

# BUILDING ENVELOPE DESIGN

*Maximizing Efficiency & Occupant Comfort*

Tyler Dagenais  
Co-owner/Manager



# Outline

- ▶ Intro - me, Prairie ICF
- ▶ Building Envelope - What? Why?
- ▶ Options - Our Products
- ▶ Aeroseal Envelope
  - ▶ Process
  - ▶ Results
- ▶ Upcoming Changes to NBC
- ▶ Outsulation/Power of One
- ▶ Questions?

# My background

- ▶ Construction through high school and University
- ▶ Received B. Comm from U of S and immediately entered Construction Industry
- ▶ Began employment with Prairie ICF (then PR Sustainable Homes) in April 2007 as a Sales Rep
- ▶ Co-owner since 2018
- ▶ Involved in countless residential and commercial projects

# History of Prairie ICF

- ▶ Incorporated in 2005
- ▶ Currently operate in Martensville, SK with projects throughout SK, AB, and beyond
- ▶ Initial focus on distribution of Nudura Insulated Concrete Forms (ICFs) but has since expanded to include Dryvit exterior finish systems, and Aero seal Envelope (formerly Aerobarrier)
- ▶ Services offered include in-house design or design assistance, training, rentals, and material supply
- ▶ Member of SRHBA, Concrete Sask, SCA, EMTF

# Building Envelopes - What is it?

- ▶ A Building's Envelope is the various construction assemblies that separate the interior conditioned space from the exterior environment
- ▶ Roof, basement floor, walls (including W&D, insulation, WRB, exterior finish, etc)

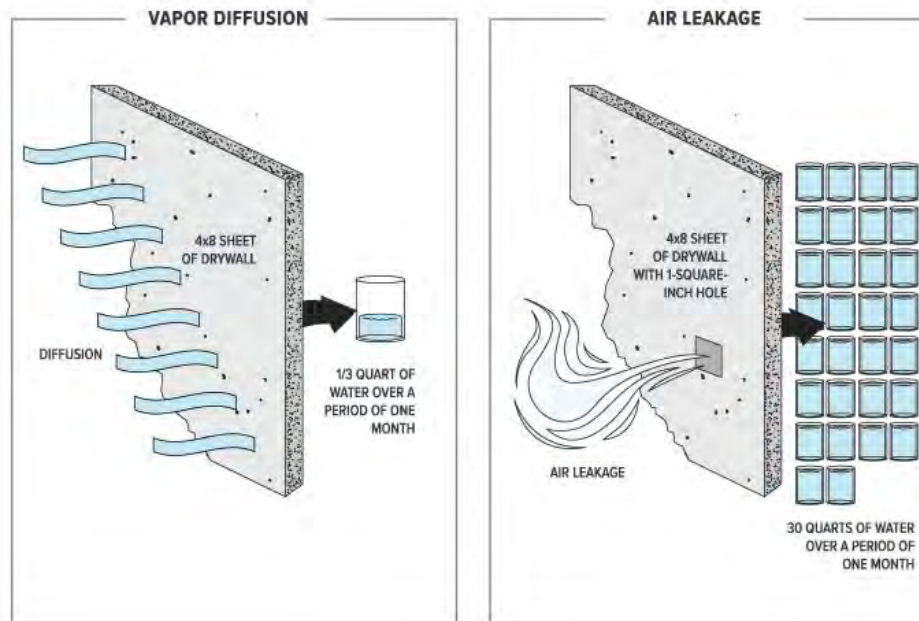


# Building Envelopes - Why is it important?

- ▶ BECAUSE SASKATCHEWAN IS COLD!!!!!!
- ▶ A building's envelope will ultimately determine energy efficiency, operating costs, occupant comfort, & air quality
- ▶ Reduce mechanical size (maybe)
- ▶ Economical from day 1 in some cases (heat type, location)
- ▶ Factors that determine performance:
  - ▶ Insulation Levels (Whole Wall R-value)
  - ▶ Thermal Mass
  - ▶ Passive Solar Gain
  - ▶ Air Tightness

