CANADA
4-H Ontario

www.4-hontario.ca

4-H ONTARIO PROJECT

EYE ON ENERGY

LEADER REFERENCE GUIDE

Credits

The 4-H Pledge

I pledge my Head to clearer thinking,
my Heart to greater loyalty,
my Hands to larger service,
my Health to better living, for my club, my community,
my country, and my world.

The 4-H Motto

Learn To Do By Doing

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4-H Ontario

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Thank you to the Eye on Energy Advisory Committee members who assisted with the creation of this resource:

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All information presented in this Project Resource was accurate at the time of printing.

4-H Ontario is pleased to be able to provide project resource reference manuals for use by volunteers in clubs. 4-H Ontario screens and trains volunteers to equip them with the tools to serve as positive role models for youth. With so many topics to choose from, 4-H volunteers are trusted to use these resources to provide safe and quality programming while using their judgement to assess the appropriateness of activities for their particular group of youth. By downloading any 4-H resource, you agree to use if for 4-H purposes and give credit to the original creators. Your provincial 4-H organization may have restrictions on the types of 4-H projects or activities which can be completed in your region.

4-H Ontario grants permission to 4-H Volunteers to photocopy this 4-H project resource for use in their local 4-H program. All information presented in this Project Resource was accurate at the time of printing.

The development of this project resource was made possible through the support of funding provided by the Stanley Knapp Resource Fund.

Sustainable Canadian Agricultural Partnership

Ontario

Canada

CANADA
4-H Ontario

4-H Inclusion Statement

4-H in Canada is open to all* without discrimination based on race, national or ethnic origin, colour, religion, sex, age or, mental or physical disability.**

4-H is dedicated to providing a safe and inclusive environment that allows for universal access and participation. Where barriers to participation are identified, 4-H will, with reasonable accommodation, adapt programs, rules, policies, or expectations to reduce or remove the barriers.

Any accommodations, changes or exceptions will be assessed on an individual basis, taking into account the individual experience of the member and their family. The physical safety and emotional well-being of members, leaders, staff and volunteers is 4-H's highest priority, and is the ultimate consideration in final decisions.

4-H Canada and local 4-H organizations consider inclusion a priority. Leaders are encouraged to work with individuals and their families to identify and discuss accommodations as required, and to reach out to provincial or national office staff for help with unresolved concerns.

**This applies to youth members (ages 6 to 21), volunteers, leaders, staff and professionals.*
***Definition of discrimination as per Canadian Charter of Rights and Freedoms.*

Déclaration sur l'inclusion des 4-H

L'adhésion aux 4-H au Canada est ouverte à tous les jeunes* sans discrimination fondée sur la race, l'origine nationale ou ethnique, la couleur de la peau, la religion, le sexe, l'âge ou le handicap mental ou physique. **

Les 4-H ont pour mission d'offrir un environnement sécuritaire et inclusif qui permet l'accès et la participation de tous. Lorsque des obstacles à la participation sont décelés, les 4-H adapteront, à l'aide de mesures d'adaptation raisonnables, les programmes, les règles, les politiques ou les attentes afin de réduire ou d'éliminer ces obstacles.

Toute mesure d'adaptation, modification ou exception sera évaluée au cas par cas, en tenant compte de l'expérience personnelle du membre et de sa famille. La sécurité physique et le bien-être émotionnel des membres, des animateurs et des animatrices, des membres du personnel et des bénévoles sont la priorité absolue des 4-H et constituent le facteur ultime à considérer lors de la prise des décisions définitives.

Les 4-H du Canada et les organisations locales des 4-H considèrent l'inclusion comme étant une priorité. Les animateurs et les animatrices sont encouragés à collaborer avec les personnes et leurs familles afin de définir et d'examiner les mesures d'adaptation, selon les besoins, et de communiquer avec le personnel du bureau provincial ou national pour obtenir de l'aide en cas de préoccupations non résolues.

**Ceci s'applique aux jeunes membres (âgés de 6 à 21 ans), aux bénévoles, aux animateurs, aux membres du personnel et aux professionnels.*
***Selon la définition de discrimination en vertu de la Charte canadienne des droits et libertés*

Welcome to 4-H Ontario's Eye On Energy Project!

This project focuses on energy conservation.

This material is intended as a reference point of information for youth to gain an awareness and understanding of the energy industry and sustainable energy.

