Building Envelope Design Competition Brief

Table of Contents

Introduction

The Tier 3 Envelope Design Competition invites industry professionals to innovate by creating a building envelope assembly for a theoretical addition to an existing community space. This addition must meet Tier 3 performance compliance standards while ensuring efficient building performance. As an educational platform, the competition inspires participants to proactively address future industry requirements.

This challenge provides valuable experience in tackling complex design issues, fostering innovative concepts that may not emerge through traditional design processes, and ultimately contributing to a more sustainable and energy-efficient built environment.

Sponsors

Building Efficiency Technology Access Centre, Red River College

City of Winnipeg

Efficiency Manitoba

Sustainable Building Manitoba

Connections Café, Construction Specifications Canada

We invite you to design a statement building envelope that not only stands out architecturally but also adheres to the standards of the National Energy Building Code (NECB) 2020 code. As our climate changes, it is important to ensure that the building envelope can withstand these environmental challenges.

This competition is an opportunity to develop a design that is both energy efficient and resilient.

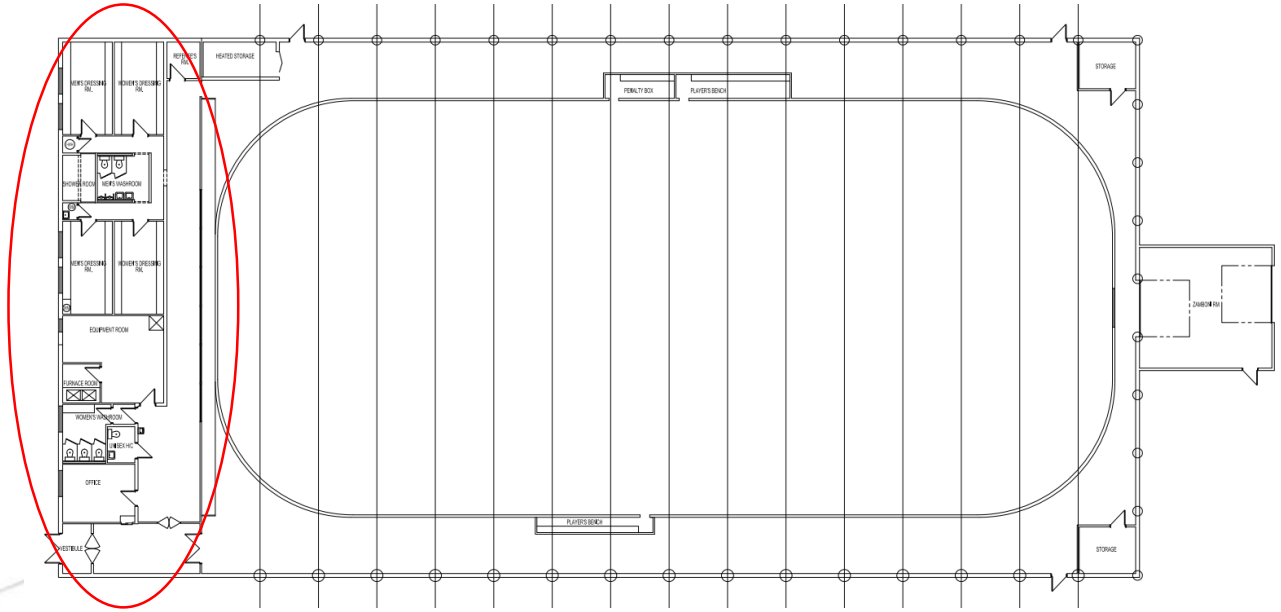
Objectives of the Competition

The competition invites participants to design a prototype for the architectural envelope of a building façade that ensures overall efficient building performance while maintaining a striking aesthetic.

Project Background

A fictional City of Winnipeg arena, built in 1970, requires redevelopment and expansion of its front area to better serve the community's needs.

Existing Arena



The ice surface and surrounding building will remain, but the plan is to demolish and build a new addition. While the layout of the addition has been finalized, the development of the exterior envelope is still undecided.

NECB 2020 – Tier 3

There are two possible compliance paths that may be selected in order to demonstrate that their building design complies with the NECB.

National Energy Code of Canada for Buildings 2020 Document: NECB 2020

Prescriptive versus Performance description:

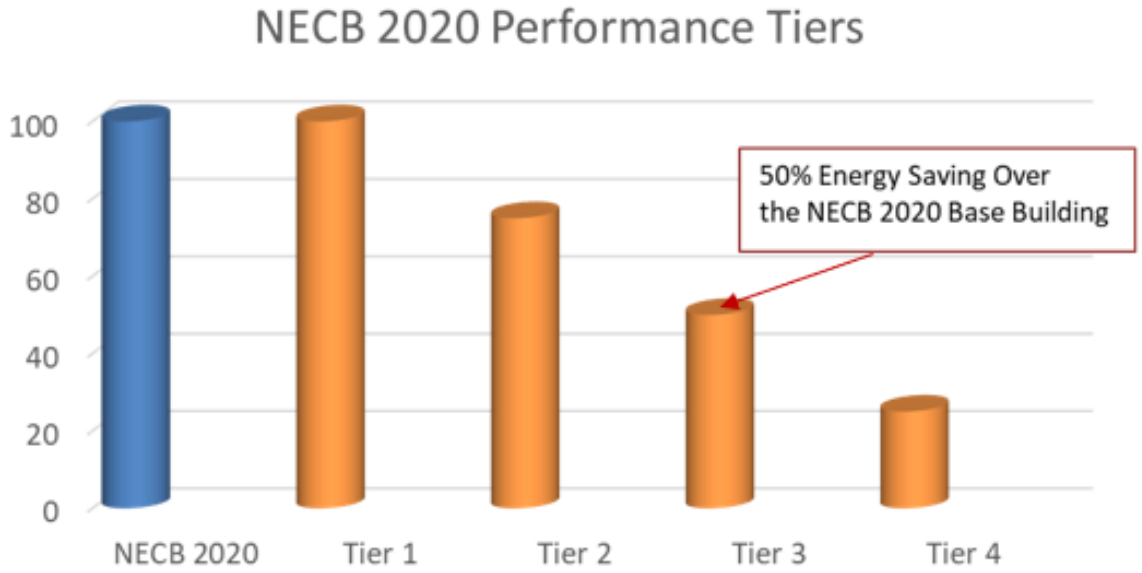
The **Prescriptive Path** involves following the prescriptive requirements of each section of the code. for each of the five building systems (envelope, HVAC, lighting, service water heating, and electrical systems).

