Millennium
Exhibition Centre
Altona, MB

GREEN AUDIT
FINAL REPORT

PREPARED BY

Climate Action Team

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Climate Action Team

ABOUT US

Manitoba’s Climate Action Team (CAT) engaged Millennium Exhibition Centre (MEC) to perform a community building green audit. The project leads were Jonah Langelotz and Sean Birkett. They worked in collaboration with MEC’s Earth Team, CAT’s Team (Josep Seras-Gubert, Durdana Islam, Nick Portengen, and Ashtyn Nauffts) and Mark Ranson for the building inspection and energy analysis assessment.

Manitoba's Climate Action Team

The Community Building Green Audit (CBGA) is part of the project "Manitoba's Road to Resilience: Community Climate Action for a Net Zero Future" carried out by Manitoba's Climate Action Team (CAT). CAT’s mission is to provide a framework for individuals, organizations, and communities to communicate and collaborate on a non-partisan, specific, and actionable path that will help Manitoba achieve resilience to climate impacts and move swiftly toward a fossil-fuel free future.

The purpose of this project is to build momentum for climate action by engaging and educating Manitobans and directly supporting specific settler communities and First Nations, with the end goal to create community climate action plans.

Millennium Exhibition Centre (Altona, MB)

Community Building Green Audit

The CBGA is a process carried out by CAT instructors. There are two main objectives of the CBGA: establish a sustainability strategy within the chosen community building and provide those involved with tools and skills to carry out CBGA's of their own. The CBGA is designed to work together with stakeholders and community members of the building to educate, raise climate awareness, and inspire them to pursue attainable climate actions.

Making organizations more sustainable provides a whole host of benefits, including environmental, business, and health improvements. In this project, CAT has worked with community members in Altona to help strengthen and enhance the capacity of the Millennium Exhibition Centre (MEC) from a climate change and climate adaptation perspective. By working together, CAT instructors and Altona community members have found better and less carbon intensive ways to operate and deliver services.

Community Building Green Audit

The Four Steps

Assess Areas of Impact

- Conduct a building and energy assessment
- Conduct a waste audit
- Conduct a comprehensive sustainability audit covering governance, operations, transportation, commuting options, and food practices.

Raise Environmental Awareness

- Identify key champions (Earth Team) to lead the project internally.
- Lead Information sessions on climate impacts
- Facilitate a creative process to generate climate action ideas, discuss them, and select the most feasible ones.

Create Final Report

- Prepare report summarizing the findings from the assessments.
- Present key findings and a list of climate actions for reducing negative climate impacts and GHG emissions.

Implement of Action Plan

- Based on the report's recommendations, MEC will implement climate actions. CAT instructors will be available to offer advice.

Millennium Exhibition Centre

The Millennium Exhibition Centre (MEC) is a central gathering place for the community of Altona and it hosts many events such as hockey tournaments, curling bonspiels, banquets, socials, weddings, recreation programs, meetings, craft facilities, and a place to get together with friends and family.

MEC has an NHL sized ice-rink, walking/running track, baseball/softball training tunnel, curling, meeting rooms and community centre area.

Location

The Millennium Exhibition Centre is located at 227 10th Ave NW in Altona, MB.

Operation

MEC has operating hours of 8:30-5:00, 5 days a week from April - September, and open everyday 7am-midnight (October - March).

Earth Team

The Earth Team forms the sustainability strategy at MEC

The Earth Team is vital to MEC's sustainability strategy. It consists of community members from diverse backgrounds who collaborate to initiate and guide the development of an effective sustainability strategy.

David Sawatzky

Melissa Tiessen-Dyck

Shaina Schroeder

Michael Hiebert

Winnie Yu

The Earth Team are the internal sustainability leaders.
They have two roles:

MEC CBGA

- Participate in informative sessions
- Contribute ideas during the creative process
- Select the most feasible actions
- Implement the final action plan.

Future Green Audits

- Replicate CBGA experience they had at MEC
- Apply the knowledge and resources obtained from the MEC CBGA process to conduct audits in other locations within their community.

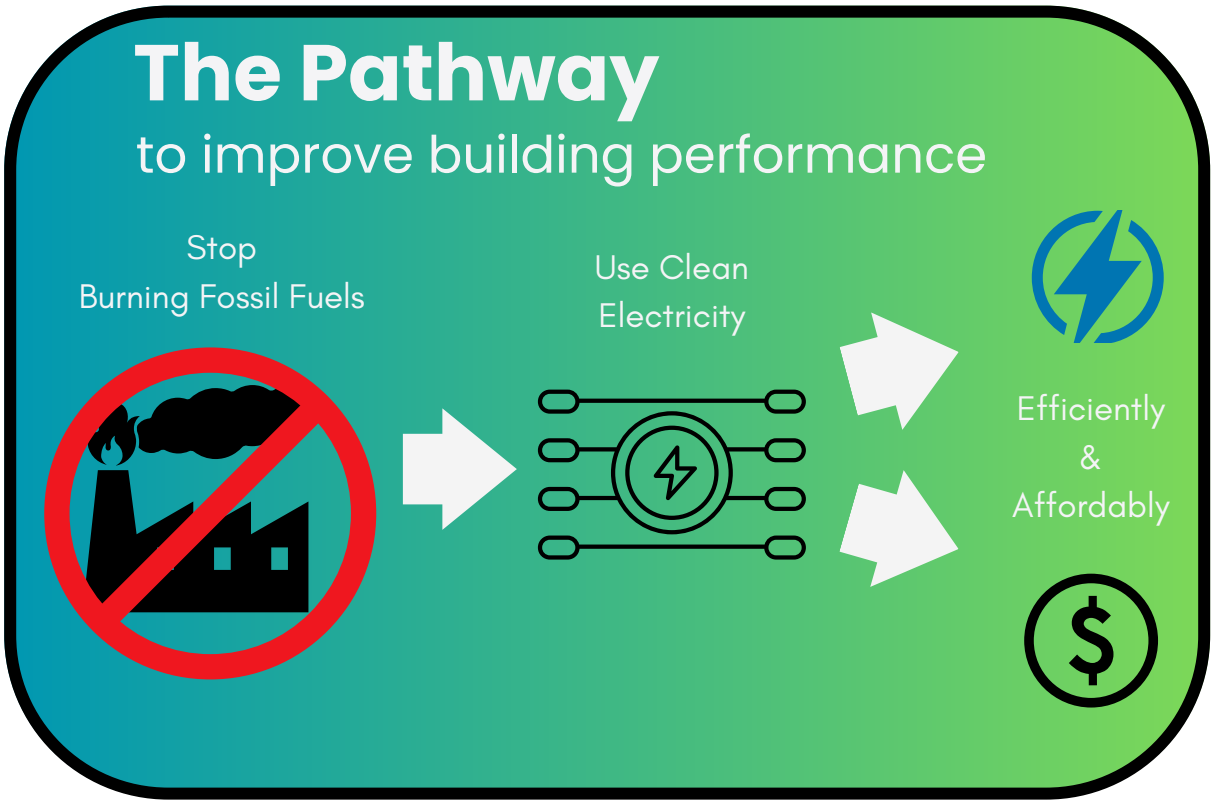
Areas of Impact

The following infographic shows the areas at MEC that impact the planet. Climate change is a global phenomenon, and the scale can be overwhelming. However, by looking at it on a local level and seeing how it all fits in the bigger picture helps make it more approachable so that remediation strategies can be developed and implemented.

Building & Energy

The main systems in buildings that produce GHG emissions are heating, lighting, ventilation, cooling, electronics and appliances.

In Manitoba, buildings represented 17% of its GHG emissions in 2018, primarily due to burning natural gas for indoor space heating and hot water heating. Only 0.2% of emissions came from electricity generation, since most is from hydroelectric power. To meet the United Nations Environment Program emissions goal, which aims for a 45% reduction in annual emissions from 2010 levels by 2030 and worldwide net zero emissions by 2050, Manitoba's building sector needs to achieve a 42% reduction from 2018 levels by 2030.



Millennium Exhibition Centre

MEC Annual Impact

Electricity Usage

Electricity is the primary source of energy use at MEC. In Manitoba our electricity is generated primarily through the use of hydro dams, which is a low-carbon, renewable energy source. The table below gives estimates for how electrical energy at MEC is being used and its corresponding emissions, both in Manitoba and how they might appear on a global scale. This helps show that even though emissions from electricity generation in MB remains very low, by using less energy overall, energy from Manitoba can be shared with neighbouring jurisdictions to displace their carbon intensive energy production with the renewable sources that exist here. This would be an overall net gain for the planet.

	Energy Use		Cost	GHG Emissions	
				Manitoba	Global
Refrigeration		55%	$36,690	0.017 Mt CO2e	293.88 Mt CO2e
Pumps		14%	$9,339	0.004 Mt CO2e	74.81 Mt CO2e
Lighting		13%	$8,672	0.004 Mt CO2e	69.46 Mt CO2e
Fans		10%	$6,671	0.003 Mt CO2e	53.43Mt CO2e
Appliances		2.6%	$1,734	0.001 Mt CO2e	13.89 Mt CO2e
Other		2.2%	$1,468	0.001 Mt CO2e	11.76 Mt CO2e
Subfloor Heat		2%	$1,334	0.001 Mt CO2e	10.69 Mt CO2e
Electronics		1.2%	$801	0.000 Mt CO2e	6.41 Mt CO2e
	712,440 kWh		**$66,709**	**0.31 Mt CO2e**	**534.33 Mt CO2e**

Equivalent to about 769 miles by car

Equivalent to about 1,326,000 miles by car

BUILDING & ENERGY

Millennium Exhibition Centre

MEC Annual Impact

Electricity Usage

The main electrical energy usage comes from running the refrigeration compressors for the ice rinks and lighting. The ice plant is by far the largest user of electricity in the building and is pumping large amounts of heat to the outside of the building through the condenser
On average, as much as 7.2 million BTUs of heat, or more than 2,000 kilowatt-hours, are generated each day by an ice plant.
By implementing heat-recovery systems, ice rinks can realize overall heating savings of more than 75 percent. Most of the waste heat available comes from the refrigeration condenser, but some heat can be also recovered from the building's exhaust air.
Recovered heat could be used for space heating, domestic hot water heating, subfloor heating, floodwater heating, ice melting, and preheating cold outdoor air for ventilation. Presently all of the above is heated with natural gas.