# Building Envelopes - Why is it important?

- ▶ Uncontrolled air leakage accounts for 25-40% of energy usage (per energystar.gov)
- ▶ Passive air movement introduces moisture, noise, and pollutants
- ▶ Moisture = mold, rot, decay, reduction in insulation performance



# Building Envelopes - Why is it important?

- ▶ 3 steps to energy efficient design to maximize your investment (taken from an article by Dr. Rob Dumont)
  - ▶ #1: Design to eliminate wasted space, maximize passive solar gain, light colors, etc
    - ▶ ELIMINATE LOAD AT DESIGN
  - ▶ #2: Building envelope should be well insulated, air tight, high thermal mass
    - ▶ REDUCE THE REMAINING LOAD
  - ▶ #3: Mechanical system should be most efficient/economical for remaining load
    - ▶ PROVIDE NEEDED LOAD REMAINING



# What is the “best” option?

- ▶ Countless options available - often site location, access to materials/trades, etc will determine best for a given project
- ▶ Double Stud Walls
- ▶ SIPS
- ▶ Straw Bale
- ▶ ICF
- ▶ Exterior Insulation

# Common Nudura Options



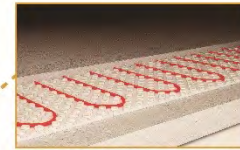
NUDURA Ceiling Technology



Brick Ledge & ICF Connector



NUDURA Standard Form & Waterproofing Membrane



HYDROFOAM® Radiant Heat Insulation



NUDURA 90° Form

# Building an ICF wall

## 1. Prepare Footings For Block



# Building an ICF wall

## 2. Stack Forms & Create Openings



# Building an ICF wall

## 3. Place Rebar In The Walls





# Building an ICF wall

## 4. Align Wall For Concrete Pour



# Building an ICF wall

## 5. Pour Concrete into walls



# Building an ICF wall

6. Install electrical, plumbing & roof

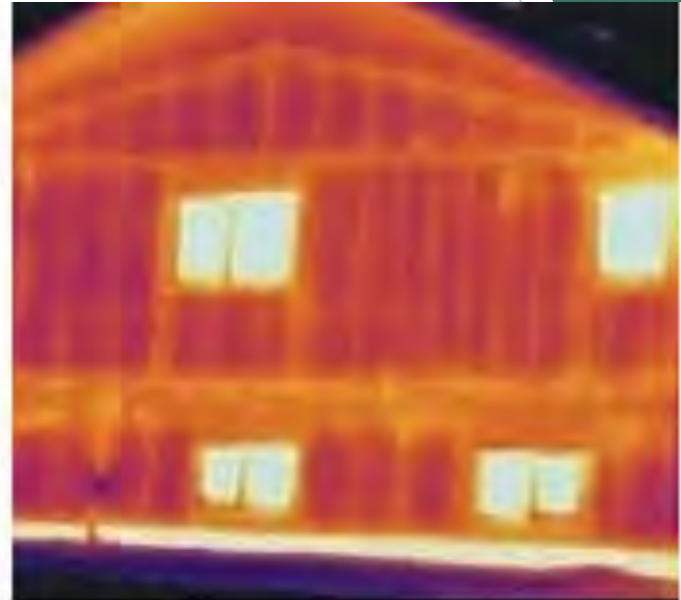




# R-value

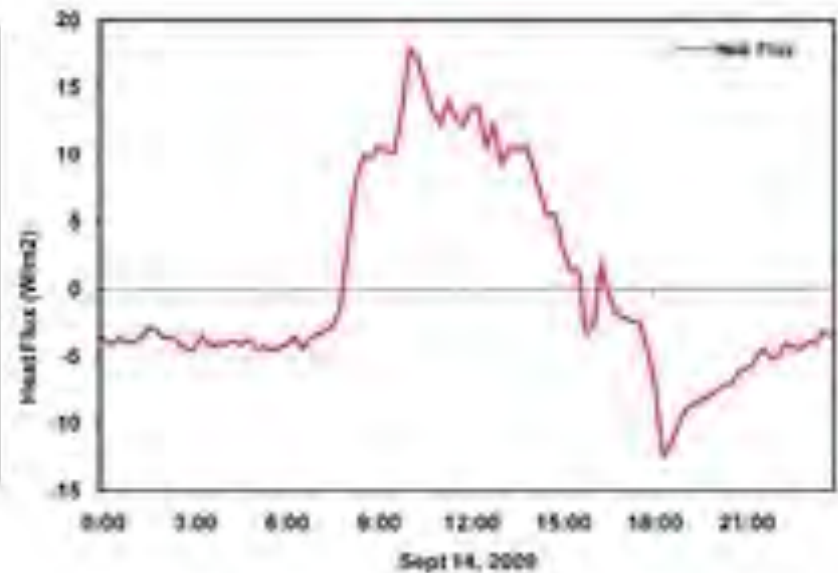
