SUSTAINABLE PRACTICES
FOR BUILDING OWNERS AND OCCUPANTS

BUILDING ENVELOPE

INSULATION
AIR INFILTRATION
WINDOWS

Insulation

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Background:
In Rochester, 57% of the housing stock was built before 1940. As a result, many of these homes do not have adequate insulation, making energy conservation a challenge.

Concept:
Insulation slows the rate of heat transfer between the conditioned indoor space and the outside environment. Insulation creates trapped air spaces, which serve as a good insulator, since the thermal conductivity of air is low compared to solid materials.

Helpful Tools:
The U.S. Department of Energy created an online tool called the Home Energy Saver. This tool allows you to:

- Understand the paybacks of potential insulation upgrades.
- Understand the carbon impact of those upgrades.
- Receive recommendations for the best locations to insulate.

Did you know?
R-values are the key indicator of an insulation's thermal performance. The higher the R value, better the thermal performance of the insulation.

Did you know?
New construction in Rochester is guided by Section 39 of the City Code. Thermal shell requirements are set in this section according to the 2015 International Energy Conservation Code (IECC) for both commercial and residential buildings. Existing buildings do not need to comply with code - but some renovations do need to meet thermal shell requirements.

Hyperlink: http://homeenergysaver.lbl.gov/consumer/

Insulation

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TARGET GROUP	WHAT CAN I DO
Developer, Landlord, Business Owners, Institutions D L B I	• Be aware of changes to the requirements of the thermal shell of buildings (the IECC is typically updated every 3 years)
Homeowner H	• Be aware of changes to the requirements of the thermal shell of buildings (the IECC is typically updated every 3 years). • Seek the services of a qualified energy auditor who can recommend insulation improvements or do it yourself with tools like the Home Energy Saver.
Tenant T	• Ask your landlord, or potential landlord about the thermal shell of the rental property.

LOCATION IN STRUCTURE	POTENTIAL INSULATION OPTIONS
Roof	• Fiberglass batts (can be applied in a retrofit) • Blown insulation (fiberglass and foam) (can be applied in a retrofit) • Rigid foam insulation
Walls	• Fiberglass batts - for existing buildings this can be difficult to install. • Blown insulation (fiberglass and foam) - can be done with penetrations from outside the home. Works will with new construction as well. • Rigid foam insulation – suitable for retrofits and existing construction. • Vacuum-insulated panels - somewhat new technology, can be expensive but offers very high insulation values (~R-50). Offers ability for structures in harsh climates, with high energy costs to achieve higher R values with less insulation depth. • Foam insulated sheathing
Foundation	• Insulated concrete forms (new construction) • Rigid insulation under concrete pad (new construction) • Insulated core concrete masonry units (new construction)

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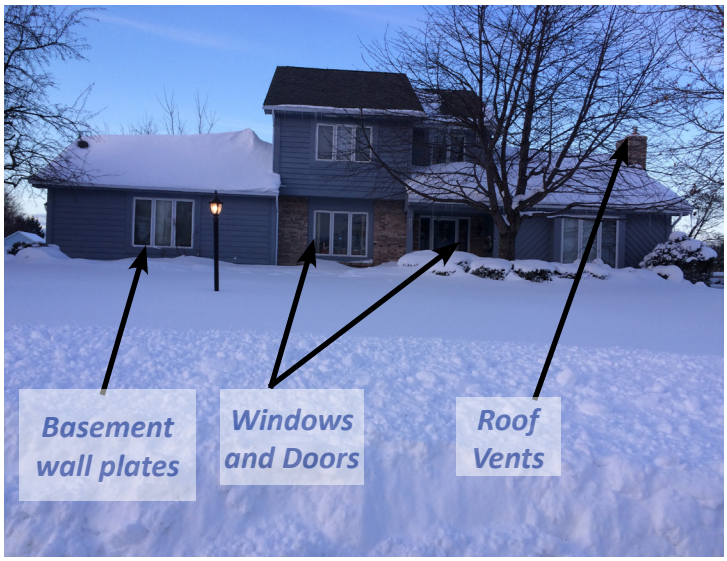
Air Infiltration

Background:
Regardless of the quality of the windows or insulation of a structure - air can still leak in through places like the bottom of a door, window cracks, fireplaces, unfinished drywall, flooring, etc.

Concept:
Air infiltration should be minimized to make energy conservation effective. However, a home that is sealed too tightly can lead to moisture and indoor air quality problems. There are guidelines on how to strike this balance and on whether mechanical ventilation may be required.



Common places of Air Infiltration in a home

Common Locations of Air Infiltration:

- Roof or wall vents
- Electrical outlets
- Recessed lights
- Attic hatch
- Outdoor water faucets
- Crawl spaces
- Door and window frame

Energy Audits

Performing energy audits on buildings can help understanding of potential areas of improvement. To learn more about how to apply for a home energy assessment click here.

Did you know?
The United States Department of Energy estimates 30% of heating and cooling costs can be saved by addressing infiltration.

Did you know?
Rochester currently uses the 2015 International Energy Conservation Code (IECC) to guide new construction. Existing buildings do not need to comply, however, additions to an existing building do need to comply with code. Code specifies that a blower door test (which tests the air-tightness of a home) must be completed. Air leakage rates need to be quantified and shown to be below established thresholds. Read more about these tests **here**.

