INFILTRATION:

The Good, The Bad, and The Ugly

Lisa Ng, PhD, National Institute of Standards and Technology
June 8, 2022

WHO AM I?

- Mechanical Engineer, NIST
  - Indoor air quality
  - Airflow and contaminant simulation
  - Energy modeling
- Member of: IBPSA-USA, ASHRAE
- Mentor

INFILTRATION – THE GOOD

- We are talking about it more

INFILTRATION – THE BAD

INFILTRATION – THE GOOD

- Understand it https://www.nist.gov/video/building-airflow-physics

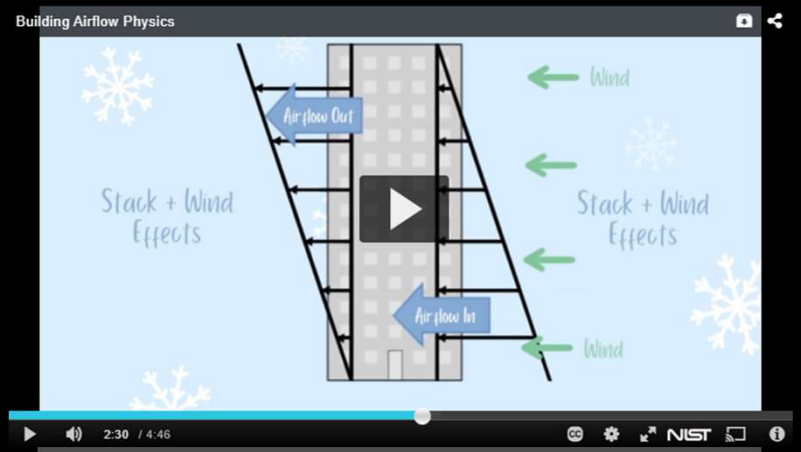
INFILTRATION – THE GOOD

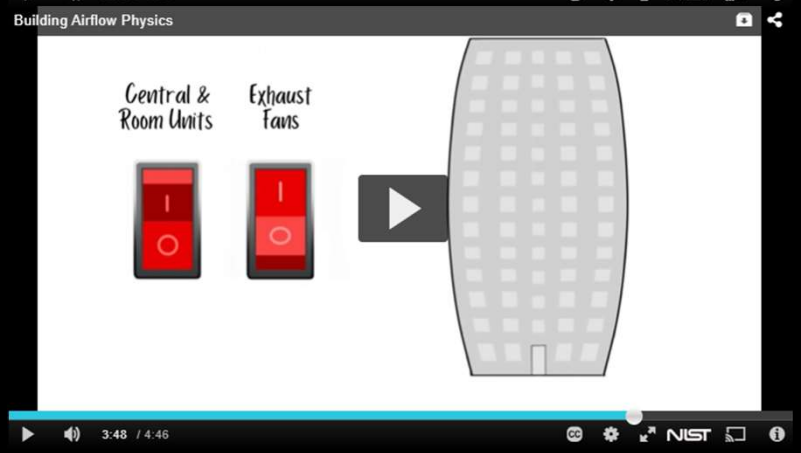
1. Which direction does air flow?

a) High temperature to low temperature
b) Low temperature to high temperature

2. Can air infiltrate buildings that are pressurized?

a) Yes
b) No
c) It depends!





INFILTRATION – THE GOOD

3. In what climate is infiltration an important issue?

a) Very cold
b) Very hot
c) It depends!

4. Infiltration is a constant value.

a) True
b) False

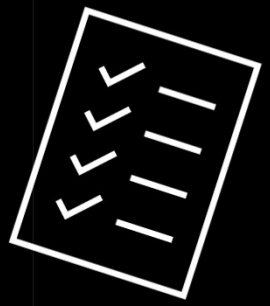
INFILTRATION – THE GOOD

- Solutions
  - Improve building envelope airtightness
  - Mechanical ventilation for indoor air quality
- Tools to evaluate its impact

+

- NIST
- Oak Ridge National Laboratory
- Air Barrier Association of America

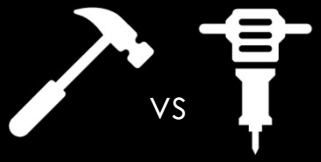
INFILTRATION – THE BAD



- How leaky is my building?
- Does infiltration even matter?
- How do I model infiltration?