Project Objectives

- Become familiar with the most common sources of energy.
- Recognize how energy is used in the home and ways to save energy and money.
- Understand what greenhouse gases are and their impact on the environment.
- Demonstrate how energy generation and energy impact the environment.
- Understand the link between waste and how to affect energy conversation positively.
- Understand transportation options, energy use, and environmental impact.
- Consider personal energy use, how choices are made about energy use, and how these choices impact the environment and the future.
- Gain experience working co-operatively as a group member by participating in club activities.
- Further develop communication, judging and public speaking skills.
- Have fun and “Learn To Do By Doing!”

How to Use This Manual

The Leader Reference Guide

4-H Ontario’s Eye on Energy project is made up of two parts:

1. **The Reference Book**

    Meeting 1 – Energy, Conservation and You

    Meeting 2 – Where Does Energy Come From?

    Meeting 3 – Energy Savings Begin at Home

    Meeting 4 – Our Choices Matter

    Meeting 5 – Energy on the Move

    Meeting 6 – Energy for the Future: Options and Choices

    Achievement Day – Held at an agricultural event or demonstration day

Each meeting has been broken down into an Introduction with Sample Meeting Agendas, References and Resources, Topic Information and Activities.

Sample Meeting Agendas – are at the beginning of each meeting. The agendas give suggestions for topic information, activities, judging and communications activities, and suggested times for each section. These are only suggestions – you will know your group best and know your members' skills and attention levels. There is more topic information and activities than what can be completed in a two-hour meeting. Be creative!

Resources, Topic Information and References – this supporting material is included to enhance your knowledge of the topics covered in each meeting.

Activities – should be combined with discussing topic information to teach members in a hands-on, interactive learning environment.

2. The Record Book
This booklet is designed to make it easier for members to record information throughout the club. Members are to record their expectations and goals for the project in addition to contact information, meeting dates, roll calls and records of activities completed at the meetings and at home. Print or photocopy pages from the Reference Book that will benefit the members as a resource or an activity. Answers for the Activity Pages can be found at the back of the Record Book.

The Record Book should be given to each member at the beginning of the first meeting.
Ask members to keep it in a binder or duotang so they can add to it easily.
Go through the Record Book with the members and explain the charts and forms.
Please encourage them to use their Record Books at every meeting and record as much information as possible. As an added incentive, a prize could be given for the best Record Book at the end of the project.

What is STEM, and Why is it Important?

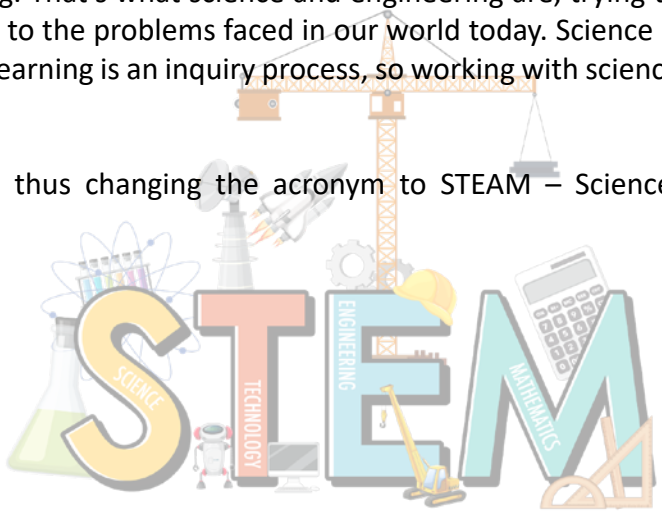
Since 1915, 4-H in Ontario has engaged youth in science, technology, engineering, and math (STEM). This has traditionally meant a solid focus on agricultural science, mechanics, entrepreneurship, natural sciences and household science. 4-H has grown to include rocketry, robotics, computer science, environmental sciences, and more. 4-H provides hands-on learning experiences to encourage learning about the world around us. Our lives are completely immersed in science and technology.

Understanding how science, engineering, and technology impact our lives, solve problems and create new ones makes it easier to navigate our modern world.

In school, science classes need to cover a broad range of topics in a limited time. At the same time, STEM in 4-H allows members and leaders time to dig deeper into ideas and concepts and to spend as much time as desired to work on projects based on personal interests, questions, and skills.

STEM in 4-H allows people to work on their questions, design tests, create models, build their understanding, and share their work with others – learn to do by doing. That's what science and engineering are, trying to understand the natural universe and develop solutions to the problems faced in our world today. Science is inquiry that uses specific approaches and skills. But all learning is an inquiry process, so working with science helps develop your learning skills and strategies.

Within 4-H, the STEM process can include the Arts, thus changing the acronym to STEAM – Science, Technology, Engineering, Art & Math.



Planning A Meeting

Plan your meetings well. Review all the information well in advance so you are prepared and ready!

