



Natural Resources  
Canada

Ressources naturelles  
Canada



ecoENERGY  
an ecoACTION Initiative

# ARENA EE WIZARD

## Modelling Guide

August 2008

Canada 

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## 1. Introduction

The Arena EE Wizard is a simplified Model National Energy Code of Canada for Buildings (MNECB) performance path tool for modelling arena-type buildings (e.g. ice rinks, skating rinks, curling sheets). It allows the modelling of refrigeration and refrigeration heat reclaim, which is not supported by EE4 modelling software.

The EE Wizard has been developed along the following guidelines:

- the EE Wizard is a Web-based MNECB compliance tool;
- the EE Wizard offers compliance credits for refrigeration equipment improvements;
- the EE Wizard must be used to submit an arena-type building to NRCan's validation of new building designs.

This document provides a detailed description of the EE Wizard, presents its features and gives summary technical descriptions of the energy efficiency measures that are offered for potential compliance credits towards NRCan's validation of new building designs.

## 2. Overview of the Arena EE Wizard

The Arena EE Wizard is an hourly-based energy simulation program that uses the same DOE-2.1E run-engine as EE4. Unlike EE4, the EE Wizard is only available via the Internet, where all input data is entered, saved and the results presented in the form of a compliance report.

The main advantage of the EE Wizard is that it offers a much quicker and easier way to model a building relative to an EE4 simulation. Furthermore, the EE Wizard incorporates a number of special refrigeration modelling routines not available elsewhere, including EE4 or DOE-2.1E.

To allow for a faster modelling of a building a number of parameters have been predefined through the use of a building archetype. The building archetype is based on the most commonly encountered building geometry, layout and systems for a given vocation. The use of an archetype enables the user to concentrate on defining only the parameters that have the greatest impact on the energy efficiency of a building while the EE Wizard automatically constructs the rest.

Many aspects of the EE Wizard are similar to those seen in EE4. For example, the EE Wizard generates a reference building that adheres to the MNECB, and ensures that the proposed building respects minimal MNECB rules. Also, all of the Performance Path related requirements stated in the “Performance Compliance for Buildings” generally apply to the EE Wizard; the “Performance Compliance for Buildings” is available at:

[http://irc.nrc-cnrc.gc.ca/pubs/codes/nrcc38731\\_e.html](http://irc.nrc-cnrc.gc.ca/pubs/codes/nrcc38731_e.html).

The EE Wizard can be accessed at [132.156.178.35/wizard1/english/index.cfm](http://132.156.178.35/wizard1/english/index.cfm) through most Web browsers. Using the EE Wizard does not require any special software to be installed on a computer, other than a Web browser and Adobe Acrobat™ Reader.

### 2.1 Starting a Project

Starting a project using the EE Wizard only requires registration so that all data can eventually be saved in a user account. The projects opened under a user account can only be accessed by that user. New users must first register before entering their projects. [Figure 2.1 – Registration for the Arena EE Wizard](#) illustrates the data required for registration. Registration is required in order for the EE Wizard to save projects under a password protected user account.

Figure 2.1 – Registration for the Arena EE Wizard

## Create Your EE Wizard Account

Please use the following form to create your EE Wizard account.

*NOTE:* you will use your email address and password to gain access to your account.

*(Required fields are indicated by \*)*

---

Organization

First Name \*

Last Name \*

Email Address \*

Phone Num.

---

Address

City

Province \*

Postal Code

---

Account Password \*

Confirm Password \*

---

[Back To Registration Page](#)

Last Modified 2008 03 25

[Important Notices](#)

After registering with the EE Wizard, users can create a new arena project or edit an existing one by simply following various links.

## **2.2 Before Entering Data**

Although the EE Wizard provides a simplified data entry process, users are still asked to enter a significant number of parameters. To simplify the data entry process and to minimize errors, an Excel Arena Help Sheet is available to the user. This spreadsheet can be downloaded and completed prior to entering data in the EE Wizard. The Arena Help Sheet presents all the data required to perform an EE Wizard simulation in a concise format.

Figure 2.2 – Defining Projects in the EE Wizard

The screenshot shows the EE Wizard interface. At the top, there is a header with the Canadian flag, 'Natural Resources Canada' / 'Ressources naturelles Canada', and the 'Canada' logo. Below this is a navigation menu with links for 'Français', 'Contact Us', 'Help', 'Search', and 'Canada Site'. A secondary menu includes 'Return Home', 'Site Map Links', 'Text View', 'Print View', and 'NRCan Site'. A banner image shows 'OFFICE OF ENERGY EFFICIENCY' and 'Commercial and Institutional Buildings'. The main content area is titled 'Welcome to the EE Wizard' and includes a 'Welcome' message and a list of steps to use the wizard. A sidebar on the left contains links: 'Home', 'Account Management', 'My Projects', 'Start a New Project', 'Validation of Designs', and 'Sign Off'. A list of help documents is provided at the bottom of the main content area.

**List all existing projects**

Home  
Account Management  
My Projects  
Start a New Project  
Validation of Designs  
Sign Off

**Creating a new project**

**Help Sheet to simplify the data entering process**

- [EE Wizard for Arenas Help Sheet \(.xls\)](#)
- [EE Wizard for Arenas Modelling Guide \(coming soon\)](#)
- [Start a New Arena Project Using the EE Wizard](#)

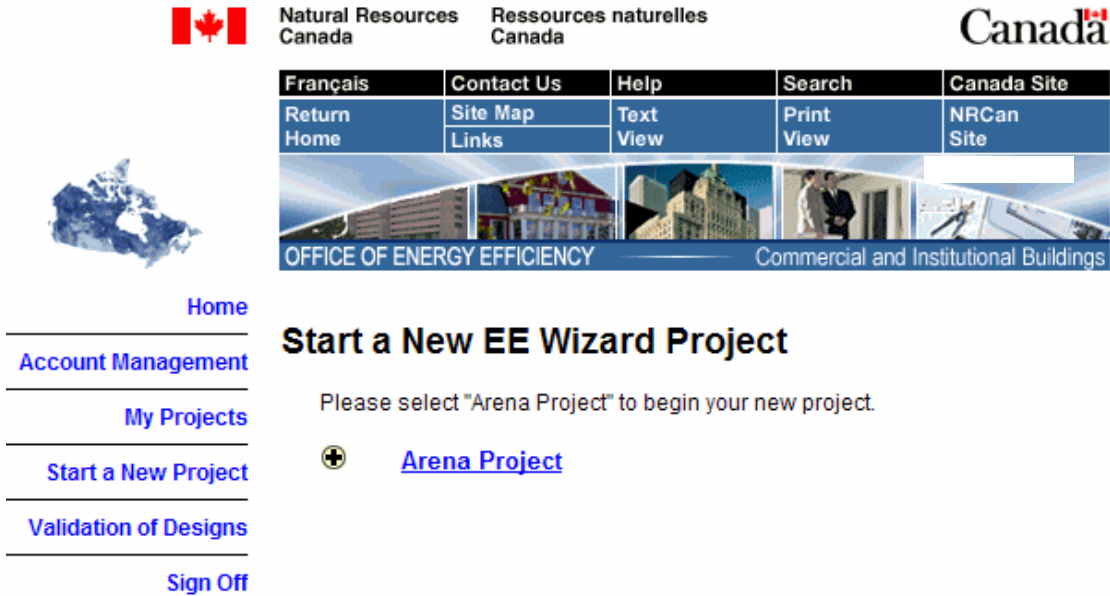
### 2.3 Creating a Project

Once the introductory page is displayed, [Figure 2.2 – Defining Projects in the EE Wizard](#), the user can create a new arena project or edit an existing one. [Figure 2.3 – Creating New Projects in EE Wizard](#) presents the page displayed



when a new project is created.

**Figure 2.3 – Creating New Projects in EE Wizard**



**Figure 2.4 – Defining a New Arena Project** presents the information needed to define a new arena project. Only the fields indicated with an asterisk are actually required for starting a new project. However, for a formal validation submission to NRCan, additional information from the applicant will be required, such as an “eco-Number”<sup>1</sup>.

Once the information has been entered a confirmation page is displayed, as shown in **Figure 2.5 – Confirming a New Arena Project**.

The user is then directed to the main page used in defining an arena project, as shown in **Figure 2.6 – Main Page for Defining an Arena Project**. On this page, the four (4) available zones for the arena are displayed along with a number of general data entry fields. These general fields include the various utility rates for the building, the weather location and a global data entry button.

The user can now proceed with the detailed definition of the building, zone by zone. Again, this process is made easier by using a completed Arena Help Sheet.

The data can be entered in any order in the EE Wizard. It is however important for the user to understand how the data is saved and managed by the EE Wizard

<sup>1</sup> For more information on how to obtain an “eco-Number”, visit the OEE’s Web page Validation of New Building Designs at <http://oee.nrcan.gc.ca/commercial/newbuildings/validation.cfm>.

before continuing with the definition of a project.

**Figure 2.4 – Defining a New Arena Project**

Natural Resources Canada / Ressources naturelles Canada

Canada Site

Français	Contact Us	Help	Search	Canada Site
Return Home	Site Map	Text View	Print View	NRCan Site
	Links			

OFFICE OF ENERGY EFFICIENCY Commercial and Institutional Buildings

**Start a New EE Wizard Project**

To start a new project, please provide the following information, and then the EE Wizard will launch.

*(Required fields are indicated by \*)*

Project Name \*

Energy Efficiency Measures

eco-Number

**Building Location**

Address

City

Province

Postal Code

Building Region

**Project Designer**

First Name

Last Name

Title

Organization Name

Phone

Email

**Project Designer Address**


Address

City

Province

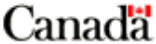
Postal Code

Figure 2.5 – Confirming a New Arena Project




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Canada



---



[Home](#)

---

[Account Management](#)

---

[My Projects](#)

---

[Start a New Project](#)


---

[Validation of Designs](#)

---

[Sign Off](#)

Français	Contact Us	Help	Search	Canada Site
Return Home	Site Map Links	Text View	Print View	NRCan Site



OFFICE OF ENERGY EFFICIENCY      Commercial and Institutional Buildings

## Confirm Your EE Wizard Project Information

Please confirm the data you have provided below. If all the information is correct, select "Continue". To make changes to your data, please select "Edit My Project Info".

---

Project Name :      example3

Project Description :

[eco-Number](#) :

---

**Building Location**

Address:

City:

Province :

Code Postal :

Building Region :

---

**Project Designer**

First Name :

Last Name :

Title :

Organization :

Phone :

Email Address :

---

**Project Designer Address**

Address:

City :

Province :

Postal Code :

---

Edit My Project Info

Continue

Figure 2.6 – Main Page for Defining an Arena Project

[Home](#)

[Account Management](#)

[My Projects](#)

[Start a New Project](#)

[Change to Imperial Unit of Measurement](#)

[Validation of Designs](#)

[Sign Off](#)

### EE Wizard Project: example3

The following diagram illustrates each zone of the Arena that you will need to define for the compliance analysis. Select the "Modify..." button in each zone, and the EE Wizard will lead you through the data entry.

---

Project Definition.

---

#### Define Building Zones

If a zone is not applicable to your Arena Project, please leave the box unchecked within that zone.

Global Data.

\*\*incomplete\*\*

---

Bleachers

\*\*incomplete\*\*

Number of Ice Sheets:

Ice Sheet #1
\*\*incomplete\*\*

Lockers/Change Rooms/ Washrooms/ Showers

\*\*incomplete\*\*

(  Check if applicable )

Entrance/Cafeteria/Snack Bar

\*\*incomplete\*\*

(  Check if applicable )

---

Multipurpose Space :
Community Centre

\*\*incomplete\*\*

(  Check if applicable )

**Building Region**

---

#### Define Utility Rates

In order to define the utility rates associated to this project, please place a check mark in the box next to each utility that applies.

<input type="button" value="Applicable"/>	<input type="button" value="Modify..."/>	Electricity - Energy Rates	n/a
	<input type="button" value="Modify..."/>	Electricity - Demand Rates	n/a
<input type="button" value="Applicable"/>	<input type="button" value="Modify..."/>	Natural Gas Rates	n/a
<input type="button" value="Applicable"/>	<input type="button" value="Modify..."/>	Propane Rates	n/a
<input type="button" value="Applicable"/>	<input type="button" value="Modify..."/>	Fuel Oil Rates	n/a

Global data applicable to every zone

4 available zones

Applicable utility rates

## 2.4 Saving Project Data

The EE Wizard allows you to save the data you've entered in a project at any point in the data entry process. The data saved is recorded in the EE Wizard database server and can later be retrieved to continue or modify a given project. No data is saved on the user's computer at any point in the analysis process.

The data is saved by clicking on the *Save* or *Save & Continue* or *Save & Go Back* buttons, as shown in [Figure 2.7 – Saving Project Data](#). Changing tabs using the upper tab buttons also saves any data entered by the user, as long as each data entry was followed by an ENTER key.

Figure 2.7 – Saving Project Data

The screenshot displays the 'EE Wizard Project: Exemple' interface. At the top, there is a navigation menu with links for 'Français', 'Contact Us', 'Help', 'Search', and 'Canada Site'. Below this is a banner for the 'OFFICE OF ENERGY EFFICIENCY'. The main content area is titled 'ZONE: Bleachers' and contains several tabs: 'Space Definition', 'Windows & Doors', 'Lighting System', 'Temp Control', 'Heating & Cooling', 'Ventilation', 'Dehumidification', and 'Refrigeration'. A yellow box labeled 'Save by changing tab' has arrows pointing to the 'Space Definition' and 'Lighting System' tabs. Below the tabs are input fields for 'Floor Area', 'Exterior Walls', 'Roof', and 'Floor On-ground'. At the bottom, there are three buttons: 'Save', 'Save & Continue >>', and '<< Save & Go Back'. A yellow box labeled 'Saving using command buttons' has arrows pointing to these three buttons.

