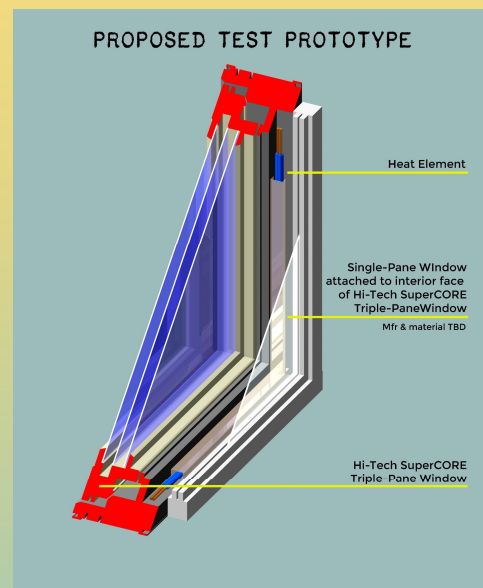
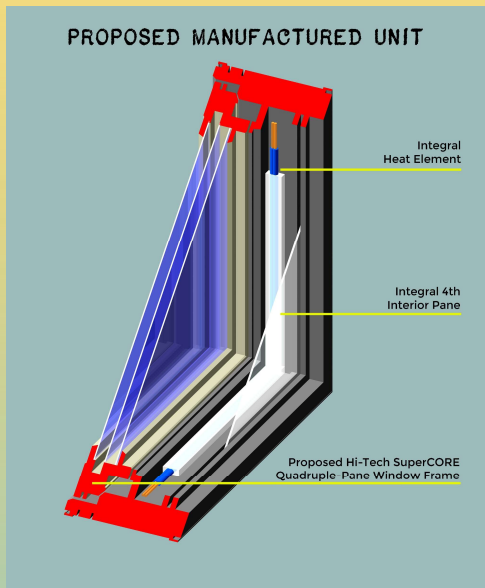


Appendix C - Poster Boards

- Poster 1 – Made in Manitoba - Manitoba WARM Window
- Poster 2 – Made in Manitoba - Insulated Panel Envelope
- Poster 3 – Envelope and Balcony Details

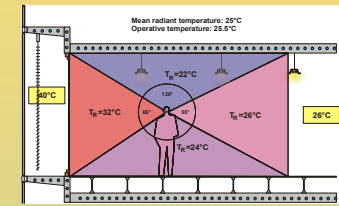
Made in Manitoba – Manitoba WARM Window

Manitoba WARM Window Team



What is a "Manitoba WARM Window"?:

- Inspiration** - The "Manitoba WARM Window" is a concept inspired by the Manitoba Hydro Office Tower double façade system.
- Quadruple Pane** - The concept consists of quadruple pane window system: a high-performance triple pane glass assembly on the exterior and a single pane on the interior.
- Inexpensive heating element** (metal covered self-regulating) embedded in the window. Self regulating to maintain the interior glass temperature at 20°C on the coldest days of winter (-35°C).
- Single pane window** (potentially removable) is mounted close to the interior wall. Potential concept: In the summer can be replaced with screen or flipped around for (low-E) reflectivity performance.



Graphic from Manitoba Hydro Office Project - The interior glass surface from the Double Façade radiates to the occupants. Occupant feels the "resultant radiant temperature" of the (warm) interior window, ceiling, floor. This figure shows resultant radiant temperature for summer conditions, but the calculation is done the same for winter (image source: Transsolar KlimaEngineering GmbH)

How it works:

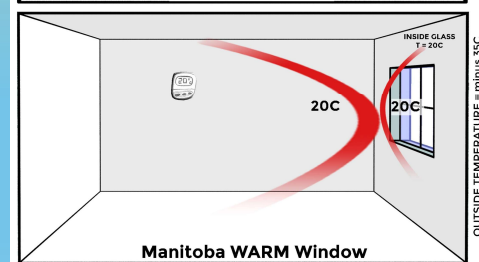
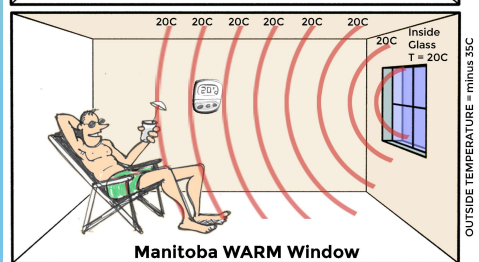
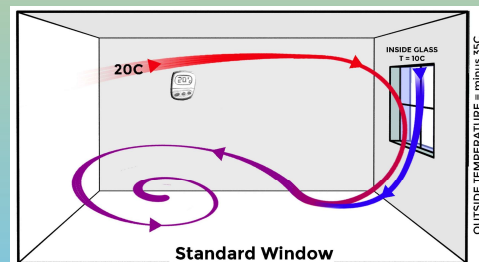
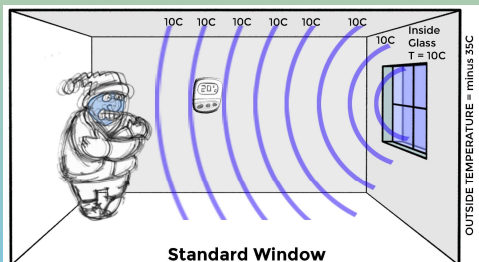
- WARM Window radiates warmth to the occupants**, instead of our traditional windows which have a low surface temperature (when -35°C) = higher thermal comfort = lower interior air temperature = less energy.
- Window heat loss is dealt-with at the source.** No cool air mixing with interior air.



Heat Element - simple and inexpensive - self regulating to 20°C

Benefits:

- Improved Thermal Comfort to Occupants** - Warm interior window surface translates into improved thermal comfort for occupants due to radiation of warm glass, instead of cold glass.
- Lower Room Temperature Setpoint** - Occupants will experience higher thermal comfort at a lower room air temperature setpoint due to the warm radiation from the window. Lower temperature = energy savings.
- Reduced Peak Electrical Demand** - The WARM Window will help stabilize temperatures within the residence, reducing the morning and evening demand peaks on the Manitoba Hydro Electrical Grid. The building mechanical systems will require less ramp-up energy to warm the space for morning and evening peak periods. Similar to the "constant temperature" Hydro Office Tower.
- Smaller Mechanical Systems (furnace)** - In winter, the output of the furnace will be lower, as the windows are already taking care of the heat losses in the window (24/7). A smaller mechanical system translates into lower mechanical system initial cost.
- Higher R-Value = lower energy** - Quadruple pane WARM Window will provide a higher R-Value than standard windows, resulting in lower overall energy consumption and electrical demand requirements.
- No Condensation or Frost on the Glass** - The WARM Window will keep the interior glass surfaces above the normal dewpoint temperatures within a residence, reducing the potential for moisture damage near the window frame.
- 100% Manitoba Made Solution** - Proposed to be manufactured using a 100% Manitoba owned and operated manufacturing facility (Hi-Tech Energy Windows, Winnipeg, 100% Metis owned).
- Readily Adaptable using Current Standard Window Manufacturing Practices** - The system utilizes standard window extrusions and glazing elements combined to create the four-pane window. A customized extrusion would likely be required for commercial production. The WARM Window could be produced by most window manufacturers in Manitoba.



Thermal Radiation - The occupant feels the temperature of the glass surface through radiation. With a WARM Window room air temperature can be lower, resulting in energy savings.

Air Mixing - In winter, denser cool air at the window sinks toward the floor, drawing warmer room air with it. This mixed air stream lowers the room temperature. The WARM Window's inside glass surface is warmer, lessening or eliminating this cooling effect. The WARM window heat loss is dealt with at the source, inside the window.

