



# **AIR LEAKAGE/ AIR SEALING**

## **How Leaky are Canadian Homes?**

### **Results, Opportunities, & Challenges**

*Energy Retrofits for Houses Conference*

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1



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## Objectives

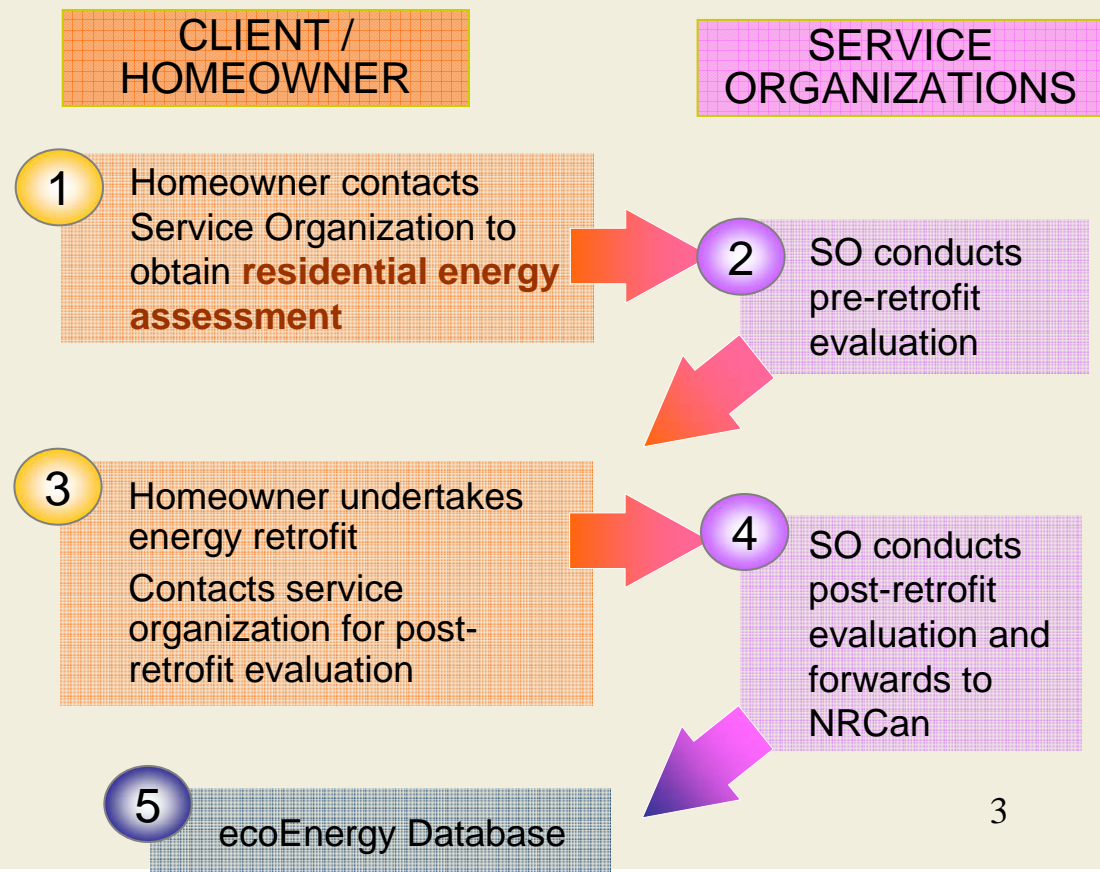
- Overview of the air tightness field test protocols, calculations, and results interpretation
- Trends in air tightness of Canadian housing evaluated under the ecoENERGY Retrofit Homes program
- Air sealing opportunities and challenges identified during the ecoENERGY Retrofit Homes program





