



Inhale or Exhale?

Why blower door mode matters.

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Learning Objectives

- Air tightness is important
- Blower door testing
- Two ways to test
- Impact of air barrier on blower door performance
- Test both ways to get an accurate measure of air-tightness

Air-tightness is key to high performance homes

- Energy efficiency
- Moisture-laden air
- Indoor air quality

Asked MS CoPilot® for help...

Air-tightness is key to high performance homes

Energy efficiency



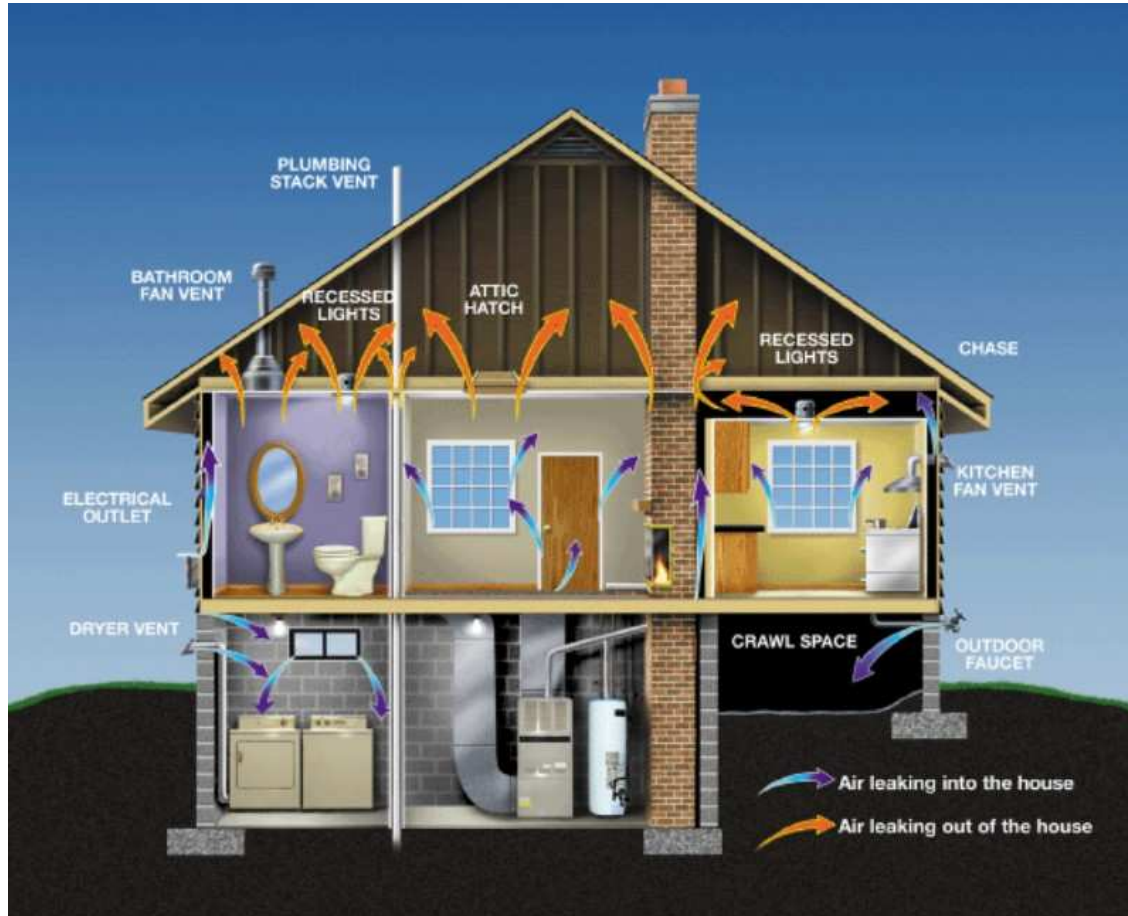
Moisture



IAQ



Blower door testing allows us to quantify air tightness of our homes



*“air leakage accounts for between **25 percent** and **40 percent** of the energy used for heating and cooling in a typical residence”*