The **Performance Path** uses the calculation methodologies provided in the NECB to trade off a limited number of mandatory requirements while still demonstrating that the overall energy efficiency of the system has not been compromised. Whole building simulation is used for this compliance path.

Entrants will be required to meet Tier 3 PERFORMANCE compliance standards

NECB 2020 – Tier 3

The project has to meet the National Energy Building Code (NECB) 2020, Tier 3 PERFORMANCE compliance standards.

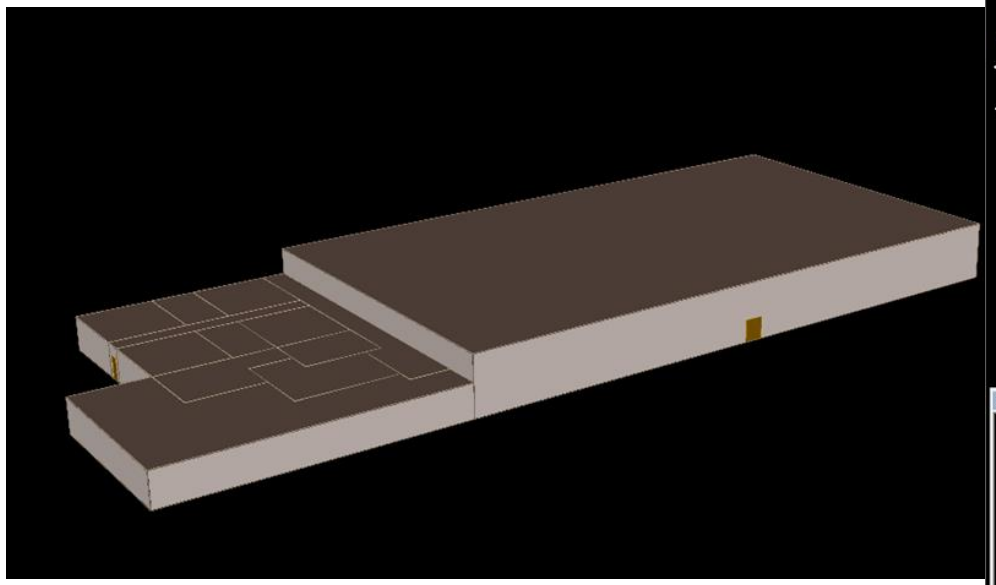


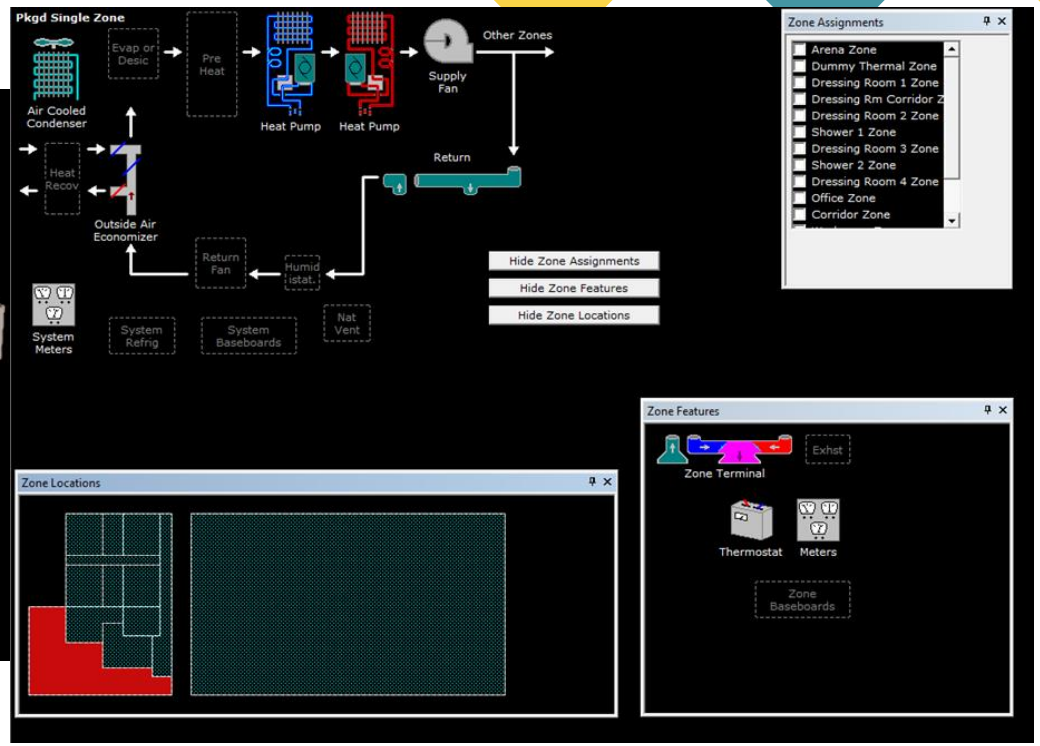
The NECB has a set of prescriptive building envelope values, however as this building is following the performance path, the competition has a calculated set of values that participants have to adhere to.

Tier 3 requires that a building is 50% more efficient overall than the corresponding base building.

Project Background

As this building is following the performance path, the competition has put together the new building addition layout, along with HVAC and electrical design. Energy modelling has been used to calculate the minimum envelope thermal resistance (R and U) values that enable the addition to reach 50% energy savings over the NECB 2020.