# ecoENERGY Retrofit Homes Program

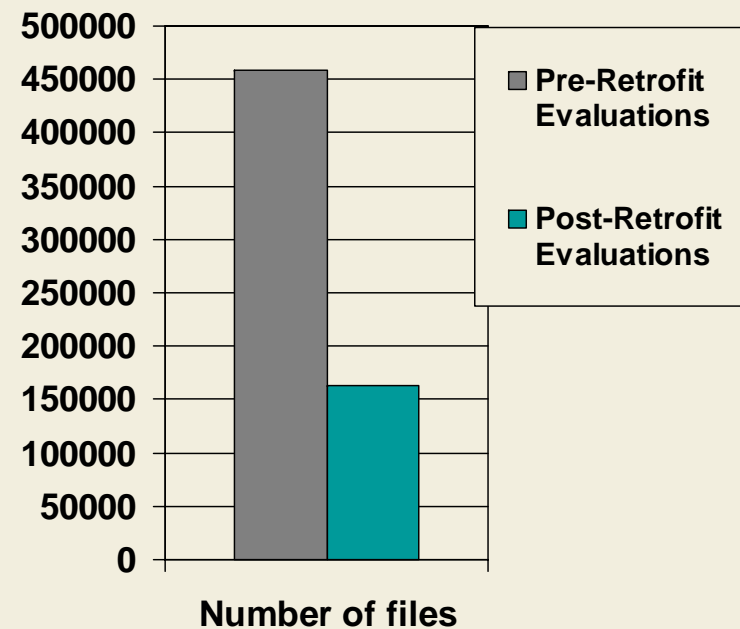
- Residential energy assessment
  - objectives
- Program delivery process





# Housing Programs - Number of Evaluations

- Since 1998
- 770,000 houses
- Under ecoENERGY
  - Service organizations
    - 1582 advisors
  - Retrofit evaluations\*:
    - Pre: 458,581
    - Post: 162,652
  - Evaluations per month:
    - Pre: 35,227
    - Post: 14,660



\*ecoENERGY data from April, 2007 – October 21, 2009





## ecoENERGY Program Impact

- Heating energy consumption reduced by 25% per house
- 8081 TJ of energy saved (assuming standard operating conditions)
- \$98 million/year in fuel savings
- 3.2 tonnes of CO<sub>2</sub> saved per house per year
- 538 kt/year of CO<sub>2</sub> emission reductions under ecoENERGY
- Equivalent to removing 134,000 cars/year from the street

5





# Air Sealing Recommendations

- Air sealing locations
- NRCan fact sheet
- Perform air sealing from interior of house
- Recommend target ACH (generated from past experience)
- Ventilation (e.g., recommend that an HRV be installed)





# Factors Affecting Air Infiltration/Leakage

## Envelope

- Caulking
- Weather stripping
- Insulation
- Punctures through the building envelope
- Window replacement or repair