Before Each Meeting

- Read the topic information and activities and photocopy any relevant resources for the Participants Journal.
- Be familiar with the topic information for each meeting. Think of imaginative ways to present the information to the participants. Do not rely on just reading the information out loud. Review available resources, plan the meetings and choose activities and themes that complement the ages and interests of your participants. Gather any equipment and/or resources that will be needed to complete the meeting.
- At least 12 hours of club meeting time is required for every project; including club business, specific project information and social recreation. The delivery format for that material is left to the discretion of the leaders. Before each meeting, create a timeline to ensure that you are providing an adequate amount of instructional time for club completion. **Note:** the best practice recommendation is that a club have multiple meeting times for each project. Included on the following page is a Leader's Planning Chart to help with the planning of meetings. In addition to the chart, keep track of what went well and what could be changed next time. That way, each time this project is run, the content of the meetings can be different!

Leader's Planning Chart

The following page includes a Leader's Planning Chart to help plan meetings. In addition to the chart, keep track of what went well and what should be changed next time. That way, each time this project is run, the content of the meetings can be different.

When planning each meeting, a typical 4-H meeting agenda should include the following:

- Welcome & Call to Order
- 4-H Pledge
- Roll Call
- Parliamentary Procedure:
  - Secretary's Report
  - Treasurer's Report (if any)
  - Press Report
  - New Business: local and provincial 4-H activities/opportunities, upcoming club activities
- Meeting content and activities
- Clean-up
- Social Recreation and/or refreshments
- Adjournment

Judging And Communications

Each meeting must include either a judging or public speaking activity.

- Judging allows the members to use judging techniques as part of the learning process. Members learn to evaluate, make decisions and communicate with others through judging. Experience with judging also helps develop critical thinking skills, confidence and self-esteem.
- Many examples are used in this reference book but use your imagination. As long as members are setting criteria and critically thinking about where items fit within that set of standards, they are learning the basic skills of judging.
- A communications activity has been provided for each meeting but can be included in the Roll Call or social recreation time. These activities do not need to involve the topic of energy conservation as the outcome is more about understanding practical communication concepts.

Electing Your Executive

All club members decide on the club executive. Review each of the roles and responsibilities with the members.

President

- The club president works closely with the Club leaders to plan meetings and other activities.
- They are the chairperson of all club meetings and ensure they start and end on time.

Vice President

- The vice president helps the president when needed and takes over the president's duties if necessary.

Secretary

- The secretary is responsible for keeping minutes of meetings, attendance records and handling the club's mail. If the club has money, the secretary may become the secretary-treasurer.

Treasurer

- The treasurer is responsible for recording the club money received or paid out. A report is usually given after the reading of the minutes.

Press Reporter

- The press reporter lets the community know about your club's activities through social media, local newspapers, radio, or 4-H newsletters.

Elections can be chaired by a youth leader, senior participant or club leader. The person chairing the elections is not eligible for any positions.

Procedure:

1. All positions are declared vacant by the chairperson, who indicates this by saying "I'd like to declare all positions vacant."
2. The group decides on the method of voting (i.e. show of hands, ballot or standing).
3. The chairperson accepts nomination from participants for each position being filled. Nominations do not require a seconder. Nominations are closed by motion or declaration by the chairperson.
4. Each participant nominated is asked if he/she will stand for the position. Names of participants who decline are crossed off.
5. Voting takes place by selected method and majority rules (i.e. participant with most votes).
6. Announce the name of the successful participant. Offer congratulations and thank all others that ran for the position.
7. If ballots are used, a motion to destroy the ballots is required and voted on.

Steps In Making A Motion

The motion is a very important key to having good meetings. Motions are a way of introducing topics for discussion and allowing each participant to speak and vote. Any participant can make a motion.

Steps in Making a Motion:

1. Address the chairperson (i.e. raise your hand).
2. Wait for the chairperson to acknowledge you.
3. Make the motion: "I move that…"
4. Another person seconds the motion: "I second the motion."
5. Chairperson states the motion.
6. Chairperson calls for discussion of the motion.
7. Chairperson restates the motion.
8. Chairperson calls the vote: "All in favour? Opposed?"
9. Chairperson announces the result of the vote: "Motion carried" or "Motion defeated."