All data in a project is available only to the user through a password protected account.

## 2.5 Getting your Results

The result of an EE Wizard simulation consists of a Compliance Report in the form of a single Acrobat (PDF) file. The file can be downloaded from the EE Wizard Web site, following a successful run, by clicking on the indicated link.

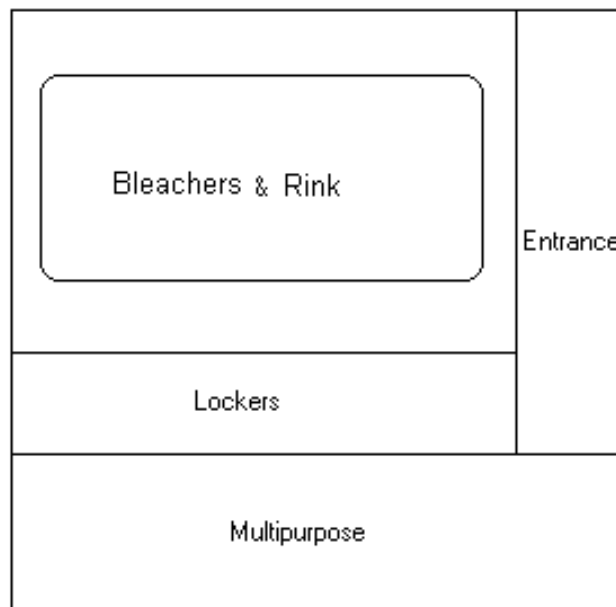
A message at the bottom of each page of the Compliance Report indicates if the report can be used as a compliant validation submission to NRCan. The EE Wizard also displays summary results directly on the Results Web page for preliminary analysis.

## 2.6 Zoning of Arenas in the EE Wizard

The building archetype adopted for arenas is based on a four-zone model as shown in [Figure 2.8 – Zoning of Arenas in the EE Wizard](#). Each zone represents a thermal block with spaces having similar periods of heating and cooling, occupation, space use, and mechanical systems.

The arena archetype has been established based on the most commonly encountered arena layout. However, each of the archetype zones, except the bleachers and rink (i.e. ice sheet) zones, can be ignored if it is not present in a given building, as will be shown in [Section 3.1 – “Space Definition”](#).

**Figure 2.8 – Zoning of Arenas in the EE Wizard**



The actual physical location of each zone relative to one another is unimportant in the EE Wizard. Therefore, the floor layout shown in [Figure 2.8](#) is for illustration purposes only. Each zone in the EE Wizard can be treated as an internal zone or completely external simply by defining the amount of exterior walls for the zone. For example, any zone with no exterior walls will be treated, implicitly, as internal.

The EE Wizard can account for heat transfer between the bleachers and rink zone and any other zones since the temperature set points for the bleachers

zone can be significantly lower than for any other zone.

## 2.7 Project Management

The EE Wizard allows the user to perform a number of operations on the projects saved in a user account. A user can create a copy of an existing project, delete an obsolete project or send a project for review to NRCAN. The latter option is covered in more detail in [Section 5 – “Validation Submission to NRCAN Using Arena EE Wizard”](#).

These options are available by selecting the “My Projects” menu item in the left hand side menu bar, as shown in [Figure 2.9 – Managing Projects in the EE Wizard](#).


To copy a project under a new name, the user has only to select the “Duplicate Project” link on the appropriate project line, as shown in [Figure 2.9 – Managing Projects in the EE Wizard](#). Doing so will bring up a page requesting the new name for the duplicated project. This option is very useful when analyzing similar buildings or when doing various scenarios on a given building for which the final design is not yet defined.

A project can be deleted using the “Delete Project” link. A deleted project is permanently erased from the user’s account. To protect against accidental deletion of projects, the EE Wizard requires a confirmation before deleting any project.

Finally, this page also allows the user to consult the results of the last simulation of a given project by selecting the “View Report” link.





Figure 2.9 – Managing Projects in the EE Wizard




Natural Resources  
Canada

Ressources naturelles  
Canada





Français	Contact Us	Help	Search	Canada Site
Return Home	Site Map Links	Text View	Print View	NRCan Site



OFFICE OF ENERGY EFFICIENCY Commercial and Institutional Buildings

[Home](#)

---

[Account Management](#)

---

[My Projects](#)

---

[Start a New Project](#)

---

[Validation of Designs](#)

---

[Sign Off](#)

## My EE Wizard Projects

Project Name	Last Modified				
<a href="#">Arena - example3</a>	05-05-2008	<a href="#">Send to NRCan for Review</a>	<a href="#">Duplicate Project</a>	<a href="#">Delete Project</a>	<a href="#">View Report</a>
<a href="#">Arena - Exemple</a>	05-05-2008	<a href="#">Send to NRCan for Review</a>	<a href="#">Duplicate Project</a>	<a href="#">Delete Project</a>	<a href="#">View Report</a>
<a href="#">Arena - Exemple2</a>	04-29-2008	<a href="#">Send to NRCan for Review</a>	<a href="#">Duplicate Project</a>	<a href="#">Delete Project</a>	

### 3. Using the Arena EE Wizard: Step-by-Step

Using the Arena EE Wizard does not require any knowledge of DOE-2.1E or EE4. It is simply a matter of filling in the required input data. The data can be entered in almost any order, with the exception of a few values. There are, however, several rules and work-arounds that must be considered when using the EE Wizard. The following presents a step-by-step description of the data input sections of the EE Wizard:

#### 3.1 Space Definition

##### Floor Area:

As shown in [Figure 2.8 – Zoning of Arenas in the EE Wizard](#), the EE Wizard allows up to 4 zones when defining an arena. The first step required when defining a zone in the EE Wizard is to enter a floor area, as shown in [Figure 3.1– Defining a Space in the Arena EE Wizard](#).

The value entered for the floor area is the total conditioned floor area of all the spaces located in a zone (as defined in MNECB article 1.1.3.2). The spaces in an actual arena may not correspond exactly to those available in the EE Wizard zones. In these cases, the user must assign each of the actual spaces to one, and only one, of the EE Wizard zones.

Some general guidelines on how to assign actual spaces to the pre-established EE Wizard zones are provided in [Section 8 – “User’s Tips”](#).

It should be noted that the zone identified as “Bleachers” in the EE Wizard also includes the ice rink or rinks, if there are more than one. Thus, the sum of all bleachers area and ice rink area MUST be entered.

NOTE: Whenever the floor area is left at 0, the EE Wizard ignores the zone. Thus, if a zone is completely defined but its floor area is left at 0, it will NOT be modelled.

Figure 3.1– Defining a Space in the Arena EE Wizard

Home

Account Management

My Projects

Start a New Project

Change to Imperial Unit of Measurement

Validation of Designs

Sign Off

Natural Resources Canada / Ressources naturelles Canada

Canada

Français | Contact Us | Help | Search | Canada Site

Return Home | Site Map | Text View | Print View | NRCan Site

Links

OFFICE OF ENERGY EFFICIENCY | Commercial and Institutional Buildings

### EE Wizard Project: Example

#### ZONE: Bleachers

Space Definition | Windows & Doors | Lighting System | Temp Control

Heating & Cooling | Ventilation | Dehumidification | Refrigeration

\* Floor Area :  ( m<sup>2</sup> )

Initial step: defining the conditioned floor area

**Exterior Walls**

\* Total Exterior Wall Area:  ( m<sup>2</sup> )

\* Average Exterior Wall R-Value:  ( m<sup>2</sup> - °C / W )

**Roof**

Total Roof Area:  ( m<sup>2</sup> )

\* Average Roof R-Value:  ( m<sup>2</sup> - °C / W )

**Floor On-ground**

Total Floor Area:  ( m<sup>2</sup> )

Insulation Type: Uninsulated

Save | Save & Continue >> | << Save & Go Back

Total Exterior Wall Area

The next step in defining a zone consists in entering its exterior wall area. This wall area is the sum of all walls exposed to ambient exterior conditions, including unconditioned spaces, for all the spaces comprised in that zone. The wall area entered must be the gross wall area, including any doors and windows.

NOTE: If windows or doors are to be defined in a zone, the value for “Total Exterior Wall Area” must be defined first.

The Wizard does not require the orientation of opaque walls. Only window elements require defining an orientation.

Average Exterior Walls R-value

If a value is entered for the exterior wall area, its average overall R-value must be defined. This R-value corresponds to the area-weighted average of all the wall-type areas and their corresponding R-values, including all thermal bridging, for all the exterior walls in a zone. Refer to MNECB Appendix C for the accepted method for calculating overall R-value including thermal bridging.

**Table 3.1 – Example of Area-weighted R-value Calculation**

Example:	Area (m <sup>2</sup> )	R-value	Area x R-value
Wall type 1 area x wall type 1 R-value =	21	9	189
Wall type 2 area x wall type 2 R-value =	44	13	572
Wall type 3 area x wall type 3 R-value =	4	6	36
Totals:	69	(797/69)	797
Area-weighted wall R-value:		11.6	

Zone wall area = 69 m<sup>2</sup>  
 Area-weighted wall R-value = 11.6 (including impact of thermal bridging)

Total Roof Area

The gross surface area of the roof, defined as the opaque roof area plus the areas of any skylights contained in the roof.

Average Roof R-value

This R-value corresponds to the area-weighted average of all the roof-type areas and their corresponding R-values, including all thermal bridging, for all the roof areas in a zone. Refer to MNECB Appendix C for the accepted method for calculating overall R-value including thermal bridging. See [Table 3.1 – Example of Area-weighted R-value Calculation](#).

Floor-on-ground area

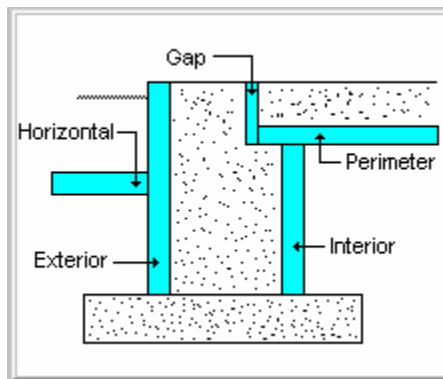
The floor-on-ground area includes any floor area that is in contact with the ground. Rules on how to consider below ground floors and walls are presented in [Section 7 – “Special Cases and Work-Arounds”](#).

For the bleachers zone, the floor-on-ground area EXCLUDES the ice sheet(s) area. The ice sheet(s) area is defined separately as will be seen in [Section 3.8 – “Refrigeration”](#).

*Floor-on-ground Insulation Type*

The level of insulation for floor-on-ground must be selected from the drop-down menu. [Figure 3.2 – Floor-On-Ground Insulation Placement](#), illustrates the meaning of each of the insulation placements referred to in the drop-down list.

**Figure 3.2 – Floor-On-Ground Insulation Placement**



NOTE: The insulation levels for a floor-on-ground do not give rise to any compliance credits towards NRCan’s validation, but are subject to mandatory requirements in the MNECB.

*Partition walls*

Finally, for all zones except the bleachers zone, the user can define a partition wall between the current zone and the bleachers zone. To do so, the user must define the area common to the bleachers zone as well as the insulation level of the partition wall. Any floors separating a zone from the bleachers zone must also be defined as a partition wall and NOT as a floor-on-ground component (e.g. a cafeteria floor above part of the bleachers).

Figure 3.3 – Defining a Partition Wall in the Arena EE Wizard

The screenshot shows the 'Arena EE Wizard' interface. At the top, there is a header with the Canadian flag, 'Natural Resources Canada' and 'Ressources naturelles Canada' logos, and the 'Canada' logo. Below this is a navigation menu with links for 'Français', 'Contact Us', 'Help', 'Search', and 'Canada Site'. A banner image shows the 'OFFICE OF ENERGY EFFICIENCY' and 'Commercial and Institutional Buildings'. On the left side, there is a vertical navigation menu with links: 'Home', 'Account Management', 'My Projects', 'Start a New Project', 'Change to Imperial Unit of Measurement', 'Validation of Designs', and 'Sign Off'. The main content area is titled 'EE Wizard Project: Exemple' and has a 'Back To Main Diagram' link. Below the title, there is a 'ZONE: Change Rooms' section with several configuration options: 'Space Definition', 'Windows & Doors', 'Lighting System', 'Temp Control', 'Heating & Cooling', and 'Ventilation'. The 'Partition Walls' option is highlighted. Below these options, there are two input fields: 'Area common to ice shed: [ ] m<sup>2</sup>' and 'Wall insulation: [ ] m<sup>2</sup> - °C / W'. A yellow callout box points to the first field with the text 'Wall AND floor area common to bleachers zone'. At the bottom, there are three buttons: 'Save', 'Save & Continue >>', and '<< Save & Go Back'.

### 3.2 Windows and Doors

Defining windows in the EE Wizard consists of entering their gross area, including framing, their orientations and types from drop-down menus.

NOTE: The sum of all window and door areas cannot exceed the “Total Exterior Wall area” for the zone.

It is not possible to define skylights or non-vertical glazing elements.

The characteristics of the windows in the pre-defined list are provided in [Table 3.2 – Window Characteristics](#).

**Table 3-2 – Window Characteristics**

Window Type	U-value W/(m <sup>2</sup> -K) / BTUH/(ft <sup>2</sup> -°F)	SHGC
Standard double/Vinyl	2.84/0.50	0.52
Standard double/Alum	3.22/0.57	0.61
Standard low-e/Vinyl	2.15/0.38	0.28
Standard low-e/Alum	2.50/0.44	0.33

Only one type of door can be defined in each zone. The total exterior door area is the sum of all opaque doors in that zone. Opaque doors are defined as doors with less than 50 % glazing. Doors with more than 50 % glazing must be treated as windows.