Hyperlink: https://www.energycodes.gov/sites/default/files/documents/BECP_Buidling%20Energy%20Code%20Resource%20Guide%20Air%20Leakage%20Guide_Sept2011_v00_lores.pdf
https://www.nyserda.ny.gov/residential

Air Infiltration

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TARGET GROUP	WHAT CAN I DO
All members of the Rochester Community N	• Be aware of changes to the requirements of air infiltration buildings (the IECC is typically updated every 3 years).
Developer, Landlord, Business Owners, Institutions D L B I	• Ensure buildings are built to code and meet blower door requirements. • On existing buildings perform tests such as the blower door test, infrared camera investigations or the basic smoke test to close leaks. • Be cautious not to seal too tightly to prevent indoor air problems. Provide mechanical ventilation if needed.
Homeowner H	• Conduct a Blower door test • Seal bottom of door, windows, frame wall, fireplace, drywall, flooring to close off locations of potential air infiltration. • Conduct a basic smoke test • Make use of Infrared cameras to detect leakage areas.
Tenant T	• Add temporary window insulation. • Add rubber water sealing to close gaps and drafts. • Consider cellular shades or insulated curtains.

Windows

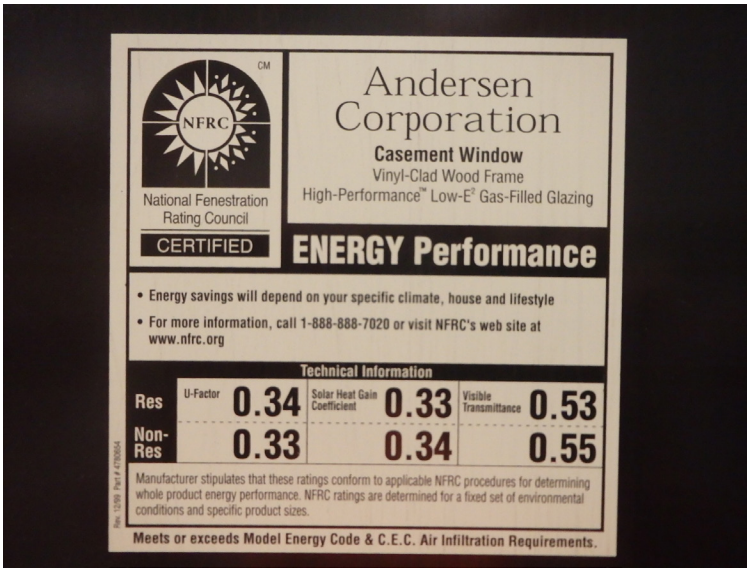
Background:
In Rochester, over 57% of the housing stock was built before 1940. House construction methods in this period often used single pane windows and minimal insulation.

Concept:
Glass has a higher thermal conductivity value than air. Double-pane windows place air in between glass, which improves the ability of the window to insulate.

Helpful Tools:
The U.S. Department of Energy made an online tool called the Home Energy Saver. This tool allows you to:

- Understand the paybacks of potential window upgrades; and
- Calculate the carbon impact of those upgrades.

Note: In order to achieve desired results, all windows in a home should be replaced.



Did you know?
The Energy Information Administration estimates that 1/3 of the heat loss associated with the average home is from windows and doors[1].

Did you know?
Rochester currently uses the 2015 International Energy Conservation Code (IECC) to guide new construction. Existing buildings do not need to comply, however, additions to an existing building do need to comply with code. Code specifies that a blower door test (which tests the air-tightness of a home) must be completed. Air leakage rates need to be quantified and shown to be below established thresholds. Read more about these tests here.

Photo Credit: https://energy.gov/energysaver/energy-efficient-windows
[1] https://energy.gov/energysaver/articles/improving-energy-efficiency-existing-windows

Windows

TARGET GROUP	WHAT CAN I DO
Developer, Landlord, Business Owners, Institutions D L B I	• Be aware of changes to window requirements for buildings (the IECC is typically updated every 3 years).
Homeowner H	• Inspect your windows. If single pane, simple treatments include installing curtains, or winter-proofing. • If double pane, replace windows if you observe moisture buildup between panes as the windows may not effectively block out air infiltration anymore. • Be aware of changes to window requirements for buildings (the IECC is typically updated every 3 years).
Tenant T	• Inspect your windows. If single pane, simple treatments include installing curtains, or winter-proofing. • If double pane, report moisture buildup between panes to the landlord as the windows may not effectively block out air infiltration anymore.

In general, there are three mechanisms that transfer heat through a window:
1) Conduction, e.g. a single pane window loses heat through conduction.
2) Convection, e.g. convective cells form in double pane windows which can transfer heat.
3) Radiation, e.g. sunlight coming through a window will heat the indoor environment.

Here is an overview of available window technologies to address these heat transfer mechanisms:

WINDOW	BENEFITS
Double Pane	• Air gaps are poor conductors for heat transfer. Gaps are typically spaced to avoid effective convection by the manufacturer which minimizes heat loss.
Walls	• Low-emissivity glass offers the ability to not only reflect solar radiation outdoors away from the home during the summer, but also reflect radiation back indoors into the home during the winter.
Foundation	• Similar to double pane windows, but often more expensive, these windows offer more insulation.
Inert Gas Filled	• Some double and triple pane windows can be filled with inert gases other than air. These gases (e.g. argon) are heavier than air and more resistant to convective cell formation, thus generating less heat loss.

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