Volunteer Responsibilities

As A Club Volunteer Your Responsibilities Are To:

- Be a Volunteer in Good Standing by completing the volunteer screening process, attending a volunteer training session and adhere to the 4-H Code of Conduct.
- Notify the local association of the club, arrange a meeting schedule and participate in club meetings, activities and the Achievement program, assuring that all meetings and activities are accessible and inclusive for all participants.
- Review the project material in the Leader Reference Manual to familiarize yourself with the information and adapt it to fit your group. Be well organized and teach the material based on your group's age, interest and experience level.
- Organize the club so participants gain parliamentary procedure, judging and communication skills.
- Ensure that participants are registered for the club using the online registration system.
- Review the Participant Agreement Form (PAF) that participants completed when registering online.
- Ensure that all participants, leaders and parent helpers know the appropriate actions during any emergency.
- Check with participants for any food allergies or dietary restrictions and plan snacks accordingly.
- Review the Risk Management Checklist(s) in this resource that have been provided by 4-H Canada.

As A Club Participant Your Responsibilities Are To:

- Participate in at least 2/3 of their own club meeting time. Clubs must have a minimum of 12 hours of meeting time.
- Complete the project requirement to the satisfaction of the club leaders.
- Take part in the project Achievement Program.
- Fill in and complete the Record Book.
- Complete any other project as required by the club leaders.

Special Projects

Individual clubs will decide if junior and senior members must complete a special activity. These projects are often done outside meeting time but could be used during a meeting and are for members interested in doing more – often senior members. It's up to you as the leader to decide if you require members to complete a Special Project for club completion. The emphasis is not on the report or the final results but on the activity and learning experience. Members may pursue an activity or idea independently and can work on the projects in pairs or small groups.

Here are some activities to get you started, but feel free to think of more!

- Collect and display ten or more items that would normally be thrown away. Explain how they can be used for other purposes.
- Interview a municipal official to find out what energy conservation measures are used in your municipality. How have they changed in the last few years?
- Develop a family action plan to save energy in your home. Describe your plan under the heat, light, water and fuel headings.
- Develop an energy-conscious package for a product that usually requires large amounts of wrapping and packaging.
- Chart the possible savings in fuel and time by using reduced tillage or updated combining operations.
- Make a home or farm building model showing the optimum use of energy conservation measures and design (e.g., orientation, solar panels, heating and cooling systems, insulation, windows and landscaping).
- Make a model showing how heat usually wasted from a barn can heat a house. Describe how it is collected, delivered, stored and used.
- Build and demonstrate a solar cooker.
- Investigate the production, use and disposal of fast food or food processing outlet-generated garbage.
- Design a new, energy-conserving transportation alternative.
- For two weeks, keep a log charting the use of a vehicle and the amount and cost of fuel used, distance travelled, purpose of trips and number of people per trip. Comment on the energy efficiency of private vehicle use.
- Build a solar or wind-powered model of the member's choosing.
- Plan an energy-efficient future community with roads, recreation facilities, homes, commercial and industrial areas, public transit, parks, waste management systems, etc.
- Produce a video on some aspects of energy conservation.
- Research the effects of energy on health.
- If each home was required to limit the garbage leaving the curb to only one bag per month, describe how you would alter your lifestyle to accommodate this change.
- An idea of your own that your 4-H leader approves.
- How does our energy consumption change when we switch from using one-use plastics to renewable sources?

Tour & Guest Speaker Ideas

- Visit a local farm implement supply company/store and learn about the conservation and energy-efficient options available.
- Tour area farms to learn about different energy conservation and management styles.
- Visit a large-scale cash crop farming operation to learn about their energy conservation methods.
- Tour a farm with a biodigester.
- Tour a solar farm or a farm/business with solar panels.
- Visit a local car dealership that sells electric/hydrid vehicles.
- Have guest speakers attend meetings to supplement the material in the Reference Manual. Speakers could include a farmer, a local business representative connected to energy use, conservation and innovation, a local energy facility staff member, a researcher, a college or university professor, or a farm supply company owner.
- Tour a machinery dealership that has various types of equipment.

What is an Achievement Program?

- An opportunity for members to share with others the knowledge and skills they have gained during this 4-H project.
- An activity that involves each member in some way.
- A chance to inform the public about the purpose and goals of the 4-H program.

Achievement Program ideas specific to this project are suggested below. Your club may wish to choose one idea or combine a few. Involve club members in selecting a suitable idea and making the necessary preparations.

- Contact the local newspaper, radio or community social media pages to tell them about your activity, the date, the time and where it will be held.
- Send a personal invitation to the group you plan to invite to the Program or an individual request from your club to visit an organization and present your Achievement Program. Don't forget to include parents/guardians and family members.
- Invite parents, the public, media and other youth groups to attend your Achievement Program.

Here are some suggestions. The second meeting should select the type of program. You may require some preparation time at your meetings before the Achievement Program.

