Dear Educators;

Thank you for booking the ***Smarter Science Better Buildings*** education program. We know that you will find this program to be a useful and exciting complement to your in-class instruction.

In 2010-11, the Western Development Museum (WDM) was fortunate to display a net zero home at the WDM Saskatoon for people to tour. This was an opportunity to show the public how homes could be built to be more energy efficient. While the home was on display, the Western Development Museum, Saskatchewan Environmental Society, Vereco Homes, Sun Ridge Residential and Saskatoon Public Schools partnered to create this two-hour education program for Grade 7. The program is an opportunity for students, and adults to learn about making our homes more sustainable and energy efficient.

In this document, you will find all the information you need to deliver this program. The following are included.

Section One:	Before your visit and program information.
Section Two:	Workstation information for teachers and chaperones.
Section Three:	Program introduction script.
Section Four:	Instruction for the Museum gallery tour.
Section Five:	Program closing questions and information.
Section Six:	Additional resources.

If you have any questions about the program, please call the WDM location where you booked your tour. We look forward to seeing you.

Sincerely,

Western Development Museum Education Staff

SMARTER SCIENCE BETTER BUILDINGS

Curriculum Connections

Science 7
Physical Science - Heat and Temperature
HT 7.1 Assess the impact of past and current heating and cooling technologies related to food, clothing and shelter on self, society and the environment.
Life Science - Interactions with the Ecosystem
IE 7.4 Analyze how ecosystems change in response to natural and human influences and propose actions to reduce the impact of human behaviour on a specific ecosystem.
Science 7 Pearson Saskatchewan Science 7 - Big Idea 5.0.
Traditional knowledge and practices have been used to produce clothing and shelter (p.224--231)

Integration with other subjects

Social Studies 7
IN7.1 Examine the effects of globalization on the lives of people in Canada and in circumpolar and Pacific Rim countries.
IN7.3 Analyze the relationship of technology to globalization.
RW7.2 Investigate the influence of resources upon economic conditions of peoples in circumpolar and Pacific Rim countries.
RW7.3 Assess the ecological stewardship of economies of Canada and the circumpolar and Pacific Rim countries.

English Language Arts 7
C7.1 Create various visual, oral, written, and multimedia (including digital) texts that explore identity (e.g., Exploring Thoughts, Feelings, and Ideas), social responsibility (e.g., Taking Action), and efficacy (e.g., Building a Better World).

Arts Education 7
CP7.12 Use image-making skills, tools, techniques and problem-solving abilities in a variety of visual arts media.

Mathematics 7
SP7.2 Demonstrate an understanding of circle graphs.
P7.1 Demonstrate an understanding of the relationships between oral and written patterns, graphs and linear relations.

SECTION ONE: Before Your Visit and Program Information

Smarter Science Better Buildings offers you and your students an educational and entertaining way to learn more about energy efficient buildings. In order to make your visit to the WDM more enjoyable, we have included a list of instructions and suggestions. Before coming to the Museum, please familiarize yourself and your chaperones with the program instructions.

The ***Smarter Science Better Buildings*** program is made up of six workstations and a tour of Museum exhibit buildings and related artifacts.

1. Before your visit, divide your class into six groups. Please make these groups as equal in size as possible. Each group should, ideally, have no more than six or seven students. If you have a larger class (more than 40 students), please consult with WDM Education staff to determine how to best divide your students into groups.

2. Bring two chaperones with you to help move students around the Museum.

3. Show your students the 12-minute introduction video. It provides an introduction to the program and an overview of the concepts of heat and temperature. You will find this video at:
   Smarter Science Better Buildings - Western Development Museum (wdm.ca).
   Note: It may be helpful to students if they have been introduced to concepts like radiation, convection and conduction before they attend the program.

4. Print copies of the student package which includes the scavenger hunt and the workstation guiding questions. You will need six packages or one per group. Copies can be found on the ***Smarter Science Better Buildings*** webpage at: Smarter Science Better Buildings - Western Development Museum (wdm.ca), then scroll down and click on the Student Package for the WDM location that you will be visiting.

5. Bring a clipboard and pencil for each group.

6. The program involves two components of approximately 50 minutes each. Component one involves students investigating themed workstations. The second component consists of a visit to the Museum galleries looking at exhibits relating to energy efficiency and sustainable living. Please note that with larger groups, half of your students will start on the workstations while the other half starts in the Museum galleries. After 50 minutes, these groups will switch places.

Component One - Workstations

The workstations are designed to discuss six themes. Students will explore each workstation by answering questions about the themes.