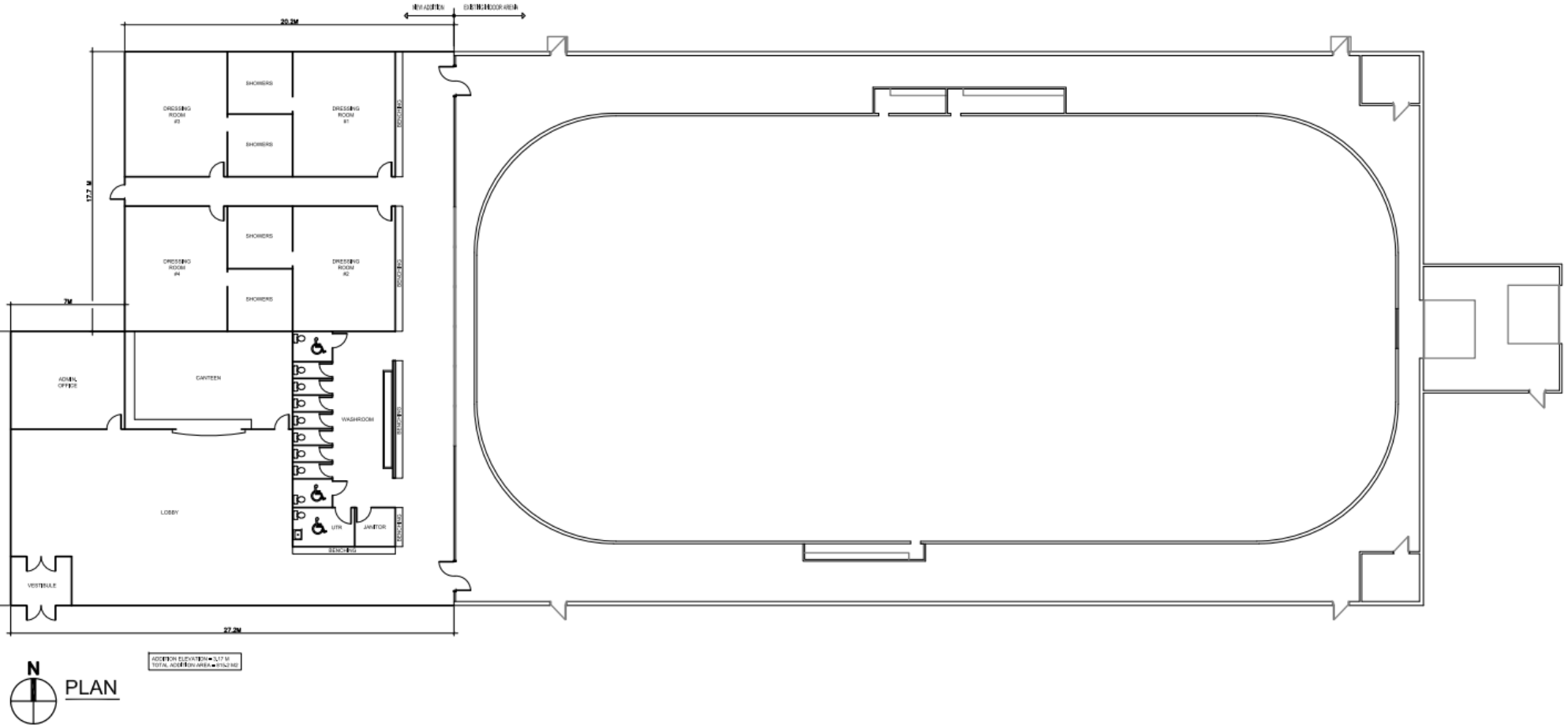


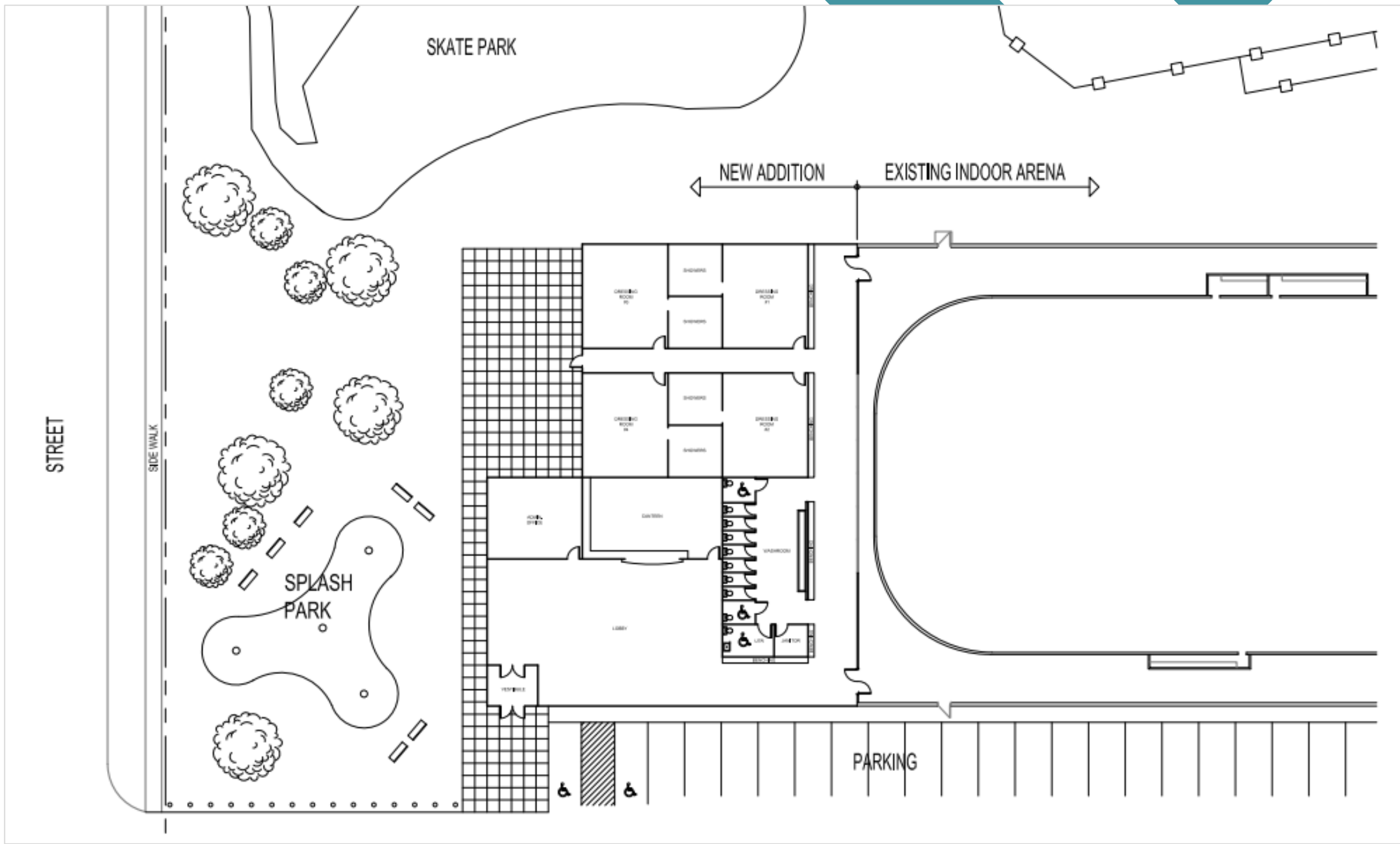


Project Background

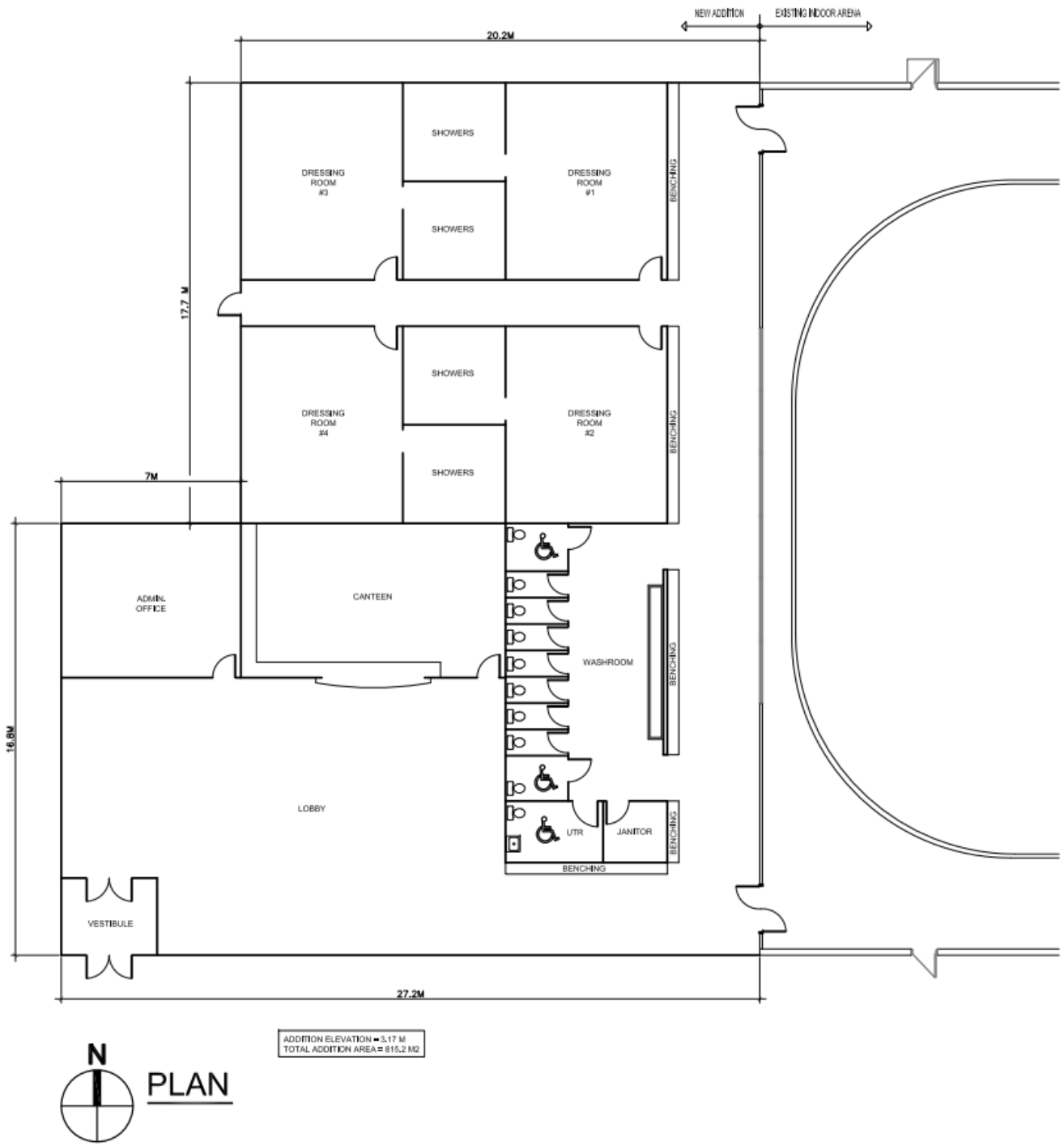
The design layout for the addition, including all mechanical and electrical systems, has been completed.

The existing rink space is not part of the project.




SKATE PARK
NEW ADDITION
EXISTING INDOOR ARENA
STREET
SIDE WALK
SPLASH
PARK
PARKING

Floor to Floor Height:
3.17m (10.4 ft)