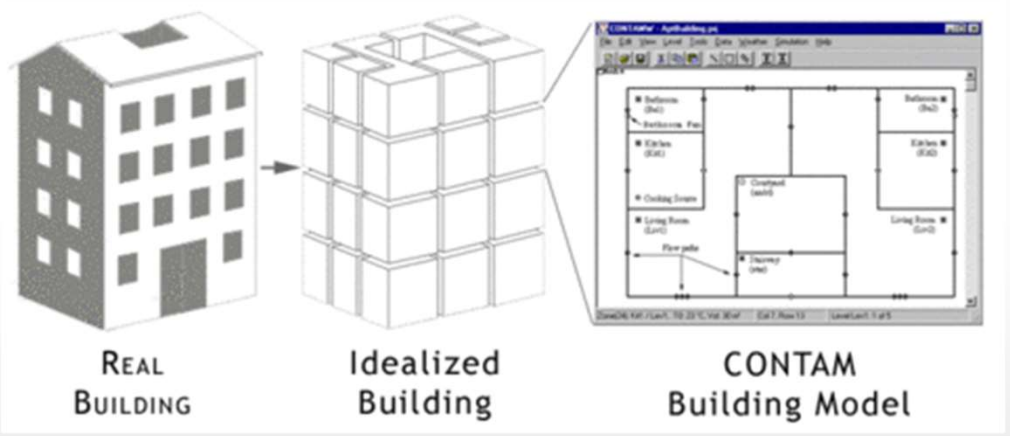
INFILTRATION – THE UGLY

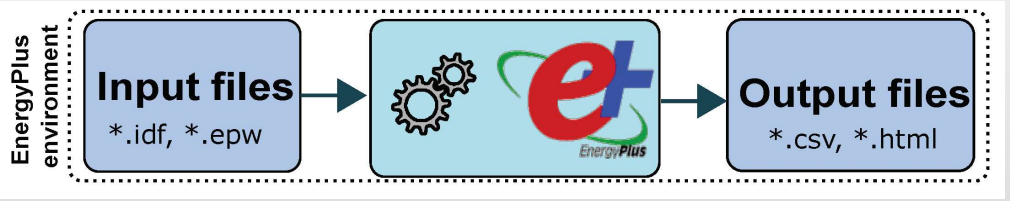
- Assuming 0 or constant infiltration
- Not taking into account HVAC system operation or weather in simulations
- Not using available tools



TOOLS

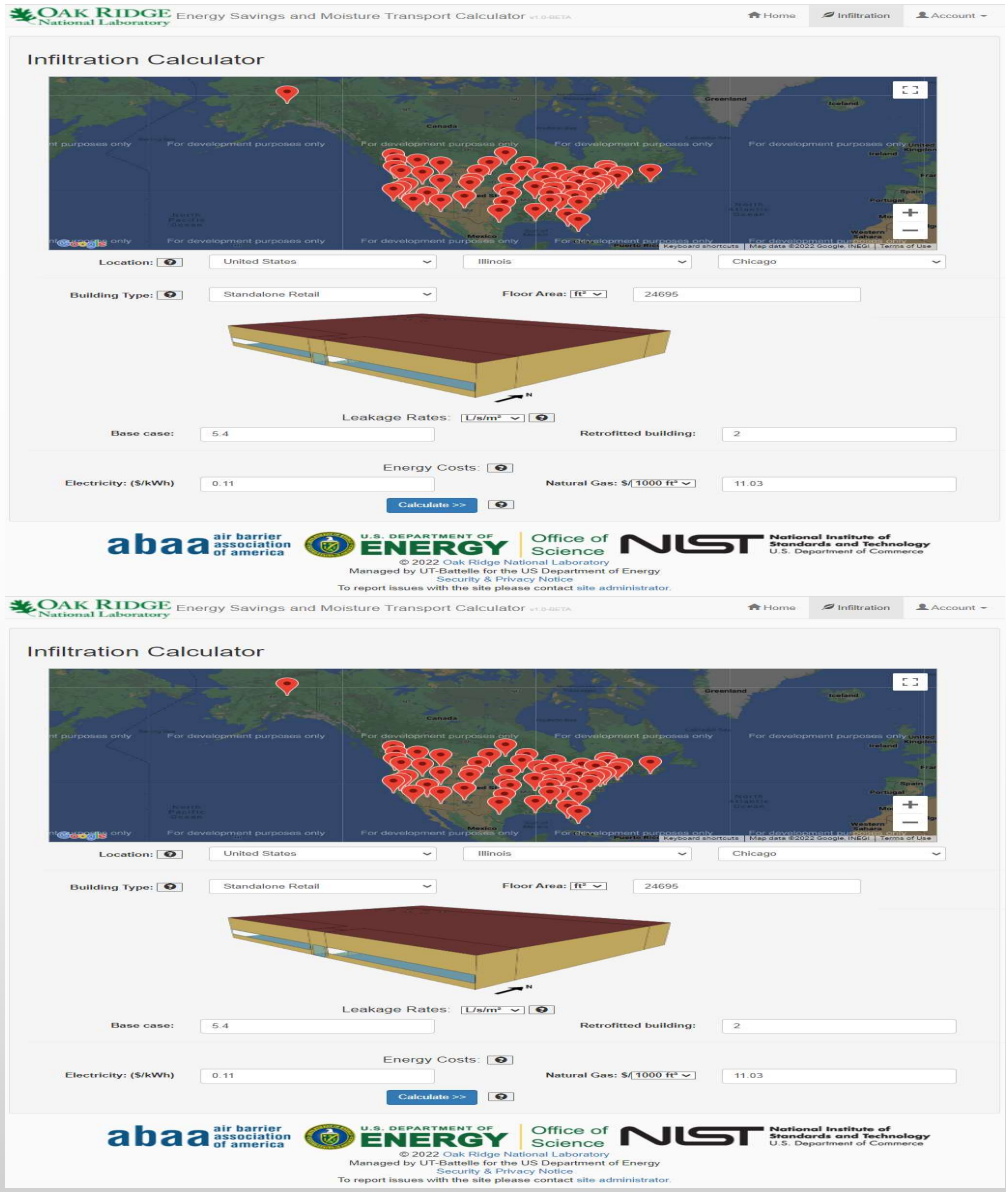
NIST, Oak Ridge National Laboratory and Air Barrier Association of America