Workstation Themes

- ✓ Net Zero Home Model
- ✓ Lighting and Appliances
- ✓ Water
- ✓ Solar
- ✓ Retrofits
- ✓ Building Materials

Component Two - Museum Gallery Tours

The Museum gallery tour allows students to look at historical examples of building efficiency and inefficiency. Students are asked to answer questions about these exhibits and to think about how buildings were designed in the past and how we can learn from them.

Students will tour the following at each WDM location.

Moose Jaw
Explore the Railway Station and other exhibit buildings as well as the *100 Years of Saskatchewan History* exhibit.

North Battleford
Explore selected buildings in the Heritage Village as well as the *100 Years of Saskatchewan History* exhibit.

Saskatoon
Explore the First Nations Log House, Sod House, Eaton's Catalogue House and other displays within the *A Saskatchewan Story* exhibit. If time allows, you can also visit the *Fueled by Innovation* exhibit.

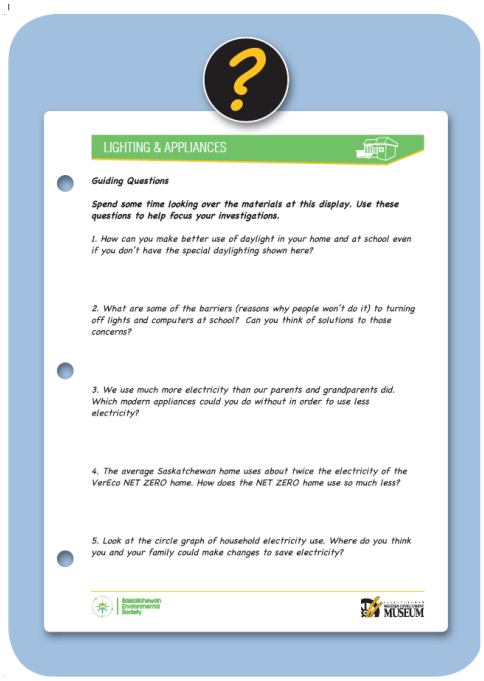
Yorkton
Explore the Settlers Cabin, Showcase Room exhibits as well as the *100 Years of Saskatchewan History* exhibit.

SECTION TWO - Workstation Information for Teachers and Chaperones

Each workstation focuses on a different topic and is designed to highlight these 3 areas

- General information (centre section)
- Innovative technology and design (left panel)
- Making changes in our homes (right panel)

Guiding questions (like those pictured below) at each display and in student packages help to focus student investigations. A list of display topics appears later in this manual. The guiding questions do not cover all topics and you may want to ask students to focus on specific areas to help them generate inquiry questions for further research. Students will have about 8 minutes at each station.



SECTION THREE - Program Introduction Script

Do you know what a net zero home is? A net zero home is one that produces as much energy and electricity as it uses. It does this by being very energy efficient and by making energy with solar panels placed on the south side of the home. Is your home like this? Do you think there are things you can do in your home to make it more energy efficient?

Today, you will be exploring six workstations that focus on how a net zero home uses energy efficiently and generates the energy it needs. The displays also show innovative technologies to help us build better, smarter buildings. While you are at each workstation, use the guiding questions to help you focus your investigations. Take some time to read the information and examine the technologies. You can touch these displays, but treat them respectfully. You will have 8 minutes at each workstation. We will use a timer and when it beeps, your group will move to the next station.

You will also be touring some of the exhibit buildings at the Museum, as well as some of the other exhibits that center around generating electricity or using energy efficiently. While you are touring the Museum's exhibit buildings, use the scavenger hunt to guide your groups' discussion. Buildings in the Museum are full of artifacts that should not be touched. Stay with your group on the tour and return to the room when you are done (about 50 minutes). There is a connection between the workstations and

the exhibit buildings at the Museum. Throughout history, people in Saskatchewan have been using local, natural materials to build their homes, and to try to keep themselves comfortable through long, cold winters and hot summers. These people learned a lot about how to be energy efficient with what they had. Now, we know many things about how both natural and synthetic materials can be used to save energy in our buildings. A tool we use to measure a building's energy efficiency is the Energy Rating System. One way to determine this is to have a blower door test done. Have any of you had a blower door tests done in your own home? **(Show Photo #1 of the Energy Rating System)** A blower door test helps to show where heat is escaping your home and where cold air is getting in. It shows you where you can make changes to improve the energy efficiency of your home.

Photo #1

The WDM had Sun Ridge Residential rate the energy efficiency of many of its historical buildings. When you tour these buildings, you can compare their efficiency to the modern buildings that are included in the workstations. Try to figure out why they are efficient or inefficient. There are other exhibits at the Museum that connect to energy efficiency – your scavenger hunt will lead you to them.

Remember, the workstations are made to be explored and touched respectfully. The Museum exhibits are not.

Please see the following pages for more information on the Workstations.