**Figure 3.4 – Defining Windows and Doors in the EE Wizard**

**Home**  
[Account Management](#)  
[My Projects](#)  
[Start a New Project](#)  
[Change to Imperial Unit of Measurement](#)  
[Validation of Designs](#)  
[Sign Off](#)

**EE Wizard Project: Exemple** [Back To Main Diagram](#)

**ZONE: Bleachers**

Space Definition **Windows & Doors** Lighting System Temp Control  
 Heating & Cooling Ventilation Dehumidification Refrigeration

**Windows**

Orientation	Area ( m <sup>2</sup> )	Type
▼	0.00	Standard double/Vinyl ▼
▼	0.00	Standard double/Vinyl ▼
▼	0.00	Standard double/Vinyl ▼
▼	0.00	Standard double/Vinyl ▼

**Exterior Doors**

\* Total Exterior Doors Area:  ( m<sup>2</sup> )

Type:  ▼

Up to 4 orientations or window types per zone

### **3.3 Lighting System**

The EE Wizard only requires three data entries to define a zone's lighting system.

#### **3.3.1 Average Lighting Power Density (LPD)**

The only mandatory element in defining a zone's lighting system is the average lighting power density (LPD). This LPD is the area-weighted average LPD of all spaces in the zone.

**IMPORTANT:** The LPD defined for the bleachers zone must NOT include the lighting fixtures serving the ice sheet(s). These elements are defined separately as will be shown in [Section 3.8 – “Refrigeration”](#).

#### **3.3.2 Type of Lighting Control**

Automatic lighting control strategies can be defined in the EE Wizard by selecting from a drop-down menu. Choices range from occupancy control to daylight sensing (DS) control with continuous dimming, multiple step dimming or on/off control. Only one type of control strategy is possible in a zone.

#### **3.3.3 Percentage of Lights Controlled**

After defining the type of control strategy used in a zone, the user must specify what percentage of the lights are controlled by these sensors. The percentage entered is the power-weighted average of the lights controlled to the total lighting power in the zone (ballasts included).



Figure 3.5 – Defining the Lighting System in the EE Wizard

The screenshot shows the EE Wizard interface for defining a lighting system. At the top, there are logos for Natural Resources Canada and the Office of Energy Efficiency. A navigation menu on the left includes links like Home, Account Management, My Projects, Start a New Project, Change to Imperial Unit of Measurement, Validation of Designs, and Sign Off. The main area is titled 'EE Wizard Project: Exemple' and 'ZONE: Bleachers'. Below this, there are buttons for 'Space Definition', 'Windows & Doors', 'Lighting System' (which is highlighted), and 'Temp Control'. Further down, there are buttons for 'Heating & Cooling', 'Ventilation', 'Dehumidification', and 'Refrigeration'. The 'Lighting System' configuration area includes a text input for '\* Average Lighting Power Density: : 0.00 ( W / m <sup>2</sup> )', a dropdown menu for 'Type of lighting control:' set to 'None', and a text input for 'Fraction of lights controlled: 0.00 %'. At the bottom, there are three buttons: 'Save', 'Save & Continue >>', and '<< Save & Go Back'. A yellow callout box points to the LPD input field with the text: 'Area-weighted average NOTE: Ice sheet(s) lighting excluded from this average LPD'.

### 3.4 Temperature Control

Each zone in the EE Wizard can have its own temperature set points for heating and cooling. These set points must be greater than 12.8 °C (55.05°F). Since the EE Wizard accounts for heat transfer between the bleachers zone and any other zone, it is important to enter the correct set points. Furthermore, the heating set point for the bleachers zone has a very significant influence on the refrigeration load. Therefore, caution must be used when selecting a set point greater than 15 °C (59°F) in this zone as it may lead to unrealistic refrigeration loads.

If there is no cooling capacity defined in a zone, the cooling set point is ignored and can be left as is.


If a heating set back is present in a zone, the EE Wizard will automatically reduce the temperature set point by 4 °C (39.2 °F), according to the temperature schedule shown in [Table 3.3 – Arena Default Schedule Details](#). If cooling control is selected, the cooling temperature set point will be set to 35 °C (95 °F) during unoccupied periods.

The arena EE Wizard imposes a predefined daily and weekly schedule for all the zones in the building. This pre-defined schedule cannot be modified. However, the user is able to impose the yearly operating schedule by defining the number of weeks of operation for the ice sheet(s), as presented in [Section 3.8 – “Refrigeration”](#). The weekly schedule will be repeated during each week of operation defined by the user in [Section 3.8](#).

The weekly schedule determines the hourly profiles for lighting use, ventilation and outside air schedule, equipment use and set back periods. The hourly profiles corresponding to the predefined schedule are provided in [Table 3.3](#).

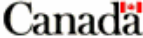
The fan schedules in [Table 3.3](#) apply to ventilation, outside air and exhaust fan control.

Figure 3.6 – Defining the Temperature Set Points in the EE Wizard





Natural Resources  
Canada

Ressources naturelles  
Canada



Français	Contact Us	Help	Search	Canada Site
Return Home	Site Map Links	Text View	Print View	NRCan Site

**EE Wizard Project: Exemple**

[Back To Main Diagram](#)

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**ZONE: Bleachers**

Space Definition	Windows & Doors	Lighting System	Temp Control
Heating & Cooling	Ventilation	Dehumidification	Refrigeration

Heating Set Point:  ( Min. 12.8 °C )

Heating Setback:  Set Back

Cooling Set Point:  ( Min. 12.8 °C )

Cooling Control:  Stopped

Bleachers set point is usually no more than 15 °C.

**Table 3.3 – Arena Default Schedule Details**

	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12	
<b>Occupants</b>																									
Mon - Fri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Sat	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
Sun	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
<b>Lighting</b>																									
Mon - Fri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sat	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sun	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Receptacle</b>																									
Mon - Fri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sat	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sun	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Fans</b>																									
Mon - Fri	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	On	On	On	On	On	On	On	On	On	On	On	On
Sat	Off	Off	Off	Off	Off	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
Sun	Off	Off	Off	Off	Off	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
<b>Cooling</b>																									
Mon - Fri	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB
Sat	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB
Sun	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB
<b>Heating</b>																									
Mon - Fri	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB
Sat	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB
Sun	SB	SB	SB	SB	SB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB	NSB

SB: Set back possible  
 NSB: no set back possibility

### 3.5 Heating and Cooling

The EE Wizard simplifies the definition of the mechanical system by setting up most of its parameters and by predetermining the system's type. The missing information must be completed, including the heating and cooling capacity, the source of heating, the heating efficiency, as well as the central system and baseboard capacity.

The EE Wizard allows two different configurations for the building HVAC system. These configurations are:

- Integrated geothermal system for HVAC and refrigeration;
- Standard single zone systems for the 4 zones with separate refrigeration system.

The selection of integrated geothermal system is made in the “Global Data” section, as shown in [Figure 3.7 – Selecting HVAC System Type in the EE Wizard](#) (see “Global Data” button in [Figure 2.6 – Main Page for Defining an Arena Project](#) ).

Figure 3.7 – Selecting HVAC System Type in the EE Wizard

While selecting geothermal system in the “Global Data” page, the user can also select the Radiant in-floor heating option for the bleachers zone. This option is ONLY available for geothermal system and only for the bleachers section. The radiant in-floor option may reduce energy consumption and give rise to compliance credits by allowing a lower set point in the bleachers zone compared to that of a conventional forced-air system. However, some of that gain may be partially offset by additional radiant gain from the warm floor to the ice through reflection on the ceiling.

The EE Wizard automatically adjusts the reference building set point to credit the presence of the radiant in-floor system.

Once the system type is selected, either geothermal or conventional, the user must define the system's heating and cooling capacities, heating source, and any terminal or baseboard heating used in a zone.

For the conventional system option, the heating and cooling systems, and their equivalents, defined by the EE Wizard for the arena zones are:

*Bleachers zone:* Unit heaters/force flow heaters/duct heaters with the option of baseboards and cooling outdoor air from a make-up air unit and exhaust OR roof-top unit (RTU) with optional cooling. There is the option of packaged dehumidification units.

*Entrance:* RTUs with optional cooling and optional baseboards.

*Lockers zone:* Baseboards or force flow heaters; optional cooling.

*Multipurpose zone:* RTUs with cooling and optional baseboards.

All RTUs described above are single-zone/constant-volume packaged units. A combination of furnace or boiler and air-conditioner can also be treated as equivalent to one of these RTUs as long as the system brings in the minimum outdoor air required by the MNECB.

All RTUs are equipped with a dry bulb controlled economizer in the proposed building. This configuration cannot be modified.

Similar to the assigning of an arena's actual spaces to those available in the EE Wizard, the user must assign actual arena systems to those available in the EE Wizard. Some general guidelines on how to assign actual systems to the pre-established EE Wizard systems are provided in [Section 8 – “User’s Tips”](#).

Figure 3.8 - Defining the Heating & Cooling System in the EE Wizard

The screenshot displays the EE Wizard software interface. At the top, there is a header with the Canadian flag, 'Natural Resources Canada' logo, and 'Ressources naturelles Canada' text. Below this is a navigation menu with options like 'Français', 'Contact Us', 'Help', 'Search', and 'Canada Site'. The main content area is titled 'EE Wizard Project: Exemple' and includes a 'Back To Main Diagram' link. The 'Heating & Cooling' section is active, showing a 'Total installed capacity' box pointing to 'Central' and 'Baseboard' capacity fields. The 'Central' capacity is set to 233.00 kW and the 'Baseboard' capacity is 0.00 kW. The source is set to 'Electricity' and the heating efficiency is 73.00%.

### 3.5.1 Heating Capacity

These values represent the total heating capacity both for the central system (e.g. RTUs, force flow heaters, duct heaters) and baseboards (and/or terminal). However, when only one type of equipment is present in a zone (such as baseboards), it is better to define this capacity as central instead of terminal. In the simulation, all terminal/baseboard heating equipment has priority over any



type of heat recovery system (e.g. heat recovery ventilators, refrigeration heat recovery).

NOTE: The central heating capacity field is unavailable for geothermal system type. In this case, the EE Wizard automatically sizes the heating capacity for the zone.

### **3.5.2 Heating Source**

These fields are used to determine the heating source for central and baseboard equipment. The central heating source is unavailable when geothermal system is selected. Selecting “Heat Pump” has the effect of using an air-to-air type heat pump for the zone.

### **3.5.3 Heating Efficiency**

This value refers to the instantaneous efficiency and not the annual fuel utilization efficiency (AFUE). The value is specified in % for combustion type system and as coefficient of performance (COP) for geothermal system. The COP must be entered at standard test conditions (CSA-446).

### **3.5.4 Cooling Capacity**

This value represents the total cooling capacity for the zone from all cooling equipment (e.g. window air-conditioners, RTUs). Enter 0 if no cooling equipment is present.

NOTE: The central cooling capacity field is available for the geothermal system type. In this case, the EE Wizard does not automatically size the cooling capacity for the zone.

### **3.5.5 Cooling Efficiency**

This value is specified in terms of energy efficiency ratio (EER) or COP. The efficiency must be entered at standard rating conditions (e.g. such as CSA-446 for geothermal systems or appropriate ARI conditions for other equipment types).

## **3.6 Ventilation**

The second part of defining the mechanical system involves describing its ventilation components, as shown in [Figure 3.9 - Defining the Ventilation System in the EE Wizard](#).

### 3.6.1 Supply fan

The first set of entries describes the supply fan(s). The supply system is described by the total air flow assigned to the zone, its design static pressure and the combined fan/motor efficiency or the fan motor(s) power. If multiple fans serve the zone, the flow is the sum of all air flows from all fans. The static pressure is set by default equal to that of the reference building at 325 Pa (1.3 in. wg). For multiple fans, the static pressure is calculated as the flow-weighted average of all fan static pressures.

Whenever a supply fan power is entered, it has priority over the static pressure and motor efficiency data.

The EE Wizard does not allow defining a return fan system.

### 3.6.2 Outdoor air

Two entries define the outside air flow to a zone: the total design outdoor air flow rate and the total local exhaust flow rate.

The value entered for the total design outdoor air flow rate must be greater than that specified by the MNECB for compliance with NRCAN's validation. This minimum required value is displayed on the screen by the EE Wizard. Also, the amount of local exhaust must be smaller or equal to the specified total design outside air flow rate. If the total outside air flow rate is below that required by the MNECB, the EE Wizard will perform the simulation but the Compliance Report will indicate an error and will not be accepted for compliance with NRCAN's validation of new building designs.

If a heat recovery ventilator (HRV) is present on the ventilation system, its effectiveness is specified in terms of %. The value entered must be obtained from accredited tests using a recognized standard (e.g. such as CSA or ARI). Appropriate documentation must be provided attesting to the HRV performance. The static pressure drop due to an HRV must be included in the ventilation system design static pressure defined earlier. Whenever heat recovery is specified, it is important to know that all local exhaust is rejected directly to the outside, by-passing the HRV. Whenever zonal exhaust is ducted back to the HRV, this flow must not be defined as local exhaust.

Intermittent exhaust fans should only be defined in proportion of their actual usage compared to that presented in the schedule of [Table 3.3 – Arena Default Schedule Details](#) (e.g. a 100 CFM fan used for 2 h/day should be defined as having  $100 * 14h / 93h = 15$  CFM since the fan schedule in [Table 3.3](#) indicates a 93 h/wk [Mon – Sun] schedule for all fans).