## Mechanical

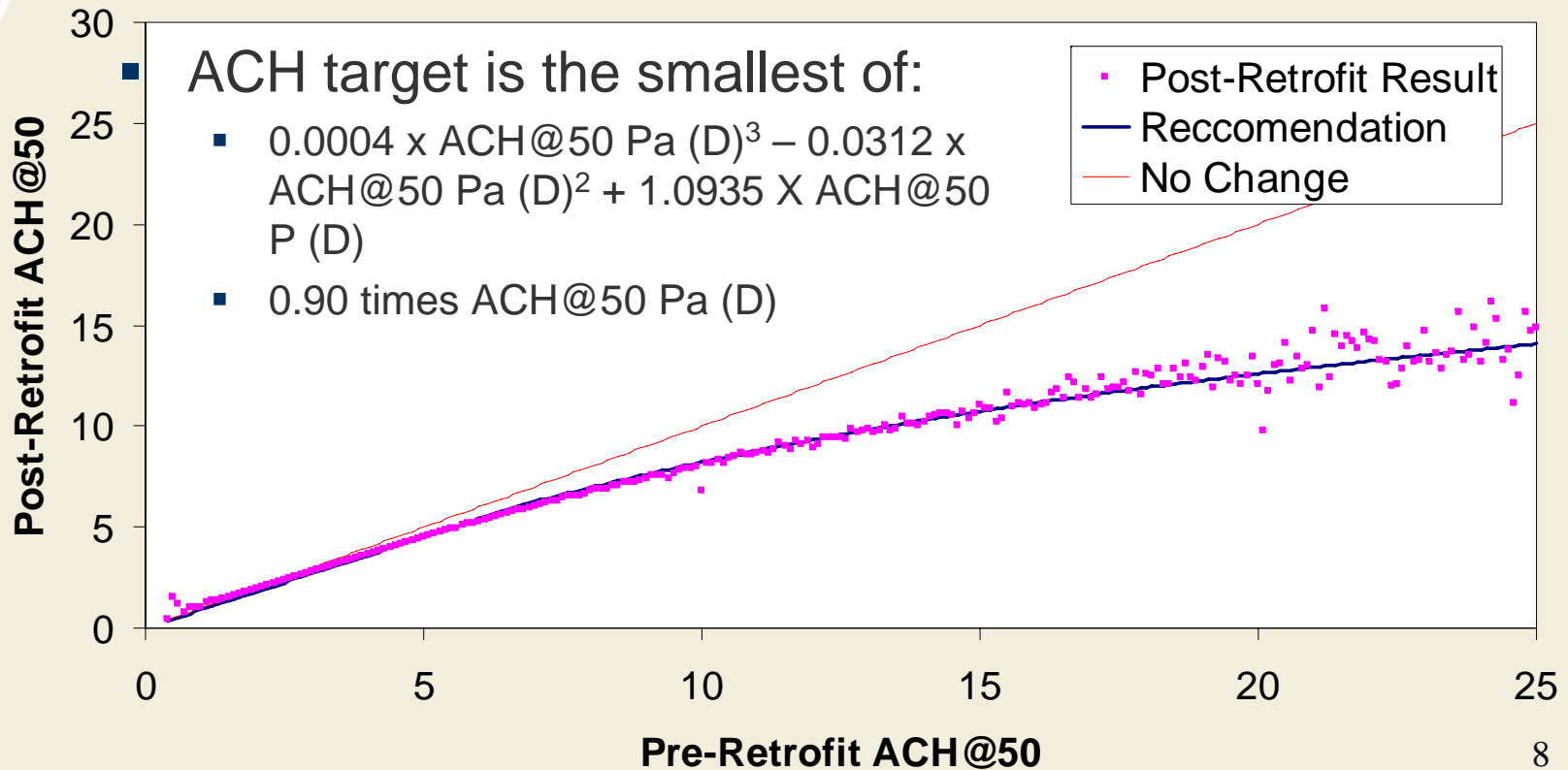
- Heating equipment replacement / adding condensing heating equipment
- Replacing baffles on venting equipment and installing flue dampers
- Adding a motorized damper on combustion air supply<sup>7</sup>





# Recommend target ACH

## Post-retrofit ACH vs Pre-retrofit ACH





# Recommended Ventilation – Toronto

Location

TORONTO

## (A) One-Storey House

Air change rate per hour @ 50 Pa	Natural air change rate	Recommended ventilation to meet 0.30 ac/h during critical month of heating season, ac/h	Setting for Outside Temperature Controlled Ventilation (OCTV), °C
Col. 1	Col. 2	Col. 4	Col. 5
Above 10	> 0.30		
10	> 0.30		
9	> 0.30		
8	0.25	0.06	Exhaust-only
7	0.21	0.11	Exhaust-only
6	0.18	0.14	Exhaust-only
5	0.15	0.16	Balanced HRV
4	0.11	0.20	Balanced HRV
3	0.09	0.23	Balanced HRV
2	0.08	0.23	Balanced HRV