Model Home Workstation

List of topics

General

- What is net zero? Definitions of reduce, reuse, replace.
- What has history taught us about good design?
- What does energy efficiency cost?

Includes a 1/24th scale model of a net zero home. Solar panels are visible, as well as a cistern on the right side. There is xeriscaping along the front of the property. A button lifts the roof so the interior, wall construction and roof insulation can be seen. To the left of the net zero home model is a puzzle model of a double wall.

Innovation and Design

- Building Envelope.
- LEED - Leadership in Energy and Environmental Design.
- Double wall construction. Model of a wall has separate pieces of installation to install.
- Renewed use of cisterns.

Making Changes:

- The connection between energy efficient homes and climate change.
- Moving closer to net zero.
- Q = A x ΔT/R : Adjusting home size, temperature and insulation values to change energy use

Additional Resources - Model Home:
Vereco (net zero) Homes website: https://Vereco.ca/

Lighting and Appliances Workstation

List of Topics

General

- Electricity use of average SK home compared to a net zero home.
- Where SK electricity comes from.
- How electricity is used in SK homes.
- Net zero use of electricity - reduce, reuse, replace.
- Home electricity use over time.
- How lighting works - display of different lamps and their energy use.
- What is EnergyStar?

Includes a light pipe (daylight tube) and working lights for energy comparisons as well as examples of electricity saving devices.

Innovation and Design

- Daylighting - mirror ducts, light shelves and light pipes.
- Gym lighting retrofit shows reduced power use.
- Smart Power Bars - reduce phantom load.

Making Changes

- Audits - lights on, phantom load.
- Drying clothes outside.

Additional Resources- Lighting and Appliances:
Lighting and appliance efficiency - https://Vereco.ca/
Energy audits - http://environmentalsociety.ca/resources/teachers/dcs-resources/

Water Workstation

List of Topics

General

- Daily water use of average SK home compared to a net zero home.
- How water is used in SK homes.
- Water use math questions.
- Daily water use in Canada compared to the UK and Ethiopia.
- Water treatment process.
- Water saving showerheads and aerators.
- Water use in toilets - old tank compared to new 2 button flush tank.

Includes toilet tanks, a drain water heat recovery PowerPipe, examples of water saving showerheads and other devices.

Innovation and Design

- Grey water systems.
- Drain water heat recovery.
- Urinal sensors.

Making Changes

- Audits- leaking toilets and taps.
- Rain barrels.
- Reducing lawn watering.

Additional Resources – Water:
Vereco (net zero) Homes website - https://www.Vereco.ca/
Water Treatment Flow Diagram - http://www.saskatoon.ca - search Water Treatment Plant, Treatment process.
Water audits - http://www.environmentalsociety.ca/main/programs/destination-conservation-saskatchewan/

Solar Workstation

List of Topics

General

- Solar Energy - light and heat.
- Solar panels needed on typical SK house compared to a net zero home.
- Average annual hours of sunshine.

Innovation and Design

- Passive solar design.
- Solar photovoltaic panels.
- Solar evacuated tubes.
- Radiant floor heating.
- Letting the light in.
- Solar walls.

Making Changes

- How we use solar panels.
- Shade your windows.

Includes a working solar photovoltaic panel with meter, solar evacuated tubes, passive design and interior lighting models and radiant floor heating model.

Additional Resources - Solar
Passive solar, solar photovoltaic and solar evacuated tubes - https://www.Vereco.ca
Solar Wall by Conserval Engineering – www.solarwall.com
Annual Hours of Sunshine – https://www.currentresults.com/Weather/Canada/Saskatchewan/average-saskatchewan-weather.php

Retrofits Workstation

List of Topics

General

- Timeline of homes and energy ratings/energy use.
- Building codes.
- EnerGuide® Rating System.
- A real retrofit - before and after.
- Furnace efficiency and costs.

Includes timeline of homes with ratings/energy use, working window display, retrofit materials and programmable thermostat.

Innovation and Design

- Energy efficient windows.
- Window comparison display.

Making Changes

- Audit – drafts.
- Programmable thermostats.
- Retrofits to windows, doors, hot water pipes, basements and outlets.

Additional Resources – Retrofits:
Energy efficient homes - https://www.nrcan.gc.ca/energy/efficiency/homes/20548
EnerGuide® Home Evaluation - https://www.nrcan.gc.ca/energy-efficiency/energuide-canada/energuide-energy-efficiency-home/after-your-energuide-home-evaluation/20572
Vereco (net zero) Homes website - https://www.Vereco.ca
Home energy efficiency- https://www.saskenergy.com/ways-save

Building Materials Workstation

List of Topics

General

- Lifecycle of cellulose insulation.
- Sustainable buildings.
- Evaluating sustainable materials - flooring, roofing, lumber/siding, countertops.
- R values of various materials.
- What is R value?
- R value of typical SK home compared to net zero home.
- What is thermal mass?