Figure 3.9 - Defining the Ventilation System in the EE Wizard

**Supply Fan**

\* Total Air Flow Rate:  ( L / s )

Design Static Pressure:  ( Pa )

Combined Motor/Fan Efficiency (> 25%, < 100% ):  %

Supply Fan Power:  ( kW )

**Outside Air**

\* Total Outside Air Flow Rate:  ( L / s )

\* Total Local Exhaust Flow Rate:  ( L / s )

Heat Recovery Ventilator Efficiency:  %

**Callout 1:** This entry has priority over the fan efficiency and static pressure entries

**Callout 2:** Must meet MNECB minimum for compliance

Buttons: Save, Save & Continue >>, << Save & Go Back

### 3.7 Dehumidification

Only the bleachers zone offers the possibility of defining dehumidification. This is attributable to the potentially significant impact that high humidity levels can have

on the refrigeration system energy use. Other zones follow rules set by NRCan’s validation, which do not allow credits for dehumidification.

Only one type of dehumidification system is currently offered for arenas, namely packaged units. These units are pre-assembled dehumidifiers, often hung near the ceiling, which reject their condenser heat to the bleachers zone.

When a dehumidification system is defined in the proposed building, the reference building also has dehumidification based on packaged units. The minimum set point allowed in the reference building is 40 % RH (relative humidity). If the proposed building has a set point lower than 40%, the reference will remain at 40 % otherwise it will adopt the same RH setting as that of the Proposed.

Figure 3.10 - Defining the Dehumidification System in EE Wizard

The screenshot shows the EE Wizard software interface. At the top, there are logos for Natural Resources Canada and the Office of Energy Efficiency. A navigation menu includes options like 'Français', 'Contact Us', 'Help', 'Search', and 'Canada Site'. The main content area is titled 'EE Wizard Project: Exemple' and 'ZONE: Bleachers'. A grid of system definition options is displayed, with 'Dehumidification' highlighted in orange. Below this grid, there is a checkbox for 'Space has dehumidification' which is currently unchecked. A 'System Definition' box contains a 'Control Set Point' input field (set to 40%) and a 'Type' dropdown menu. At the bottom, there are three buttons: 'Save', 'Save & Continue >>', and '<< Save & Go Back'.

If multiple ice sheets are present, but only some of them have dehumidification, the user **must not** define any dehumidification for the bleachers zone.

### **3.8 Refrigeration**

Accurately defining the refrigeration system and its loads is very important for arenas since refrigeration can account for more than 50% of the total arena energy use. For an arena to be compliant with NRCan's validation of new building designs, it is necessary to incorporate a number of energy efficiency measures to the refrigeration system design.

In order to completely define the refrigeration system and its loads in the EE Wizard, the user must access three different data entry pages.

#### **3.8.1 Global Data Page**

This page is used to define the total installed lighting power over all the ice sheets. This lighting power not only uses energy for its primary lighting purpose but also represent a significant load to the refrigeration system since up to 60% of the lighting power is picked up as a thermal load by the ice surfaces. It is important for the user to know that the reference building will have a lighting power density of  $13 \text{ W/m}^2$  over the ice sheets for arenas with bleachers having a capacity of less than 500 occupants, and of  $28 \text{ W/m}^2$  for larger arenas. Thus, any lighting power over and above these values will penalize a validation submission to NRCan since it will use more electricity for lighting AND for refrigeration.

Figure 3.11 - Defining the Total Lighting Power over the Ice Sheets

The screenshot shows the EE Wizard Project: Exemple interface. On the left is a navigation menu with links: Home, Account Management, My Projects, Start a New Project, Change to Imperial Unit of Measurement, Validation of Designs, and Sign Off. The main content area is titled 'EE Wizard Project: Exemple' and includes a 'Back To Main Diagram' link. The 'Global Data' section contains the following fields:

- Geothermal (all zones):  Yes
- Radiant in-floor option (only applicable if Geothermal is checked):  Yes
- \* Total Installed Lighting Power over ice sheets (> 0) [ ] ( kW )

The 'Service Hot Water' section includes:

- \* Energy source for SHW: Electricity (dropdown)
- \* Efficiency (25-100%): 100.0 %
- Nominal flow rate (L / s): Showers [0.1577], Faucets [0.1389]
- Motion activated faucets:  Yes
- Percentage of motion activated faucets (0-100%): 0.0 %

At the bottom are two buttons: 'Update Info' and 'Update Info & Return to Diagram'. A yellow callout box with the text 'This value applies to all ice sheets in the building.' points to the lighting power input field.

### 3.8.2 Ice Sheet Page

The EE Wizard allows defining up to 4 separate ice sheets in an arena, as shown in [Figure 3.12 – Defining Multiple Ice Sheets](#). Each ice sheet shares a number of common attributes, namely:

- all ice sheets are in the same zone (same heating set point);
- all ice sheets have the same LPD;

- all ice sheets share a common refrigeration system. However, if multiple compressors are used, the compressors are staged according to the number of operating ice sheet.

Other attributes are specific to each ice sheet and allow the user to define multiple usage ice-sheet buildings, as shown in [Figure 3.13 – Specific Ice Sheet Parameters](#) :

- ice sheet area;
- emissivity of ceiling above ice sheet;
- ice sheet usage;
- ice sheet temperature;
- number of resurfacings per week;
- number of weeks of operation per year;
- number of seats for the ice sheet's bleachers.

Each of these parameters has an influence on the refrigeration load or energy use of the refrigeration system. Some of these parameters can also give rise to compliance credits.

NOTE: If a building has multiple ice sheets sharing identical or almost identical characteristics, such as multiple hockey rinks operating for the same number of weeks, they can be defined as a single larger ice sheet.

#### Ice Sheet Area

Enter the total ice sheet area. The total area for all ice sheets must be smaller than the area specified for the bleachers/Rink zone (see [Figure 3.1 - Defining a Space in the Arena EE Wizard](#)).

#### Ceiling Emissivity

Infrared radiant heat load is a significant component of an ice sheet refrigeration load (up to 35%). A good part of this load comes from the radiative heat emitted from the ceiling.

The emissivity of the ceiling above the ice sheet is usually about 0.85 unless a low emissivity ceiling is used. In such cases, the emissivity normally varies between 0.05 and 0.2. This entry can provide compliance credits since the reference building has a standard ceiling with 0.85 emissivity.

#### Number of Resurfacings Per Week

This value represents the average number of resurfacings per week. A typical hockey rink will have about 65 resurfacings per week. The reference building will

always have the same number of resurfacings as the proposed building. The EE Wizard calculates the total water volume required for a resurfacing based on 0.3 L/m<sup>2</sup> (0.0075 usgal/ft<sup>2</sup>) of ice surface.

### Number of Seats

The number of seats in the bleachers associated with the ice sheet serves to determine the lighting power density over the ice for the reference building. Any sheet with more than 500 seats will have 28 W/m<sup>2</sup> while any sheet with less than 500 will have 13 W/m<sup>2</sup>.

### Ice Sheet Temperature

Default values are provided depending on the ice sheet usage. This value serves to determine the convective and radiative loads on the ice sheet. The reference building always has the same temperature as the proposed building.

### Number of Weeks of Ice Usage

This entry serves in defining how many weeks per year the ice sheet will operate. Each ice sheet may have different operating periods. The weekly schedule of [Table 3.3 – Arena Default Schedule Details](#) is used for every operating week. If a building has many ice sheets operating for different periods, the HVAC system will operate as per the longest operating period of any ice sheet. However, the refrigeration system operation and the refrigeration load will be adjusted as per each ice sheet operating period. The EE Wizard automatically adjusts the operating period so that any off-time will be centred around the summer month (with mid-July being the actual center of any off period).

### Ice Sheet Usage

The ice sheet usage only serves, in the EE Wizard to set the default ice temperature value.



Figure 3.12 - Defining Multiple Ice Sheets

**Validation of Designs**

**Define Building Zones**

**Sign Off** If a zone is not applicable to your Arena Project, please leave the box unchecked within that zone.

**Global Data.**  **\*\*incomplete\*\***

---

**Breachers**  **\*\*incomplete\*\***

Number of Ice Sheets:

<b>Ice Sheet #1</b> <b>**incomplete**</b>	<input type="button" value="Modify..."/>
<b>Ice Sheet #2</b> <b>**incomplete**</b>	<input type="button" value="Modify..."/>
<b>Ice Sheet #3</b> <b>**incomplete**</b>	<input type="button" value="Modify..."/>
<b>Ice Sheet #4</b> <b>**incomplete**</b>	<input type="button" value="Modify..."/>

---

<b>Lockers/Change Rooms/ Washrooms/ Showers</b> <input type="button" value="Modify..."/> <b>**incomplete**</b> ( <input checked="" type="checkbox"/> Check if applicable )	<b>Entrance/Cafeteria/ Snack Bar</b> <input type="button" value="Modify..."/> <b>**incomplete**</b> ( <input checked="" type="checkbox"/> Check if applicable )
---	--

---

**Multipurpose Space :**    
  
**\*\*incomplete\*\***  
(  Check if applicable )

Up to 4 different ice sheets per building are possible.

Figure 3.13 - Specific Ice Sheet Parameters

The screenshot displays the 'EE Wizard Project: Exemple' interface. On the left is a sidebar with links: Home, Account Management, My Projects, Start a New Project, Change to Imperial Unit of Measurement, Validation of Designs, and Sign Off. The main area is titled 'ICE SHEET: # 1' and contains the following parameters:

- \* Ice Sheet Area:  (m<sup>2</sup>)
- \* Ceiling emissivity:
- \* Number of resurfacing per week:
- \* Number of Seats (Bleacher Capacity):  (highlighted by a yellow callout box with the text 'Applies only to this sheet's bleachers.')
  - Ice sheet average temperature:  °C
- \* Number of weeks of ice operation:
- \* Ice sheet usage:  (dropdown menu)

At the bottom are 'Save' and 'Save & Continue >>' buttons.

### 3.8.3 Refrigeration Page

The last page used in defining the refrigeration system can be found in the bleachers zone under the “Refrigeration” tab. This page serves in defining the actual refrigeration plant and the secondary (i.e. brine) refrigerant loop. Many items on this page provide credits towards NRCan’s validation compliance and it is more than likely that any successful validation submission to NRCan will need to exploit some of these energy efficiency measures.

As previously mentioned, the refrigeration equipment defined in this page serves all the ice sheets defined for the building. Whenever ice sheets do not operate, compressors will be staged off, if multiple compressors are used.

### Compressor EER

This value represents the average compressor EER at the specified rating conditions of 37.8 °C (100 °F) condensing, -15.0 °C (5 °F) evaporating and -12.2 °C (10 °F) superheat. When multiple compressors are present, this value should be the capacity-weighted average of the EER ratings.

Compliance credits are available for high efficiency compressors since the reference building always has compressors with an EER of 9.

### Compressor Nominal Total Capacity

The capacity specified for this field represents the total installed compressor **MOTOR** capacity at the following rating conditions: 37.8 °C (100 °F) condensing, -15.0 °C (5 °F) evaporating and -12.2 °C (10 °F) superheat.

The EE Wizard splits this capacity evenly when there are multiple compressors. The resulting refrigeration capacity is obtained from this motor capacity and the previously defined compressor EER.

### Number of Compressors

Identify the number of compressors in the refrigeration plant. The reference building has the same number of compressors as the proposed design. The EE Wizard considers all compressors to be identical.

### Floating Head Pressure

Select this box if the refrigeration system's condensing pressure is allowed to fluctuate with exterior conditions. The reference building does not have floating head pressure control and compliance credits are available for this measure.

### Discharge Pressure Control Setting

This value identifies the temperature setting for the floating head pressure control; therefore, it is only active when the previous checkbox is selected. The reference building has a constant head pressure setting of 37.8 °C (100 °F). Any value below this temperature will provide potential compliance credits since a lower setting reduces the compressors energy use.

### Types of Subcooling

Subcooling the liquid refrigerant leaving the condenser can also help reduce the compressor energy use and increase the system's capacity. Two types of subcooling are offered: mechanical or natural. The reference building does not have a subcooler.

### Types of Condensers

Select from the available list of condensers. The reference building always has an air-cooled condenser.

### Types of Evaporators

Select from the available list of evaporators. The reference building always has a direct expansion evaporator.

### Number of Brine Circuit Passes

This value represents the number of brine circuit passes under the ice sheet before returning to the heat exchanger. Systems with 4 or 5 passes are more efficient since they operate with a greater temperature drop across each loop, which allows reducing the pump motor power. Ice temperature uniformity must however be ensured when using more passes. The reference building always uses a 2-pass loop and compliance credits are available for systems using 4 or 5 pass loops.

### Brine Pump Motor Capacity

This value represents the total capacity (in kW or hp) of the brine pumps used in day-time (occupied) operation. If different pumps are used for night-time operation, these should not be included in the total capacity.

### Brine Pump Control Strategy

Select one of the three available options: none, Day/Night, Two speed/Two pumps.

The default is to have no brine pump control strategy and have the pumps running continuously. This is the option always used in the reference building.

The Day/Night option consists of turning off the brine pumps during off-hours. This option must be used with caution in order to maintain adequate ice conditions.

The last option consists of having either two pumps or a two-speed pump where the smaller pump or lower speed is used for off-hours operation. In such cases, the capacity of the smaller pump is automatically set by the EE Wizard at 1/8 of the entered pump capacity.

Brine Pump Motor Efficiency

This represents the average efficiency of the brine pump motors. If more than one main motor is used, the value entered is the power-weighted average efficiency. The reference building has an efficiency of 80%.

Heat Recovery – Nominal Coil Capacity – Air-Side

The EE Wizard allows the user to define a refrigeration heat recovery system to heat the bleachers zone (and only the bleachers zone). This heat recovery replaces some or all of the condenser capacity and represents a potentially significant compliance credit since the reference building does not have air-side heat recovery for the bleachers zone.

The value entered here must be the nominal coil capacity at normal operating conditions both on the air-side and the refrigeration-side of the coil. Refrigeration and HVAC specifications and drawings must indicate how this recovery system is implanted and controlled.