## (B) Two-Storey House

Air change rate per hour @ 50 Pa	Natural air change rate	Recommended ventilation to meet 0.30 ac/h during critical month of heating season, ac/h	Setting for Outside Temperature Controlled Ventilation (OCTV), °C
Col. 1	Col. 2	Col. 4	Col. 5
Above 7	> 0.30		
6	> 0.30		
5	0.25	0.06	Exhaust-only
4	0.19	0.12	Exhaust-only
3	0.14	0.18	Balanced HRV
2	0.11	0.21	Balanced HRV



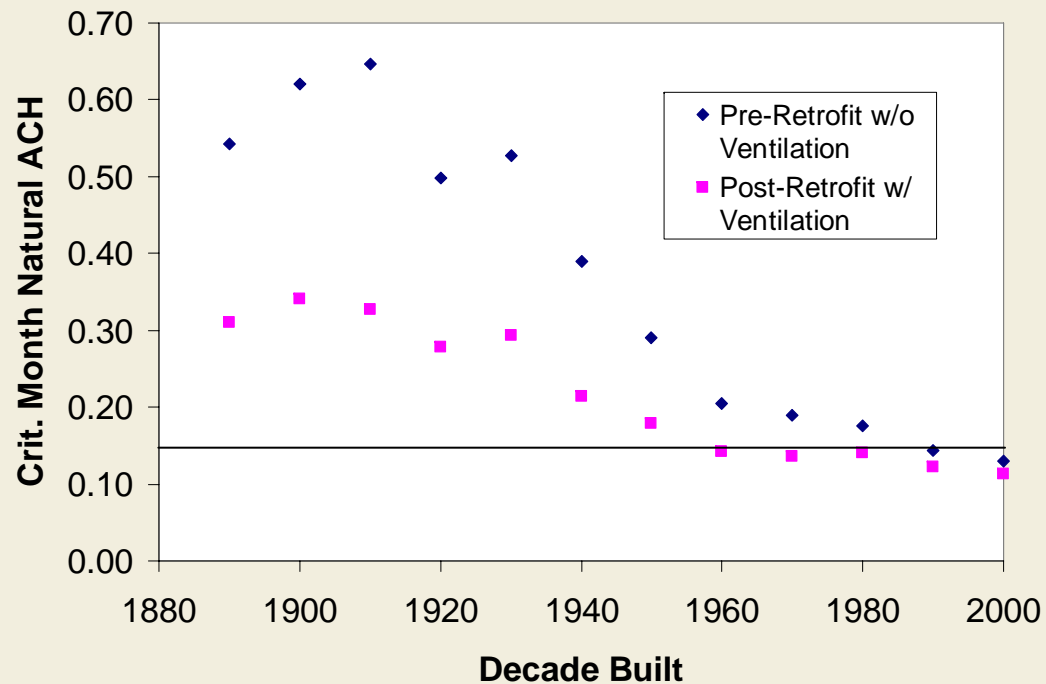
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# Heat Recovery Ventilators and Air Leakage



- 4% of homeowners have installed HRVs
- HRV recommended when less than 0.15 ac/h