Includes the lifecycle of cellulose insulation. Examples of building materials for comparison of R value, thermal mass and evaluating sustainability based on four factors

- Is it made from a renewable resource?
- How much energy does it take to make it?
- Where does the product come from?
- Is it recyclable at end of life?

Innovation and Design

- Reclaimed wood.
- FSC lumber.
- Straw bale construction.
- Saved from the landfill - deconstructing a food plant.

Making Changes

- Shopping list - what to consider when buying materials.

Additional Resources- Building Materials
Thermal Mass, R values https://www.Vereco.ca
Forest Stewardship Council Canada (FSC lumber) – https://ca.fsc.org/
Recycle Saskatchewan website - www.recyclesaskatchewan.ca
Waste Reduction website - www.saskwastereduction.ca

SECTION FOUR - Museum Gallery Tour (approx. 50 minutes)

Students will explore the Museum exhibits answering questions about the energy efficiency, or inefficiency, of exhibit buildings as well as exploring related displays. The Museum building itself may also be included in the questions.

Each group of students should have **one** copy of the scavenger hunt. The scavenger hunts are part of the student package available on the WDM website at: https://wdm.ca/for_teachers/smarter-science-better-buildings/

A map is included in the student package to guide groups through the exhibits.

Teachers and/or chaperones are responsible for the supervision of students during the scavenger hunt. This may mean that the six smaller groups will be joined into one larger group.

Students will work their way through the Museum exhibits, answering questions provided and discussing what they see. Energy ratings are displayed near each exhibit building. Is the energy rating what you would expect for those buildings? Have students identify where air would leak into homes and where heat would be lost. As students tour the exhibits, have them compare the exhibit buildings to each other. What factors make some of the buildings more energy efficient than others? What factors make modern buildings more or less energy efficient than these buildings?


Western Development Museum

SECTION FIVE: Closing Questions and Information

Ask students the following questions.

- ✓ Name some things that were new to you today. What technologies were interesting?
- ✓ Would you like living or working in any of the buildings you saw in the Museum today?
- ✓ Which buildings would be more energy efficient and why?
- ✓ What are inexpensive things you can do to make buildings more energy efficient?

SECTION SIX - Additional Resources

Western Development Museum - program application, introductory video and additional resources - Smarter Science Better Buildings - Western Development Museum (wdm.ca)

Saskatchewan Environmental Society - Destination Conservation Saskatchewan free lesson plans, audits and campaigns, program information and additional resources - http://www.environmentalsociety.ca/main/programs/destination-conservation-saskatchewan/

The Vereco Homes website has detailed explanations of many of the topics in the workstations. Click on the specific area under Articles and Resources. www.Vereco.ca

SaskEnergy- www.saskenergy.com - Go to Residential, Saving Energy, for tips and efficiencies for the home.

SaskPower- www.saskpower.com - Go to Efficiency Programs and Tips.

Model Home/Historic Buildings
Vereco (net zero) Homes website https://Vereco.ca/
WDM North Battleford's Farm House & Village - https://wdm.ca/exhibits/heritage-village/
WDM Saskatoon's Sod House - https://wdm.ca/exhibits_articles/sod-house/
WDM Yorkton's Settlers Cabin - https://wdm.ca/exhibits_articles/log-home/
WDM Yorkton's Showcase Rooms - https://wdm.ca/exhibits/showcase-rooms/

Lighting and Appliances
Lighting and appliance efficiency - https://Vereco.ca/
Energy audits - http://environmentalsociety.ca/resources/teachers/dcs-resources/

Water
Vereco (net zero) Homes website - https://www.Vereco.ca/
Water Treatment Flow Diagram - http://www.saskatoon.ca - search Water Treatment Plant, Treatment process.
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Solar Wall by Conserval Engineering – www.solarwall.com
Annual Hours of Sunshine – https://www.currentresults.com/Weather/Canada/Saskatchewan/average-saskatchewan-weather.php

Retrofits
Energy efficient homes: https://www.nrcan.gc.ca/energy/efficiency/homes/20548
EnerGuide® Home Evaluation - https://www.nrcan.gc.ca/energy-efficiency/energuide-canada/energuide-energy-efficiency-home/after-your-energuide-home-evaluation/20572
Vereco (net zero) Homes website - https://www.Vereco.ca
Home energy efficiency- https://www.saskenergy.com/ways-save

Building Materials
Thermal Mass, R values https://www.Vereco.ca
Forest Stewardship Council Canada (FSC lumber) – https://ca.fsc.org/
Recycle Saskatchewan website - www.recyclesaskatchewan.ca
Waste Reduction website - www.saskwastereduction.ca

Last modified: December 2021