HI-TECH ENERGY WINDOWS LTD. SuperCORE
A New Generation of Windows & Doors

- SuperCORE** - Thermally superior to all other windows including hollow core PVC, foam filled PVC, fiberglass and wood.
- SuperCAP** - Provides a visibly superior finish and unmatched impact resistance.
- Platinum SuperSPACER** - For increased energy efficiency and to reduce condensation.
- Energy Smart Glass Options** - Provides optimal insulating value for peak energy efficiency.
- Stronger Welds** - Solid SuperCORE allows the entire internal surface to be fusion welded providing a stronger, more comprehensive bond.
- Clean Sightlines** - Using a high purity silicone formulation for ultimate seal durability, unsightly black gaskets have been eliminated creating clean sightlines.
- Santoprene Seals** - Winked corners for a superior airtight seal for the life of the window.

Lowest Heat Transfer Rate

NO window outperforms SuperCORE

www.hitechwindows.ca

Canada ENERGYGUIDE

ENERGY PERFORMANCE RATINGS (Standard Conditions)

U-Value	0.14	0.80	0.29
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ADDITIONAL PERFORMANCE RATINGS (All Insulating Windows)

U-Value	0.50	0.3	0.15
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Super CORE U-Value (W/m² · K)

Picture	Classroom	Awning	Slider	Single Hung
U-Value	0.14	0.19	0.19	0.05

Super CORE windows can achieve U-Values as low as 0.08

The "Manitoba WARM Window" is a registered trademark of Hi-Tech Energy Windows Ltd.

Made in Manitoba – Insulated Panel Envelope

Manitoba WARM Window Team



4 STOREY MULTI-UNIT BUILDING

IQALUIT, NU



Greenstone Insulated Panel Envelope – The building enclosure is detailed to control all four layers; liquid, air, water vapour, and heat. The envelope consists of structural insulated panels (R-43.5) on the walls, and (R-55) on the roof. The panels provide a continuous wall and roof system.

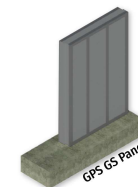
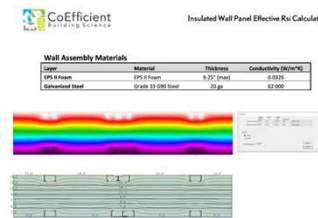
This insulated panel system provides exceptional R-Values using closed cell Graphite Polystyrene insulation. The panels have been used successfully in arctic climates. The wall and roof systems are further detailed to address a water control layer, air control layer, vapour control layer and the thermal control layer.

Benefits:

The 100% owned and manufactured in Brandon, Manitoba system is light, easy to install, leading to reduced labour and efficient construction. In summary the insulated panel approach will result in:

- High Thermal Performance.** The GS Insulated Panel has high effective R-Values in a single-step prefab system. The panels provide a tight envelope that is energy efficient by addressing thermal bridging and water, air, and vapour penetration.
- Airtight.** With proper detailing, GS Panel houses have come in as low as 0.20 ACH 50 PA, exceeding passive house standards.
- Proven Performance in Cold Climates.** Some of these projects are in the high arctic (Iqaluit, NU) and northern climates.
- Durable with Good Structure Integrity.** Each project is reviewed and stamped by an engineer, and the panels are custom designed custom for your build, ensuring ultimate structural integrity.
- Accelerated Completion and Labour Savings.** The panels combine framing, insulation, and vapour barrier into one pre-fab step, increasing speed of construction and reducing labour costs. No stud framing required on interior walls. Drywall is applied directly on the insulated panels which have built-in metal studs at standard spacings. Similarly, the exterior walls have thermally isolated connections for Fibre Cement Siding. Panels are prefabricated specifically for the project, and are relatively light, improving construction speeds, and reduced heavy equipment required on site.
- Environmentally Responsible.** The graphite polystyrene insulation is manufactured using atmospheric air, not toxic gases. This means these panels will never off-gas into the home, providing healthy air quality and consistent lifetime R-Values.
- Generational Housing.** The panels are made from hydrophobic non-organic materials that will never rot or mould. When properly protected the building will last for generations.

	WOOD	STEEL STUD	ICF	SIPs	GS PANEL
Single Step Building Envelope	-	-	-	✓	✓
Visible Structural Integrity	✓	✓	-	✓	✓
No Thermal Bridging	-	-	✓	-	✓
Permanent R-Values (200+ Years)	-	-	✓	-	✓



EXPANDED POLYSTYRENE (EPS AND GFS)

EPS is a rigid cellular plastic that is up to 97% atmospheric air. EPS has no trapped gases which create inflated R-values; this means no toxic off-gassing and a maintained R-value.