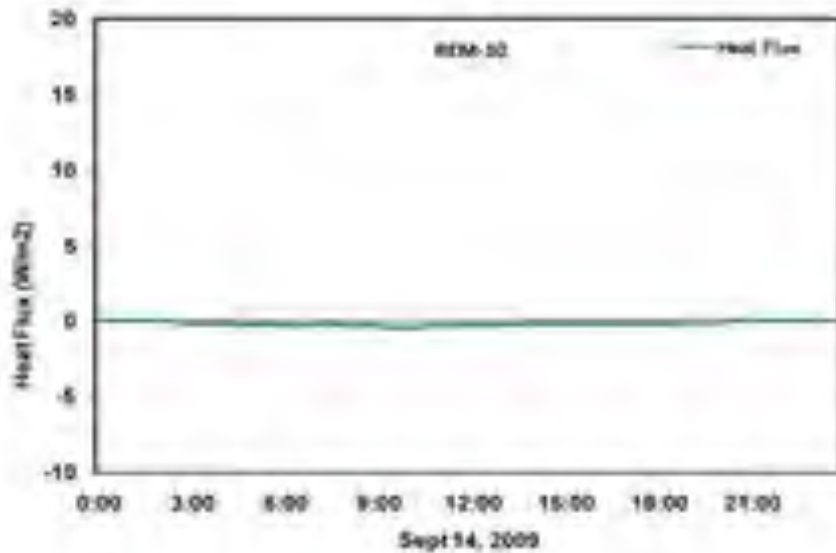


**ICF Home**



**Stick frame with Batt  
Insulation**

# Heat Flow



- ▶ ICF vs identical wood frame structure at same location over 24 hrs
- ▶ Above line = heat gain; below line = heat loss

# Energy Savings



THERMAL PERFORMANCE OF AN INSULATED CONCRETE FORM WALL SYSTEM  
AND A 2X6 WOOD FRAME WALL SYSTEM, IN ACCORDANCE WITH TEST  
PROCEDURE ASTM C1363-11

Prepared for:

ICFMA  
11-300 EARL GREY DRIVE, SUITE 460  
OTTAWA, ON, CANADA  
K2T 1C1

CLEB LABORATORY INC.

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The results in this report relate only to the items tested. This report shall not be reproduced except in full, without the written approval of CLEB laboratory Inc.

- ▶ Test conducted by CLEB Labs (commissioned by ICFMA)
- ▶ ASTM C1363-11 “Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus” @ -35C exterior, 21C interior
- ▶ Wood wall = 60hrs to reach steady state
- ▶ ICF wall = 324hrs to steady state
- ▶ 60% energy savings

# Typical Nudura wall



- ▶ Continuous Insulation
- ▶ Air Tight
- ▶ No Thermal Bridge
- ▶ High Thermal Mass
- ▶ Fire Rated
- ▶ Moisture Resistance
- ▶ Strong/Safe
- ▶ Floor/Ceiling Insulation Complements ICF

# Air Tightness with ICF



To: Alex Liolios  
6645 Glen Walter Rd, Cornwall, ON, K6H 5R5  
[Alexliolios87@hotmail.com](mailto:Alexliolios87@hotmail.com)

Date: February 17<sup>th</sup>, 2023

Regarding: Final Airtightness Test

Dear Alex,

The final airtightness test was performed on Tuesday February 14<sup>th</sup>, 2023, by me, Stephen Magneron. I take personal responsibility for the accuracy of the information provided.

The result is 0.03 ACH depressurization, 0.03 ACH Pressurization for an average of 0.03 ACH.