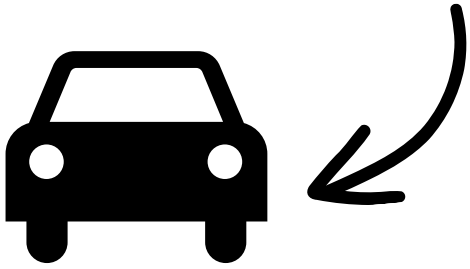
Millennium Exhibition Centre

MEC Annual Impact

Natural Gas Usage

The natural gas usage at MEC is primarily used for heating systems and domestic hot water heating.
The change rooms have a central exhaust system that removes stale air from there and pumps it directly to the outdoors. This system requires “make up” air to be heated via natural gas. Installing a well-balanced HRV (Heat Recovery Ventilator) would reclaim at least 80% of the heat being exhausted to the outside and does not require gas fired “make up” air system. Below are estimates of natural gas usage and associated emissions at MEC.

	Energy Use	Cost	GHG Emissions
Heating	85%	$17,450	182.12 Mt CO2e
Hot Water & Ice Surfacing	15%	$3,079	32.14 Mt CO2e
	109,317 m^3	**$20,530**	**214.26 Mt CO2e**



Equivalent to about
532,000 miles by car

Transportation

Transportation significantly impacts our daily lives and contributes to both personal and work-related GHG emissions. The built environment, including factors like distance between destination and the convenience of bus, bike, or pedestrian travel, influences our transportation options.

In Manitoba, transportation emissions represented 37% of total emissions in 2020, making it the largest single GHG contributor. Even more concerning is that transportation emissions are increasing, as the rise in travel volume and the growing preference for SUVs, trucks and vans over lower-emitting sedans outweigh improvements in vehicle efficiency. Hybrid vehicles owned in the province increased from 4,633 to 8,071 and fully electric vehicles from 118 to 875 in 2021, out of a total of 922,081 vehicles. From 1990 to 2020, car usage decreased by 44% while vans, SUVs, and trucks saw a substantial increase of 133%.

The Pathway

to move all goods and people without fossil fuels

Move people and goods without burning Fossil Fuels

Instead

- More High-Speed Internet (virtual travel)
- Minimize travel needed by densification
- Increase car-share availability
- More active transportation instead of vehicles
- Improve public transit (reduce car dependency)
- Make all needed vehicles EV's

Transportation

Rural Environment

Rural environments, like Altona, tend to rely more heavily on personal vehicles for transportation. This choice is primarily due to the distance travelled and how dangerous it is to walk or bike on the side of the road.
In spite of this, there are options to help reduce GHG emissions related to transportation.

These include considering things such as;

- Type of vehicle used (size, fuel efficiency, electric if feasible)
- Number of household vehicles (share rather than 1 per driver)
- Number of trips (Plan efficient trips to reduce overall km's travelled)
- Carpooling (whenever possible, with family/friends or through GoManitoba ride matching program)
- Avoid vehicle use (bike/walk when feasible, bus if available)

Photo from: https://www.travelmanitoba.com/directory/altona/

Millennium Exhibition Centre

Transportation Data

The transportation infrastructure present at MEC includes a large parking lot, and bike racks for bicycle parking. The following table shows estimates of annual emissions from MEC vehicles and staff based on usage and commuting practices. It has been divided between summer and winter driving practices to reflect the seasonal modes of transport by staff members.

Practices & Emissions

									GHG emissions	
Summer										
Drive Alone	5.75	Staff	114	km/day	x 120	days/year	x 206	grs/km	2.82 Mt CO2e	100%
biking	3.25	Staff	30	km/day	x 120	day/year	x 0	grs/km	0 Mt CO2e	0%
									2.82 Mt CO2e	
Winter										
Drive Alone	5	Staff	12.8	km/day	x 120	days/year	x 206	grs/km	0.31 Mt CO2e	5%
biking	1	Staff	12	km/day	x 120	day/year	x 0	grs/km	0 Mt CO2e	0%
Zamboni	1	VEHICLE	40	gal/week	x 30	weeks/year	x 5,750	grs/gal	6.9 Mt CO2e	95%
									7.21 Mt CO2e	

Waste

Today's modern world is driven by consumption and fueled by advanced marketing, technology, and global shipping. This encourages us to make new purchases over repairing or reusing items. Consequently, we are buying more than necessary and generating an unprecedented amount of waste, contributing to the highest global waste levels ever recorded. Furthermore, the lack of widespread composting in our cities and communities leads to increased methane buildup in our landfills.

To create a notable environmental impact, we need to prioritize recycling, repairing, and reducing our waste. Actions such as community or home composting, tool-sharing, item swapping, adopting a zero-plastic policy, and proper recycling practices pave the way for accelerated sustainability leadership. Starting small and gradually expanding these initiatives is the key to success.

The Pathway

to send less waste to the landfill

- Waste Prevention → Borrow, rent & share items
- Reuse & Repair → Repurpose, Thrift, donate items
- Remanufacture & Refurbish → Restore old objects, reuse parts
- Recycling & Composting → Convert waste into new products
- Energy Recovery → Use biomass to create biofuel

Millennium Exhibition Centre

Waste Audit

In Manitoba, our waste diversion programs are only successful in diverting 19% of all waste generated (as of 2018). Generating on average 900,000 tonnes of waste annually as a province, this is an area we must improve. We took a closer look at MEC by conducting a waste audit to help to identify how MEC can improve its waste management and reduce its overall climate impact.

MEC's Waste Management

At the time of the waste audit, MEC had garbage, recycling and some compost bins available. All three streams are disposed of regularly. There were some areas that lacked green bins for organic waste so there was room for improvement as seen in the results.

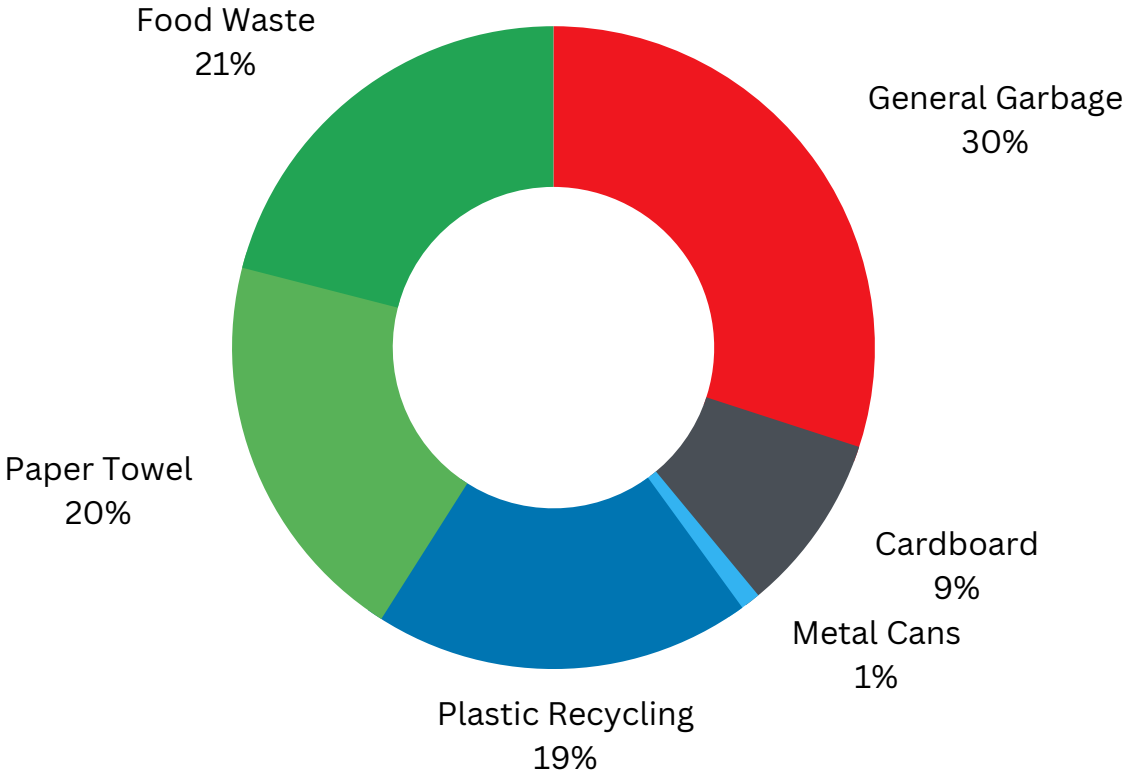
Waste Audit Sorting Procedure

Each garbage, recycling and food waste bag was weighed, opened, and sorted into specific categories by CAT waste auditors. After sorting the materials from each category were weighed again and recorded.

Millennium Exhibition Centre

Waste Audit Results

The total quantity of waste collected and sorted by the auditors during the audit period and adjusted for a one-day sample was 17.98kg of waste. The following chart illustrates a snapshot of the waste generated at MEC within the sampling period based on the data collected during the waste audit.



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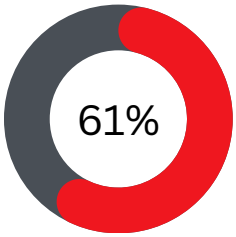
Waste Audit Results

Before Sorting

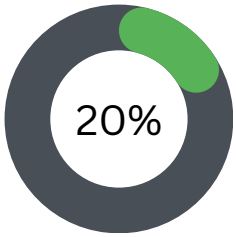
To the Landfill

Garbage

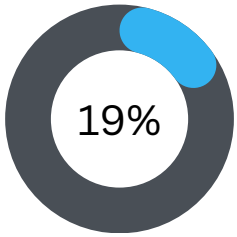


Diverted from the Landfill

Organics



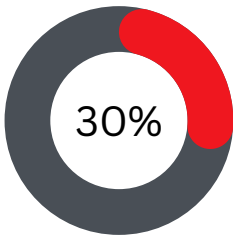
Recycling



After Sorting

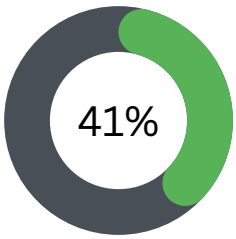
To the Landfill

Garbage

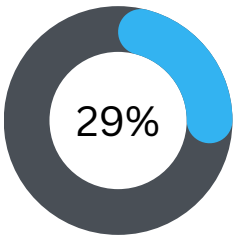


Diverted from the Landfill

Organics



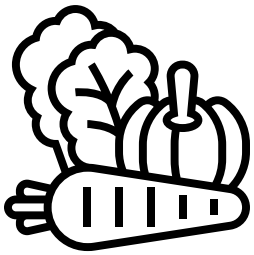
Recycling



Summary

While MEC does have three functioning waste streams, there is room for improving their efficacy. In this audit we were able to divert half of the waste that was into garbage to either organics or recycling. A big part of this was paper towels. See climate actions below for ways to improve going forward.