Blower door testing allows us to quantify air tightness of our homes



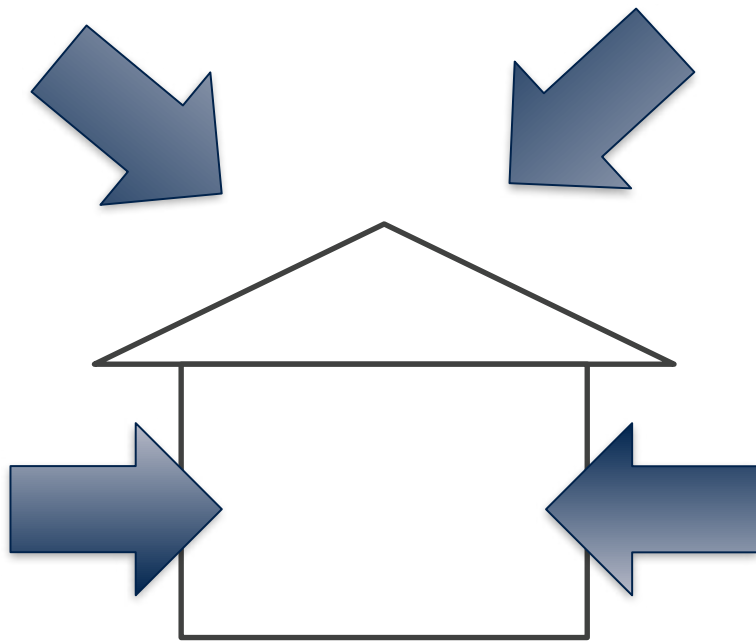
*“air leakage accounts for between **25 percent** and **40 percent** of the energy used for heating and cooling in a typical residence”*



The blower door test has become an important test for air-tightness

Air-tightness (ACH50) is key test for builders

ACH50: Air Changes per Hour at 50 Pa
Simulates 20mph wind on all sides



$$|P_{\text{outside}} - P_{\text{inside}}| = 50 \text{ Pa}$$

Climate Zone	IECC 2021 [1]	DOE ZERH (rev 7) [2]
1, 2	5	3
3, 4		2.5
5, 6, 7	3	2
8		1.5