The building has two zones that are separated by a solid ICF wall. It was not possible to introduce a wall for the test, so two sets of Minneapolis Duct Blaster B units were used. Each unit was installed at the front door of each unit. TECLOG4 was used to perform the 2-zone whole building test. The building was so tight that only the blower door in the left unit was used for the test. The blower door in the right unit was essentially used to measure the pressure. The entire test took a little over 2.5 hours.

The results have been sent to The Energy Conservatory for their review. Their response is pending.

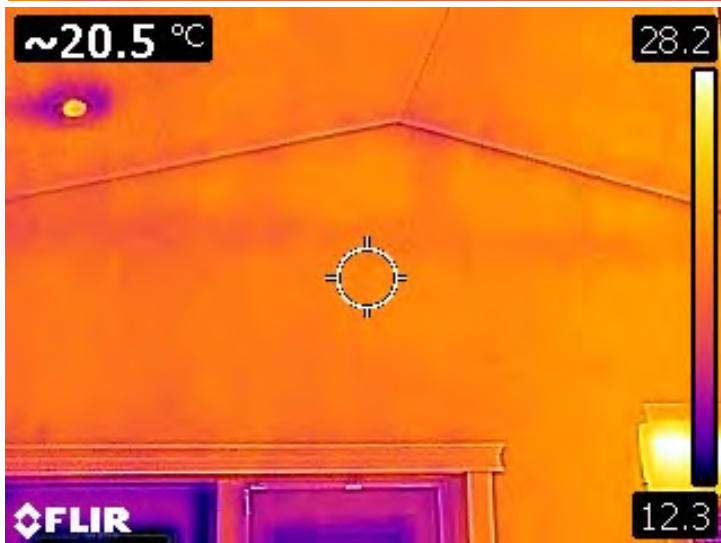
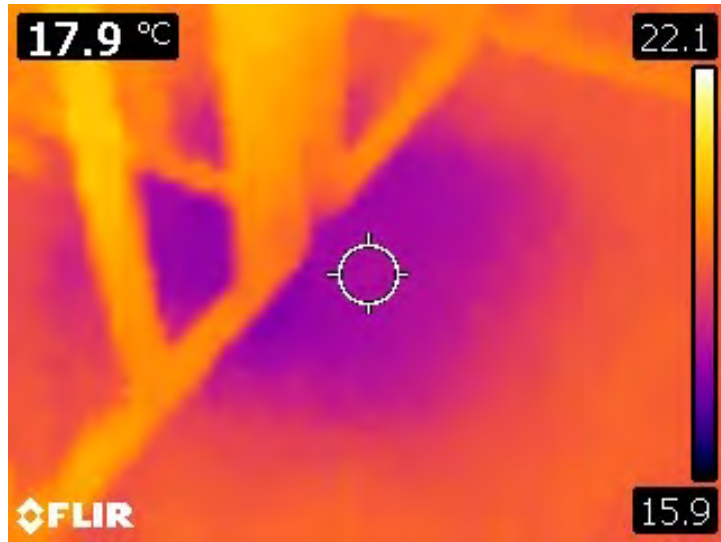
Note that individual unit testing was conducted before the whole building airtightness test. The Left unit achieved 0.09 ACH and the Right unit achieved 0.10 ACH, depressurization only.

Regards,

**Stephen Magneron** CPHC, PHIUS+Verifier, REA  
Ontario Regional Manager  
Homesol Building Solutions Inc.

- ▶ Side-by-Side Duplex
- ▶ ICF party wall between units
- ▶ Final test = 0.03ACH

# Not just the walls!!!



- ▶ Basement floors
- ▶ Rim Boards
- ▶ Ceilings
- ▶ Mech & Elec Penetrations

That's old....What's new???