Food



Food sustainability can be improved in several ways. It can be enhanced by supporting food sovereignty and security, by shortening the food chain and supporting local food economies, and by reducing food waste by diverting food scraps from the landfill.

In Manitoba, 4% of greenhouse gas emissions are from the waste sector, with 40% of Winnipeg's waste being organic materials (both food waste and leaf and yard waste). It is estimated that at least 22% of avoidable food waste comes from individual households. Thus, policies which reduce food waste can have a significant impact on the environmental sustainability of MEC.

In addition, at least 14% of Manitobans are food insecure, and world hunger remains an enormous problem, with some estimates suggesting 2 billion people are food insecure. Addressing food insecurity through learning and food policies can have a positive impact on the lives of many people in Altona.

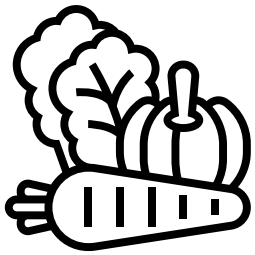
Agriculture produces 31% of GHG emissions in Manitoba. They mainly come from fertilizers, livestock and manure management. Organic waste from households produces 6% of GHG emissions in Manitoba.

The Pathway

Eat all the food we buy. Buy food produced without synthetic fertilizers and diesel.

- Rule of 5 "N"s
- Green Fertilizers
- Biological Nitrogen
- Gardening & Food Preservation
- Composting
- Alternative Fuel

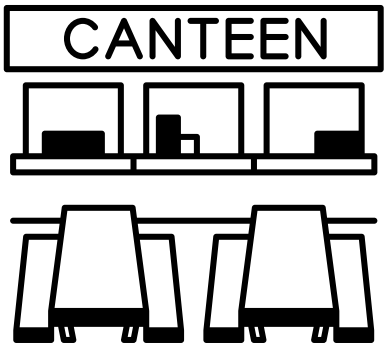
Rule of 5 "N"s: **Nearby** - produced close to you, **Naked** - without packaging, **Nutritious** - low in preservatives and chemicals, **New Now** - in season food, **Natural** - produced through holistic means

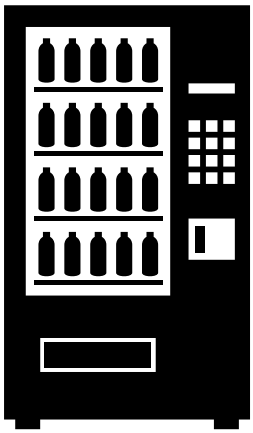


Millennium Exhibition Centre

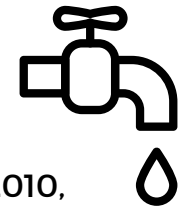
Food at MEC

- Catering in the facility is on a per event basis.
- The kitchen is used for food preparation for catered events. It does not have a food service function.
- The canteen is run by the local minor hockey association
- The canteen does not use locally sourced foods. Caterers have the option to use local foods, but MEC has no control over their decisions.
- MEC has several vending machines that dispense drinks and snacks





Water



Water is essential for life and climate change is affecting water. In 2010, the United Nations declared that water and sanitation are human rights, acknowledging that they are essential to the realization of all other rights. We must not take clean water for granted; we must protect it and use it wisely.

Local Situation

Where does freshwater come from in Altona?
1,700,000 L of water from the Red River flows 20km from Letellier, MB to the Altona Public Water System

Where does wastewater go in Altona?
Wastewater flows to the aerated lagoon at 7088 Road 5 West, where it is treated before returning to the Red River.

Why should we care about saving water?

- It acknowledges a social injustice
- It minimizes the effects of floods, droughts, and water shortages
- It reduces the energy required to treat, pump, and heat water
- It diverts wastewater from rivers and lakes
- It guards against rising costs

The Pathway

Use Water Wisely

- Harvest Water → Install rain barrels
- Save Water → Upgrade equipment when replacing
- Reuse Water → Manage grey water
- Reduce Wastewater → Avoiding chemicals in our water
- Promote access to water for all → Supporting Indigenous projects
- Restore the water cycle → Replacing pavement for gardens

Millennium Exhibition Centre

Annual Water Usage

Below are estimates of the annual water usage at MEC. The majority of the water usage is due to ice resurfacing at the arenas. See climate actions for possible ways to improve upon these estimates.

		Water Usage	Cost
Sinks	(45)	0.9%	$100
Toilets	(34)	2.7%	$303
Urinals	(18)	0.9%	$100
Shower	(3)	4.8%	$551
Drinking fountains	(9)	0.4%	$42
Dishwasher	(1)	0.1%	$11
Bottle Filling Station	(1)	0.7%	$83
Ice Making		8.5%	$971
Ice Resurfacing		81%	$9,264
		3239.89 m3	**$11,425**

WATER

Green Infrastructure

Green infrastructure plays a crucial role in enhancing urban environments and addressing a range of environmental and social challenges. It refers to the strategic integration of natural elements, such as trees, vegetation, wetlands, and permeable surfaces, within urban settings. Green infrastructure helps manage stormwater runoff, contributes to improved air quality by absorbing pollutants and producing oxygen, and provides habitats for wildlife (EPA, 2023). Green infrastructure is recognized as a valuable approach to building sustainable, resilient, aesthetic, and livable cities.

Context in Canada

- 9% of the world's forests are in Canada
- 78% of Canadian forests are located in the boreal zone
- 38% of Canada's land is covered by forests
- 9th most paved country
- 2nd most paved per person

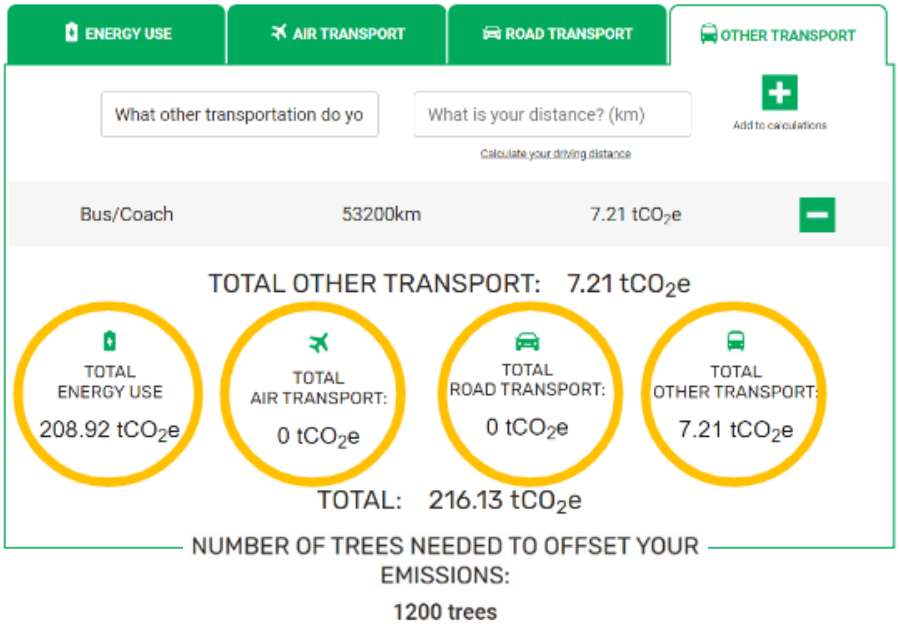
Pavement Problems

- Reduced groundwater recharge
- Increased stormwater runoff
- Heat island effect
- Increased pollution

Millennium Exhibition Centre

The Green Infrastructure present at MEC is limited. It is a large building surrounded by a very large parking lot. During the Green Audit, discussions were had about ways to possibly enhance and add additional green infrastructure to the MEC property.

Tree planting is one way MEC could offset their emissions from energy use and transportation. In total MEC would need to plant 1200 trees to offset emissions.



This diagram estimates how many trees would be needed to offset MEC's estimated annual emissions. Calculator thanks to Tree Canada (https://treecanada.ca/carbon-calculator/)

Climate Action Plan

Climate Action Implementation & Policy Recommendations

In the Final session the Earth Team's discussion found that the climate actions for MEC consisted of both specific changes MEC could make in its building operations and programming, as well as larger policy actions that they could recommend to decision makers to improve the environmental culture and climate impact of MEC in the community of Altona, MB.

1. Building Operations and Programming Actions

- Short-Term Actions
- Mid-Term Actions
- Long-Term Actions

2. Climate Policy Actions

- Purchasing Policy - Equipment
- Purchasing Policy - Food
- Green Initiatives Policies
- Contractual / Rental Agreement Policies

Criteria for Actions Ratings

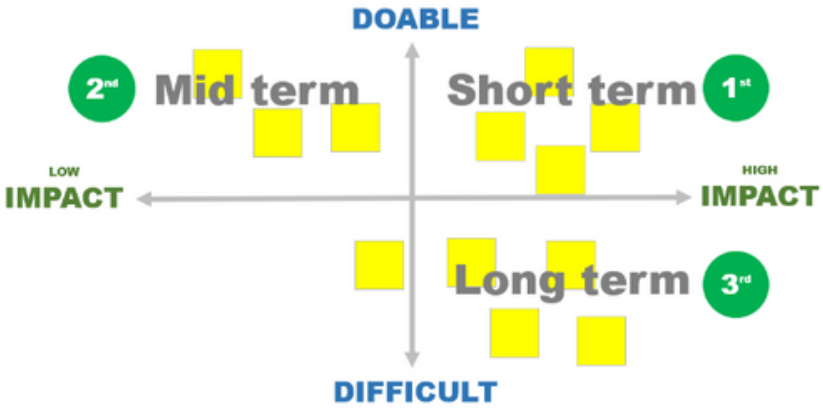
The way to transform the ideas into actions was by following a 1-5 rating scheme:
1 - being the lowest rating
5 - being the highest rating
These ratings were used to determine both how **doable** the action is, and how big it's **climate impact** would be

Doable Factors

- Cost
- Time Required
- Complexity
- Earth Team Subjective Rating

Climate Impact Factors

- Environmental Culture
- Emissions Reductions/Energy Savings
- Resource Conservation



The actions in the **1st** quadrant: Implement in the short term, as they are potentially easy to execute with a high impact.
The actions in the **2nd** quadrant: Implement in the mid-term, as they are potentially easy to accomplish but have a lower impact.
The actions in the **3rd** quadrant: Implement in the long term, as they are potentially challenging to implement but with a high impact.