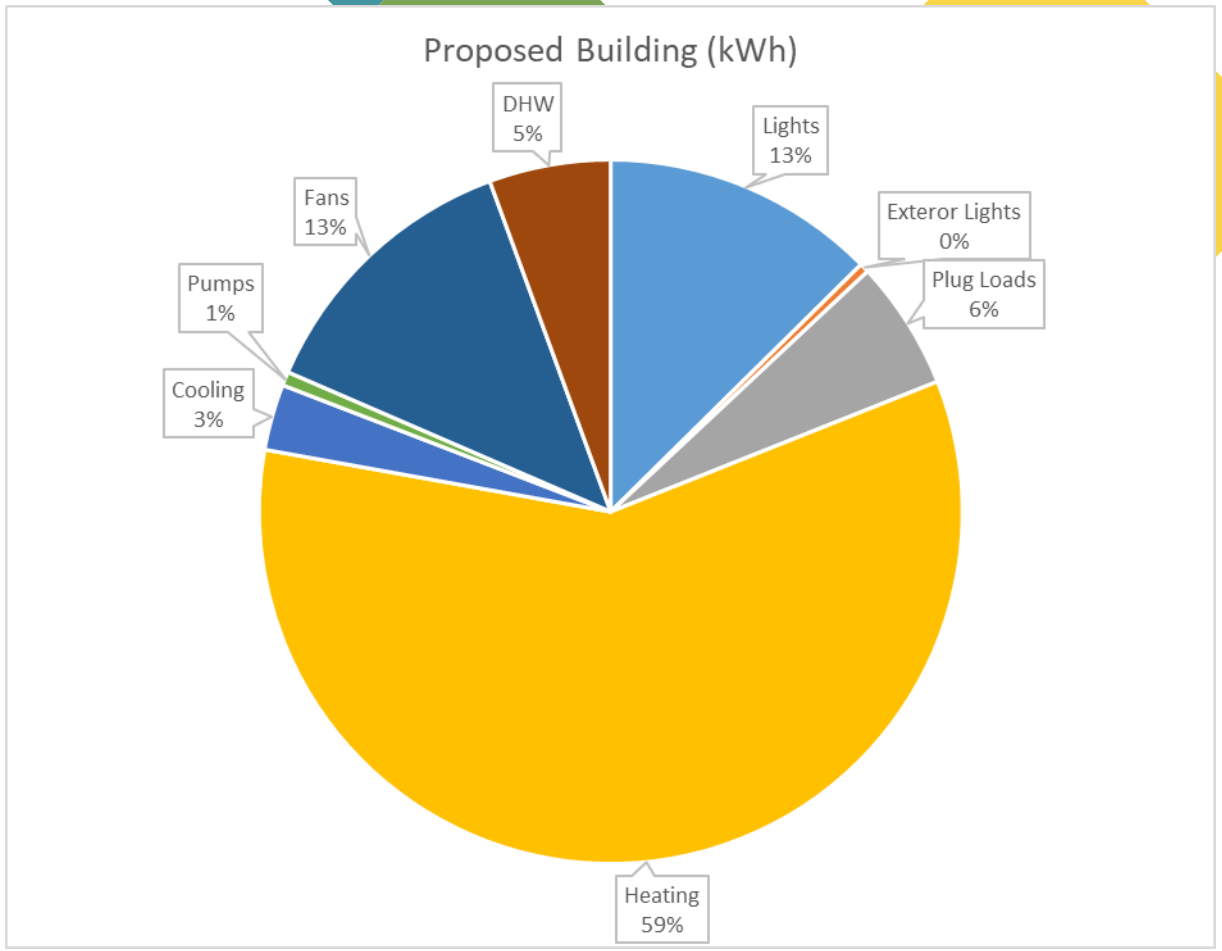
Project Background

The energy model was developed using key building parameters, but it is intended for **background information only** and is **NOT** required for the envelope analysis

Parameter	Input
Area	815 m^2 (8,773 ft^2)
Conditioning Setpoints	Heating: 22 °C Cooling: 24 °C
Schedule	Sports Arena: NECB Operating Schedule B
Lighting Power Density	Average: 6.5 W/m^2 (0.6 W/ft^2)
Heating	Heat Pump, COP 2.17 with Electric Supplemental Heating
Cooling	Heat Pump COP 4.40
Heat Recovery Efficiency	80%
Infiltration	0.098 (cfm)/ft^2 @ 5 Pa

Project Background

	Proposed Electricity (kWh)	NECB 2020 Electricity (kWh)
Lights	27,780	35,188
Exterior Lights	948	1,265
Plug Loads	13,081	13,081
Heating	129,704	338,531
Cooling	6,678	7,169
Pumps	1,400	2,740
Fans	28,473	28,735
DHW	12,320	14,075
	220,384	**440,784**
Energy Savings Against NECB 2020	50%	Tier 3
Area	815	m^2
EUI	270	kWh/m^2



Materials

Participants are instructive to utilize products that are easily accessible and can be ordered for delivery within Manitoba. A materials list will not be provided. Additional points will be awarded for the incorporation of locally manufactured materials. Please be aware that material costs will not be a factor in the competition’s evaluation.

Envelope Requirements

Energy modelling has been used to calculate the minimum envelope thermal resistance (R and U) values that enable the addition to reach 50% energy savings over the NECB 2020.

The calculated **minimum** required envelope thermal resistance values are as follows:

Roof	Clear Field with Thermal Bridging	R40
	Clear Field with Thermal Bridging and Linear Transmittance	R24
Above Ground Vertical Façade: Wall/Windows	Clear Field with Thermal Bridging	R30
	Clear Field with Thermal Bridging and Linear Transmittance	R18

The specified overall R-value for the wall and window system requires applicants to carefully balance the window-to-wall ratio. This balance must not only meet the required performance standards for the building envelope but also take into account the visual appeal and architectural aesthetics of the proposed design.

Envelope Requirements

Clear field transmittance is the heat flow from the wall, floor or roof assembly. This transmittance includes the effects of uniformly distributed thermal bridging components, like brick ties, structural framing like studs, and structural cladding attachments that would not be practical to account for on an individual basis. The clear field transmittance is a heat flow per area and is represented by a U-value denoted as the clear field (Uo).

Linear transmittance is the additional heat flow caused by details that are linear. This includes slab edges, corners, parapets, and transitions between assemblies. The linear transmittance is a heat flow per length and is represented by psi (Ψ).

It is important to understand the thermal bridging effects of your proposed envelope design early in the design process.