- Organize a public forum, workshop or seminar on energy alternatives. Set up a 4-H information booth and invite people from your community who use alternative energy to set up their display booths or publicly speak about the type of energy they use and how they use it.
- Organize a public display about how to conserve energy in everyday life.
- Organize an energy tour of your neighbourhood. Select a walking or cycling route where you can point out homes, businesses, buildings, streets, walkways, etc., that use energy wisely.
- Plan an energy-wise potluck dinner. Invite guests using invitations made from discarded materials. Encourage food items prepared using energy-conserving techniques and ingredients (microwave, air-fryer, non-processed, no packaging). Ask guests to bring dishes and utensils that can be washed for reuse. The club could also prepare displays and skits.
- Plan an Energy Fair for another youth group or sports team. Set up stations for them to try some of the activities from the project. Make it very hands-on and lots of fun. Invite them to join you for your next 4-H project.
- Work with a local farm operation that utilizes innovative energy strategies to host an Open House.

Leader's Planning Chart

Mtg. #	Date/Place	Topics Covered	Activities	Materials Needed

Community Event Checklist

Community Events refer to activities hosted and organized by an outside party that are attended by a 4-H group.

Examples include, but are not limited to: club members volunteering at a community event or fundraiser, or attending an exhibition or a trade show.

Risk Management Strategies

Safety information and recommendations contained in this safety checklist are believed to reflect best practices to reduce risk. The suggested risk management strategies are considered minimum standards for participating in a community event.

Preparation

- All youth members and their parents/guardians are informed of potential risks involved in the activity, as well as the safety rules and procedures.
- Safety rules and procedures are learned prior to participation.
- Emergency contact and medical information for all participants will be on-hand throughout the event, as well as dedicated phones for emergencies.
- A first aid kit will be available.
- Set a muster point at the event for everyone to gather in case of an emergency, or if separated from the group. Ensure all participants are aware of this emergency plan.

Supervision

- Adheres to Youth Safety Supervision Policy, Rule of Two, and Supervision Ratios.
- At large events, you may partner with other 4-H groups to provide greater supervision coverage.
- Members must stay within supervised areas as explained by leaders.
- At a public event, the overall group may break into smaller groups. Smaller groups may be supervised in public view by one trained leader or screened volunteer. The maximum number of youth per supervisor must follow the supervision ratio.
- There must never be a situation where an adult is one-on-one with a youth. If a member needs individual attention, engage a fellow supervisor or another adult for assistance.
- Ensure all adults communicate a safety plan to youth and everyone knows how to contact the trained leader in charge in case of an emergency.
- If working in conjunction with another volunteer group, members must be supervised by a 4-H trained leader and/or trained volunteer. Volunteers from other organizations have not met our screening requirements.
- Safety rules and procedures are enforced throughout the activity.
- Emergency action plan is in place to deal with accidents/injuries.

Clothing/Footwear

- Appropriate and properly fitted footwear is worn.
- Appropriate clothing is worn.

Glossary

ALGAE - Plural Noun (singular: alga) diverse group of aquatic organisms, the largest of which are seaweeds.

ANTHRACITE – Noun, the most valuable type of coal, contains high carbon content. Also called hard coal, black coal, and stone coal.

ATMOSPHERE – Noun, layers of gases surrounding a planet or other celestial body.

ATOM – Noun is an element's basic unit, composed of three major parts: electrons, protons, and neutrons.

BIOMASS ENERGY – Noun, renewable energy derived from living or recently living organisms, primarily plants.

BIOMASS FEEDSTOCK – Noun, crop, residue, and other organic material that can produce energy on an industrial scale.

BYPRODUCT – Noun, a substance that is created by the production of another material.

CARBON BUDGET – Noun, the total amount of carbon and carbon compounds in the Earth and Earth's atmosphere.

CARBON DIOXIDE – Noun, a greenhouse gas produced by animals during respiration and used by plants during photosynthesis. Carbon dioxide is also the byproduct of burning fossil fuels.

CARBONIZATION – Noun, the process of organic matter turning into carbon, usually under high temperatures and pressure.

CLEAN ENERGY – Noun, the energy that, when generated, doesn't release harmful exhaust into the air. We're using this term to talk about clean energy for cooking, like electricity or solar instead of wood, coal, or charcoal - which create smoke when they burn, which is dangerous for people to breathe.

CLIMATE CHANGE – Noun, gradual changes in all the interconnected weather elements on our planet.

COAL – Noun, dark, solid fossil fuel mined from the earth.

COMBUST – Verb, to burn.

CONTAMINATE – Verb, to poison or make hazardous.

