Center in Gary, Ind., Thursday, Aug. 20, 2026, more than a week after a deadly storm passed through the area.
Nam Y. Huh/AP Photo/Nam Y. Huh/AP

GARY, Ind. — Tens of thousands of residents in northwest Indiana were in survival mode Thursday as they endured a ninth day without power, throwing

"I didn't really even notice." — Violeta Burokas, homeowner, Beverly Shores, IN. Chicago Sun-Times, September 26, 2026.



MARK A. MILLER
ARCHITECTURE
ARCHITECTS / BUILDERS



*Phius CORE, Design Certified,
May 1, 2023.*

Envelope: **Wall R-39** (framing + continuous insulation, cellulose/XPS),
Roof R-72 (vented above-deck, cellulose),
Basement **slab R-20**

Who Can't Wait?

Passive Survivability:

Keep people safe when the grid goes down.

2.5

Heat deaths per 100,000 people in 2023

American Indian and Alaska Native people have the highest heat death rate of any racial or ethnic group in the U.S.

Nearly tripled since 2018



New Mexico Pueblo Communities

High climate exposure and limited refuge options.



Remote Navajo Households

High exposure, high isolation, limited infrastructure.



Rural Tribal Households

Distance and infrastructure challenges increase risk.



Older Manufactured Homes

Aging units are more vulnerable during extreme heat and outages.

6.5x

More power outages per year than the U.S. average

Tribal communities lose power far more often than the rest of the country.

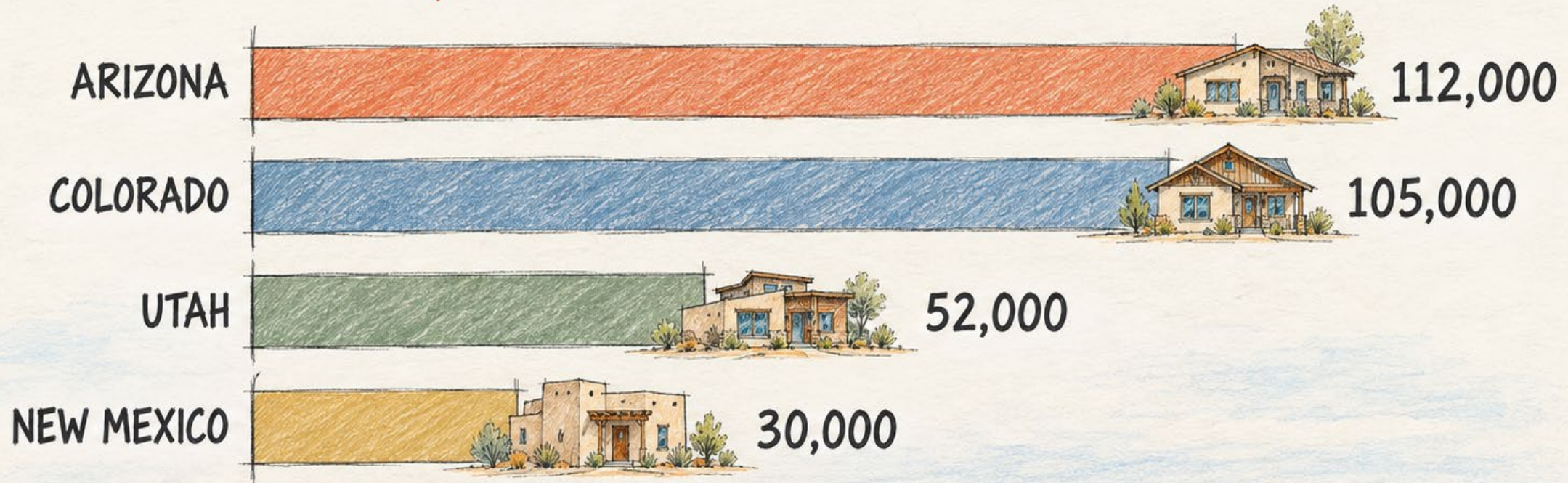
Energy burden 28% above average

Sources: Hong, Dalisay, Xie, Public Health Reports 140(4), 2025, doi.org/10.1177/00333549251342904 (CDC WONDER data).

U.S. DOE Office of Indian Energy, Tribal Electricity Access and Reliability, Report to Congress, August 2023, energy.gov/indianenergy

Who Can't Wait?

THE FOUR CORNERS STATES ARE ABOUT **299,000** HOMES SHORT



Homes of any type. Estimate includes a 5% vacancy target. Figures rounded.
Source: Up for Growth, Housing Underproduction in the U.S. 2024 (2022 data).

Housing first. Workforce Second. Services follow.