Building Operations & Programming Actions

- Short-Term Actions
- Mid-Term Actions
- Long-Term Actions

HOW TO READ THIS SECTION

- Action
  - Brief description
  - Estimated Cost
- Ratings*
  - Doable
  - Climate Impact

*To see ratings criteria see *Appendix 1* (page 69)

Short-Term Actions

Track and Display MEC's sustainability progress for building users

Turn down the temperature in zones that are not being used

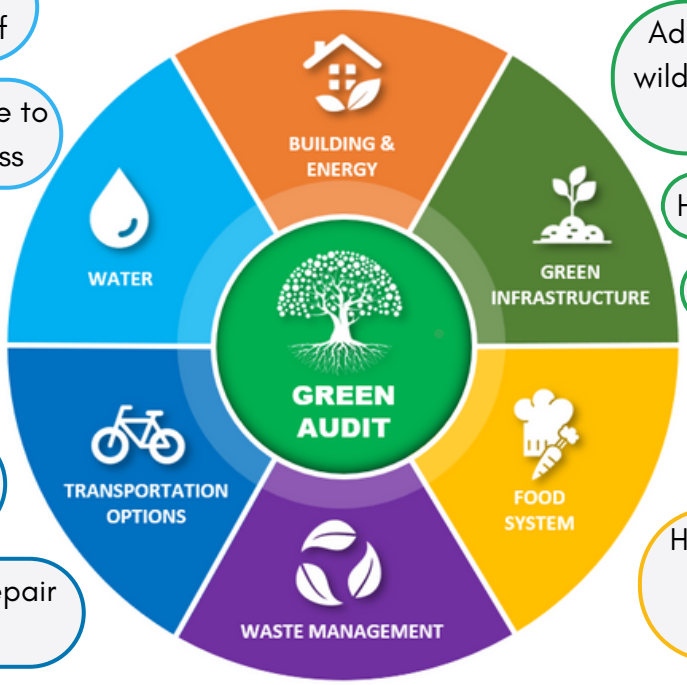
Install smart/programmable thermostats & weekly schedule

Host a Lunch N Learn about MEC's Energy Use

Implement rain barrels to harvest water off the roof

Display MEC's water usage to promote water awareness

Reduce Ice resurfacing



Add native grasses, shrubs, wildflowers, herbs to outdoor MEC vegetation

Hold gardening workshops

Host tree planting events

Add more Idle free zones

Hold workshops for bike maintenance training

Make bike pumps & bike repair kits available

Host workshops on food preservation

Host workshops on food procurement & food planning

Add preferred parking spots for carpooling

Host workshop teaching people how to ride a bike

Provide maintenance on current walking/biking trails to increase usage

Add signage showing which items go where

Ensure all waste stations have garbage, recycling and compost bins

Add more compost bins

Design more appealing & fun waste bins

Conduct annual waste audits to track building performance

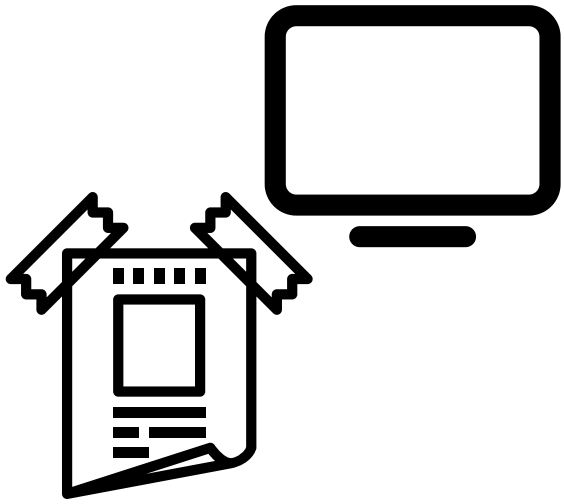
Have specialized waste drop-off events at MEC

Short-Term Actions

Track and Display MEC's sustainability progress for building users

This action requires MEC to create a display, either digital or physical, to update building users as to the upgrades and changes they are making to implement sustainability and energy efficiency. A good communication strategy will be required to inform building users of this exciting progress.

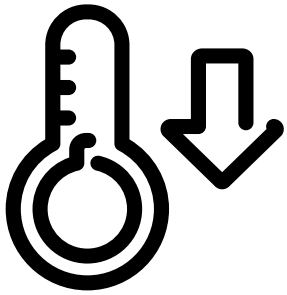
Estimated Cost: Will vary based on communication method chosen, will take staff time.



Turn down the temperature in zones that are not being used

This action is a short term measure to limit energy waste by heating areas of MEC that are not being used. This action requires good planning, and diligent monitoring to ensure rooms are heated when needed and heated less when not in use.

Estimated Cost: Staff time and equipment for zoning controls.



Short-Term Actions

Install smart/programmable thermostats & weekly schedule

Programmable thermostats help to sustain adequate heating and cooling for the times of day when the building is most regularly in use. Used properly, they can reduce energy usage of your HVAC systems by maximizing the energy used when most needed in the building. Consider installing multiple thermostats, which control different building zones, and are optimized according to weekly schedules.

Estimated Cost: $400-$1,200, check with an HVAC contractor

Doable 3

Climate Impact 3

Host a Lunch N Learn about MEC's Energy Use

This action is intended to be a way to inform community members about MEC's energy use and engage with building stakeholders and raise awareness of the different energy savings strategies being implemented.

Estimated Cost: Depends on size of Lunch-N-Learn. Cost of food and staff time to prepare presentation.

Doable 4

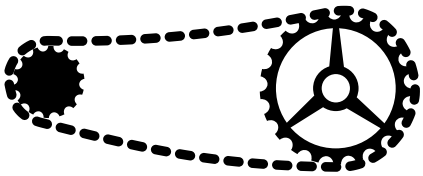
Climate Impact 3

Short-Term Actions

Hold workshops for bike maintenance training

Work with a community partner organization to host bike maintenance training workshops. This will provide education to community members on keeping their bikes running smoothly and will increase the number of people choosing to commute by bike.

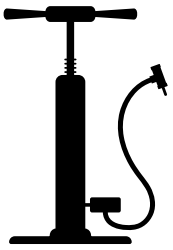
Estimated Cost: $200+ depending on agreement



Make bike pumps & bike repair kits available

Having accessible bike essentials including bike pumps and repair kits will encourage building users to choose to commute and visit MEC by bike knowing they can easily work on their bike if any problems arise.

Estimated Cost: $100-$200

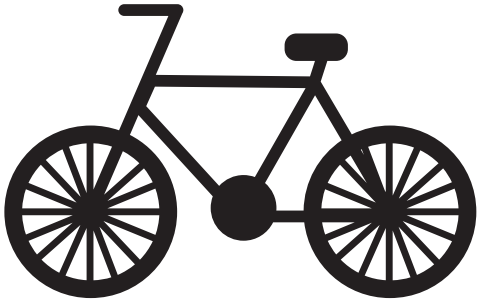


Short-Term Actions

Host workshop teaching people how to ride a bike

Partner with a community bike organization to host workshops on how to ride bikes safely. This should encourage building users to feel more confident choosing to bike and increase biking transportation.

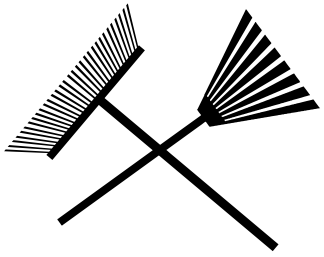
Estimated Cost: $50 per participant, depending on agreement.



Provide maintenance on current walking/ biking trails to increase usage

Partner with Altona Community Action Network (ACAN) to maintain biking and walking trails to keep them safe and accessible. Doing this will encourage residents to use the trails more.

Estimated Cost: To be discussed with ACAN.

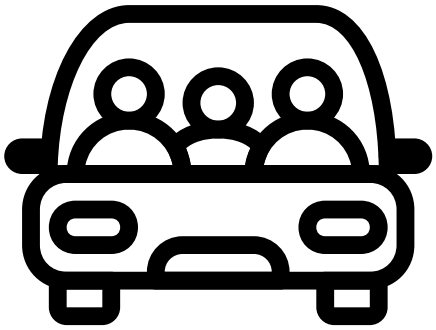


Short-Term Actions

Add preferred parking spots for carpooling

To encourage residents to carpool to MEC, designate preferred parking spots to people who are carpooling. This will encourage and remind people to carpool to MEC in order to get better parking spots.

Estimated Cost: Cost of new signage and installation.



Add more "idle free" zones

Designate certain areas in the MEC parking lot as “idle free” zones to encourage residents to turn off their vehicles to reduce greenhouse gas emissions. This could include the parking lot and close to the entrance for people picking up or dropping off others.

Estimated Cost: Cost of new signage and installation. ($30 + shipping) see additional resources.

Short-Term Actions

Add more compost bins

Adding more compost bins around the building will make it easier for building users to choose to throw their organic waste into the compost instead of the more accessible garbage or recycling bins.

Estimated Cost: $50-$100/bin

Doable 4

Climate Impact 4

Add signage showing which items go where

Create signage to demonstrate which products go where near waste and recycling bins. Generally, signs with pictures of examples rather than text works best!

Estimated Cost: $200-$700 (estimated creation and printing costs)

Doable 4

Climate Impact 4

Short-Term Actions

Ensure all waste stations have garbage, recycling and compost bins

By ensuring that there is accessible garbage, recycling and compost bins at every waste station, patrons will be more likely to dispose of their waste correctly. This will improve the diversion rate at MEC.

Estimated Cost: Cost of adding bins where not all three options are present.

Doable 4

Climate Impact 3

Conduct annual waste audits to track building performance

Hire a group who conducts waste audits to come to MEC to assess how well the waste streams are being used and managed. Annual waste audits allow an opportunity to see where the building is improving as well as areas for improvement.Use results to continue engaging with MEC stakeholders on how to best manage MEC's waste.