ELECTRICITY – Noun, set of physical phenomena associated with the presence and flow of electric charge.

EMIT – Verb, to give off or send out.

ENVIRONMENT – Noun, conditions that surround and influence an organism or community.

EXTRACT – Verb, to pull out.

FOSSIL FUEL – Noun, coal, oil, or natural gas. Fossil fuels formed from the remains of ancient plants and animals.

FRACKING – Verb, the process usually used to extract oil and natural gas in which fractures in the Earth's surface are opened and widened by injecting water, chemicals, and sand at high pressure, is called hydraulic fracturing.

GASOLINE – Noun, a liquid mixture made from oil and used to run many motor vehicles.

GENERATE – Verb, to create or begin.

GENERATOR – Noun, a machine that takes one type of energy and turns it into electricity. Generators are often found in power stations.

GREENHOUSE EFFECT – Noun, a phenomenon where gases allow sunlight to enter Earth's atmosphere but make it difficult for heat to escape.

GREENHOUSE GAS – Noun, gas in the atmosphere, such as carbon dioxide, methane, water vapour, and

ozone, that absorbs solar heat reflected by the surface of the Earth, warming the atmosphere.

HABITAT – Noun, the environment where an organism lives throughout the year or for shorter periods.

HYGIENE – Noun, science and methods of keeping clean and healthy.

LNG – Noun, (liquified natural gas) natural gas that has been cooled and liquified for easy storage and transportation.

METHANE – Noun, the chemical compound that is the essential ingredient of natural gas.

NATURAL GAS – Noun, is a type of fossil fuel made up mostly of methane.

NONRENEWABLE ENERGY – Noun, energy resources that are exhaustible relative to the human life span, such as gas, coal, or petroleum.

NUCLEAR ENERGY – Noun, the energy released by reactions among the nuclei of atoms.

NUCLEAR FISSION – Noun, is the process where the nucleus of an atom splits, releasing energy.

OFFSHORE – Adjective, involving underwater facilities or resources, usually miles from the coast.

OIL PLATFORM – Noun, large, elevated structure with facilities to extract and process oil and natural gas from undersea locations.

PEAT – Noun, partially decayed organic material layers found in some wetlands. Peat can be dried and burned as fuel.

PETROLEUM – Noun, a fossil fuel formed from the remains of ancient organisms and also called crude oil.

PHOTOSYNTHESIS – Noun, the process by which plants turn water, sunlight, and carbon dioxide into water, oxygen, and simple sugars.

PLANKTON - Plural Noun, (singular: plankton) microscopic aquatic organisms.

POLLUTANT – Noun, chemical or other substance that harms a natural resource.

POWER GRID – Noun, the network that delivers electricity to all our homes, businesses, and communities. Electricity can be generated in different ways, and the power grid brings it to where it is used.

RADIOACTIVE WASTE – Noun, the byproduct of nuclear fission that emits heat, or radiation, that can damage the tissue of living organisms.

REFINE – Verb, to make more pure or clean.

RENEWABLE ENERGY – Noun, the energy obtained from virtually inexhaustible sources replenish naturally over small time scales relative to the human life span.

REPLENISH – Verb, to supply or refill.

RESERVOIR – Noun, natural or manufactured lake.

RURAL – Adjective, concerning country life or areas with few residents.

SEDIMENT – Noun, solid material transported and deposited by water, ice, and wind.

SEQUESTER – Verb, to isolate or remove.

SUSTAINABLE – Adjective, something that can last and not run out. These goals are trying to achieve a sustainable world where all people's basic needs are met, and our environment's health is not in danger of being used up or damaged.

SUSTAINABLE ENERGY – Noun, energy sources that can last and won't run out, like coal, oil, or gas.

TOXIC – Adjective, poisonous.

URANIUM – Noun, the chemical element with the symbol U. Fuel used to produce nuclear energy.

URBAN AREA – Noun, developed, densely populated area where most inhabitants have non-agricultural jobs.

VEGETATION – Noun, all the plant life of a specific place.

WETLAND – Noun, land area covered by shallow water or saturated by water.

The 4-H Pledge

I pledge
My head to clearer thinking,
My heart to greater loyalty,
My hands to larger service,
My health to better living,
For my club, my community,
my country, and my world.

CANADA
4-H Ontario

Energy, Conservation and You

Meeting 1 – Energy, Conservation and You

Setting Objectives:
- To welcome members and introduce the project.

Learning Outcomes:
- Members will become familiar with the other members of the club.
- Members will become familiar with the 4-H club process (pledge, parliamentary procedure, electing an executive, judging, and communications).
- Members are introduced to what will happen during the Eye on Energy club meetings and events.
- Members know that everyone uses energy and that we must use energy responsibly.