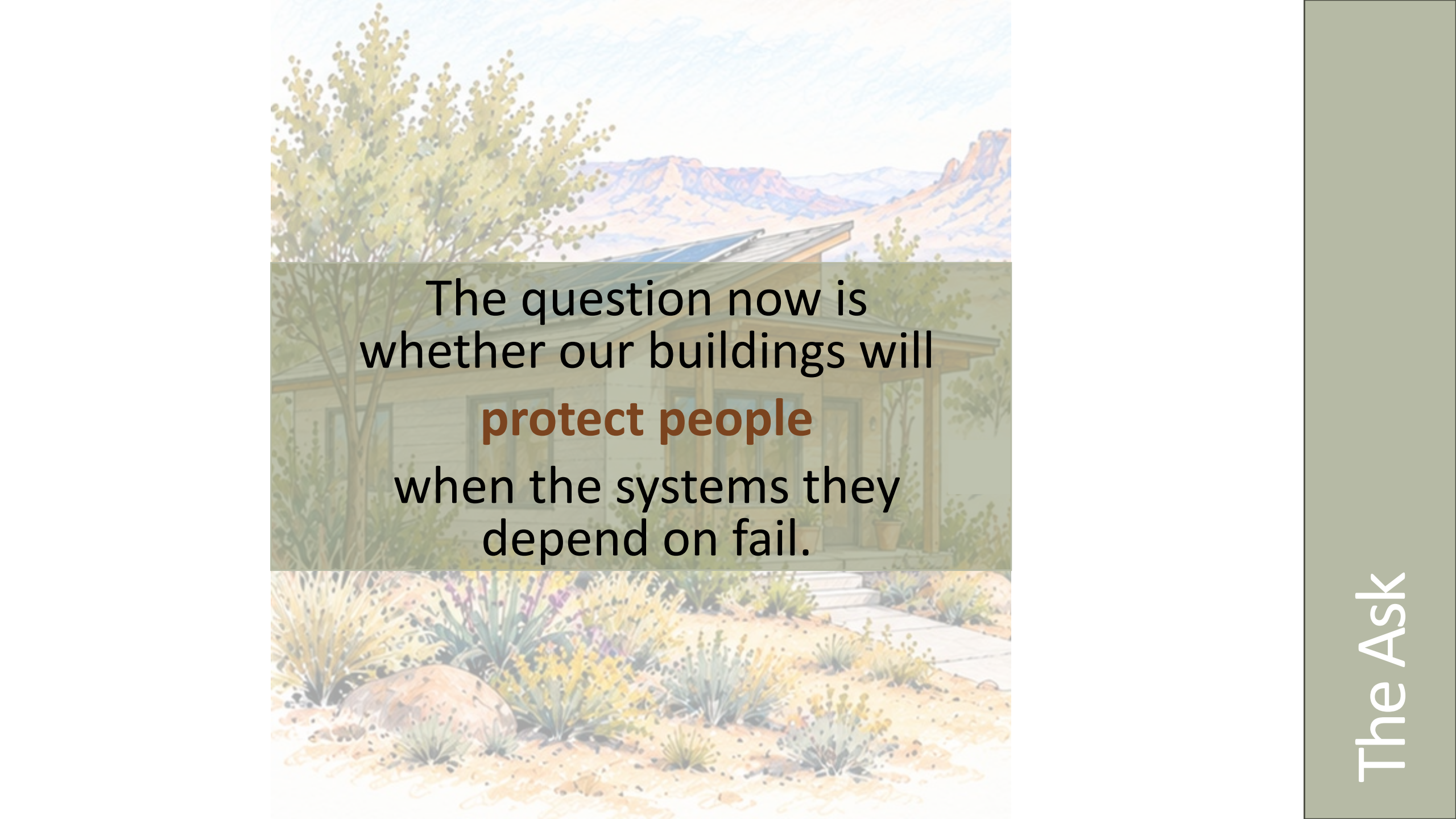
IHS has a vacancy rate near 30 percent.

IHS officials say housing shortages make vacancies harder to fill. Rural districts in New Mexico and Arizona are in dire need of teacher housing.



GAO ties provider recruitment and retention directly to insufficient housing (GAO-18-580). Teachers, EMS, and water and utility operators hit the same wall.

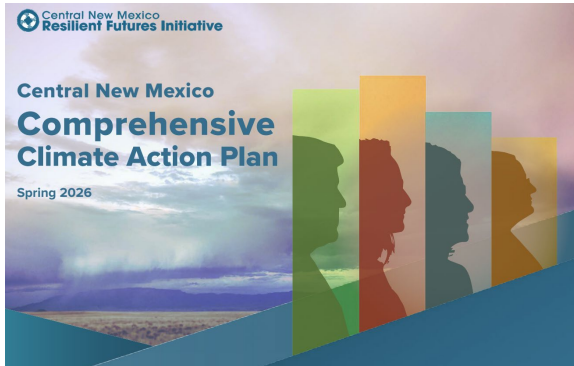
Sources: IHS, January 2026. GAO-18-580. NM PSFA. CNN, 2023



The question now is
whether our buildings will
protect people
when the systems they
depend on fail.



UNM Sustainability Expo



Policy Advisor



COA Earth Day Festival

THERMAL ENVELOPE COMPONENTS	R-VALUE MINIMUM REQUIREMENT
Walls	20
Roofs , Ceilings & Floors	30



Cool Box Challenge

With 80lbs of Ice to Start

After 48 hours
 Code Box: 20lbs Phius Box: 60lbs

Central New Mexico
Community College

THERMAL ENVELOPE COMPONENTS	R-VALUE MINIMUM REQUIREMENT
Walls & Floors	32
Roofs & Ceilings	62



COOL BOX CHALLENGE TESTS AT CNM TESTS HIGH-PERFORMANCE INSULATION

KRQE LOCAL REPORTING YOU CAN TRUST

Pushing the Envelope

Santa Clara Pueblo



Governor's Building —
Fully electric

Central New Mexico



NM Veterans Home —
Fully electric; projected net zero

University of New Mexico



Public Safety Headquarters —
First fully electric building on campus

Albuquerque Community Safety Building



First fully electric building —
Houses crisis-response social workers

When **extreme climate** events occur.

When the **grid fails**.

The building becomes the last line of defense for
safe and habitable survivability.

Let's design it to protect people.



Passive Survivability