Estimated Cost: ~$2000/waste audit

Doable 3

Climate Impact 4

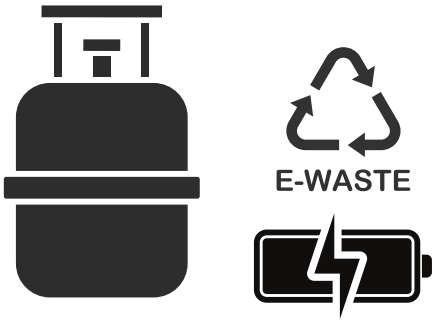
Short-Term Actions

Design more appealing & fun waste bins

This action is a way to involve the community in helping to enhance MEC's waste strategy. MEC could host a competition inviting community members to get creative and make some fun waste bin designs to make the bins more appealing throughout MEC's building.

Estimated Cost: Cost of running the contest and cost of supplies for painting or decorating the bins.

Have specialized waste drop-off events at MEC

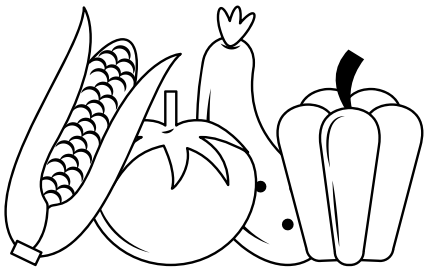


Host waste drop-off events throughout the year to encourage residents to dispose of specialized waste easily (e-waste, propane tank, etc.) Promoting these events will remind people to hold onto their items until the event instead of throwing it into the trash where it would not be disposed of correctly.

Estimated Cost: Logistics of coordinating drop-off so that the waste goes to the right location.

Short-Term Actions

Host workshops on food procurement & food planning



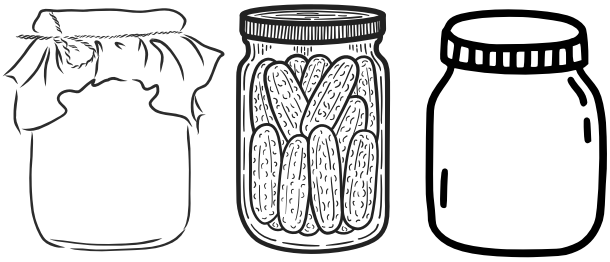
Partner with people or organizations to host food workshops to help residents buy and manage their food more efficiently. This could include local and seasonal eating and could involve gardens that are set up at MEC.

Estimated Cost: you can partner with people who use MEC and make an agreement with them

Doable 4

Climate Impact 3

Host workshops on food preservation



Partner with community member or an organization (or community garden) to host food preservation workshops to educate residents on how to make their food last longer, which would cut down on food waste and help save money. This could involve setting up gardens at MEC and using food from there to preserve.

Estimated Cost: workshop cost or fee for partnership

Doable 4

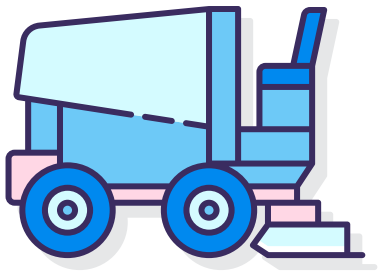
Climate Impact 3

Short-Term Actions

Reduce Ice resurfacing (scrape only)

Resurfacing ice can be water and energy intensive, and resurfacing only when necessary would save water and money. Other options include scraping the ice, resurfacing at a steady pace/with recycled water from the snowmelt or recycling the snow back into the zamboni for the next resurfacing.

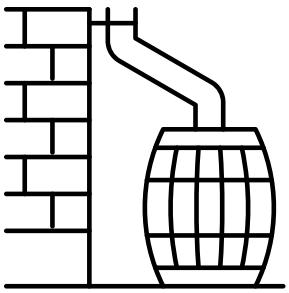
Estimated Cost: Varies based on approach (scraping would reduce water consumption).



Implement rain barrels to harvest water off the roof

Rain barrels can harvest water off the roof from the gutters/downspouts, and this water can be recycled to be used to water the plants around the community centre. You can partner with ACAN and support other organizations with purchases of rain barrels.

Estimated Cost: $300+

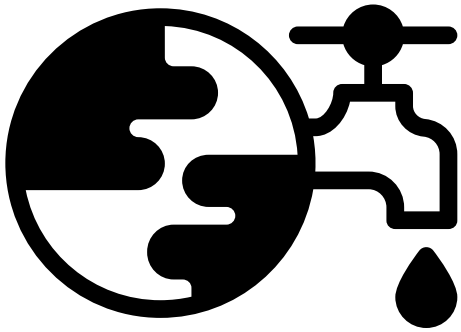


Short-Term Actions

Display MEC's water usage to promote water awareness

Creating signage or a kiosk that shows the water usage at MEC would promote water awareness and hopefully encourage people to cut down on their water use. This could also help get community buy-in to reducing ice resurfacing and other conservation measures being implemented at MEC. This display could also incorporate simple tips on how to reduce water usage at home.

Estimated Cost: Varies based on type and size of display and resources. ($500+)



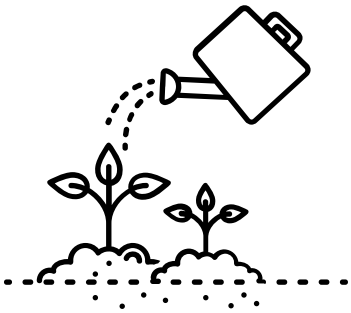
WATER

Short-Term Actions

Host tree planting events

Planting trees around the community centre will help to add vegetation to the area, make it cooler and build community at the centre. Look at native tree species when planting new trees.

Estimated Cost: $100-$2,000 (depending on the tree, size and maturity)



Add native grasses, shrubs, wildflowers, herbs to outdoor MEC vegetation

Work with stakeholders to learn about the best spots to plant around the community centre. Use plants and flowers native to southern Manitoba which will benefit the area more and require less maintenance.

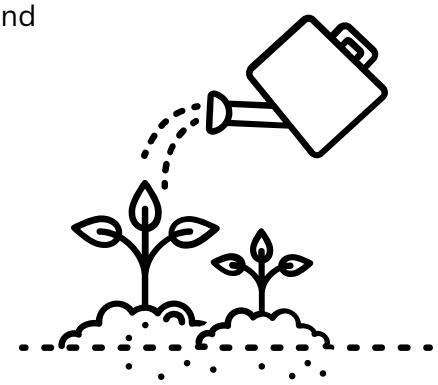
Estimated Cost: Up to $500 + regular watering

Short-Term Actions

Host gardening workshops

Partner with community gardens to learn about gardening which could be done at MEC and participants can also take that knowledge for their own spaces. Planting could incorporate produce and native plant and tree species.

Estimated Cost: Cost of agreement for the workshop and potential plants



Mid-Term Actions

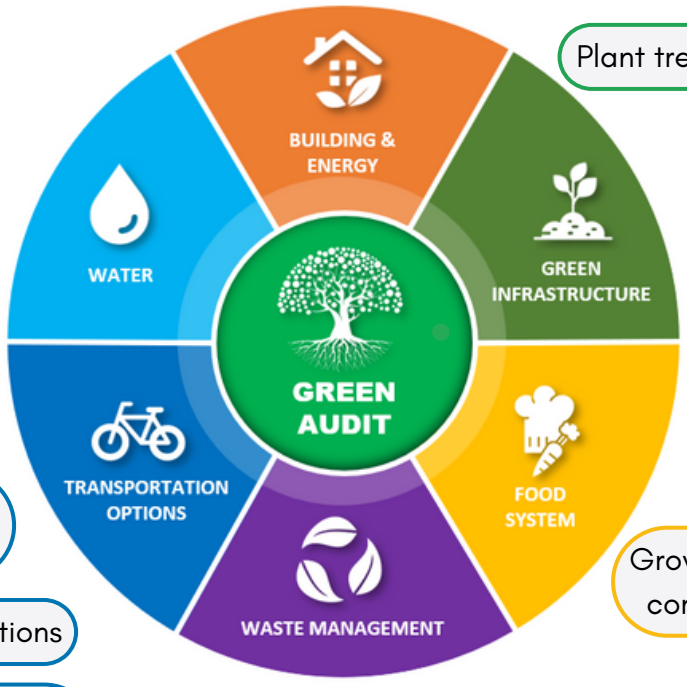
Analyze and optimize operating hours to decrease the amount of time heating needs to be on

Install automatic light system or movement sensor switches

Add Carbon Monoxide Detectors

Get Smart Power Bars

Perform Air Leakage Test



Plant trees on edges of parking lot

Buy FSC Certified paper

Add beehives to MEC outdoor area

Grow garden and use food for community meals (w/ACAN)

Get similar sized garbage, compost, and recycling bins with coloured labelling

Study lifetime Economics of an EV purchase

Add more EV charging stations

Add spaces to put warm clothes after walking or biking

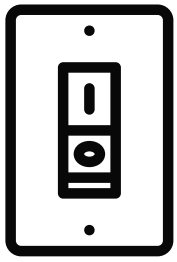
Get Plug-in Outlets for Parked EV's

Mid-Term Actions

Install automatic light system or movement sensor switches

By moving all light switches to motion activated or automatic light switches this will help reduce the amount of time lights are left on in a room where they are not being used and reduce energy use.

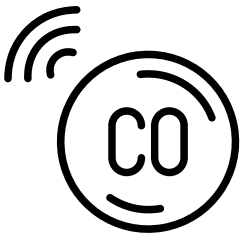
Estimated Cost: Consult with Lighting contractor



Add Carbon Monoxide Detectors

This recommendation is a health and safety recommendation to eliminate the risk of carbon monoxide poisoning. These detectors should be placed near any gas appliances in the building that have a risk of producing carbon monoxide.

Estimated Cost: $50-$100/ detector

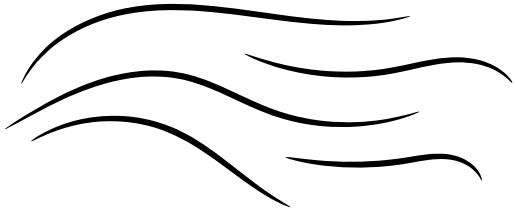


Mid-Term Actions

Perform Air Leakage Test

Hire an energy advisor/contractor to perform an air leakage analysis of MEC using a Blower Door. This diagnostic test will help to locate areas of air leakage in the building and provide guidance on where to best invest in sealing the building envelope. Air leakage is a significant source of energy loss in buildings.