Blower door/ ACH50 targets getting more stringent

Codes driving the industry towards tighter homes

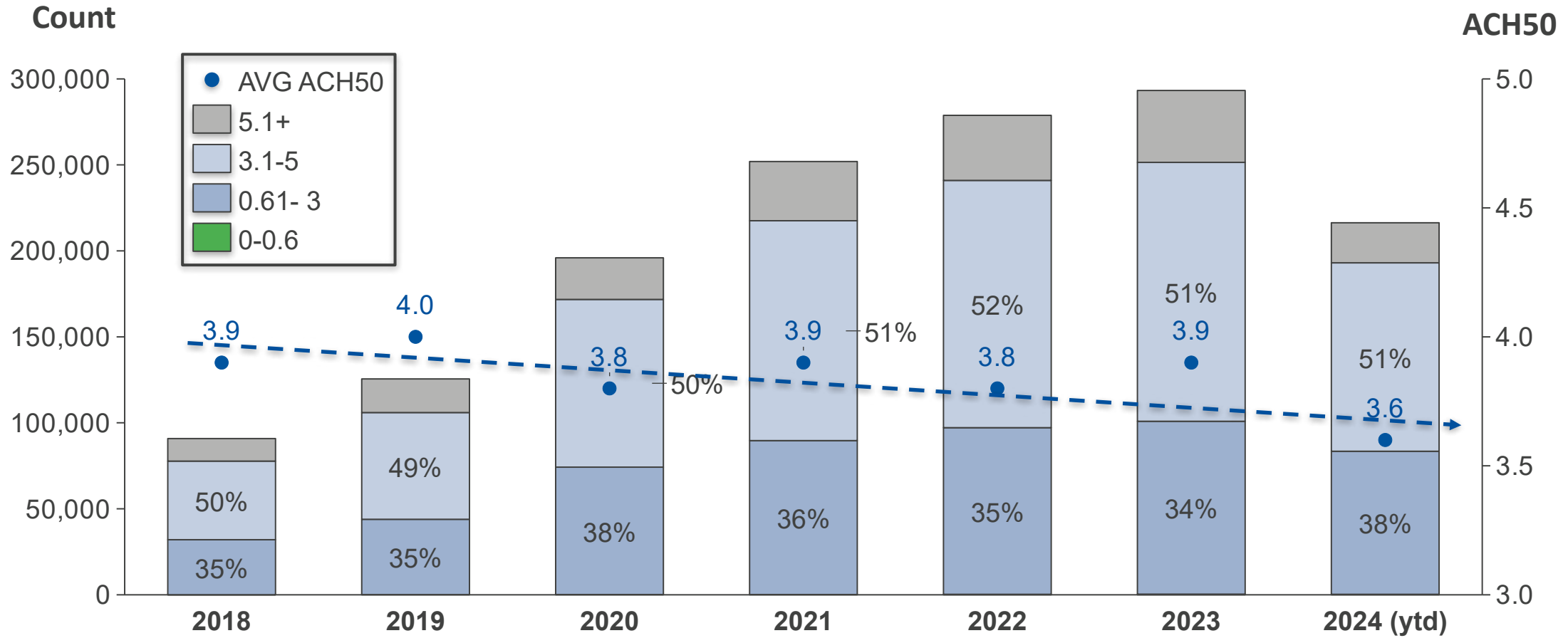
Building/ Energy Codes



a homebuilder meeting a code inspector on the jobsite

Homes are getting tighter

...But blower door performance starting to plateau



Can new building practices help builders push the envelope?

Team sought to study impact of attachment strategy on ACH50

...But jobsites can be an imperfect lab

Lab conditions enabled isolation of air barrier on air-tightness



Install/ testing done on full-sized house

Total Conditioned Floor Area, SF	1,357 ft ²
Volume excluding attic	12,215 ft ³
Volume including attic	14,192 ft ³

- Conducted testing in accordance with **ICC 380-2019**
- Measured CFM50 and calculated ACH50 (air changes per hour at 50 Pascals pressure differential) for all tests
- Test Equipment: **Minneapolis Blower Door System**, airflow accuracy $\pm 3\%$, with **TEC DG-700 manometer**

$$ACH\ 50 = \frac{CFM\ 50 \times 60}{Volume\ of\ Conditioned\ Space}$$



Team developed a baseline reflecting basic building practices



Install/ testing done on full-sized house

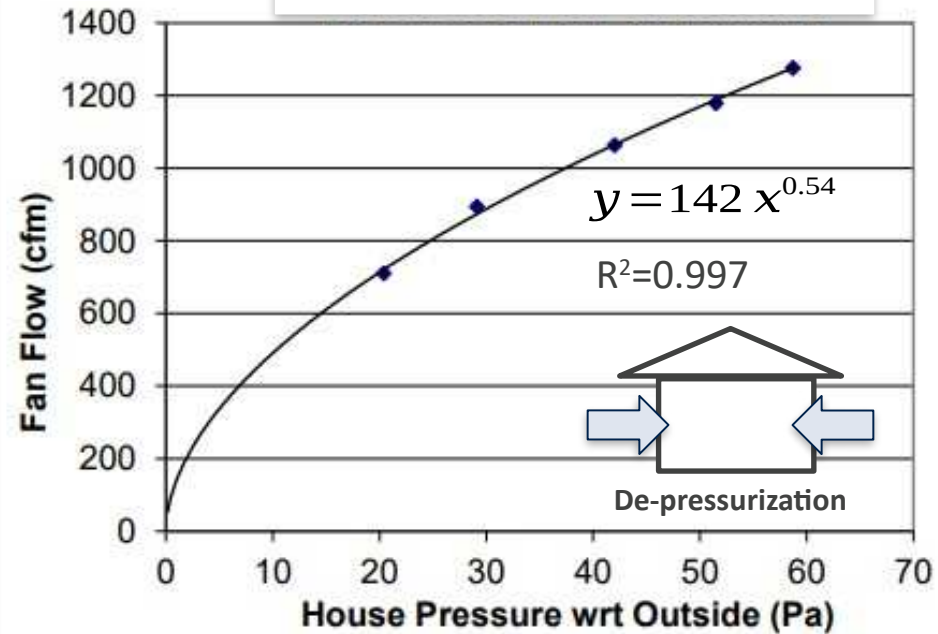
- Mechanically fastened housewrap, no taping
- Slab on grade
- Fiberglass batt in exterior walls
- Fiberglass batt in attic
- Typical air-sealing package
- Traditional ventilated attic