INFILTRATION CALCULATOR

https://airleakage-calc.ornl.gov/#/



INFILTRATION CALCULATOR

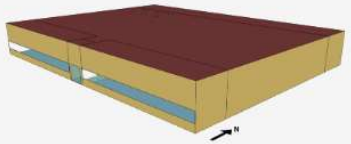
https://airleakage-calc.ornl.gov/#/

OAK RIDGE National Laboratory Energy Savings and Moisture Transport Calculator v1.0-BETA

Home | Infiltration | Account

Infiltration Calculator Results

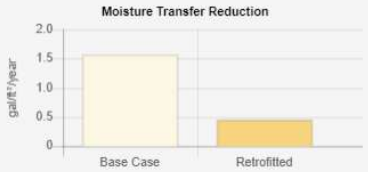
Building Type	Standalone Retail
Location	Chicago IL USA
Floor Area	24695 ft²
Energy Price	Electricity 0.11$ /kWh, Natural Gas 11.03$ /1000 ft³



Leakage Rate		Equivalent Leakage Area	
Base Case	Retrofitted Building	Base Case	Retrofitted Building
5.40 L/s/m² at 75 Pa	2.00 L/s/m² at 75 Pa	11.65 ft²	4.31 ft²

Predicted Annual Savings	Electricity	Natural Gas
Energy	9,502 kWh	329,947 ft³
Cost	$ 1,045.26	$ 3,639.32
Total Cost Savings	$ 4,684.57	

Moisture Transfer through the Wall Assembly due to Air Leakage		
Description	Base Case	Retrofitted Building
Total Moisture transfer	58,631 gal/year	17,286 gal/year
Moisture transfer per envelope area	1.57 gal/ft²/year	0.46 gal/ft²/year
Moisture transfer per effective leakage area (ELA)	34.96 gal/in²/year	27.83 gal/in²/year

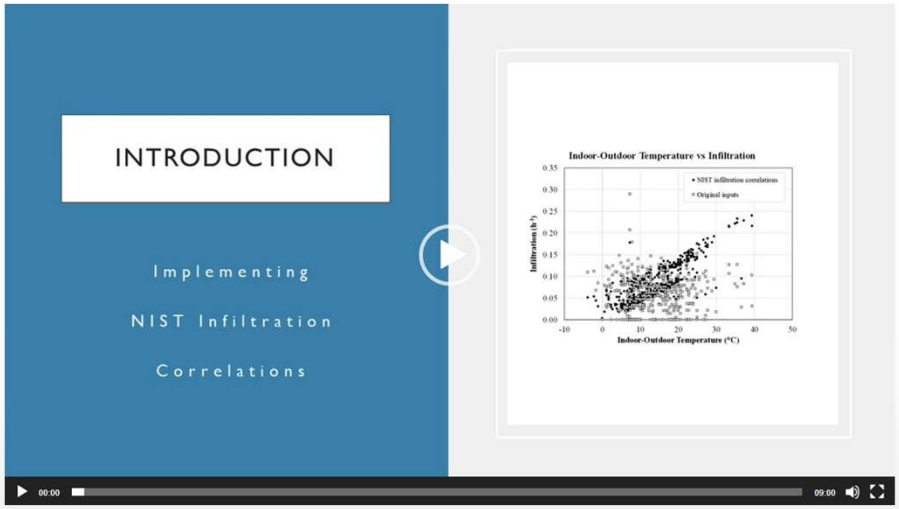


abaa air barrier association of america | U.S. DEPARTMENT OF ENERGY | Office of Science | NIST National Institute of Standards and Technology U.S. Department of Commerce

NIST INFILTRATION CORRELATIONS & HOW TO USE THEM

https://www.airbarrier.org/nist-infiltration

$$\text{Infiltration} = I_{design} \cdot F_{schedule} \left[A + B|\Delta T| + C \cdot W_s + D \cdot W_s^2\right]$$



Video: https://www.airbarrier.org/nist-infiltration/
Written tutorial: https://www.nist.gov/publications/implementing-nist-infiltration-correlations
NIST infiltration correlations: https://data.nist.gov/od/id/mds2-2598

THANK YOU!

Lisa Ng

Email: lisa.ng@nist.gov

LinkedIn: https://www.linkedin.com/in/lisachenng/

Join our list serve: infiltration+subscribe@list.nist.gov