GFS is expanded polystyrene that is infused with graphite, which increases the emissivity of the EPS over standard white EPS, making it more energy efficient. GFS Panels produced with a GFS core will be gray/platinum in color, and other than this color variation, the main difference is the superior R-values offered by the GFS option.

R-VALUES

Panel Thickness	5.5"		7.5"		9.25"		11.5"	
	EPS	GFS	EPS	GFS	EPS	GFS	EPS	GFS
Core Material (EPS: Expanded Polystyrene - Standard / GFS: Graphite Polystyrene - Premium)	EPS	GFS	EPS	GFS	EPS	GFS	EPS	GFS
EPS R-Value (tested at 24.02°C)	22.91	25.85	31.24	35.25	38.53	43.475	46.00	55.20
THERM Analysis of ICE Panel Assembly	22.18	•	30.24	•	37.3	•	44.53*	•

1-Hour FRR (Load Bearing Pre-Fabricated Wall Assembly) • 2 Layers Type X gypsum board (min 5/8") • 75° GS Panel w/ 20ga studs @ 16" c/c (max) • 1 Layer Exterior covering (see Greenstone QAI design listing B1122-1a for allowable types)	CAN/ULC S101-14/ASTM E119
2-Hour FRR (non-load Bearing Pre-Fabricated Wall Assembly) • 2 Layers Type X gypsum board (min 5/8") • 2" offset 2 bar 20 ga @ 24" c/c (max) • 2" ComfortBoard 80 • 75° GS Panel w/ 20 ga studs @ 16" c/c (max) • 1 Layer Exterior Grade Type X gypsum board (min 5/8")	CAN/ULC S101-14/ASTM E119
STC Rating = 35	ASTM E 90-09, E413-10, 1332-10A
Flame Spread Index < 250	CAN/ULC S102.2-10
Smoke Developed Index > 500	CAN/ULC S102.2-10

*estimated based on THERM Analysis of 5.5"-9.25" ICE Panels

Envelope and Balcony Details

Manitoba WARM Window Team

Envelope Details

Greenstone Insulated Panels : roof 11.5" thick; walls 9.25" thick

Summary

This submission focuses on three key elements of building design critical to the success of high performing buildings with improved thermal comfort outcomes for building occupants. The three elements include a high performing roof and wall system, self supported balconies, and the use of Manitoba WARM Windows.

A thermal analysis of the building envelope was completed by our team, based on the conceptual building system design presented here. This analysis included the assessment of the various clear field, linear interface, and point interface fields of the building's envelope. Our approach of utilizing highly effective building fenestration, high R Value wall and roof systems and minimal thermal breaks, along with the balancing of the window-to-wall ratio provided a building envelope which when analyzed, exceeds the requirements outlined in the competition

The building envelope proposed achieves NECB 2020 Tier 3 performance using key building components in a unique way, sourced from 100% Manitoba owned, operated manufacturers. The products are practical, adaptable, durable, locally produced and facilitate accelerated construction methods.

Manitoba WARM Window - Thermal Performance

Thermal performance was assessed based on the methodology of the Competition Brief Tier 3 base building. Our team's design was able to achieve the following effective R-Value (hr-ft²-°F/Btu) results:

Aboveground Vertical Façade Wall/Windows	Clear Field with Thermal Bridging and Linear Interfaces	R24.7
Roof	Clear Field with Thermal Bridging and Linear Interfaces	R50.3