Reference Material in this Section:
- Electing Your Executive
- Parliamentary Procedure – Steps in Making a Motion
- The 24hr clock
- Judging: Giving Reasons

Activities:
- Activity 1: Let's Go for a Spin
- Activity 2: Electing Our Executive
- Activity 3: Where Does Electricity Come From?
- Activity 4: Tracking Electricity Use
- Activity 5: Judging Sources of Electricity

Preparation and Equipment:
- Laptop, tablet or computer with a monitor and access to the Internet

SAMPLE MEETING AGENDA Time: (generally) 2 hours 10 minutes

Welcome, Call to order, Pledge	Welcome the club members to the project. Call the meeting to order or lead the members through reciting the 4-H Pledge.	10 minutes
Introduction	Members get to know each other a bit better by doing the interactive energizer **Activity 1: Let's Go for a Spin**	10 minutes
Roll Call	After the group is more comfortable after the icebreaker, hand out the Record Books. Outline the Club Project and discuss project objectives/club requirements. Fill out club and participant information in the Record Books on page 6. Highlight what you plan to cover at each meeting and the expectations of club members for club completion: meeting attendance, judging throughout the meetings, achievement event, meeting dates, etc.	10 minutes

Roll Call continued	Encourage members to fill in the meeting dates and notes in their Record Book on page 7 as you highlight them. Direct members to page 8 and ask them to complete the Member Expectations and Goals. Give the group time to complete their answers and then introduce the concept of Roll Call by inviting each member to share their name and one of their responses from this page.	
Topic Information Discussion	Parliamentary Procedure and Electing Our Executive. Introduce or review parliamentary procedure and the election process by reviewing the points in the Topic Information section.	10 minutes
Activity Related to Topic	Elect the executive following the procedure in **Activity 2: Electing Our Executive.**	15 minutes
Topic Information Discussion	Review What is Energy?	10 minutes
Activity Related to Topic	**Activity 3: Where Does Electricity Come From?**	10 minutes
Topic Information Discussion	Introduce/review the 24-Hour Clock and IESO Website	10 minutes
Activity Related to Topic	**Activity 4: Tracking Electricity Use**	15 minutes
Topic Information Discussion	Introduce/review the key points of Judging	10 minutes
Activity Related to Topic	**Activity 5: Judging Sources of Electricity**	15 minutes
Wrap up, Social Time And Adjournment	Recap topics covered in this meeting and review the **At Home Challenge:** Use a laptop or tablet to visit https://www.ieso.ca/en/Sector-Participants/Settlements/Peak-Tracker. Scroll down to the heading "Today's Ontario Demand Forecast" and record the megawatts of energy used for one day at 1:00, 7:00, 11:00, 15:00, and 19:00. • Why do you think the amount changes? • What happens during these specific times of day that would affect the amount of energy being used?	5 minutes
At Home Challenge	Share the activity with the members. Let them know that they will be expected to report on their activity during Roll Call in Meeting 2. Plot energy use at a given time using IESO website info	

What is Energy?

Energy is anything that can produce a change in matter. Matter is anything that takes up space. Air, water, rocks and even people are examples of matter.

Energy is present everywhere. The energy produced by a motor drives a car. The energy produced by the wind turns the blades of a windmill. Animals can run from the energy provided by food.

Energy follows specific natural laws, including:

- Energy can not be created or destroyed. It can only be transferred from one object to another object.
- Energy comes in different forms and can be divided into categories, including light energy (e.g. a light bulb), elastic energy (e.g. a bent diving board), chemical energy (e.g. gas in a car), mechanical energy (e.g. riding a bicycle), nuclear energy (e.g. the sun), among others.
- Energy transforms. For example, when we use a battery for a flashlight, the chemical energy in the battery converts into electric energy to light up the light bulb in the flashlight. Another example is when we mix hot and cold water in the bathtub.
- Energy can be stored. An example is how mobile phone batteries store energy until we need to make a call or use an app.

What Does It Mean to Conserve Energy?

Energy conservation is reducing wasteful energy consumption by using fewer energy resources. This can be done by using energy more effectively or changing your behaviour to use less energy. Examples of energy conservation include using energy-efficient light bulbs, upgrading appliances, air drying your laundry and dishes and turning off lights when they are not in use.

Watch and Learn!

This video shares the main properties of energy and what types of energy there are. Understand why energy is transformed, transferred, transported and stored and the differences between renewable and non-renewable energy sources.