## ecoENERGY Air Change per Hour @ 50 Pa Statistics

- By year of construction
- Frequency
- By province
- Improvement by city

11



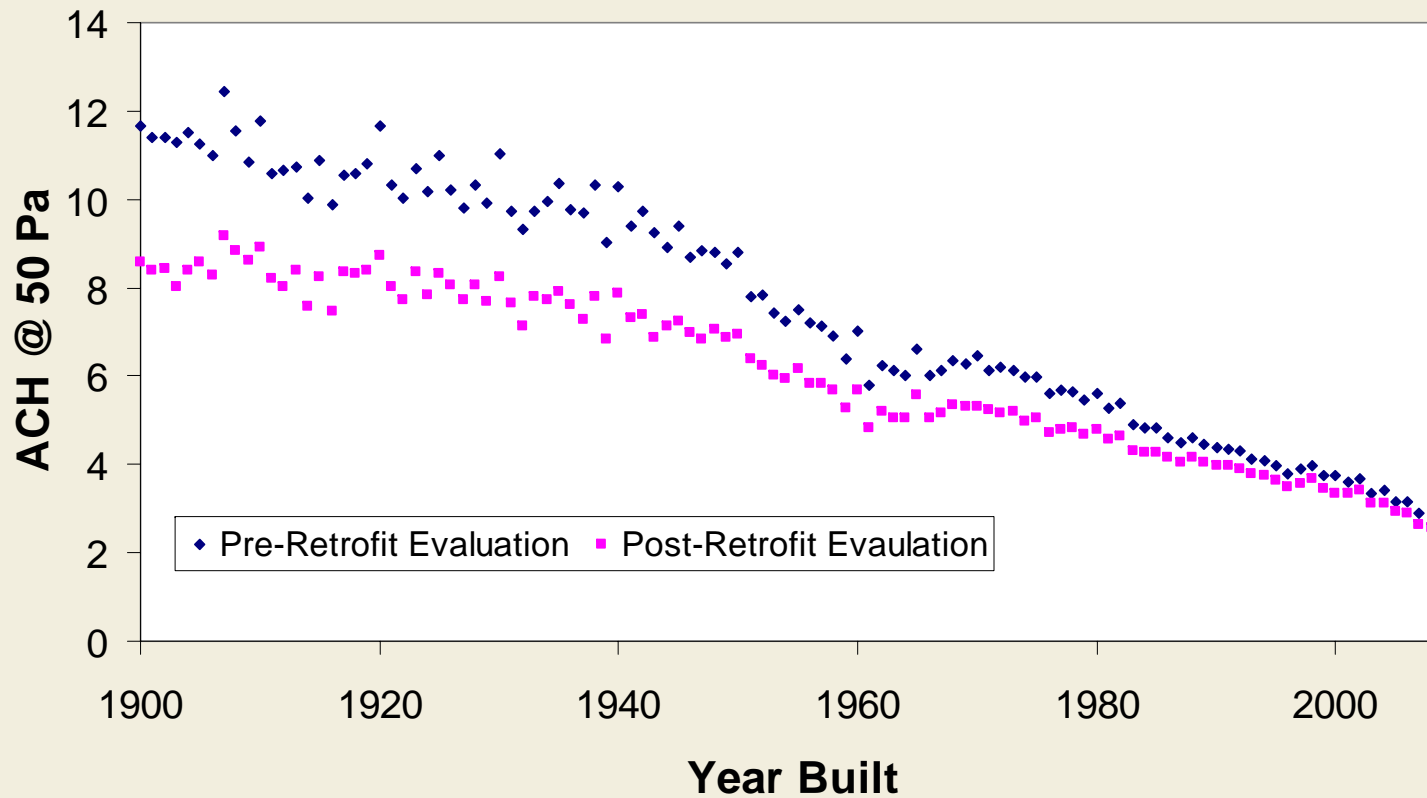
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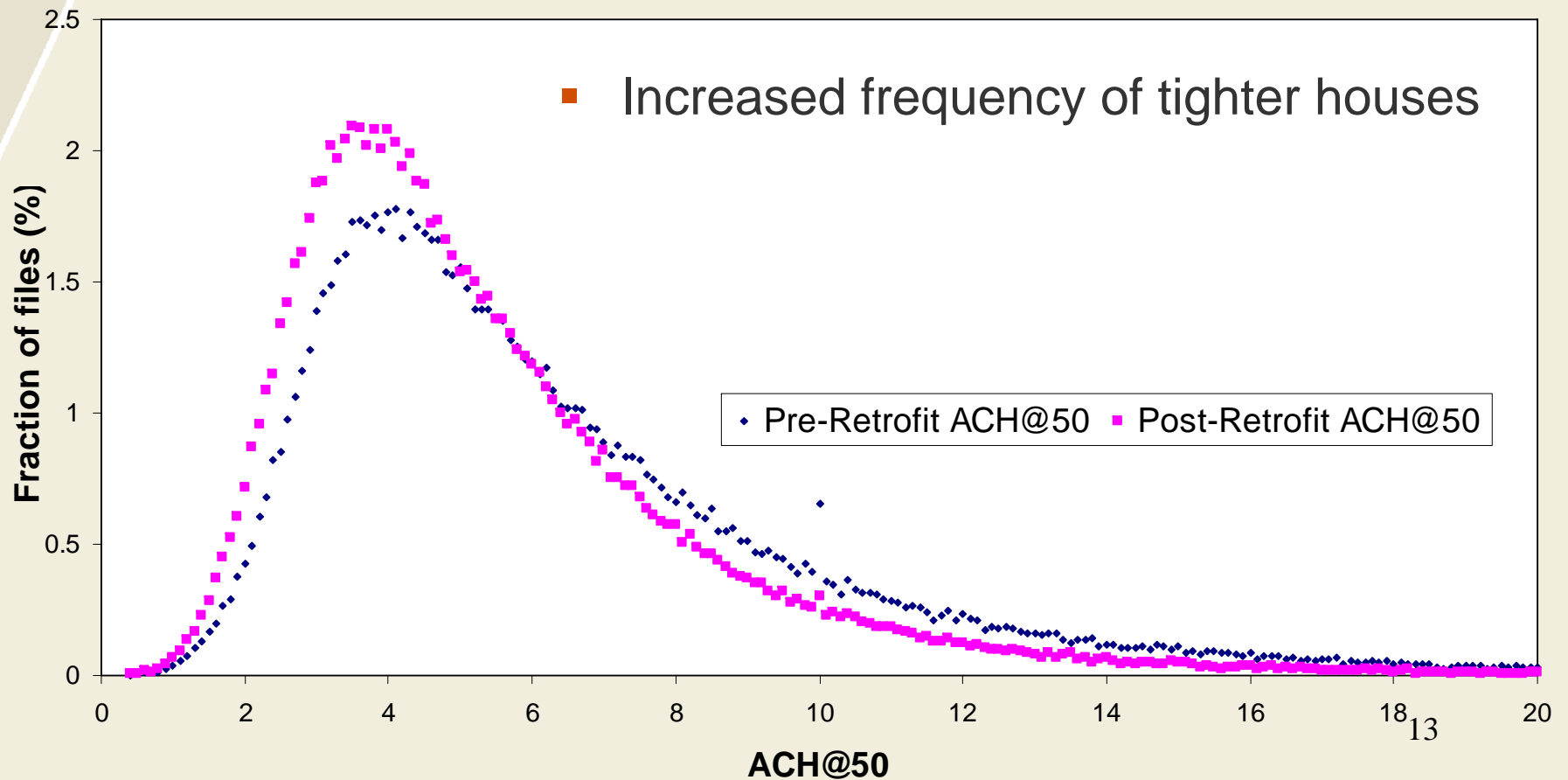