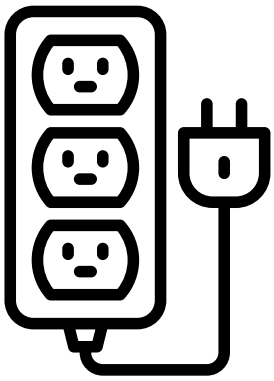
Estimated Cost: $600+ depending on the contractor and number of blower door fans required + travel



Get Smart Power Bars

This action would require changing all power bars in the building to smart power bars. Smart power bars eliminate phantom load being drawn by devices that are only used occasionally, but always stay plugged in (e.g. printers, computers, small appliances, etc.)

Estimated Cost: $30-$80 per power bar

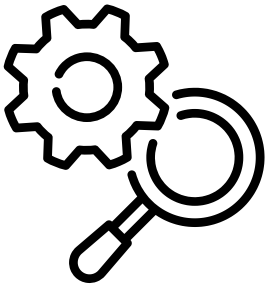


Mid-Term Actions

Analyze and optimize operating hours to decrease the amount of time heating needs to be on

This action may pair well with the smart thermostat action in the short term since from those systems you would be able to find heating and cooling data which then could be analyzed. From this analysis, combined with an analysis of building programming schedules, an optimization of best hours to be operating that both serve the community and conserve energy could be determined.

Estimated Cost: Staff time and/or hiring a consultant to analyze building data to propose best solution for MEC and its goals for serving the community of Altona.



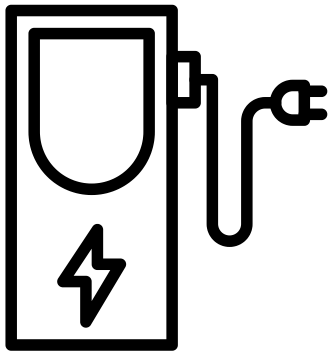
Doable	3
Climate Impact	3

Mid-Term Actions

Add more EV charging stations

Installing more EV charging stations will allow more people with electric vehicles access at the community centre, as well as bringing attention to the viability of electric vehicles.

Estimated Cost: $1,000-$3,000 per charging station. Consult with Electrical contractor.



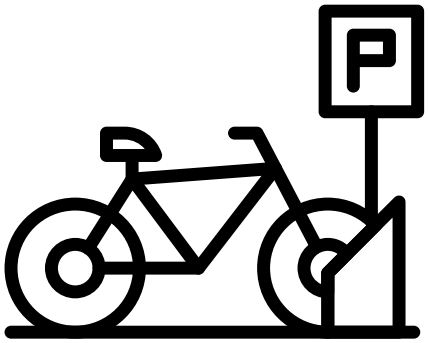
Doable 3

Climate Impact 3

Install more bike racks in preferred locations

By installing additional bike racks, community members will be encouraged to bike to MEC knowing they have somewhere safe to park their bike. Seeing bike infrastructure would help encourage community members to think of biking as a viable transportation option.

Estimated Cost: $100 - $3,000 depending on the type of bike rack/storage



Doable 3

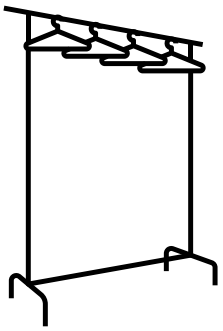
Climate Impact 2

Mid-Term Actions

Add spaces to put warm clothes after walking or biking

This climate action is intended to provide the infrastructure to encourage people to use active transportation to come to MEC whether for a visit or as a team member or regular commuter. This requires creating a designated and organized zone where people can safely store their warm clothes after walking or biking in the winter.

Estimated Cost: Time to set-up space and cost of equipment (hangers, etc.)

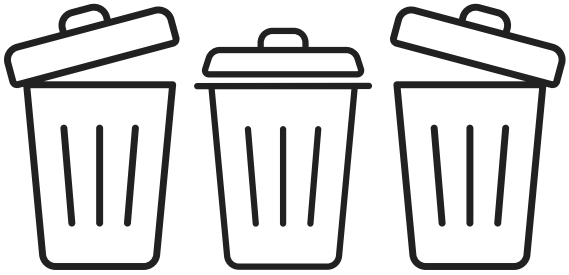


Mid-Term Actions

Get similar sized garbage, compost, and recycling bins with coloured labelling

Ensuring there are garbage, composting and recycling bins at the centre (and that they are kept together) will make it easier for residents to dispose of their waste correctly, and having them similar sizes will make residents think more about what waste goes where. Having coloured labelling will also help make it easy to tell what goes where.

Estimated Cost: $200 - $700 (creating labelling and printing)



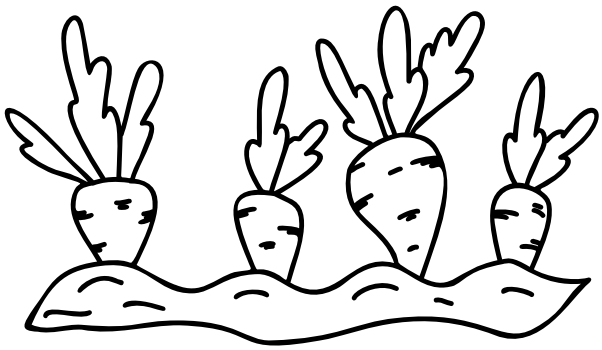
Doable	4
Climate Impact	2

Mid-Term Actions

Grow garden and use food for community meals (w/ACAN)

Partner with ACAN to start a community garden where community members can participate in the garden and the food that is grown can be enjoyed together during community meals. This fosters community with the benefits of local and seasonal food.

Estimated cost: To be determined in consultation with ACAN



Doable	3
Climate Impact	5

FOOD

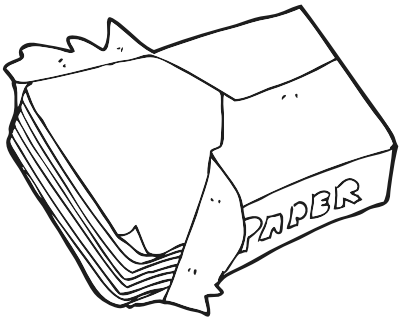
Mid-Term Actions

GREEN INFRASTRUCTURE

Buy FSC Certified paper

Buying certified FSC paper is an easy switch, and ensures that the paper is sourced from well-managed forests. While the cost is a slight increase, it contributes to the holistic sustainability of MEC's operations.

Estimated Cost: Typically 10% to 20% more than regular paper.



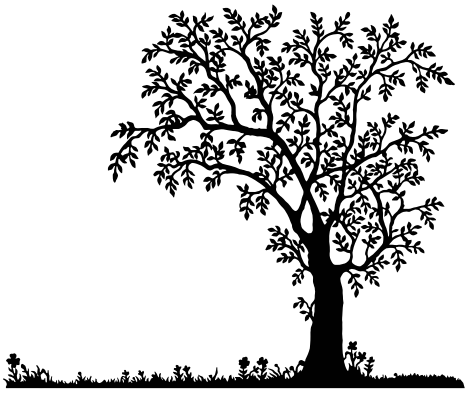
Doable 5

Climate Impact 2

Plant trees on edges of parking lot

Adding trees alongside parking lots will help MEC reduce water runoff, lower the urban heat island effect, improve the area's air quality and make the parking lot multi-use so people can comfortably enjoy more outdoor space.

Estimated Cost: $100-$2,000 per tree (depending on type, size and maturity)



Doable 3

Climate Impact 4

Mid-Term Actions

Add beehives to MEC outdoor area (ACAN)

Partner with ACAN to add beehives outside MEC which will produce local products like honey and beeswax, as well as increase their benefits as crop pollinators.

Estimated Cost: $500+ for starter beehive essentials

Doable	3
Climate Impact	3

Long-Term Actions

Install Heat Recovery Ventilation System

Install wind power generator

Install automated HVAC controls

Create stormwater management pond

Reuse the water (snow) from the rink

Replace parking lot with permeable pavement

Implement a living wall

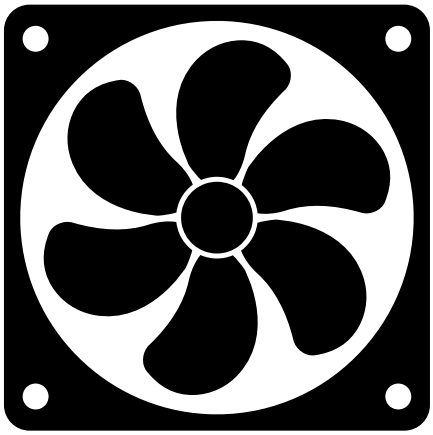
Get electric bikes to be used for free

Long-Term Actions

Install Heat Recovery Ventilation System

Consider installing solar power on the roof of MEC to reduce the electricity bills of the building. This would require consulting a solar contractor to determine solar system location. Again rebates are available through Efficiency Manitoba for grid connected solar systems.

Estimated Cost: $15,000 + depending on size and scale of the project. Consult with your local solar contractor.



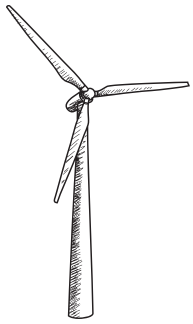
Doable 2

Climate Impact 4

Install wind power generator

This action would involve consulting with a wind power company to determine the options for harnessing wind power to generate electricity to supplement MEC's energy and generate more of it on site. Since MEC is located in a fairly large and open area, wind power generation may be a suitable way to generate clean electricity on site and reduce energy bills.

Estimated Cost: Consult with a wind power company and electrical contractor for scope of work and estimate.



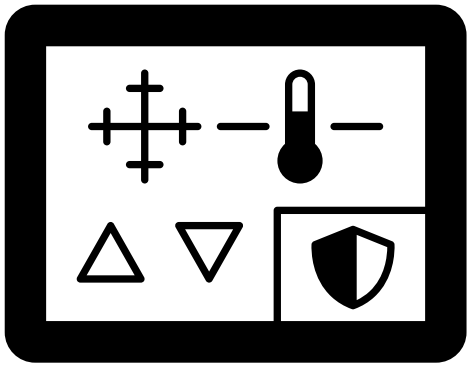
Doable 2

Climate Impact 4

Long-Term Actions

Install automated HVAC controls

This action would work in conjunction with the smart thermostats and heating and cooling analysis completed in earlier phases of the climate action plan. Based on the results and information gathered there, an opportunity may come to install automated HVAC controls for all aspects of MEC. Heating and cooling of the building, the arenas, the HRV etc. to both simplify and maximize the building's HVAC efficiencies.