Multi-point CFM50 data used to calculate ACH50

1. Test



2. Multi-point Regression



3. Calculate ACH50

$$CFM\ 50 = 142 \times 50^{0.54}$$

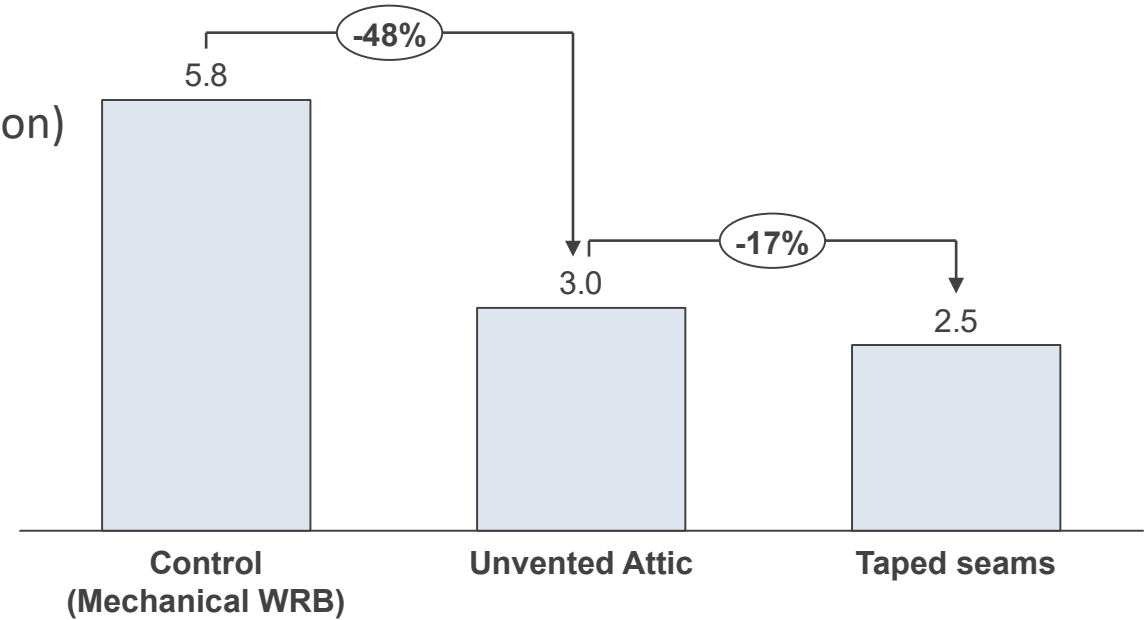
$$ACH\ 50 = \frac{CFM\ 50 \times 60}{Volume}$$

5.8 ACH 50

Unvented attic and taped seams improves air-tightness



Blower Door
[ACH50]
(de-pressurization)