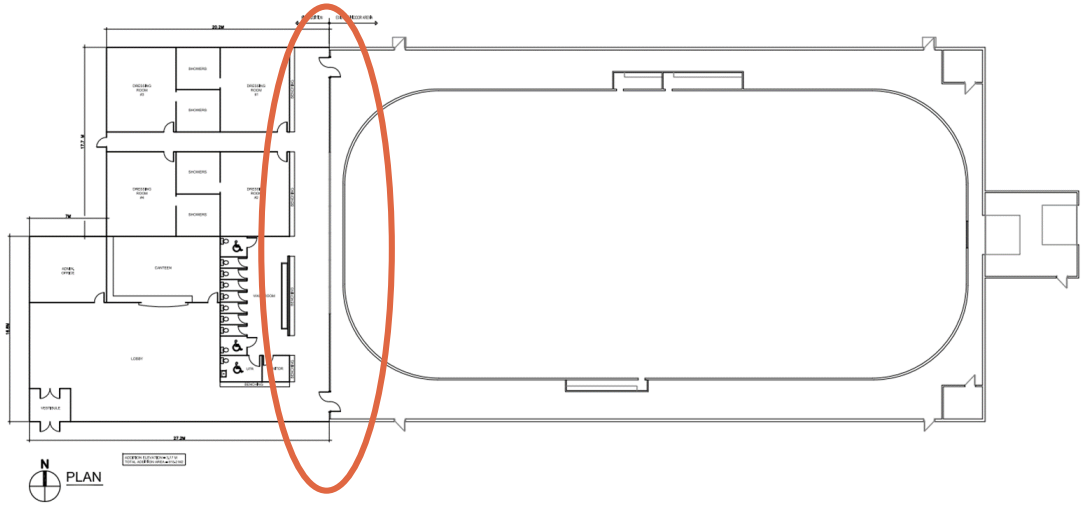
Envelope Requirements

Any material that are easily accessible and can be ordered for delivery within Manitoba, can be used as long as the overall calculated thermal resistance values meet the minimum requirements.

The existing rink and associated envelope is not part of the competition.

The existing rink is a conditioned space.

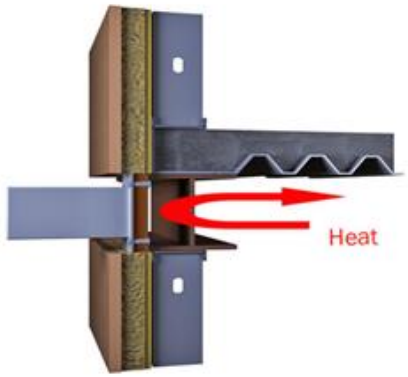
The wall that separates the existing rink and new addition is not part of the competition.



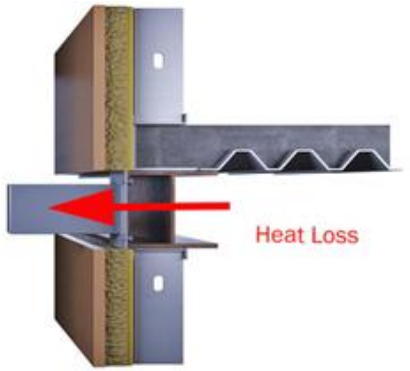
Thermal Bridging

The National Energy Code of Canada for Buildings (NECB) 2020 outlines specific methods for calculating thermal resistance (R-value) of building envelope assemblies:

1. **Identify the Assembly Layers:** Identify each layer in the building assembly, including exterior finishes, sheathing, insulation, air/vapor barriers, and interior finishes.
2. **Determine the Thermal Resistance of Each Layer:** Find the thermal resistance (R-value) of each material layer. This information is usually available from manufacturers or standard reference tables.
3. **Adjust for Thermal Bridging:** If the assembly includes components that create thermal bridges (e.g., studs, fasteners), the effective R-value must be adjusted.



With Thermal Break



Without Thermal Break

Thermal Bridging

As per the NECB, in calculating the overall thermal transmittance of assemblies the junctions between the following building envelope materials, components, and assemblies will be considered:

i) glazing assemblies,
ii) spandrels,
iii) parapets,
iv) roof-to-wall junctions,
v) corners, and
vi) edges of walls or floors, and
vii) secondary structural members

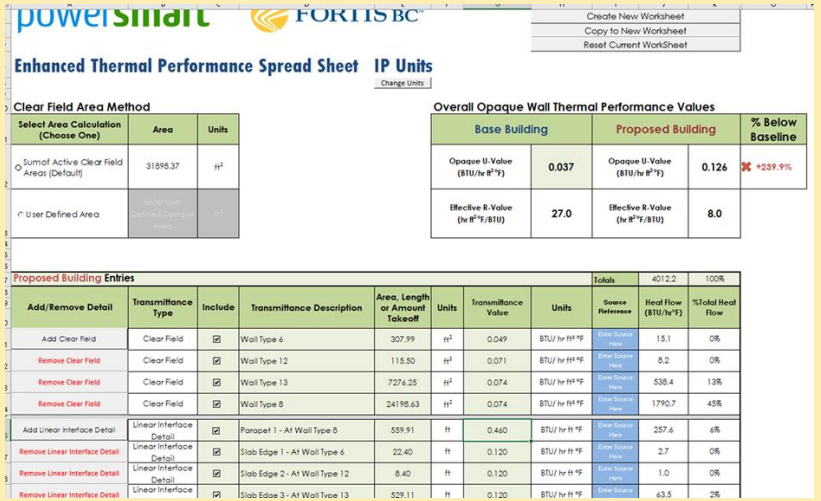
You need to calculate:

- Clear field with Thermal Bridging
- Area or Length takeoffs
- *Linear Interface Detail*

Please use the Thermal Bridging guide and spreadsheet located on the BC Hydro website:
https://www.bchydro.com/powersmart/business/programs/new-construction/whole-building-design.html

Enhanced Thermal Performance Spreadsheet:
https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/builders-developers/betbg-enhanced-spreadsheet.xlsm

Thermal Bridging Methodology:
https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/builders-developers/base-building-u-values-03102015.pdf



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Create New Worksheet
Copy to New Worksheet
Reset Current WorkSheet