Estimated Cost: Please consult with an HVAC contractor to determine feasibility and cost of completing this installation.

Doable 3

Climate Impact 3

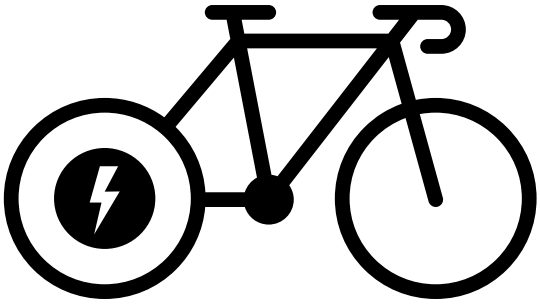
BUILDING & ENERGY

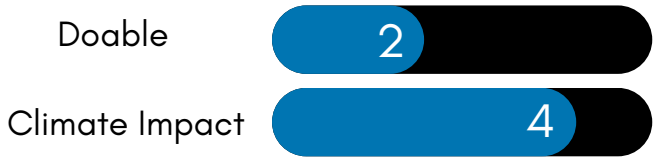
Long-Term Actions

Get electric bikes to be used for free

Electric bikes can encourage residents to travel more sustainably, while also being a more accessible option to more people. Free e-bike use would reduce some barriers that MEC building users could face.

Estimated Cost: $1000-$4000 for a standard e-bike





Long-Term Actions

Create stormwater management pond

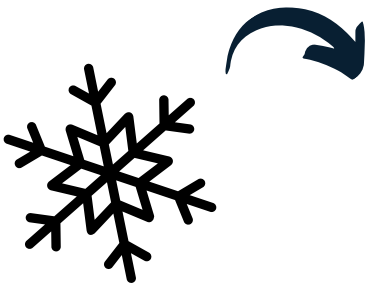
MEC could create stormwater management ponds, as they are used to manage rain and surface water runoff. This could help reduce erosion, and absorb the excess water that occurs in heavy rain conditions

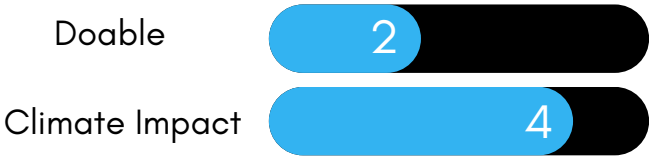
Estimated Cost: Consult with Landscaping contractor.

Reuse the water (snow) from the rink

The snow from the ice rink could be recycled and reused in the Zamboni for the next ice resurfacing, or for other greywater purposes.

Estimated Cost: Varies based on system implemented for water re-use.



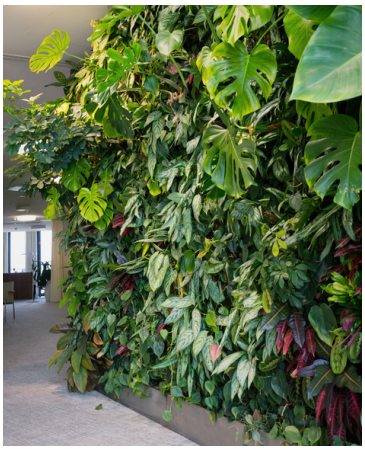


Long-Term Actions

Implement a living wall

Building a living wall at the MEC would involve finding a space, constructing the wall and deciding what plants to choose. Having a living wall would benefit MEC by reducing heat and pollution, improve biodiversity and would make the space more green.

Estimated Cost: around $150 per square foot. Consult with contractor.



Doable 3

Climate Impact 3

Replace Parking lot with permeable pavement

Eventually it may come time for MEC to replace its parking lot. One option would be to replace it with pavers, or other permeable pavement material. For plowing purposes you may want a hybrid system, with asphalt or concrete on the main drive part and permeable pavers in the spots where the parked cars sit. This provides an opportunity for water to drain and for groundwater to be replenished. It also helps mitigate the heat island effect.

Estimated Cost: Depends on size of parking lot and size of area you are converting to permeable pavement as compared to asphalt. Consult with a local construction landscaping contractor.

Doable 2

Climate Impact 3

Climate Policy Actions

During the final session with the Earth Team some climate actions were determined to fit best as policy recommendations.

The following recommendations could be adopted by the leaders of MEC in order to commit to implementing green initiatives on an ongoing basis. These climate policy actions are intended to improve the environmental culture and limit the climate impact of MEC in the community of Altona, MB.

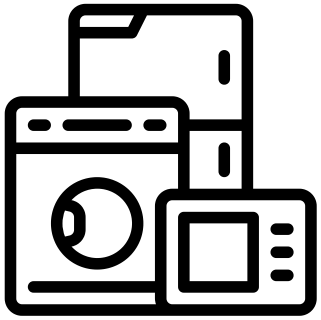
The Climate Policy Actions were divided into four sections:

1. Purchasing Policy - Equipment
2. Purchasing Policy - Food
3. Green Initiatives
4. Contractual / Rental Agreement Policies

Purchasing Policy Equipment

When replacing appliances or electronics, buy EnergyStar

This proposal aims to codify that when MEC needs to replace or update an appliance, from an oven to a refrigerator, to a computer, to a fan, space heater, etc. that MEC will make a point to purchase Energy Star equipment to improve the building's efficiencies.



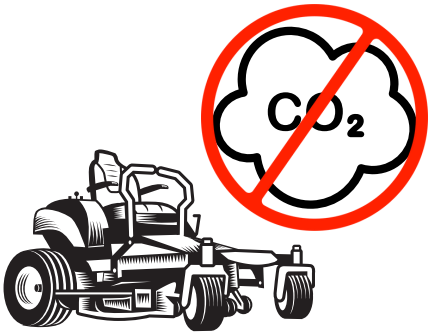
Estimated Cost: Typically, slightly more up-front cost but with energy savings when used. Cost varies based on appliance or device being replaced.

Doable 4

Climate Impact 3

Replace gas-powered equipment and tools with electric ones

This policy proposal is to ensure that gas-powered equipment and tools will be replaced with non-emitting electric versions when it comes time to replace. Having this purchasing policy ensures budgets and research can be focused on finding a suitable non-emitting alternative.



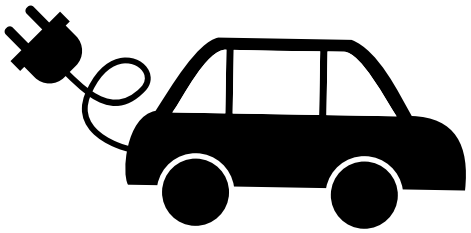
Estimated Cost: Consider the lifetime cost when comparing to a conventional option. Cost depends on equipment being replaced.

Doable 3

Climate Impact 4

Purchasing Policy Equipment

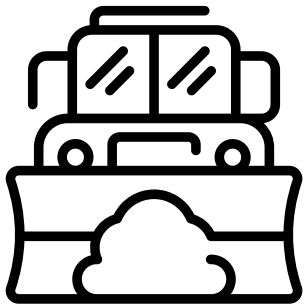
Replace vehicles with more energy efficient models



The policy proposal is to establish that all vehicles for MEC will be replaced with more energy efficient ones (ideally fully electric or perhaps plug-in hybrid). This policy will likely require advanced budgeting and preparation to ensure its successful implementation.

Estimated Cost: Policy implementation will cost the expense of new or used efficient vehicle replacement for MEC.

Replace snow removal equipment with EV alternatives



This policy specifies snow removal equipment (snow blowers, snowplows, etc.) to be replaced with electric alternatives. Some of this could happen more quickly, others may have to wait until it is time to replace, but the policy helps to prepare for these changes.

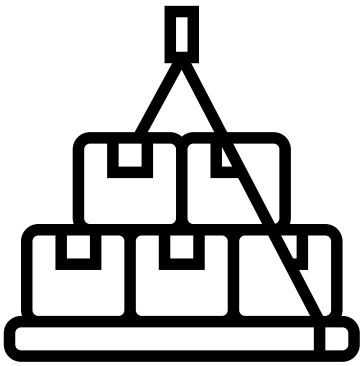
Estimated Cost: Varies based on equipment replaced

Purchasing Policy Equipment

Implement policy encouraging the purchase of lightly or not packaged items and bulk purchasing

This policy aims to have MEC purchase its products without packaging and or minimally packaged when possible.This can include using strategies like buying products in bulk (perhaps in partnership with other municipal buildings. It would also involve evaluating which products are necessary and looking at finding opportunities to purchase them with minimal packaging.

Estimated Cost: Will vary based on what items need to be purchased. Buying in bulk in partnership with other buildings could reduce cost



Purchasing Policy Equipment

Install low-flow toilets, sinks, and urinals when replacing old ones

This action is already being accomplished in some capacity at MEC. However, not all equipment has been updated. This climate action is a policy recommendation. Consider adopting a policy that when in need of replacing, all new water using devices (toilets, urinals, and sinks/faucets) must be replaced with WaterSense or low-flow devices.

Cost: Free to create the policy. Replacement cost will depend on specific device and contractor fees. Consult with your contractor for an accurate estimate.

Purchasing Policy Food

Buy imperfect produce

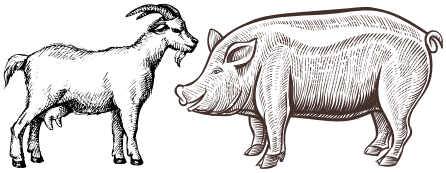
This policy is to implement that food purchased at MEC should when possible be imperfect produce that is still edible and useable, in order to help save food that might otherwise not be eaten.

Estimated Cost: Free to implement, produce often the same price or slightly cheaper!

Doable 4

Climate Impact 3

Partner with local farmers where inedible food can go to livestock



This policy is to implement that leftover food from MEC events could be connected to local farmers who may be able to use it to feed livestock.

Estimated Cost: free, partnership with farmers

Doable 4

Climate Impact 3

Sell food near expiry for cheaper or donate it

This policy perhaps applies most to the canteen. The action is to make sure food gets consumed rather than tossed, and this policy aims to implement this.