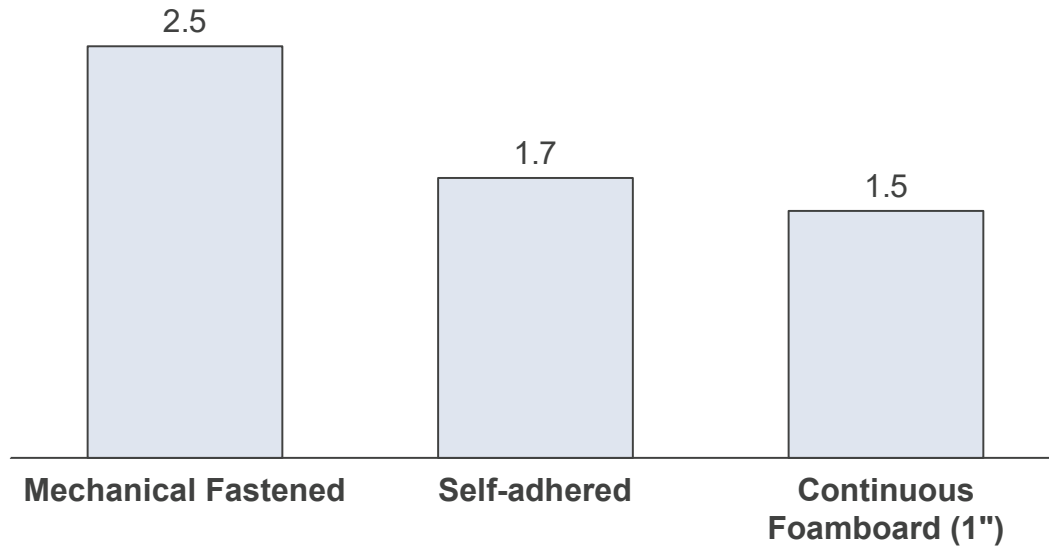


Sprayfoam unventilated attic

1. Simplifies the geometry for air-sealing
2. Increases the conditioned volume
3. brings the ducts and mechanicals into conditioned space

Exterior air-sealing approach simplifies geometry

Blower Door [ACH50]
(de-pressurization)



Fastening method for air-barrier can impact blower door performance

Proper taping is required to achieve air-tightness with mechanically fastened WRB

Mechanical-fastened WRB



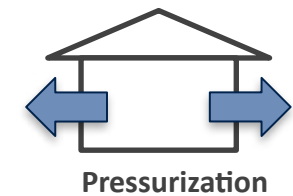
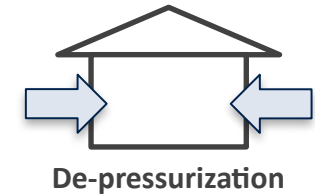
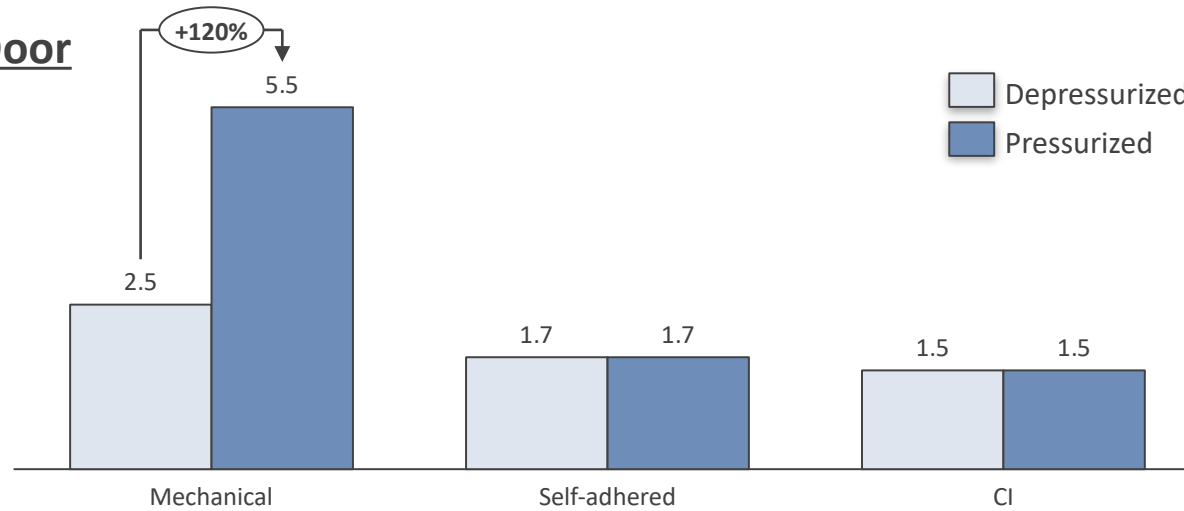
Self-adhered WRB



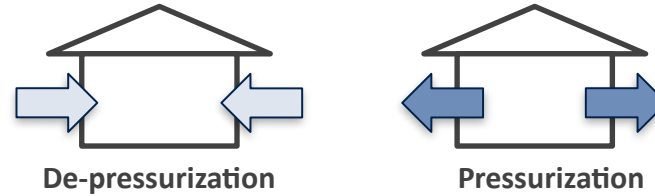
1" CI (EPS)