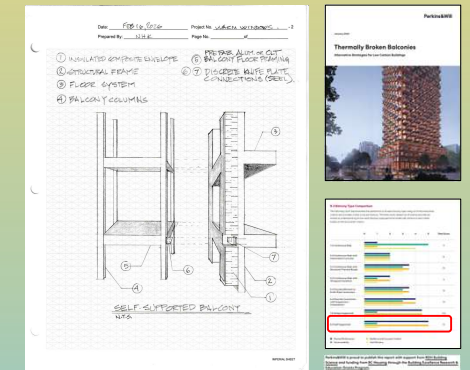
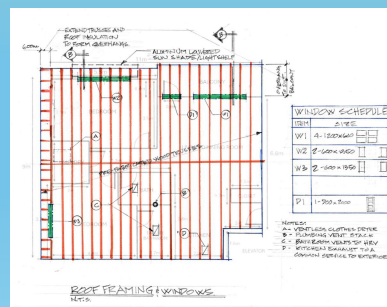
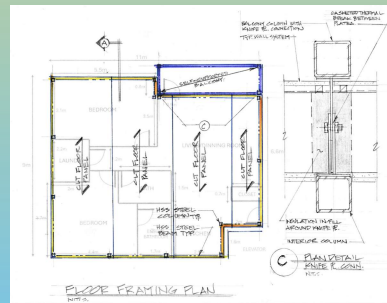
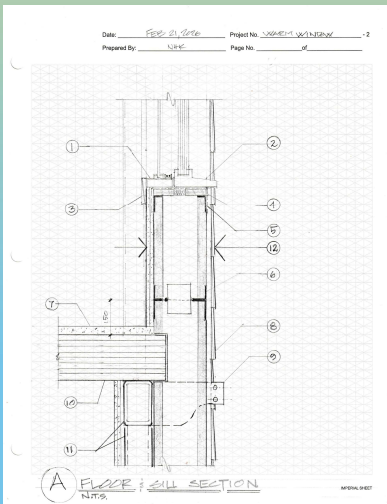
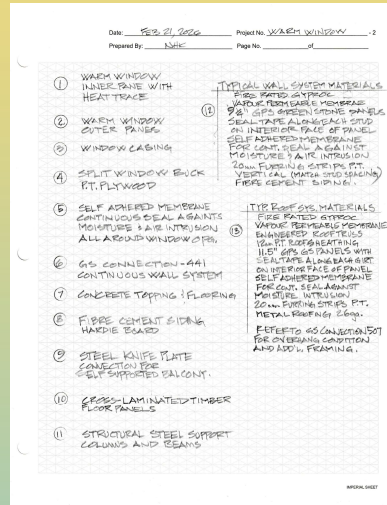
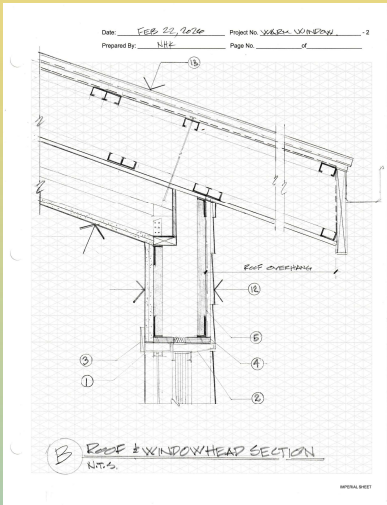
This is the result of careful consideration of innovative building component systems; the proposed building is anticipated to exceed the thermal performance by **14.9%** and **4.6%** for the wall and roof system respectively of the Competition Brief Tier 3 base building.

Self-Supported Balcony

The self-supported balcony will have the best Thermal Performance when compared with other balcony options. (Reference: Perkins and Will - Thermally Broken Balconies, Alternative Strategies for Low Carbon Buildings, January 2022)

Benefits:

- 1. Minimized Thermal Bridging** - Knife plate connections at discrete locations provide lateral stability with reduced thermal bridging.
- 2. Construction Efficiency** - Balcony can be prefabricated off-site, then installed after the building envelope is complete.



Contextual Rendering - Our building envelope finish materials includes fibre cement exterior panels, such as Cedral Fibre Cement Siding or Hardie Panel Siding, and metal roofing from a Manitoba company such as InSTEEL in Winkler. These products are available in many colours, styles and textures and offer tremendous flexibility to customize each MURB unit with an identity to suit the neighbourhood and with appropriate contextual sensitivity. Our building envelope features large windows, made possible by the combination of the Manitoba WARM Window and exceptional thermal performance of the envelope.