# Aeroseal Envelope: The Process

- ▶ STEP 1: Prep
- ▶ STEP 2: Blower door pressurizes a building
- ▶ STEP 3: Atomized caulking is dispersed
- ▶ STEP 4: Software provides real-time data to reach target ACH50
- ▶ STEP 5: Clean up and submit sealing report



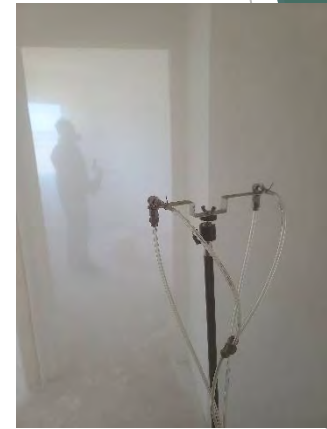
# The Aeroseal Envelope Process: Step 1 - PREP



# The Aeroseal Envelope Process: Step 2 - Pressurize

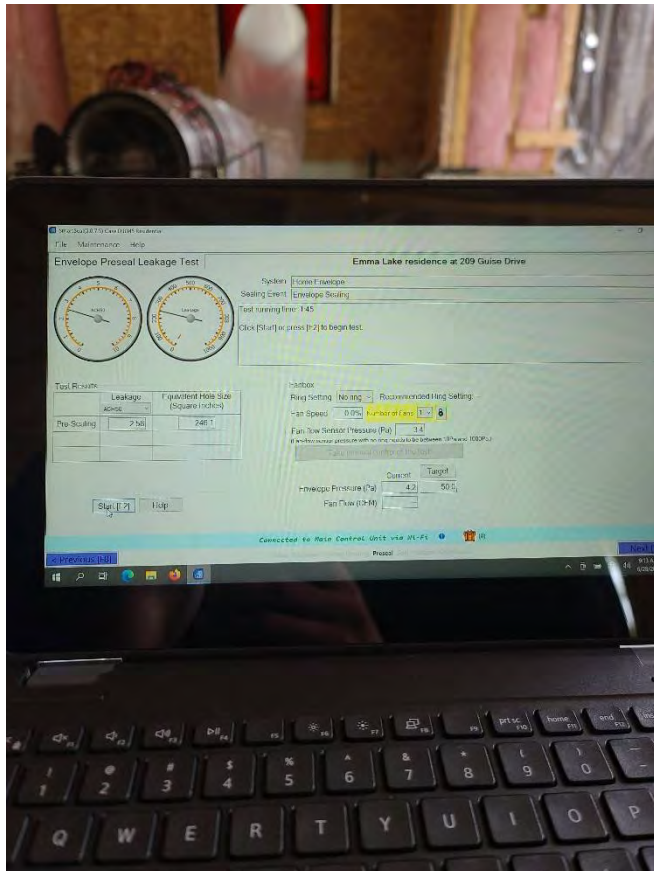


# The Aeroseal Envelope Process: Step 3 - Seal





# The AeroSeal Envelope Process: Step 4 - Monitor



# The Aeroseal Envelope Process: Step 5 - Clean & Report

## Envelope Sealing Results:

### **BEFORE SERVICE**

**630.3 CFM of Leakage**, equivalent to a  
**75.9 Square Inch Hole**, or  
**1.98 Air Changes per Hour**

(for your 2124-ft<sup>2</sup> structure  
enclosing a volume of 19116 cubic feet)