IMPORTANT: When the geothermal system option is selected, the EE Wizard automatically incorporates air-side heat recovery to the proposed design and disregards any value entered for this parameter.

Heat Recovery – Nominal Exchanger Capacity – Service Hot Water (SHW)

Refrigeration heat recovery can also be used to preheat the arena's service hot water (SHW). The service hot water load is made up of the resurfacing water need and the general building needs, as defined in [Section 3.9 – “Service Water Heating”](#). This heat recovery also replaces some of the condenser capacity and usually takes the form of a desuperheater. The reference building always has a desuperheating heat recovery system for SHW.

The value entered here must be the nominal exchanger capacity at normal operating conditions both on the water-side and the refrigeration-side of the exchanger. Refrigeration and SHW specifications and drawings must indicate how this recovery system is implanted and controlled.

Whenever air-side and SHW heat recovery are simultaneously specified, the SHW heat recovery exchanger has priority over the air-side heat recovery coil.


Heat Recovery – Nominal Exchanger Capacity – Subfloor Heating


Most arenas have some form of heating under the ice sheets to prevent frost heaving of the floor slab. In the EE Wizard, this subfloor heating is predefined as electric heating with an average value of  $1.436 \text{ W/m}^2$  ( $0.1335 \text{ W/ft}^2$ ) and is constantly operating throughout the ice sheet operating period.

Specifying refrigeration heat recovery for subfloor heating displaces this electric load by recovered energy from the condensers. The reference building does not have subfloor heat recovery.

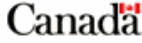
Whenever air-side and/or SHW heat recovery are simultaneously specified with subfloor heat recovery, they both have priority over the subfloor heat recovery exchanger.

Figure 3.14 - Refrigeration System Data





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## EE Wizard Project: Exemple

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### ZONE: Bleachers

Space Definition
Windows & Doors
Lighting System
Temp Control

Heating & Cooling
Ventilation
Dehumidification
Refrigeration

\* Compressors average nominal EER:  Btu / h - W

---

\* Compressor nominal total capacity:  kW

---

\* Number of Compressors:

---

\* Floating Head Pressure:  Yes

---

\* Discharge pressure control setting:  °C

---

Type of subcooling:

---

Type of condensers:

---

Type of evaporator:

---

Number of brine circuit pass:

---

Brine pump capacity:  kW

---

Brine pump control strategy:

---

Brine pump motor efficiency:  %

---

Heat Recovery - Nominal Coil Capacity - Air Side:  kW

---

Heat Recovery - Nominal Exchanger Capacity - SHW:  kW

---

Heat Recovery - Nominal Exchanger Capacity - Subfloor Heating:  kW

Save

Save & Continue >>


<< Save & Go Back

### 3.9 Service Water Heating

The “Global Data” page, presented earlier in [Section 3.8.1 – “Global Data Page”](#) and shown in [Figure 3.11 – Defining the Total Lighting Power over the Ice Sheets](#), also serves in defining the SHW system for the arena (with the exception of resurfacing loads and refrigeration heat recovery). Defining the SHW system consists mainly of specifying the energy source, other than heat recovery, for the SHW and the efficiency of the system. Optionally, the user may elect to define the average nominal flow rate for the showers and faucets used in the arena in order to obtain compliance credits. The default values shown in the EE Wizard are the values used in the reference building. Finally, additional credits can be obtained if motion activated faucets are used. In all cases (i.e. low-flow devices or motion activated faucets), supporting documentation must be provided.




Figure 3.15- Defining the SHW System in EE Wizard




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## EE Wizard Project: Exemple

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### Global Data

Geothermal (all zones):  Yes

Radiant in-floor option  
*(only applicable if Geothermal is checked):*  Yes

\* Total Installed Lighting Power over ice sheets (> 0)  ( kW )

**Service Hot Water**

\* Energy source for SHW:  ▾

\* Efficiency (25-100%):  %

	Showers	Faucets
Nominal flow rate (L / s)	<input style="width: 60px;" type="text" value="0.1577"/>	<input style="width: 60px;" type="text" value="0.1389"/>

Motion activated faucets:  Yes

Percentage of motion activated faucets (0-100%)  %

Update Info

Update Info & Return to Diagram

### 3.10 Multipurpose Zone

A final element available in the main diagram page is the vocation for the Multipurpose zone. This zone serves to represent any space located within the arena building and not covered by any of the three other zones. The user can select from a list of 4 possible vocations:

- Community Centre
- Recreation
- Auditorium
- Offices

Selecting the vocation changes the default and reference building parameters associated with that zone, as shown in [Table 3.4 – Multipurpose Zone Default Values](#).

**Table 3.4 - Multipurpose Zone Default Values**

Vocation	Occupant Density (m <sup>2</sup> /occ.)	Plug Load (W/m <sup>2</sup> )	SHW Load (L/s/m <sup>2</sup> )	Minimum OA (L/s/m <sup>2</sup> )	LPD (W/m <sup>2</sup> )
Community Centre	5.0	0.97	7.92E-05	1.498	19.4
Recreation	10.0	0.97	1.58E-04	2.996	7.5
Auditorium	5.0	2.47	1.58E-04	1.498	17.2
Offices	20.0	7.53	1.19E-04	0.498	19.4

Vocation	Occupant Density (ft <sup>2</sup> /occ.)	Plug Load (W/ft <sup>2</sup> )	SHW Load (gpm/ft <sup>2</sup> )	Minimum OA (CFM/pi <sup>2</sup> )	LPD (W/ft <sup>2</sup> )
Community Centre	53.8	0.09	2.785e-5	0.295	1.80
Recreation	107.7	0.09	5.571e-5	0.59	0.70
Auditorium	53.8	0.23	5.571e-5	0.295	1.60
Offices	215.3	0.70	4.186e-5	0.098	1.80

## 4. Defining the Arena Reference Building

A series of additional compliance rules were necessary in order to integrate arenas to NRCan's validation of new building designs. These rules serve to define the reference building and, at the same time, indicate where additional compliance credits can be obtained.

The rules for arenas are presented in [Appendix B](#) of this guide. It should be noted that all other validation rules also apply to arenas, including those listed in the "Performance Compliance for Buildings – Specifications for Calculation Procedures for Demonstrating Compliance to the Model National Energy Code for Buildings Using Whole Building Performance" [Canadian Commission on Building and Fire Codes (CCBFC), May 1999]. Validation rules are listed at: <http://oee.nrcan.gc.ca/commercial/newbuildings/validation.cfm>.

## 5. Validation Submission to NRCan Using Arena EE Wizard

Submitting an arena project to NRCan's validation of new building designs follows the same steps as that for a standard Performance Path submission, as described on NRCan's validation of new building designs website:

<http://oee.nrcan.gc.ca/commercial/newbuildings/validation.cfm>.

The initial step consists in obtaining a validation project "eco-Number". The next step requires gathering all the information needed to complete an Arena EE Wizard run, although preliminary and intermediate runs can be performed to guide the design.

Once the design is complete and all information has been collected, a final EE Wizard run is performed and the EE Wizard Summary Compliance Report is downloaded by the applicant. The report must be printed for eventual signing and validation submission to NRCan with all other required documents (refer to NRCan's Web page Validation of new building designs, at the link above).

The final simulation run MUST also be sent by the user for NRCan review using the indicated link on the Project Management page (refer to [Figure 2.9 – Managing Projects in the EE Wizard](#) ).

It is important for the applicant to send all required documents to NRCan, specifically the technical documents justifying any measures modelled using the EE Wizard.

## **6. Overview of Possible Energy Efficiency Measures Available to Arenas through the EE Wizard**

The following list presents a non-exhaustive review of energy efficiency measures providing potential compliance credits (or penalties) and that are available to arenas through the EE Wizard:

### **Envelope**

- Better wall insulation (above grade walls only)
- Better roof insulation
- Better windows (usually of little significance for arenas)

### **HVAC**

- Improved thermal efficiency for combustion-type heating system
- Use of heat pump loop heating system with possible earth-loop connection (GSHP)
- Radiant in-floor heating (geothermal only)
- Use of conventional HRVs
- High efficiency dehumidification system (i.e. EER)
- Heat recovery for space heating from refrigeration system
- High efficiency fan/motors
- High efficiency cooling system

### **Refrigeration/Brine loop**

- High efficiency compressors
- Optimised discharge pressure control (head pressure)
- Water and evaporative condenser
- Flooded evaporator
- Brine Pump Control
- Refrigerant subcooling (mechanical or natural)
- Reduced refrigeration load from lighting elements
- Reduced load from pumping elements
- Reduced load from humidity control
- Multistage pumps/multiple pumps for the brine loop
- Optimised brine pump control (day/night control)
- 4 or 5 pass brine circuits
- High efficiency pump/motors

### **Service Hot Water**

- Heat recovery for water heating or preheating from refrigeration system (above desuperheating)

- Low flow shower heads and faucets
- Motion activated faucets
- Improved efficiency for water heater combustion-type

**Lighting**

- Reduced lighting levels (below MNECB)
- Occupant sensors
- Daylight controls

The following sections provide summary descriptions of the principal measures available in the EE Wizard.

**6.1 Building Envelope**

The EE Wizard offers potential credits for an improved envelope compared to the MNECB prescriptive values for the region specified and its main heating source (as stated in Appendix A of the MNECB). Thus, similarly to what is offered by EE4, the user can specify higher wall, roof and window R-values. Note that the windows R-values are pre-established.

Windows in the reference building will always have the same solar heat gain coefficient (SHGC) and the same orientation as those in the proposed building.

**6.2 Lighting**

Lighting credits are available whenever the proposed building has a lower LPD than the reference building. The reference values for zonal LPDs in the EE Wizard are given in [Table 6.1 – LPD in the Reference Arena Building](#).

**Table 6.1 – LPD in the Reference Arena Building**

Zone	Lighting Power Density (W/m <sup>2</sup> )
Bleachers	13 or 28
Lockers	8.6
Entrance	10.8
Multipurpose	7.5 or 18.3 or 19.4

Additional credits can be obtained through the use of automatic controls. The reference building does not have any kind of automatic control. The credits for each type of control can be translated into an LPD reduction for the proposed building, for the fraction where the control is applied, as per [Table 6.2 – LPD reduction for each automatic control strategy](#).

**Table 6.2 – LPD reduction for each automatic control strategy**

Control Type	LDP credit
Daylight sensing control (DS) - continuous dimming	30 %
DS - multiple step dimming	20 %
DS - ON/OFF	10 %
Occupancy sensor	30 %
Occupancy sensor and DS - continuous dimming	40 %
Occupancy sensor and DS - multiple step dimming	35 %
Occupancy sensor and DS - ON/OFF	35 %

### 6.3 Mechanical System

Credits towards NRCan’s validation for the mechanical system are basically the same as those available for the standard Performance Path method, with the significant exception concerning the possibility to select the integrated geothermal system which provides automatic refrigeration heat recovery capabilities to the HVAC system.

Otherwise, credits for the following are available:

- HRVs;
- high efficiency mechanical cooling;
- high efficiency heating (fuel-fired units); and
- high efficiency supply fans.

Furthermore, significant credit can still be obtained from conventional refrigeration heat recovery for space heating purposes in the bleachers zone (other than the geothermal option).

The reference building will always have an 80% efficiency fuel-fired heating system (if proposed is fuel-fired), a 40 % combined fan/motor efficiency with 325 Pa (1.3 in wg) static pressure and a cooling system with COP of 3.4. The reference building has no HRV and no refrigeration heat recovery coil.

### 6.4 Dehumidification

As mentioned in [Section 3.7 – “Dehumidification”](#), compliance credits are available for arenas regarding dehumidification. These credits are only available for the bleachers zone. Whenever the proposed building has dehumidification, the reference building also has dehumidification.

Having a more efficient dehumidifying system is only part of the credits that can be gained from dehumidification: there are also credits from a lower refrigeration load.

Dehumidification can only be defined if all the ice sheets and associated bleachers are served by a dehumidification system.

## **6.5 Refrigeration**

The refrigeration system offers many opportunities for energy efficiency improvements in an arena. Through the EE Wizard, a number of measures are available and provide credits towards NRCan's validation.

### Heat Recovery

An arena refrigeration system usually rejects more heat than it needs for heating purposes. This heat can be used in great part to offset the building heating load or the SHW load.

Various levels of heat recovery are possible. The more common type is called desuperheating. In this system, the hot refrigerant gas leaving the compressors is sent to a heat exchanger that is used to preheat the service hot water. The hot gas is cooled but does not condensate in the heat exchanger. The cooled gas can then be directed to the system condensers for complete condensation. This type of system typically allows recovering from 15 % to 30 % of the total energy in the refrigerant stream.

Another common type of heat recovery is a condensing-type recovery system. In this system, the hot gas from the compressors is sent to the heat exchanger located in the ventilation system, in the bleachers zone, where it is cooled and condensed. When the gas fully condenses, the system is termed a "fully-condensing recovery system". Many designs achieve high levels of condensation but do not get full recovery. An auxiliary condenser is usually needed to ensure that liquid refrigerant is always available at the expansion devices.

The reference system has desuperheating heat recovery for SHW needs.

### Floating Head Pressure Control

When the compressors send hot refrigerant gas to the condenser, the pressure in the condenser is usually maintained at a minimum value in order to ensure proper operation of the expansion devices. However, keeping a higher condensing pressure requires more work from the compressors. Systems can be designed to operate adequately even at low condensing pressures, these systems offer significant energy performance gains. It should be noted that when heat recovery is used, the condensing pressure is maintained higher, even with such systems, in order to allow the heat recovery.



The reference system does not have floating head pressure control and has a setting of 37.8 °C (100 °F).

### Liquid Refrigerant Sub-Cooling

Mechanical sub-cooling and natural sub-cooling are effective methods of cooling liquid refrigerant below its saturation pressure in order to increase system capacity and improve efficiency. Sub-cooling the refrigerant increases the cooling capacity and may decrease the compressor power (depending on the sub-cooling technology), thereby increasing the overall efficiency of the system.