# Air Leakage by Year



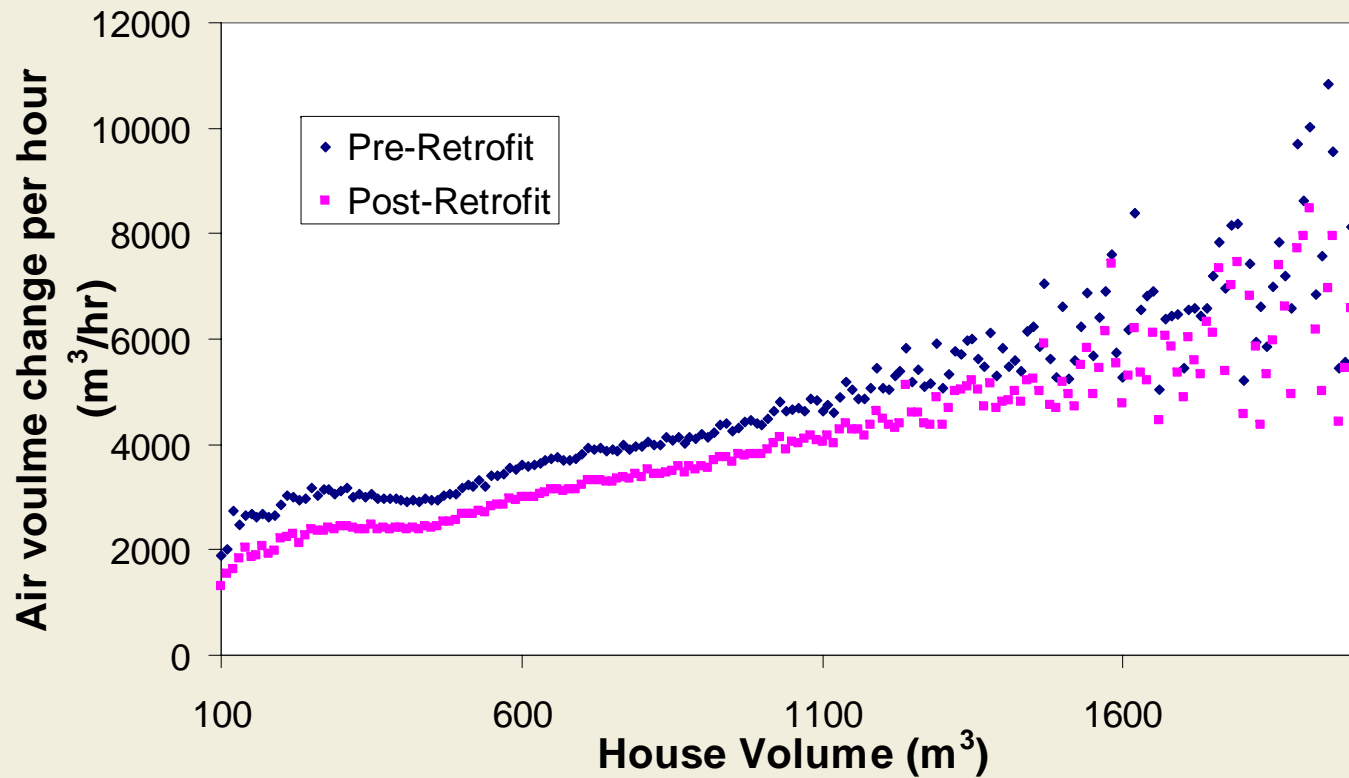


# Frequency vs ACH @ 50 Pa





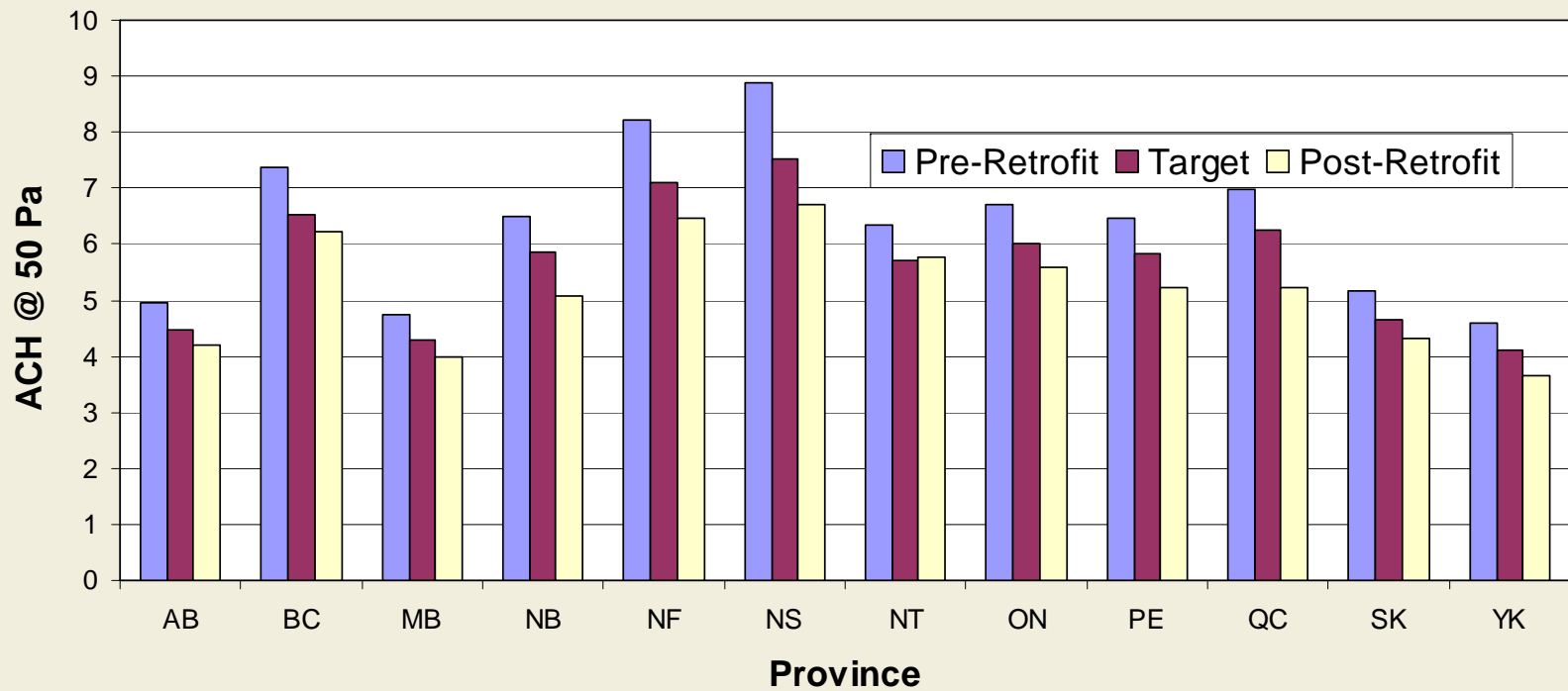
# Air Volume change per hour by House Volume





# Air Leakage by Province

## Air Tightness of Canadian Provinces





## Air Leakage Improvement by City

City	Number of Evaluations	Pre-Retrofit ACH@50	Post-Retrofit ACH@50	% ACH Improvement
Halifax	3330	8.33	6.42	23%
Quebec	2665	6.32	4.79	24%
Toronto Area	25122	5.88	5.18	11%
Winnipeg	4564	4.79	4.01	16%
Saskatoon	4892	4.58	3.95	14%
Vancouver	6148	8.68	7.29	16%