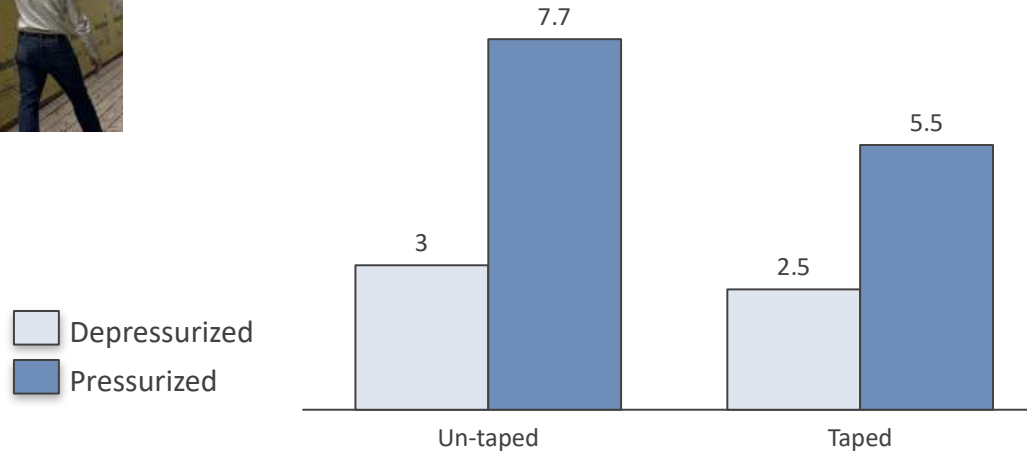
Blower Door
[ACH50]



To achieve air-tightness with mechanically fastened WRB, proper taping is important