Mechanical sub-cooling consists of having a secondary vapour compression system, whose only purpose is to cool down the liquid refrigerant coming out of the condenser. On the other hand, a natural sub-cooler consists only of an additional heat exchanger located in cold ambient air. This sub-cooler takes advantage of the usual cold climate during which arenas operate to further cool down the liquid refrigerant.

The reference building does not have a sub-cooler.

### Type of Condenser

The most common condenser used in arena refrigeration systems is the air-cooled finned-tube condenser. Other types of condensers are also possible and may provide energy efficiency benefits. A water-cooled or an evaporative condenser can often maintain a lower condensing pressure. However, spraying down a conventional air-cooled condenser with water to turn it into an evaporating condenser is strongly discouraged, as it will significantly shorten its durability. Specifically designed evaporative condensers must be used.

The reference building uses a conventional air-cooled condenser.

### Type of Evaporator

The EE Wizard offers the choice of a direct expansion evaporator (DX) or a flooded evaporator.

In a direct expansion evaporator, the liquid refrigerant is evaporated and a significant portion of the exchanger is in contact only with a mixture of mainly gas and a small fraction liquid. The heat exchange in these portions of the evaporator is degraded given the lower heat transfer characteristics of the refrigerant gas compared to that of the liquid. Therefore, such systems have lower overall efficiencies.

In a flooded evaporator, the exchanger is mostly filled with liquid refrigerant to enhance the heat transfer between the refrigerant and the brine loop. This type of design significantly improves the system overall efficiency.

The reference building uses a DX evaporator.

### High-Efficiency Compressors

Refrigeration compressors are characterized by the energy efficiency ratio (EER). EERs are identical to coefficient of performance (COP) and only their units are different ( $COP = EER / 3.413$ ); the higher the EER, the more efficient a compressor.

Credits toward NRCan's validation are available if high efficiency compressors are used in the proposed design (EER above 9 at specified rating conditions).

### Brine Pump Control

Many arenas have brine pumps that operate continuously during the ice season. This type of operation causes a double energy efficiency penalty. On the one hand, the pumps use electricity 24 hours per day to operate at their nominal load and on the other hand, this load is transferred in great part to the refrigeration system as an additional refrigeration load.

By adjusting the pump capacity to the actual load on the ice sheet provides a significant energy efficiency opportunity. Various methods are available to achieve a reduction in pumping energy use, such as variable speed drives, two speed pumps, multiple pumps, or even stopping the pumps at night-time. The EE Wizard offers two brine pumps control strategies, namely:

- Stopping the pumps at night-time,
- Using two pumps or a two-speed pump

The user should be cautious about stopping the pump at night in order to ensure that ice surface conditions will not be deteriorated.

## 7. Special Cases and Work-Arounds

Basements: The wizard assumes that all arenas have a slab-on-ground. For cases where there are below ground spaces a special work-around has been adopted. In such cases, the zone's floor area must include all the conditioned floor area, including that of the below ground space. The ground floor area must also be the sum of all floors in contact with the ground, regardless of their depth. The underground wall area must be included in the total exterior wall area. The average exterior wall R-value must be calculated as the area-weighted average of all exterior AND below ground walls R-values. However, the below-ground wall R-value can be estimated as the actual below-ground wall R-value PLUS a value of R-10 to account for the ground insulating and dampening effect.

## 8. User's Tips

### **Space assignment guidelines:**

- Any spaces within the ice shed not explicitly covered by the EE Wizard's zones should be put into the bleachers zone.
- Vestibules should be included in the entrance zone.
- Manager office, employees' rooms and restrooms should be assigned to the entrance zone or multipurpose zone.

### **System assignment guidelines:**

- When multiple units serve a single EE Wizard zone, the total heating and cooling capacity must be entered.
- The equipment efficiency must be defined as a capacity-weighted average of all the units in that zone.
- The fuel source for terminal/baseboard heating cannot be of a combustible-type source unless the central system is also of the same source.
- Baseboard heaters in the Wizard include unit heaters, standard baseboard heaters, duct heaters, or any other heating devices not installed in a RTU.
- Only one central heating source can be chosen. If a zone is served by units with different sources, the source with the greatest energy source adjustment factor (ESAF, see MNECB 1.1.3.2) and representing more than 10% of the installed capacity must be selected.
- When a single unit serves more than one EE Wizard zone, its capacity must be divided between each zone in proportion to their respective thermal loads (not provided by the EE Wizard).

### **General tips**

- It is generally better to compile all the required data off-line before entering it into the Wizard.
- Using an Excel spreadsheet, such as the one provided on the Wizard Web Site, can greatly facilitate the data compiling effort and minimize the risk of errors.
- After 30 minutes of inactivity, the Wizard will automatically log you off.
- The Wizard can perform preliminary evaluations even if the final data is not entirely known. This may guide the applicant in the selection of energy efficiency measures prior to final design.
- Units in the EE Wizard can be changed at any time. Some pages can be filled in SI mode while others in IP.

- When the EE Wizard reports an insufficient heating error, there are two possible ways to fix it; either the heating capacity in the zone must be increased OR the ventilation air flow must be increased to better match the specified heating capacity.

## 9. Example: Defining a Validation Compliant Arena in EE Wizard

This example serves to demonstrate measures required by an arena project to comply with NRCan's validation using the EE Wizard. The example project's data is summarized, and all the necessary information to complete an EE Wizard simulation is provided below. Most of this information is generally available directly from the architectural, mechanical, and electrical drawings. Additional information could be obtained from equipment manufacturers' standard data sheets.

### **Description**

This arena has a total floor area of 3762 m<sup>2</sup> (40 500 ft<sup>2</sup>) which includes 2322.6 m<sup>2</sup> (25 000 ft<sup>2</sup>) for the ice shed. Walls and roofs are of similar construction throughout the building. The great majority of the building's fenestration is located in the entrance and multipurpose sections. A section of this arena serves as a small auditorium and has been defined as such in the multipurpose zone.

*Total Floor Space:* 3762 m<sup>2</sup> (40 500 ft<sup>2</sup>)

*Walls:* RSI-3.52 (R-20)

*Roof:* RSI-5.28 (R-30)

*Fenestration:* Standard insulating glass with aluminium frames

As presented in [Figure 9.4 – The Arena EE Wizard Summary Results](#) and [Figure 9.5 – Compliance Report - A](#), this arena complies with NRCan's validation and achieves a 35.6% reduction in energy use compared to the MNECB reference building. For the rates used in this example, this performance leads to simulated annual energy savings of \$49,698. This result was achieved without the use of energy efficiency measures such as refrigeration heat recovery for air heating or the use of geothermal energy systems.

### **Bleachers Zone:**

This area represents the bulk of the arena and houses its single ice sheet. All other rooms located within this space, namely the small mechanical room and the ice resurfacing room, were combined with the bleachers zone. The ice sheet occupies 1579.9 m<sup>2</sup> (17000 ft<sup>2</sup>) out of the total entered area of 2322.6 m<sup>2</sup> (25000 ft<sup>2</sup>). In the actual design, the space is served by force flow heaters over the bleachers and a large exhaust fan coupled with a relief damper for outdoor air.

These heaters will be merged into one equivalent unit for modelling purposes and defined as central heating. The total air flow includes the flows from the heaters as well as that of the exhaust fan; the motor capacity represents the sum of all these fan motors.

The refrigeration system for this arena incorporates a number of features providing credits towards NRCan’s validation compliance, namely:

- a low emissivity ceiling
- high efficiency compressors
- a flooded-type evaporator
- a 4-pass brine loop
- a two-speed brine pump
- a desuperheater for service water heating
- a natural subcooler
- a floating head pressure control strategy

The arena does not have refrigeration heat recovery for air heating or subfloor heating for the ice sheet.

The main data required for this zone are presented below. [Figure 9.1 – Detailed input data - A](#) through [Figure 9.3 – Detailed input data - C](#) present the detailed data input summary for the entire building as presented in the EE Wizard’s compliance report.

<i>Floor area:</i>	2322.6 m <sup>2</sup> (25 000 ft <sup>2</sup> )
<i>Exterior walls:</i>	1021.9 m <sup>2</sup> (11 000 ft <sup>2</sup> )
<i>Roof area:</i>	2322.6 m <sup>2</sup> (25 000 ft <sup>2</sup> )
<i>Floor-on-ground area:</i>	743.2 m <sup>2</sup> (8000 ft <sup>2</sup> ) with RSI-1.76 (R-10) interior wall insulation – excludes the ice sheet floor area.
<i>Windows:</i>	5.6 m <sup>2</sup> (60 ft <sup>2</sup> ) North, (60 ft <sup>2</sup> ) North-East
<i>Doors:</i>	18.6 m <sup>2</sup> (200 ft <sup>2</sup> ) - ice resurfacing machine.
<i>Lighting:</i>	8.6 W/ m <sup>2</sup> (0.8 W/ft <sup>2</sup> ) EXCLUDES lights over ice sheet.
<i>Heating set point:</i>	15.6 °C (60 °F)
<i>Packaged unit dehumidification with 50 % RH set point</i>	
<i>Heating and Ventilation:</i>	Heated (natural gas, 82% eff.) no cooling
<i>Natural gas heating:</i>	322.3 kW (1 100 000 BTU/h)
<i>Heat Recovery:</i>	none
<i>Supply air :</i>	8024 L/s (17 000 cfm)
<i>Outside air :</i>	5192 L/s (11 000 cfm)
<i>Exhaust:</i>	5192 L/s (11 000 cfm)
<i>Refrigeration:</i>	EER = 10.5

*Compressor motor capacity* 27 kW (or 80 Tons nominal refrigeration capacity -  
 > 27\*3413\*10.5/12000)  
 Natural subcooling system  
 Floating head pressure, 15.6 °C (60 °F)  
 Flooded evaporator  
 4 pass brine circuit  
 25 hp main pump, 2-speed  
 58.6 kW (200 000 BTUh) desuperheater for SHW

**Lockers Zone:**

This area includes all the locker rooms, access corridors, washrooms and showers. This space is served by electric baseboards as well as a natural gas duct heater in the fresh air system. The required data for this zone are presented below. This space is located inside the ice shed and does not have an exposed roof. Therefore, it has no exterior roof but this ceiling must be defined as a partition wall with the bleachers zone.

*Floor area:* 464.5 m<sup>2</sup> (5000 ft<sup>2</sup>)  
*Exterior walls:* 185.8 m<sup>2</sup> (2000 ft<sup>2</sup>)  
*Roof area:* 0 m<sup>2</sup> (0 ft<sup>2</sup>)  
*Partition wall area:* 622.5 m<sup>2</sup> (6700 ft<sup>2</sup>)  
*Floor-on-ground area:* 464.5 m<sup>2</sup> (5000 ft<sup>2</sup>) with RSI-1.76 (R-10) interior wall insulation  
*Windows:* none  
*Lighting:* 8.6 W/m<sup>2</sup> (0.8 W/ft<sup>2</sup>), 90% controlled by occupancy sensors  
*Heating set point:* 22.0 °C (71.6 °F)

*Heating and Ventilation:* Heated with a natural gas (82% eff.) duct heater and electric baseboards

*Natural gas heating:* 43.9 kW (150 000 BTUh)  
*Baseboards :* 29.3 kW  
*Standard HRV,* 65% effectiveness  
*Cooling:* none  
*Supply air :* 2171 L/s (4600 cfm)  
*Outside air :* 1180 L/s (2500 cfm)  
*Exhaust:* 118 L/s (250 cfm)



**Entrance Zone:**

The entrance zone defined for this arena includes a small snack-bar and eating area, a number of small offices, the entrance lobby and the vestibule. This zone has a significant common wall with the ice shed.

<i>Floor area:</i>	325.2 m <sup>2</sup> (3 500 ft <sup>2</sup> )
<i>Exterior walls:</i>	278.7 m <sup>2</sup> (3 000 ft <sup>2</sup> )
<i>Roof area:</i>	325.2 m <sup>2</sup> (3 500 ft <sup>2</sup> )
<i>Partition wall area:</i>	185.8 m <sup>2</sup> (2 000 ft <sup>2</sup> )
<i>Floor-on-ground area:</i>	325.2 m <sup>2</sup> (3 500 ft <sup>2</sup> ) with RSI-1.76 (R-10) interior wall insulation
<i>Windows:</i>	19.5 m <sup>2</sup> (210 ft <sup>2</sup> ) South (including the glazed vestibule doors), 6.50 m <sup>2</sup> (70 ft <sup>2</sup> ) East, standard double glazed/aluminium frames
<i>Lighting:</i>	16.2 W/m <sup>2</sup> (1.5 W/ft <sup>2</sup> ) (area-weighted average of all rooms)
<i>Heating set point:</i>	22.0 °C (71.6 °F) with setback
<i>Cooling set point:</i>	24.0 °C (75.2 °F) with setback
<i>Heating and Ventilation:</i>	Heated (natural gas, 82% eff.) with roof-top unit and some electric baseboards
<i>Natural gas heating:</i>	49.8 kW (170 000 BTU/h)
<i>Baseboards:</i>	7.3 kW
<i>Heat Recovery:</i>	none
<i>Cooling:</i>	10.5 kW (36 000 BTU/h), EER = 12
<i>Supply air :</i>	1652 L/s (3 500 cfm)
<i>Outdoor air :</i>	330 L/s (700 cfm)
<i>Exhaust:</i>	236 L/s (500 cfm) (kitchen hood and washrooms)

**Multipurpose Zone:**

This last area represents an additional room located within this arena and serving mainly as an auditorium. It has no common wall with the ice shed.