Estimated Cost: free, partnership canteen. Must be managed well

Doable 4

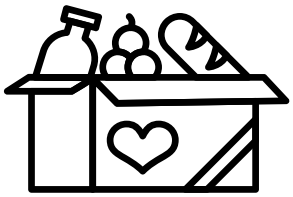
Climate Impact 4

Purchasing Policy Food

Use kitchens to prepare food for the food banks

This policy proposes using the kitchens in MEC to partner with local food banks to prepare food for food bank users.

Estimated Cost: Free, logistics with food bank required.



Doable 4

Climate Impact 2

Include culturally diverse foods

This policy aims to include culturally diverse food options at MEC food services to accommodate and include different cultures present in Altona.

Estimated Cost: research and changing food options to include more variety.

Doable 5

Climate Impact 1

Include healthy options on the canteen menu

This policy aims to work with the canteen to ensure healthy food is included on the menu to give options to MEC patrons.

Estimated Cost: Slightly more but healthier for everyone and usually less packaged.

Doable 5

Climate Impact 1

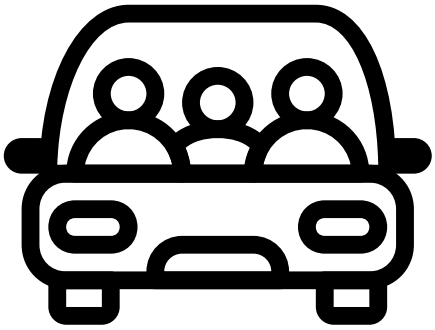
Green Initiatives Policy

TRANSPORTATION

Develop a Hockey parent carpool incentive

This Green Initiative action is for the hockey group who runs the canteen could provide a carpooling incentive to hockey parents which rewards kids/parents with canteen discounts. An alternative incentive could be created.

Estimated Cost: Extra $$ to cover the incentive



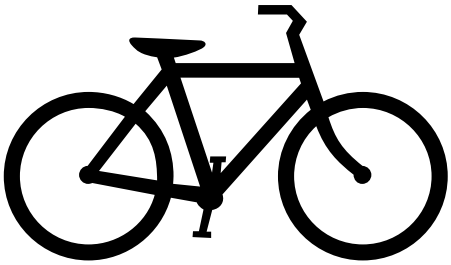
Doable 4

Climate Impact 4

Incentivize active transportation for all staff

This initiative is another incentive being offered to staff to encourage active transportation. This could be a financial incentive or other agreed upon incentive for MEC staff.

Estimated Cost: Could be $50-$100 per month per staff member



Doable 4

Climate Impact 4

Green Initiatives Policy

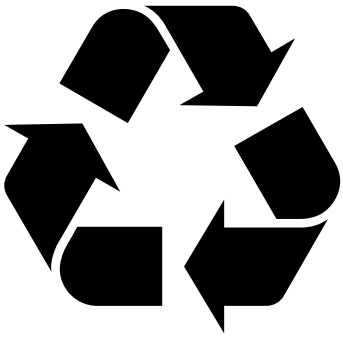
Implement a Low-Waste policy at MEC

This policy proposal requires MEC to develop a low waste policy for its building operations. This could include policies such as;

- all paper towel be tossed in the organics bin
- batteries and e-waste have a proper disposal location on site
- hazardous waste be sent to the proper disposal facility
- Supplies purchased are reusable when possible

Other ideas should be added and included to create MEC's low-waste or zero-waste policy. This policy could be made specifically for MEC or a policy that could be applied more widely to all municipal buildings in Altona.

Estimated Cost: Staff time to create and implement the policy



Contractual & Rental Agreement Policies

Implement a green component to user agreements

Some proposals suggested by the Earth Team to include in user contracts were:

- Request users buy low-waste options.
- Instruct groups to follow recycling, composting and waste disposal strategy.
- Offer use of reusable cutlery and dishwasher to minimize waste.

Estimated Cost: Policy implementation, staff time

Doable 4

Climate Impact 4

Add clause requiring some local food procurement

Another policy proposal recommended in user contracts was a stipulation for caterers that a portion of the food provided must come from local food sources.

Estimated Cost: free, some sort of accountability with caterers would be required for implementation.

Doable 3

Climate Impact 3

The Pathway

Mindset Shift

Through this process you have gained a holistic understanding about the climate impact of the building and you have created a climate action plan! Now, the real work begins and the real impact MEC will have on the environment comes from changing MEC's actions and its collective mindset.

MEC must take action gradually. They may find that some decisions and actions that negatively affect the environment are non-negotiable and must be done, but many others can be changed or replaced. This process may take a long time. There will be lots of learning, mistakes, and learning from those mistakes. It requires patience! If it was easy, the world would not be in the state it is in today. Real change happens when individuals collectively make changes.

Action, Implementation, Monitoring

The next step is to implement the actions outlined in the report. Short term, mid-term, and long-term time frames are subjective to what MEC is capable of achieving. Don't get frustrated if the implementation process gets stalled or takes longer than anticipated.

Once actions and upgrades are put in place, MEC should keep track and monitor the progress. Tracking the progress and monitoring the implemented actions is essential to be sure they are achieving the intended outcomes.

Acknowledgements

Thank you very much to the Earth Team and Millennium Exhibition Centre for your active engagement in the Community Building Green Audit. We hope the information contained in this final report will be helpful and inspire you to implement many of these climate actions!

Thank you also to ECCC for funding this project.

Manitoba's Climate Action Team will be available to offer advice and assistance if you have any questions.

We thank you for your continued engagement and commitment to climate action!

Project developed by

Climate Action Team

Project funded by

Environment and Climate Change Canada

Environnement et Changement climatique Canada

Appendix 1

How Doable?

Cost

5: Free - $250
4: $250-$999
3: $1,000-$4,999
2: $5,000-$20,000
1: >$20,000

Time Required

5: Right away
4: Up to a day
3: Up to a month
2: Up to a year
1: More than a year

Subjective Rating

The Earth Team rated the ideas based on their subjective opinion.
5 - 'I really like it'
1 - 'I don't like it at all'

Complexity

5: Not much thinking required
4: Requires research and thinking
3: Requires a contractor, administrative work, or logistics
2: Requires training, processing information, and public communication
1: Requires monitoring, tracking, and maintenance

Effective Climate Impact?

Environmental Culture

5: You will change your habits and be an advocate for others to change
4: You will change your habits
3: You will learn something, but not change
2: You will think a bit, but not change
1: You won't notice anything and not change

Resource Conservation

5: 80%-100%
4: 40%-79%
3: 20%-39%
2: 1%-19%
1: 0%

Emissions Reductions

5: 80%-100%
4: 20%-79%
3: 1%-19%
2: 0%
1: Idea will create emissions

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https://www.tcat.ca/wp-content/uploads/2016/08/Costing-of-Bicycle-Infrastructure-and-Programs-in-Canada.pdf

https://www.almanac.com/beekeeping-101-why-raise-honeybees

Additional Resources

Idle Free Zone Signs
https://climatechangeconnection.org/resources/idle-free-zone-signs/

Carbon offset
https://www.terrapass.com/climate-change/carbon-offsets-explained

Carbon zero calculator
https://www.carbonzero.ca/calculate/

Canada green building council
https://www.cagbc.org/news-resources/research-and-reports/building-solutions-to-climate-change/

ENERGY STAR Canada
https://www.nrcan.gc.ca/energy-efficiency/energy-star-canada/18953

Lightning Research Center School of Architecture
https://www.lrc.rpi.edu/resources/pdf/dorene1.pdf

MANITOBA'S ROAD TO RESILIENCE website
https://www.climateactionmb.ca/road2resilience/

Kisik clean energy
https://www.kisikcleanenergy.com/

Economizers information sheet
factsheet (prismengineering.com)

Cars, planes, trains: where do CO2 emissions from transport come from?
https://ourworldindata.org/co2-emissions-from-transport

Additional Resources (Continued)

National inventory GHG
https://publications.gc.ca/collections/collection_2021/eccc/En81-4-1-2019-eng.pdf

The green recovery: how Australia can close the recycling loop
https://youtu.be/WFniQ8zJ8ng

Circular economy – Ellen MacArthur foundation
https://www.ellenmacarthurfoundation.org/

National waste report
http://publications.gc.ca/collections/collection_2020/eccc/en14/En14-405-2020-eng.pdf

Wastewise – where to recycle in Manitoba
https://www.gov.mb.ca/sd/wastewise/pros.html

Winnipeg household waste during the pandemic
https://globalnews.ca/news/7697189/winnipeg-household-waste-high/

IPCC Report: Climate change induced droughts major driver of food insecurity
https://www.youtube.com/watch?v=OWEXD0T5GVE

World food day: the fight against food waste
https://www.aljazeera.com/news/2019/10/16/world-food-day-the-fight-against-food-waste

Carbon brief - food systems responsible for 'one third' of human-caused emissions
https://www.carbonbrief.org/food-systems-responsible-for-one-third-of-human-caused-emissions?utm_source=newsletter&utm_medium=email&utm_campaign=food&utm_content=2021-03-11&mkt_tok=MjExLU5KWS0xNjUAAAF7wJCCzz7bX3qhk4UoW2v2Iwf44EnoKMPW7QDW2nuqiI9PqaaYNjvnsmY0lOKkwnSx2I8tqMRmUa83fTbOzAh3YzLVuCSB0tNU3PNDWxVL8IwyNRA

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Forth Whyte farms
https://www.fortwhyte.org/about/fortwhyte-farms/

Waste reduction week in Canada – food waste in Canada facts
https://wrwcanada.com/en/get-involved/resources/food-waste-themed-resources/food-waste-canada-facts

Household food insecurity in Canada early in the COVID-19 pandemic
https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2022002/article/00002-eng.pdf?st=YO3u1YYg

Niche - the interconnected nature of food security and food sovereignty
https://niche-canada.org/2020/05/22/the-interconnected-nature-of-food-security-and-food-sovereignty/

Fairtrade Manitoba
http://fairtrademanitoba.ca/

University of Manitoba – energy and water management
https://umanitoba.ca/sustainability/sustainability-initiatives/energy-and-water

California State University
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Forests and Climate Change
https://climateatlas.ca/forests-and-climate-change

Carbon offset calculator
https://treecanada.ca/reforestation-carbon-offsetting/grow-clean-air/carbon-calculator/

Depave Paradise
https://depaveparadise.ca/

Green Over Grey Company
http://www.greenovergrey.com/green-wall-benefits/energy-savings.php#:~:text=With%20each%20additional%20plant%20this,by%20up%20to%2020%25

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