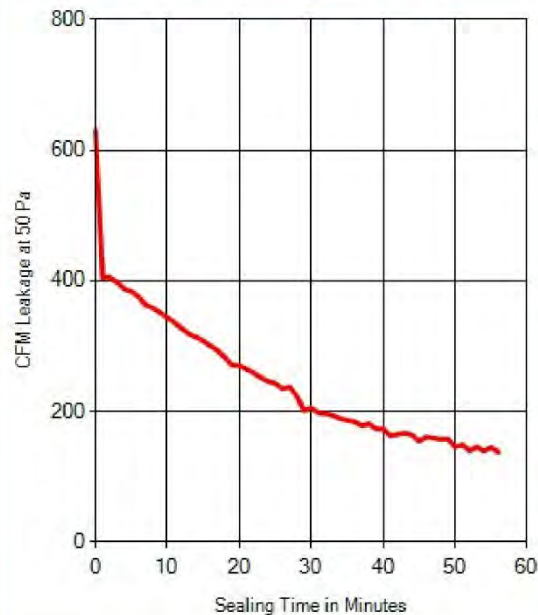
### **AFTER SERVICE**

**137.4 CFM of Leakage**, equivalent to a  
**16.5 Square Inch Hole**, or  
**0.43 Air Changes per Hour**

This corresponds to a  
**78.2% Reduction**  
**in Envelope Leakage**

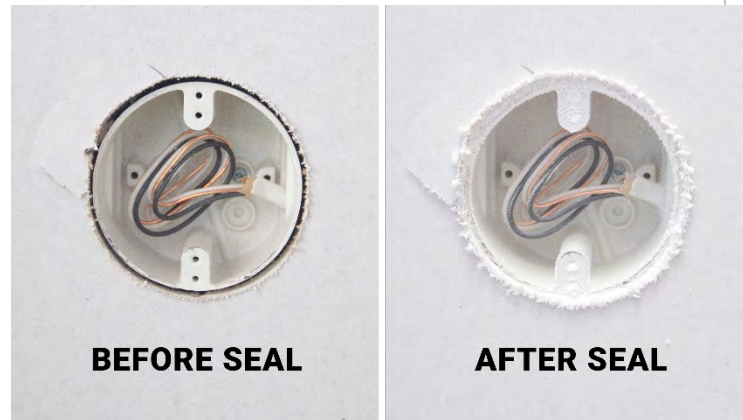
**NOTE:** Envelope leakage and air-change results are  
calculated at a standard pressure of 50 Pa.  
Sealing time elapsed: 1:07:59

## Envelope Sealing Progress:



# Typical Results

- ▶ Improvements in overall air tightness typically 50% or greater
- ▶ 80-90% improvements are common



# IS IT SAFE?

- ▶ Sealant is water soluble, ultra-low VOC organic compound
- ▶ Inert (not a reactive process) = no off-gassing
- ▶ GREENGUARD Gold Certified (used in schools, hospitals, etc)
- ▶ DO NOT ENTER WHEN SEALING (PPE REQUIRED)
  - ▶ Safe to enter 20-30 min after seal is completed

# PROS

- ▶ Single family home can be sealed in 5-8 hours
- ▶ Real-time monitoring allows target ACH50 to be achieved
- ▶ No active compounds
- ▶ No change to construction details/schedule
- ▶ Able to seal up to ½” size hole
- ▶ Automated
- ▶ Economical
- ▶ Improve air tightness, sound rating, and odor transmission (multi-family party walls)
- ▶ Simulated 50-year durability test with little/no degradation



# CONS

- ▶ Difficult & costly in currently occupied homes (extensive prep to protect finishes from sealant)
- ▶ Added cost (\$2000-4000 for average home - minimal for performance improvements)
- ▶ Availability of new technology limited in some areas - network is rapidly growing
- ▶ Primary air barrier installation will affect cost of AeroSeal Envelope application
  - ▶ AE complements the existing envelope - it does NOT replace the need for good building practices