<i>Floor area:</i>	650.3 m <sup>2</sup> (7 000 ft <sup>2</sup> )
<i>Exterior walls:</i>	325.2 m <sup>2</sup> (3 500 ft <sup>2</sup> )
<i>Roof area:</i>	650.3 m <sup>2</sup> (7 000 ft <sup>2</sup> )
<i>Floor-on-ground area:</i>	650.3 m <sup>2</sup> (7 000 ft <sup>2</sup> ) with RSI-1.76 (R-10) interior wall insulation
<i>Windows:</i>	23.2 m <sup>2</sup> (250 ft <sup>2</sup> ), South-West 23.2 m <sup>2</sup> (250 ft <sup>2</sup> ), West
<i>Doors:</i>	9.3 m <sup>2</sup> (100 ft <sup>2</sup> )
<i>Lighting:</i>	12.9 W/m <sup>2</sup> (1.2 W/ft <sup>2</sup> ) with occupancy sensors
<i>Heating set point:</i>	22.0 °C (71.6 °F)

## Arena EE Wizard

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*Cooling set point:* 24.0 °C (75.2 °F)  
*Heating and Ventilation:* Heated (natural gas, 82% eff.) and cooled with 1 rooftop unit  
*Natural gas heating:* 58.6 kW (200 000 BTUh)  
*Heat recovery:* None  
*Cooling:* 14.1 kW (48 000 BTUh), EER = 12  
*Supply air :* 2832 L/s (6 000 cfm)  
*Outside air :* 991 L/s (2 100 cfm)  
*Exhaust:* 47 L/s (100 cfm)

Figure 9.1 – Detailed input data - A

Attribute Name	Units ( IP )	Zones			
		Bleachers/Ice Sheet	Change Rooms	Entrance	Multipurpose
Floor area	ft <sup>2</sup>	25000.00	5000.00	3500.00	7000.00
<b>Exterior Walls</b>					
Total exterior wall area	ft <sup>2</sup>	11000.00	2000.00	3000.00	3500.00
Average exterior wall R-value	ft <sup>2</sup> -h <sup>-2</sup> F/ Btu	20.00	20.00	20.00	20.00
<b>Exposed Roof</b>					
Total exposed roof area	ft <sup>2</sup>	25000.00	5000.00	3500.00	7000.00
Average exposed roof R-value	ft <sup>2</sup> -h <sup>-2</sup> F/ Btu	30.00	30.00	30.00	30.00
<b>Floor On-ground</b>					
Total floor on-ground area	ft <sup>2</sup>	8000.00	5000.00	3500.00	3500.00
Insulation type	n/a	Uninsulated	R-10 Int.	R-10 Int.	Uninsulated
<b>Windows Definition</b>					
Window #1 orientation ( N-S-W-E )	n/a	North	North	South	South-West
Windows area	ft <sup>2</sup>	80.00	0.00	210.00	250.05
Windows Type	n/a	Standard double/Alum	Standard double/Vinyl	Standard double/Alum	Standard double/Alum
Window #2 orientation ( N-S-W-E )	n/a	North-East	North	East	West
Windows area	ft <sup>2</sup>	80.00	0.00	89.97	250.05
Windows Type	n/a	Standard double/Alum	Standard double/Vinyl	Standard double/Alum	Standard double/Alum
Window #3 orientation ( N-S-W-E )	n/a	North	North	North	North
Windows area	ft <sup>2</sup>	0.00	0.00	0.00	0.00
Windows Type	n/a	Standard double/Vinyl	Standard double/Vinyl	Standard double/Vinyl	Standard double/Vinyl
Window #4 orientation ( N-S-W-E )	n/a	North	North	North	North
Windows area	ft <sup>2</sup>	0.00	0.00	0.00	0.00
Windows Type	n/a	Standard double/Vinyl	Standard double/Vinyl	Standard double/Vinyl	Standard double/Vinyl
<b>Exterior Doors</b>					
Total exterior door area	ft <sup>2</sup>	200.00	1.00	89.97	100.10
Door Type	n/a	Insulated Metal	Insulated Metal	Insulated Metal	Insulated Metal
<b>Partition Walls</b>					
Area common to ice shed	ft <sup>2</sup>	0.00	8700.00	2000.04	0.00
Wall insulation	ft <sup>2</sup> -h <sup>-2</sup> F/ Btu	0.00	5.00	5.00	0.00
<b>Lighting</b>					
Average lighting power density	W/ ft <sup>2</sup>	0.80	0.80	1.50	1.20
Type of lighting control	n/a	None	Occupancy sensor	None	Occupancy sensor
Fraction of lights controlled	%	0.00	90.00	0.00	100.00
<b>Temperature Controls</b>					
Heating set point	°F	80.00	71.80	71.80	71.80
Heating Setback ( yes or no )	n/a	No	No	Yes	No
Cooling set point	°F	75.20	75.20	75.20	75.20
Cooling Control ( yes or no )	n/a	No	No	Yes	No
<b>Heating Systems</b>					
Geothermal (yes or no)	n/a	No	No	No	No
Radiant in-floor option (yes or no)	n/a	No	No	No	No
System heating capacity	Btu / h	1099999.98	150001.35	170000.00	200000.00
System baseboard capacity	Btu / h	0.00	100000.90	26000.00	0.00
System source ( electricity,natural gas etc )	n/a	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Baseboard source ( electricity,natural gas etc )	n/a	Electricity	Electricity	Electricity	Electricity
System Heating efficiency - no geothermal system	%	82.00	82.00	82.00	82.00
System Heating efficiency (COP) - using geothermal system	n/a				
<b>Cooling Systems</b>					
System cooling capacity	Btu / h	1.00	34.13	36000.00	48000.00
System cooling efficiency (EER )	Btu / h-W	10.50	14.20	12.00	12.00
System cooling efficiency ( COP )	n/a	3.08	4.18	3.52	3.52

Figure 9.2 – Detailed input data - B

Attribute Name	Units ( IP )	Zones			
		Bleachers/Ice Sheet	Change Rooms	Entrance	Multipurpose
<b>Supply Fan</b>					
Supply flow	CFM	17000.00	4800.00	3500.00	8000.00
Supply static	in H <sub>2</sub> O	1.30	1.30	1.30	1.30
Combined Supply efficiency	%	40.00	40.00	40.00	40.00
Supply fan power	hp	9.98	2.99	2.50	9.98
<b>Outside Air</b>					
Outside air flow	CFM	11000.00	2500.00	700.00	2100.00
Exhaust flow	CFM	11000.00	250.00	500.00	100.00
Heat recovery efficiency	%	0.00	65.00	0.00	65.00
<b>Dehumidification</b>					
Space has dehumidification ( yes or no )	n/a	Yes	No	No	No
Dehumidification control	%	60.00	0.00	0.00	0.00
Dehumidification type	n/a	Packaged units	Packaged units	Packaged units	Packaged units
<b>Ice sheet data</b>					
Number of ice sheet	n/a	1.00			
Total installed Lighting Power over Ice Sheets	kW	15.00			
Ice sheet #1 area	ft <sup>2</sup>	17000.00			
Ceiling emissivity #1	n/a	0.05			
Number of resurfacing per week #1	n/a	65.00			
Number of seats (Bleacher Capacity) #1	n/a	400.00			
Ice sheet average temperature #1	oF	26.00			
Number of weeks of ice operation #1	n/a	42.00			
Ice sheet usage #1	n/a	Hockey			
Ice sheet #2 area	ft <sup>2</sup>	0.00			
Ceiling emissivity #2	n/a	0.85			
Number of resurfacing per week #2	n/a	65.00			
Number of seats (Bleacher Capacity) #2	n/a	200.00			
Ice sheet average temperature #2	oF	24.08			
Number of weeks of ice operation #2	n/a	36.00			
Ice sheet usage #2	n/a	Hockey			
Ice sheet #3 area	ft <sup>2</sup>	0.00			
Ceiling emissivity #3	n/a	0.85			
Number of resurfacing per week #3	n/a	65.00			
Number of seats (Bleacher Capacity) #3	n/a	200.00			
Ice sheet average temperature #3	oF	24.08			
Number of weeks of ice operation #3	n/a	36.00			
Ice sheet usage #3	n/a	Hockey			
Ice sheet #4 area	ft <sup>2</sup>	0.00			
Ceiling emissivity #4	n/a	0.85			
Number of resurfacing per week #4	n/a	65.00			
Number of seats (Bleacher Capacity) #4	n/a	200.00			
Ice sheet average temperature #4	oF	24.08			
Number of weeks of ice operation #4	n/a	36.00			
Ice sheet usage #4	n/a	Hockey			
<b>Refrigeration Equipment</b>					
Compressor average nominal EER	Btu / h-W	10.50			
Compressor nominal total capacity	hp	20.16			
Number of compressors	n/a	4.00			
Floating Head Pressure	n/a	Yes			
Discharge pressure control setting	oF	60.01			
Type of subcooling	n/a	Natural (OA)			

Figure 9.3 – Detailed input data - C

Attribute Name	Units ( IP )	Zones			
		Bleachers/Ice Sheet	Change Rooms	Entrance	Multipurpose
Type of condensers	n/a	Air-cooled			
Type of evaporator	n/a	Flooded			
Number of brine circuit pass	n/a	4 passes			
Brine pump capacity	Btu / h	24.95			
Brine pump control strategy	n/a	Two speed/Two pumps			
Brine pump motor efficiency	n/a	80.00			
Heat Recovery - Nominal Coil Capacity - Air Side	Btu / h	0.00			
Heat Recovery - Nominal Exchanger Capacity - SHW	Btu / h	200001.79			
Heat Recovery - Nominal Exchanger Capacity - Subfloor Heating	Btu / h	0.00			
<b>Service Hot Water</b>					
Energy source for SHW	n/a	Electricity			
Efficiency	%	100.00			
Low flow showers - Nominal flow rate	gpm	1.50			
Low flow faucets - Nominal flow rate	gpm	1.20			
percentage of SHW for showers	%	80.00			
percentage of SHW for faucets	%	20.00			
Motion activated faucets (yes or no)	n/a	No			
percentage of motion activated faucets	%	0.00			
<b>Global Data</b>					
Vocation of Multipurpose Zone	n/a				Auditorium

Figure 9.4 – The Arena EE Wizard Summary Results

Natural Resources Canada / Ressources naturelles Canada

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Sign Off

Below are the results of the compliance analysis.

REFERENCE BUILDING	PROPOSED BUILDING
Annual Energy Use	Annual Energy Use
Electricity: 3809.8 MBTU	Electricity: 2509.0 MBTU
Propane: 0.0 MBTU	Propane: 0.0 MBTU
Natural Gas: 5359.0 MBTU	Natural Gas: 3394.6 MBTU
Fuel Oil: 0.0 MBTU	Fuel Oil: 0.0 MBTU

Annual Reference Building Energy Cost: \$143,409.00

Annual Proposed Building Energy Cost: \$93,711.00

Target Energy use: 6876.6 MBTU

Percentage of MNECB: 64.4 %  
(e.g., 75% is 25% better than the MNECB)

Click on the link below to download the Compliance Report:

[English Compliance Report \(Adobe Acrobat .pdf\)](#)

Formal Validation Compliance Report to send with submission to NRCAN

NRCAN's Validation Target = 75% or less

Figure 9.5 – Compliance Report - A

GÉNIE EE POUR ARÉNAS: RAPPORT SOMMAIRE DE CONFORMITÉ				
NOM DU PROJET Example		DATE 25/08/2008		
ADRESSE DU PROJET		Numéro-éco		
PROFESSIONNEL CHARGÉ DE LA COORDINATION	TÉLÉPHONE			
AUTEUR DE LA DOCUMENTATION	TÉLÉPHONE			
RENSEIGNEMENTS GÉNÉRAUX				
EMISSION DU PERMIS DE CONSTRUCTION	SUPERFICIE DE PLANCHER DES ZONES CLIMATISÉES DU BÂTIMENT 40 499 ft <sup>2</sup>	Pourcentage atteint (%)		
LIEU Quebec - Region A		35.6		
DÉCLARATION DE CONFORMITÉ				
Ce certificat de conformité énumère les caractéristiques du bâtiment selon les dessins et devis soumis pour le permis de construction selon les requis de la section 8 du Code modèle national de l'énergie pour les bâtiments.				
AUTEUR DE LA DOCUMENTATION	SIGNATURE	DATE		
Le professionnel chargé de la coordination atteste par les présentes que la conception proposée représentée dans les documents de construction et modélisée pour cette demande de permis concorde avec tous les autres formulaires et feuilles de travail, spécifications et autres calculs soumis avec cette demande de permis. Le bâtiment proposé, dans sa conception actuelle, répond aux exigences obligatoires du Code modèle national de l'énergie pour les bâtiments (CMNÉB) et aux critères en matière d'efficacité énergétique de RNCan pour la validation de la conception des bâtiments neufs.				
<u>      </u> <u>Sceau</u>	<u>      </u> <u>Cochez une</u>			
	<input type="checkbox"/>	1. J'affirme par les présentes que je suis éligible, en vertu des dispositions des autorités compétentes, à signer ce document à titre de responsable de sa préparation et que je détiens le titre d'ingénieur civil, d'ingénieur en mécanique, d'ingénieur en électricité ou d'architecte.		
	<input type="checkbox"/>	2. J'affirme que j'ai le droit de signer ce document à titre de responsable de sa préparation; et pour la raison suivante		
_____				
_____				
_____				
PROFESSIONNEL CHARGÉ DE LA COORDINATION	SIGNATURE	DATE		
CONSOMMATION ANNUELLE D'ÉNERGIE DU BÂTIMENT PROPOSÉ				
Electricité	Gaz naturel	Propane	Mazout	Total
2 508 MBTU	3 394 MBTU	0 MBTU	0 MBTU	5 903 MBTU
CONSOMMATION ANNUELLE D'ÉNERGIE DU BÂTIMENT DE RÉFÉRENCE				
Electricité	Gaz naturel	Propane	Mazout	Total
3 809 MBTU	5 359 MBTU	0 MBTU	0 MBTU	9 168 MBTU
La conception respecte les critères de RNCan pour les bâtiments neufs				
Génie EE pour Arénas 1.9a		Page: 1 de 3		