Enhanced Thermal Performance Spread Sheet **IP Units**

Change Units

Clear Field Area Method

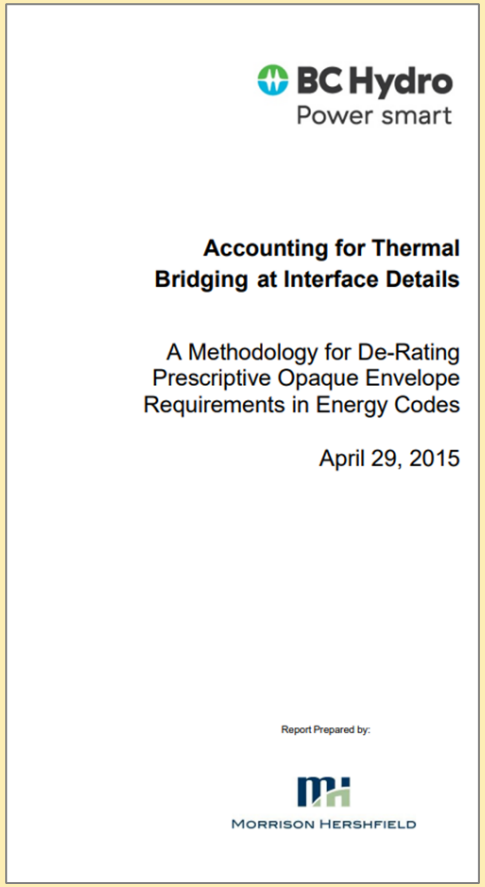
Select Area Calculation (Choose One)	Area	Units
Sum of Active Clear Field Areas (Default)	31898.37	ft²
User Defined Area	Enter User Defined Opaque Area	ft²

Overall Opaque Wall Thermal Performance Values

Base Building		Proposed Building		% Below Baseline
Opaque U-Value (BTU/hr ft²°F)	0.037	Opaque U-Value (BTU/hr ft²°F)	0.126	+239.9%
Effective R-Value (hr ft²°F/BTU)	27.0	Effective R-Value (hr ft²°F/BTU)	8.0	

Proposed Building Entries — Totals 4012.2 100%

Add/Remove Detail	Transmittance Type	Include	Transmittance Description	Area, Length or Amount Takeoff	Units	Transmittance Value	Units	Source Reference	Heat Flow (BTU/hr°F)	%Total Heat Flow
Add Clear Field	Clear Field	☑	Wall Type 6	307.99	ft²	0.049	BTU/ hr ft² °F	Enter Source Here	15.1	0%
Remove Clear Field	Clear Field	☑	Wall Type 12	115.50	ft²	0.071	BTU/ hr ft² °F	Enter Source Here	8.2	0%
Remove Clear Field	Clear Field	☑	Wall Type 13	7276.25	ft²	0.074	BTU/ hr ft² °F	Enter Source Here	538.4	13%
Remove Clear Field	Clear Field	☑	Wall Type 8	24198.63	ft²	0.074	BTU/ hr ft² °F	Enter Source Here	1790.7	45%
Add Linear Interface Detail	Linear Interface Detail	☑	Parapet 1 - At Wall Type 8	559.91	ft	0.460	BTU/ hr ft °F	Enter Source Here	257.6	6%
Remove Linear Interface Detail	Linear Interface Detail	☑	Slab Edge 1 - At Wall Type 6	22.40	ft	0.120	BTU/ hr ft °F	Enter Source Here	2.7	0%
Remove Linear Interface Detail	Linear Interface Detail	☑	Slab Edge 2 - At Wall Type 12	8.40	ft	0.120	BTU/ hr ft °F	Enter Source Here	1.0	0%
Remove Linear Interface Detail	Linear Interface Detail	☑	Slab Edge 3 - At Wall Type 13	529.11	ft	0.120	BTU/ hr ft °F	Enter Source Here	63.5	2%



BC Hydro
Power smart

Accounting for Thermal Bridging at Interface Details

A Methodology for De-Rating Prescriptive Opaque Envelope Requirements in Energy Codes

April 29, 2015

Report Prepared by:

MORRISON HERSHFIELD

Eligibility

The competition offers two streams: professional and student. Both streams require technical skills but differ in their respective entry requirements.

People who have **direct** professional relationship with jury panel members or organizers may not participate in the competition.

- A team must consist of a minimum of 2 people. There is no upper limit.
- A team can consist of members from more than one organization or company.
- Each organization or company can submit up to two teams.
- There is no limit on the number of teams that can enter from a single educational institution.

Submission Requirements
Professional Stream

There are no registration fees. Submissions will be accepted until 11:59 pm (CST) on October 28, 2024.

Submission Requirements:

1. Basic Information
   Provide the following details about your submission:
   - A short description of the project.
   - Key project members, including names, contact details, and links to professional profiles (if applicable).
   - Other partners involved (if any).
2. Short Design Report
   Describe the design concept, goals, and inspirations. Explain why your solution is feasible and how it is positioned to be realized.
3. Elevation Drawings or Sketches
   Include exterior views of the building from all sides, indicating materials and finishes.
4. Construction Drawings
   Provide typical construction drawings or sketches of the building envelope, including windows, doors, walls, roofs and any joints and junctions, included significant thermal bridges. The drawings must be clearly annotated, detailing dimensions, and materials. They do not need to be to scale, but should be thorough in detail. Please show continuity of the four principle boundary layers; water, air, vapour and thermal. The building envelope structure and materials must meet sound practice for moisture control, however, hygrothermal analysis using WUFI is not a requirement.

Submission Requirements
Professional Stream

6. **Materials and Finishes**
   Provide a bill of materials used in the proposed design.
7. **Contextual Rendering Sketches**
   Illustrate how the building fits within its environment.
8. **Thermal Bridging Calculations**
   Include calculated thermal resistance values for walls, roof, windows, and doors. Also, specify the window Solar Heat Gain Coefficient (SHGC) and visible transmittance. Thermal resistance modelling software such as Therm is not a requirement.

Use the Thermal Bridging guide and spreadsheet available on the BC Hydro website: BC Hydro Whole Building Design Guide. Ensure that all values meet or exceed the required standards:

Roof	Clear Field with Thermal Bridging	R40
	Clear Field with Thermal Bridging and Linear Interface Detail	R24
Total Above Ground Vertical Façade: Wall and Windows	Clear Field with Thermal Bridging	R30
	Clear Field with Thermal Bridging and Linear Interface Detail	R18

Submission Requirements
Student Stream

There are no registration fees. Submissions will be accepted until 11:59 pm (CST) on October 28, 2024.