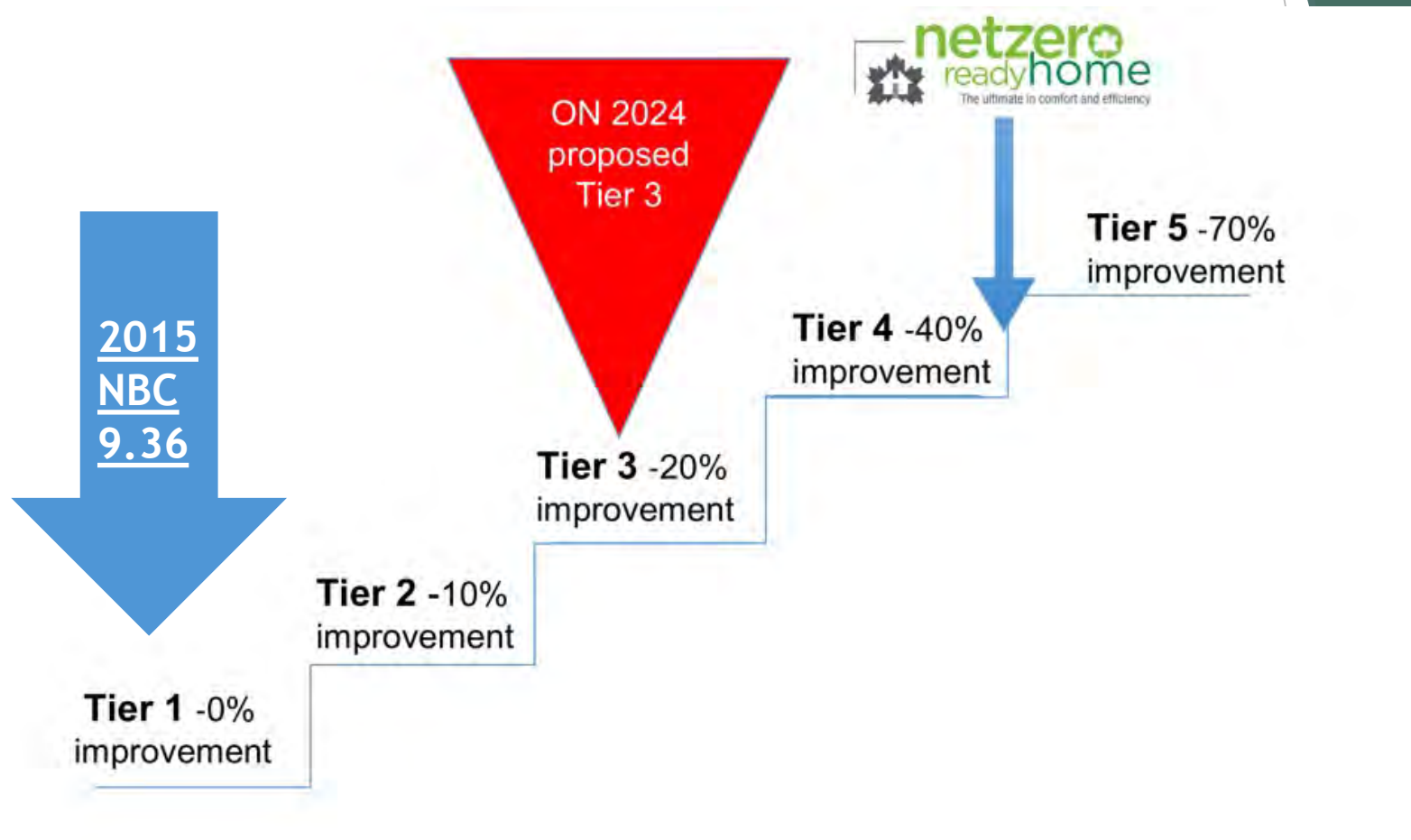
# BUT BUT BUT....A HOME HAS TO BREATHE!!!!!!

- ▶ Sure.....how much?
- ▶ ERV/HRV can offer efficiencies beyond passive air loss
- ▶ Quantify air tightness = right sized mechanical systems
- ▶ “Build Tight, Ventilate Right”

# Air Tightness and an Evolving NBC

- ▶ 5 Step Code to Net Zero mandate in 2030
- ▶ Sask currently at Tier 1
- ▶ Current default for modeling = 3.2ACH
  - ▶ Progress to 1.5ACH in 2030
- ▶ Tier 2 adoption proposed for Jan 1, 2024
  - ▶ 10% increase over current
- ▶ Tier 3 adoption proposed for Jan 1, 2025
  - ▶ “Tiered Prescriptive” approach