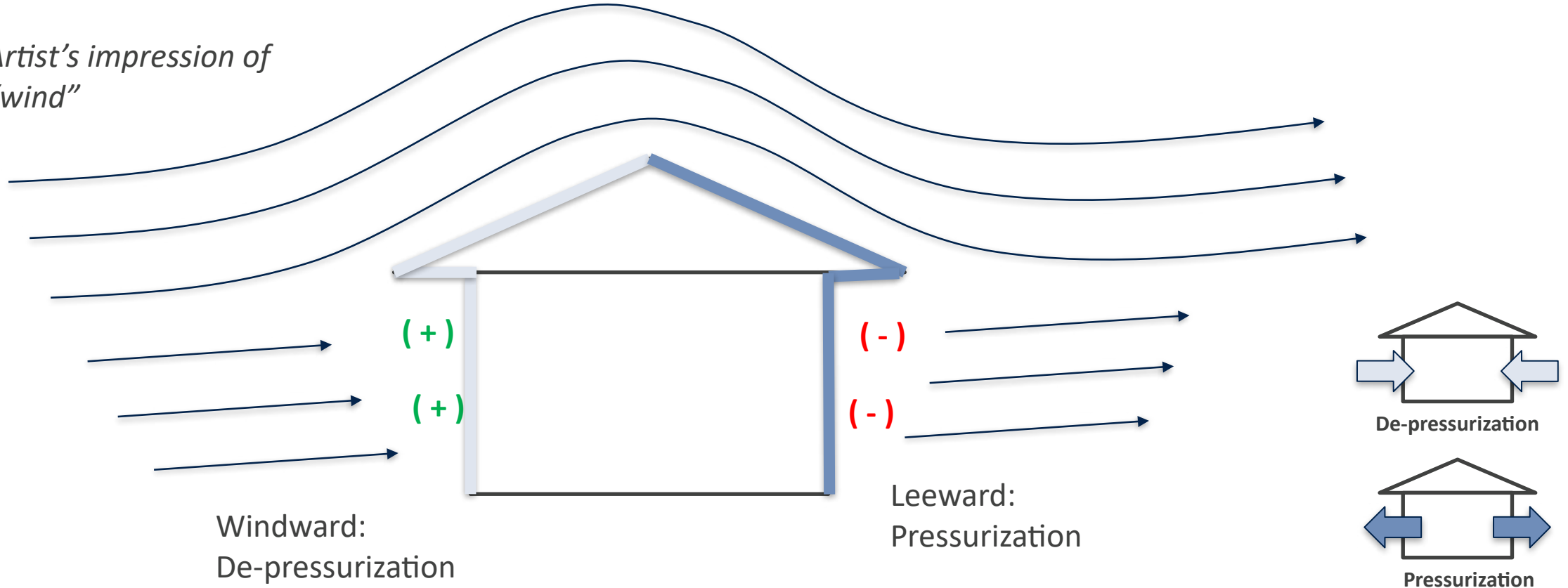
**Blower Door
[ACH50]**



Tight envelope accomplished with good attention to detail

Air barrier that performs under all conditions

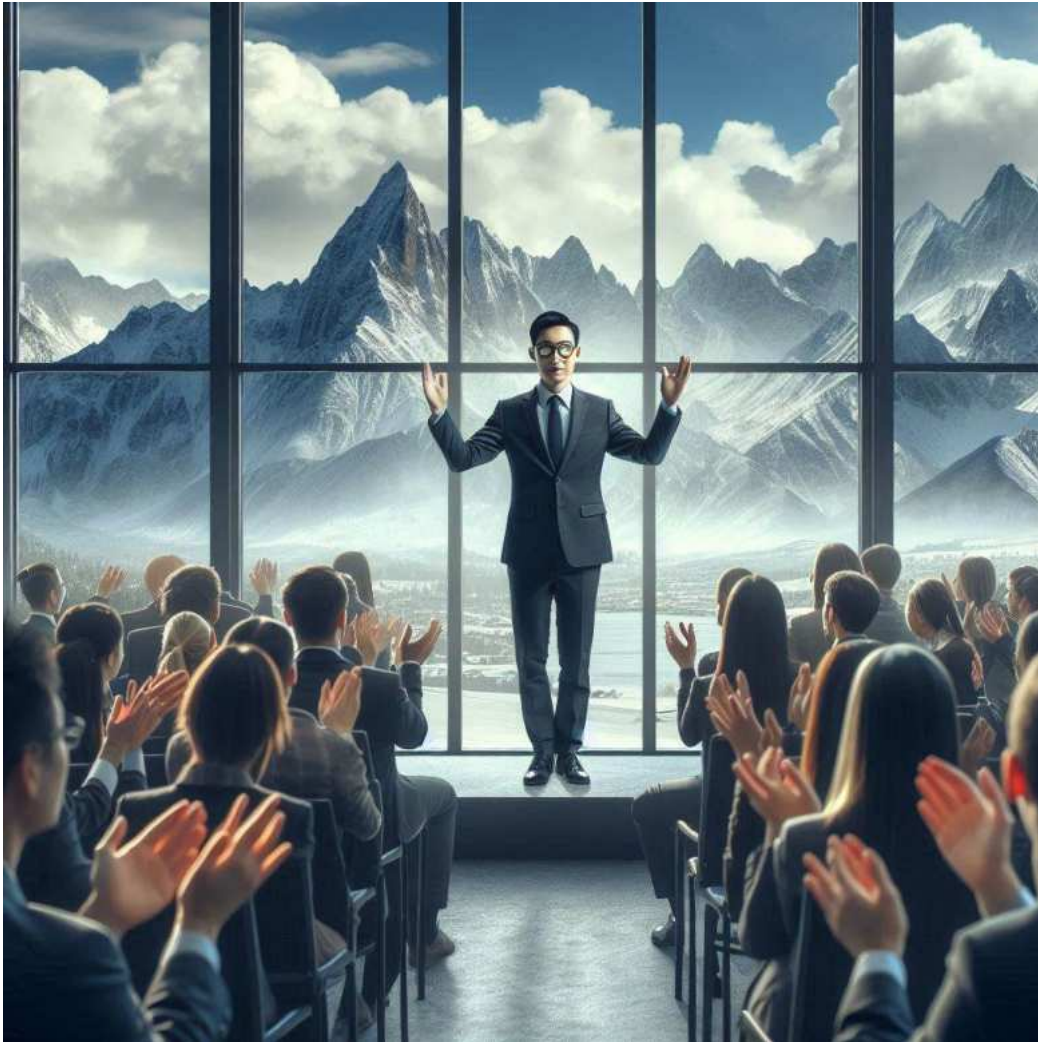
Artist's impression of "wind"



Learning Objectives

- Air tightness important for High Performance Homes
- Blower door testing measures air-tightness
- Depressurization is the common mode of testing
- Fastening method impacts air-tightness
- Builders should test with both methods to get an accurate measure of air-tightness

Inhale or Exhale? Why Blower door mode matters. Questions?



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