Submission Requirements:

1. Basic Information
   Provide the following details about your submission:
   - A short description of the project.
   - Key project members, including names and contact details.
2. Short Design Report
   Describe the design concept, goals, and inspirations.
3. Elevation Drawings or Sketches
   Include exterior views of the building from all sides, indicating materials.
4. Construction Drawings
   Provide typical construction drawings or sketches of the building envelope, including windows, doors, walls, roofs and any joints and junctions, included significant thermal bridges. The drawings must be clearly annotated, detailing dimensions, and materials. They do not need to be to scale but should be thorough in detail. Please show continuity of the four principle boundary layers; water, air, vapour and thermal. The building envelope structure and materials must meet sound practice for moisture control, however, hygrothermal analysis using WUFI is not a requirement.

Submission Requirements
Student Stream

5. **Materials and Finishes**
   Provide a bill of materials used in the proposed design.
6. **Thermal Bridging Calculations**
   Include calculated thermal resistance values for walls, roof, windows, and doors. Also, specify the window Solar Heat Gain Coefficient (SHGC) and visible transmittance. Thermal resistance modelling software such as Therm is not a requirement.

Use the Thermal Bridging guide and spreadsheet available on the BC Hydro website: BC Hydro Whole Building Design Guide. Ensure that all values meet or exceed the required standards:

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	Clear Field with Thermal Bridging and Linear Interface Detail	R24
Total Above Ground Vertical Façade: Wall and Windows	Clear Field with Thermal Bridging	R30
	Clear Field with Thermal Bridging and Linear Interface Detail	R18

Professional Advisor

If participants find any errors, discrepancies, or oversights in the Competition Brief, or if they are unsure about the meaning or intent of any requirements, they must promptly notify the Professional Advisor by 11.59pm October 14, 2024.

If the enquiry leads to a correction or clarification of the Competition Brief, the response will be provided to all participants.

If the enquiry does not require any correction or clarification of the Competition Brief, the response will be provided only to the participant who made the enquiry.

This ensures that all participants have access to the same essential information.

The Professional Advisor is **Melanie Chatfield, P.Eng**
Contact via Competition Webpage: https://efficiencymb.ca/building-envelope-design-competition/

Jury

Bruce Pauls
MArch MAA MRAIC

City of Winnipeg

Chris Buzunis
P.Eng., CEM, PMP

Province of Manitoba

Grant Walkin
CPHC CPHD M.Sc. P.Eng.

Litebox

Michael Reimer
P.Eng.

Efficiency Manitoba

Stephanie Zubriski
M.Sc., P. Eng., BECxP + CxA+BE, LEED AP BD+C, CPHD.

Crosier Kilgour

Prizes

The Building Envelope Competition Winners

1st Prize Winner	2nd Prize Winner	3rd Prize Winner
$5,000	$2,500	$1,000

The Student Prize Winners

1st Prize Winner	2nd Prize Winner	3rd Prize Winner
$5,000	$2,500	$1,000

Evaluation Criteria

Effective Thermal Performance: Assessing the ability of the designs to provide efficient insulation and thermal regulation within the building.
Daylight and Views: Considering the incorporation of natural light and optimal views into the design to enhance the overall occupant experience.
Climate Resiliency: Ensuring that the designs exhibit resilience and adaptability to varying climatic conditions.
Future Proofing: Evaluating the designs with a focus on their ability to accommodate future technological advancements and evolving sustainability standards.
Aesthetics: Judging the visual appeal and architectural aesthetics of the proposed building envelopes.
Local Materials: Ensure the use of materials and manufacturers local to Manitoba as much as possible.

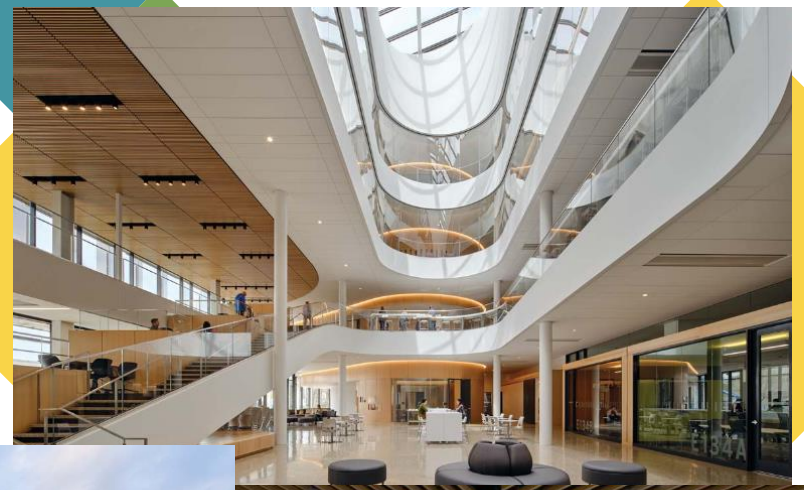
Key Dates


Closing Date for Registration
September 30 2024
Competition Q&A Deadline
October 14 2024
In order to guarantee equal opportunities to all competition participants.
No new questions will be answered after this deadline.
Closing Date for Submission
October 28 2024
11:59 pm (CST)
Announcement of Winners
November 21 2024

Post-Competition Activities

The Building Envelope Design Competition Awards will take place on Thursday, November 28th, at 3:30 p.m. at the Manitou a bi Bii daziigae building, located in Red River College's Exchange District Campus. The event will begin with a technical presentation by one of our panel judges, Grant Walkin, followed by the awards ceremony. Afterward, guests and award recipients are invited to an evening of networking with industry professionals at the Construction Specifications Canada (CSC) Connections Café.

Technical Presentation: 3:30pm – 4:30pm
Presenting of Awards: 5:00pm – 5:30pm
CSC Connections Café: 5:30 pm – 10:00pm



Thank you

Melanie Chatfield, City of Winnipeg
Bruce Pauls, City of Winnipeg
Jesse Watson, Connections Café, Construction Specifications Canada
Laura Tyler, Sustainable Building Manitoba
Ali Kaboorani, Building Efficiency Technology Access Centre, Red River College
Rob Spewak, Efficiency Manitoba/Sustainable Building Manitoba