# Air Tightness and an Evolving NBC

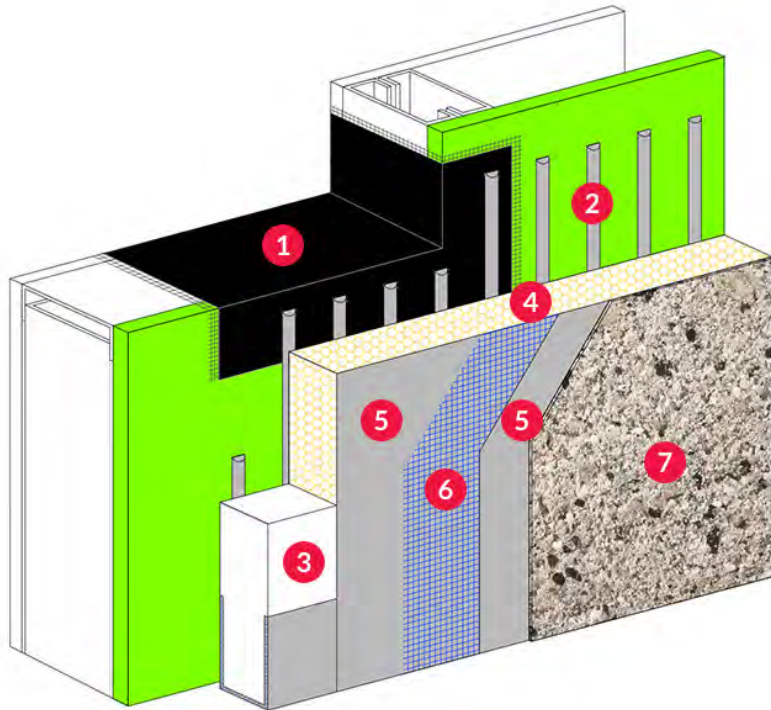


# Tiered Prescriptive Energy Code

Energy Conservation Points	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Minimum Sum - Total Points*	0	10	20	40	75
Minimum Sum - Building Envelope points	0	0	5	15	15
Minimum Airtightness Level (ACH)	2.5	2.5	2.5	2	1.5

Energy Conservation Measures and Points for Airtightness - Detached Homes						
	Zone 4	Zone 5	Zone 6	Zone 7a	Zone 7b	Zone 8
2.5 ACH	-	-	-	-	-	-
2.0 ACH	2.2	3.2	3.5	3.8	4.3	4.8
1.5 ACH	4.3	6.3	6.9	7.6	8.5	9.7
1.0 ACH	6.5	9.6	10.5	11.4	12.9	14.7
0.6 ACH	8.3	12.3	13.4	14.7	16.5	18.8
				Implications for tier 1 & 2		

# Dryvit Outsulation - EIFS



- ▶ Add approx. R8 continuous exterior insulation
- ▶ WRB
- ▶ Drainage layer
- ▶ Exterior finish (various colors, textures, specialty finishes)

# Tremco Power of One

**POWER** *of* **ONE**

One Building Envelope. One Warranty.  
One Powerful System Delivering  
Unmatched Protection for Your Work.

## Why a Single Source Matters

You've staked your reputation on ensuring that the components you install for clients deliver a building envelope that performs. It must shield against the elements, help maintain comfortable interior conditions, and resist forces like fire, explosions and natural disasters.

Why risk cobbling together the envelope with materials from dozens of different suppliers, when you can choose a Tremco Construction Products Group (CPG) building envelope — designed and tested to work as one continuous system and warranted together in a single document? That's one warranty document you can hand over to the building owners at the completion of any project, one call for them if they ever have a problem.

That means fewer call backs for you. And access to a range of technologies that will speed construction, simplify installation and lengthen the construction season. In the unlikely event of product issue, we'll also cover associated labor costs to make the repair.

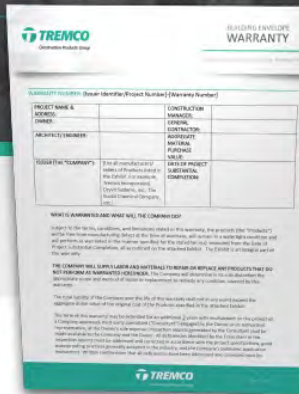
## Systems & Services Covered Under a Single Warranty

- Air & Vapor Barriers
- Cladding
- Glazing Systems
- Insulated Concrete Forms
- Sealants & Adhesives
- Traffic Coatings
- Waterproofing



**Construction Products Group**

*for Contractors*



500 Pacific Ave.

Bremerton, Washington



Scan or click to see  
the full case study

- ▶ Complete Building Envelope Warranty
- ▶ Single source
- ▶ Compatible products/details
- ▶ State of the art testing facility allow for creation and testing of new details

# Thank you!

Tyler Dagenais  
Co-owner/Manager



[www.PrairieICF.ca](http://www.PrairieICF.ca)

**306-244-2933**

*@PrairieICF*



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