- 29% of heat loss savings from air sealing

16





## Conclusion

- Efforts to reduce air leakage have been successful
- Older homes have improved more than newer homes
- Recommended air leakage reduction targets are being realized
- Air leakage varies widely by province but all have shown improvements
- Air leakage is reduced in homes that install HRVs
- Air leakage reduction can save 4% of heating energy

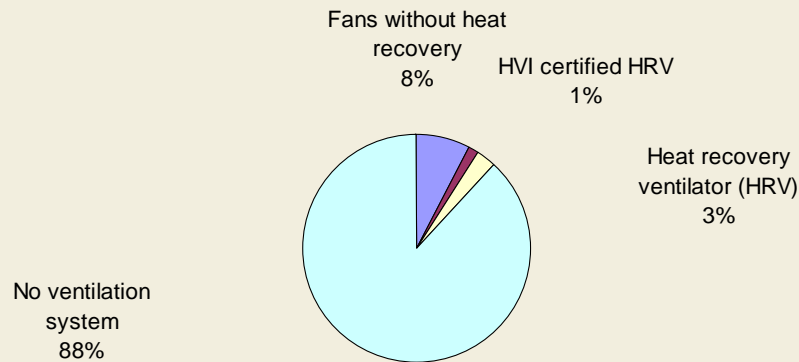




# Heat Recovery Ventilator Penetration

- 4% of homeowners have installed HRVs

Pre-Retrofit Evaluations



Post-Retrofit Evaluations