Figure 9.7 – Compliance Report - C

EE WIZARD FOR ARENAS: DETAILED COMPLIANCE REPORT						
Project Name					Date	
Example					22/08/2008	
ENVELOPE SUMMARY DATA						
				Prescriptive Requirements		
				Exceed	Deficient	
Gross Wall Area	19 499	ft <sup>2</sup>	19 499	ft <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>
Total Window Area	900	ft <sup>2</sup>	900	ft <sup>2</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Gross Roof Area	40 499	ft <sup>2</sup>	40 499	ft <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>
Total Skylight Area	0	ft <sup>2</sup>	0	ft <sup>2</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fenestration to Wall Ratio	0.02		0.02		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Overall Thermal Transmittance						
Wall	1 081	Btuh/°F	929	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Window	332	Btuh/°F	513	Btuh/°F	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Door	154	Btuh/°F	154	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Roof	2 068	Btuh/°F	1 349	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Skylight	0	Btuh/°F	0	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Above Ground Floor	0	Btuh/°F	0	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Total	3 637	Btuh/°F	2 947	Btuh/°F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Average Heat Loss Coefficient	0	Btuh/(°F-ft <sup>2</sup> )	0	Btuh/(°F-ft <sup>2</sup> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
LIGHTING SUMMARY DATA						
				Prescriptive Requirements		
				Exceed	Deficient	
Total Lighting Power	47 328	W	39 049	W	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lighting Power Density (LPD)	1.2	W/ft <sup>2</sup>	1.0	W/ft <sup>2</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
HVAC SUMMARY DATA						
Total Heating Capacity by Fuel						
Electricity	0	Btuh	125 000	Btuh		
Propane	0	Btuh	0	Btuh		
Fuel Oil	0	Btuh	0	Btuh		
Natural Gas	3 193 655	Btuh	1 620 002	Btuh		
Heat Pump	0	Btuh	0	Btuh		
Other	0	Btuh	0	Btuh		
Total Cooling Capacity by Fuel						
Electricity	87 137	Btuh	84 036	Btuh		
Propane						
Fuel Oil						
Natural Gas						
Other						
<b>Design complies with NRCAn criteria for new buildings</b>						
EE Wizard for Arenas 1.9a					Page 3 of 3	

## Appendix A

### Requirements for a Performance Path Submission to NRCan's Validation of new building designs

[NRCan Policy Statement](#)

[Background](#)

[EE4 and EE Wizard Policy](#)

[Work-around Information Requirements](#)

[Confidentiality](#)

#### **NRCan Policy Statement**

This policy statement identifies the base approach for preparing a performance path file and establishes the framework under which variations to the base approach are allowed.

#### **Background**

The EE4 software and the Arena EE Wizard were created to support NRCan's validation Performance Path, addressing the following:

- To check the compliance of the proposed building design with MNECB and NRCan's validation requirements.
- To assess the energy performance of the proposed building compared to an MNECB reference building.

EE4 and the EE Wizard incorporate all the necessary features to conduct these tasks.

All the scenarios specified by the MNECB are handled in EE4 and the EE Wizard, i.e., these completely mirror the set of MNECB requirements. These tools incorporate all of NRCan's validation rules that were developed above and beyond the MNECB rules. In summary, if it is in the MNECB or NRCan's validation, then it is coded into the tools.

Conversely, the rules of EE4 are representative of what is required by MNECB and NRCan's validation, i.e., EE4 is there to assist in checking MNECB and NRCan's validation rules. In other words, if it is in EE4 or the EE Wizard, that is because it is required by the MNECB or NRCan's validation.

However, there are two scenarios where these rules may not accurately reflect specific technologies or systems. For both scenarios NRCan may be willing to develop new validation rules for these specific technologies or systems.

Scenario 1. Existing technology or system

This is the case when NRCAN decides to change the existing set of MNECB & validation rules because it agrees that credits should be awarded, or because it wishes to correct a perceived deficiency in the existing set of rules.

When a rule is made for a specific case, in the form of a work-around or DOE0-2 measure, then NRCAN should decide whether that rule should be fully developed into an official new validation rule (MNECB rules cannot be changed, but can be overruled) or not. In the affirmative, models should be developed, and then incorporated into the tools.

Scenario 2. New technology or system

This is the case where systems or technologies are recently commercialized or used, and were not covered by the MNECB or NRCAN's validation. It should be noted that this does not refer to systems or technologies that were already addressed in the MNECB and for which neither MNECB nor NRCAN's validation give any credit. In this latter case, one should refer to the previous scenario.

NRCAN should decide whether and how to model these new technologies or systems. If a model is developed, it should be incorporated into the tools.

In all cases, it should be clear that EE4 and the EE Wizard are meant to serve as a fundamental basis for verifying compliance with MNECB and NRCAN's validation requirements, as well as for establishing the energy credit based on the precise set of rules embedded in MNECB and NRCAN's validation.

**EE4 and EE Wizard Policy**

The policy is based on a "base approach", with two variations allowed, one for specific technologies and systems, and the other when all other venues have failed. **Any changes to the EE Wizard or EE4-generated files, or any DOE-2 files generated without using the tools, will not be accepted without written permission from NRCAN prior to submitting these files to NRCAN.**

Base Approach

The tools are used exclusively to prepare a Performance Path submission. To perform an assessment in the context of the whole building performance, NRCAN has established the principle that EE4 or the EE Wizard should be used as a basis.

Variation 1

EE4 or the EE Wizard must be used first, in accordance to the base approach, to

create the reference building. Adjustments of the tool outputs may be allowed and must be well documented.

Modifying tool-generated building files is not acceptable as a standard procedure, however NRCan recognizes that this may be the most appropriate solution in some particular cases.

The tool outputs can be either supplemented with engineering data or edited through changes to the DOE-2 files. Instructions for performing modifications of tool outputs for which special validation rules have been developed are available from NRCan. **If the proposed modifications do not have established validation rules then the proponent shall notify NRCan prior to application submission.**

The engineering data used to directly modify the tool results can be generated by manual calculations or software outputs such as RETScreen. Changes made to the DOE files generated by the tools are allowed with the use of a DOE-2 software version authorized by NRCan.

#### Variation 2

The building take-off is performed directly with DOE-2 including the development of the reference building. **This is acceptable only when it is demonstrated that the other options were exhausted, and requires prior permission from NRCan to proceed with this approach.**

This approach will require the extensive checking of compliance to MNECB and NRCan's validation requirements for both reference and proposed buildings. As a result, full documentation of the process and assumptions made is required. Files must be submitted in a version of the DOE-2 software authorized by NRCan.

#### **Work-Around Information Requirements**

Software work-arounds are used for energy efficiency measures that cannot be modelled directly in EE4 or DOE-2. When work-arounds are used in a submission, supporting documentation must be incorporated in the file documentation.

For cases in which special validation rules have been developed, the applicant will follow the documentation requirements set in place by NRCan.

If the proposed modifications do not have established validation rules, then full documentation of the work-around must be submitted.

## **Confidentiality**

NRCan recognizes that, under special circumstances and for commercial reasons, the applicant may request that some information should remain confidential and that its dissemination be strictly controlled.

It is the responsibility of the applicant to specify which pieces of information should be protected, for instance certain information on drawings or specific software or software modules. Information deemed by the applicant to be confidential information must so be marked.

NRCan will take reasonable measures to treat the confidential information in a confidential manner and, unless required by law to do so or unless we have the applicant's written consent, will not divulge it to any third party, except as specified in this Policy Statement.

NRCan will ensure that this information is only shared with parties within NRCan that need to have access to it. In the case where the file is reviewed by a qualified member of the Assessors Network, NRCan will require that this information be treated in confidentiality through the establishment of non-disclosure agreements or through specific provision otherwise provided for in contracts with this party.

## Appendix B

### Reference Building Rules for the Arena EE Wizard Compliance Tool

The development of a compliance tool for ice rinks (arenas) requires defining a reference building, similarly to what is done in EE4. Generally, the definition of a reference building for MNECB compliance purposes is dictated by the “Performance Compliance for Buildings – Specifications for Calculation Procedures for Demonstrating Compliance to the Model National Energy Code for Buildings Using Whole Building Performance” [Canadian Commission on Building and Fire Codes (CCBFC), May 1999].

However, some aspects of arenas are not specifically covered by the CCBFC Specifications. For these items, a standard was established in order to define the reference building. Based on the industry’s current practices and through previous work on modelling arenas for NRCan’s validation, namely the Val-des-Monts case, combined with expertise available at NRCan and CETC-Varenes, it was possible to establish the missing specifications.

An arena requires additional specifications for its refrigeration equipment, subfloor heating of the ice sheet, brine pumping system, resurfacing, hot water needs, and dehumidification requirements. All other aspects of an arena, such as envelope, lighting levels, fresh air volumes, domestic hot water load, occupant density and mechanical systems are based upon the CCBFC specifications already in use in EE4.

#### Reference Building HVAC System

The reference building HVAC system will be force flow heaters in the bleachers zone with a make-up air unit using the heating source as prescribed by CCBFC.

#### Reference Building Refrigeration system

Defining the reference building refrigeration system is by far the most significant addition made for an arena. The following rules are applied when defining a reference building refrigeration system:

- The reference refrigeration system shall be defined in the same zone as that of the proposed building.
- The reference system shall use a 2.78°C (5 °F) evaporating temperature, regardless of refrigerant type.
- The reference system shall use a non-flooded evaporator

- The reference refrigeration system shall have the same sizing ratio as that of the proposed system with a maximum of 30% oversizing.
- The reference building shall NOT have a low emissivity ceiling.
- The reference system shall have a heat recovery system for domestic hot water only. The heat recovery capacity shall be set at 25% of the nominal condensing capacity. The nominal condensing capacity shall be estimated as the peak design evaporator load of every refrigeration compressor multiplied by the following factor:  $(EER+1)/EER$ , where EER is the compressor energy efficiency ratio at design evaporating and condensing temperatures. The evaporator load shall be estimated using the method presented in “2002 ASHRAE Handbook – Refrigeration ch.34”. The load imposed by resurfacing will be based on identical volumes of water in the reference and in the proposed buildings with a 65.6°C (150°F) water temperature. The following load components will be allowed to differ between the reference and the proposed buildings and possibly provide conformance credits: System pump work, ceiling radiation, rink humidity level, lighting radiation gains. The following loads will not give rise to conformance credits: ground heat gain/losses, header heat gain, rink air temperature, ice thickness, skaters, number of ice resurfacing.
- The reference system compressors EER shall be 9 for R-22 systems at a saturated suction temperature of -15°C (5°F), a saturated discharge temperature of 37.78°C (100°F), and for -12.22°C (10°F) superheat as per AHSRAE Standard 30. The reference building compressors EER shall be 9 for R-717 systems at a saturated suction temperature of -15°C (5°F) and a saturated discharge temperature of 37.78°C (100°F).
- The reference building shall use the same compressor part load performance curves as that of the proposed building for non-modulating compressors.
- The number of compressors in the reference building shall be identical to that in the proposed building.
- The reference system compressors shall have no capacity modulation capabilities.
- The subfloor heating system shall be electric.
- The reference system shall set its heat recovery temperature to 32.22 °C (90 °F).
- The reference system minimum condensing temperature shall be set at 37.78°C (100°F).
- The reference system condenser shall be air-cooled.
- The reference system condensers fan motor power shall be set to 0.125 kW per ton of compressor capacity. ) (i.e. 10 kW / 80 ton)
- The reference refrigeration system shall have no mechanical subcooling system. The reference refrigeration system shall have no subcooling system using the snow melting pit.
- The reference refrigeration system shall have no natural subcooling system.

### **Reference Building Secondary Coolant system**

The following rules are applied when defining a reference building secondary refrigerant (brine) system:

- The reference system shall have one (1) single speed pump for the brine loop.
- The pump's head and flow rate will be based on a two-pass piping layout and the peak design load of the ice sheet. A sizing factor identical to that of the proposed building shall be used with a maximum of 30% oversizing.
- The motor efficiency for the reference building shall be set at 80%.
- The reference building brine pump shall be continuously operating.
- The reference building brine loop shall be of 2-pass type.

### **Reference Building Dehumidification system**

NRCan's validation does not normally allow modelling dehumidification for compliance purposes. However, humidity levels in the ice rink zone can have a significant impact on the refrigeration system energy use and on the quality of the ice, therefore, dehumidification is incorporated in the EE Wizard. The following rules, based on typical designs, apply to the reference arena:

- The reference building shall have a dehumidification system if the proposed building has one. Dehumidification shall only be allowed in the bleachers and ice sheet zones.
- The reference building dehumidification system shall be based on a self-contained mechanical refrigeration unit.
- The capacity of the reference building dehumidification system shall be the same as that of the proposed building with an SHR of 0.55.
- The minimum humidity set point used for control of the dehumidification system shall be set at 40 %. If the proposed set point is lower, the reference building will use the latter.
- The unit shall be equipped with an electric defrost system.
- The dehumidification system COP shall be set in accordance to CCBFC specifications concerning reciprocating direct expansion cooling equipment.



### **Reference Building Appliance loads**

Any loads considered to be appliances are ignored, both in the proposed and reference buildings. Appliance loads for arenas exclude the central refrigeration system but include, without being limited to, the following:

- Baking equipment loads;
- Cooking and roasting equipment loads;
- Stand-alone refrigeration equipment, such as soft drink dispensers;
- Snow melting loads for the snow pit.