What is Energy? Smile and Learn https://youtu.be/aFpC1vAIgNc

Judging: Giving Reasons

Giving reasons can be the most rewarding part of judging, but it takes practice and confidence. The ability to provide a good set of reasons depends on knowing what you're looking at, knowing the right words to use, knowing the right way to give your reasons and being able to convince everyone that you're right.

How to give reasons:

1. Reasons should be short, clear and convincing. They shouldn't take more than two minutes to give.
2. Stand straight and look at the person you are speaking to.
3. Start by naming the class and giving the order of placement.
4. Explain why you placed the first over the second, the second over the third, and the third over the last.
5. Never go back. Say everything you want about one placing and then move on to the next one.
6. Keep a clear picture in your mind of what you are judging.
7. Be positive. Talk about the critical points that were better in each exhibit.
8. Don't be too hard on the exhibit that was the last. Talk about two or three wrong things and then quit.
9. Speak loudly enough for the judge to hear you confidently.
10. Know the right words to use and use them correctly. Don't get stuck using the exact words over and over.
11. Always do your best.

- **How We Use Electricity**
  Working independently or in small groups, research the different ways we use electricity and the benefits of each. Create a PowerPoint presentation that can be shared with the club members or a display that could be shown at the Achievement Program.

- **Energy and Its Surprising Role in Your Life**
  Watch the video Energy and Its Surprising Role in Your Life https://youtu.be/8aEWxUHeE1s?si=mP-sCi5P8MKi1R9jX (8:07) and answer the following questions:
  - What can you do to reduce your energy consumption?
  - What key decisions could you make to lead the charge to a more responsible future?
  - How will you share the future of your energy ecosystem?

  Share your answers with the club.

- **Agricultural Applications: Why is electricity necessary in agriculture?**
  Explore the ways that Canadian farmers use electricity in agriculture. Learn more about how farmers in other countries use electricity. Be sure to seek out information about how farmers in countries that don't have easy access to electricity can farm. Share your findings in a presentation, podcast or social media post.

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Activity #1 – Let's Go for a Spin

Do	Time: 10 minutes **Instructions:** 1. Divide the members into two groups by getting members to count 1-2-1-2 and so on. (If you get the members to count themselves off rather than counting them off, they are more likely to remember what number they are!) 2. Instruct all of the 1's to form a circle, facing out. 3. Direct all of the 2's to form a circle around the 1's facing in. Each person in the outer ring should face someone in the inner circle. For odd-numbered groups, work in a ratio of 2:1. 4. Ask members to introduce themselves to the people they are facing and answer, name a way we use energy. 5. Instruct the members in the outside circle, "Go for a Spin," 2 people to the left. Introduce yourselves to your new partner and answer the name of a type of transportation. 6. Ask the members in the outside circle, "Go for a Spin," 3 people to the right. Introduce yourselves to your new partner and answer: what is a source of energy? 7. Direct the members in the outside circle "Go for a Spin" 1 person to the right. Introduce yourselves to your new partner and answer: what is a good way to save energy? **Additional Activities:** • Have one of the senior members run this activity as their Digging Deeper project. • Leaders come up with instructions and questions related to energy and how we use it.
Reflect	**Learning Outcomes:** Members will be familiar with the other members of the project.
Apply	**Discuss The Following Prompts As A Group** • Was this easy or hard? • What did you like about this activity? • Did you meet some members you didn't know? • How do you feel now versus before we did the activity?

Activity #2 – Electing Our Executive

Do	Time: 15 minutes
	
	Materials/Resources:
	• Slips of paper (used if the group decides to vote by ballot)
	• Pens or pencils
	• Bowl or basket to put ballots into
	
	Instructions:
	• Share that any member may nominate another member.
	• Nominations do not require a seconder.
	• Elections can be chaired by a youth leader, senior member or club leader. The person chairing the elections is not eligible for any positions.
	
	Procedure:
	1. All positions are declared vacant by the chairperson, who indicates this by saying, "I'd like to declare all positions vacant."
	2. The group decides on the method of voting.
	  • By a show of hands
	  • By secret ballot
	  • By standing
	  • By saying "Yea" or "Nay."
	3. The chairperson accepts nominations from members for each position being filled. Nominations do not require a seconder. Nominations are closed by motion or declaration by the chairperson.
	4. Each member nominated is asked if they will stand for the position. Names of members who decline are crossed off.
	5. Voting occurs by selected method and majority rules (i.e. member with the most votes).
	6. Announce the name of the successful member. Offer congratulations and thank all others who ran for the position.
	7. If ballots are used, a motion to destroy the ballots is required and voted on.

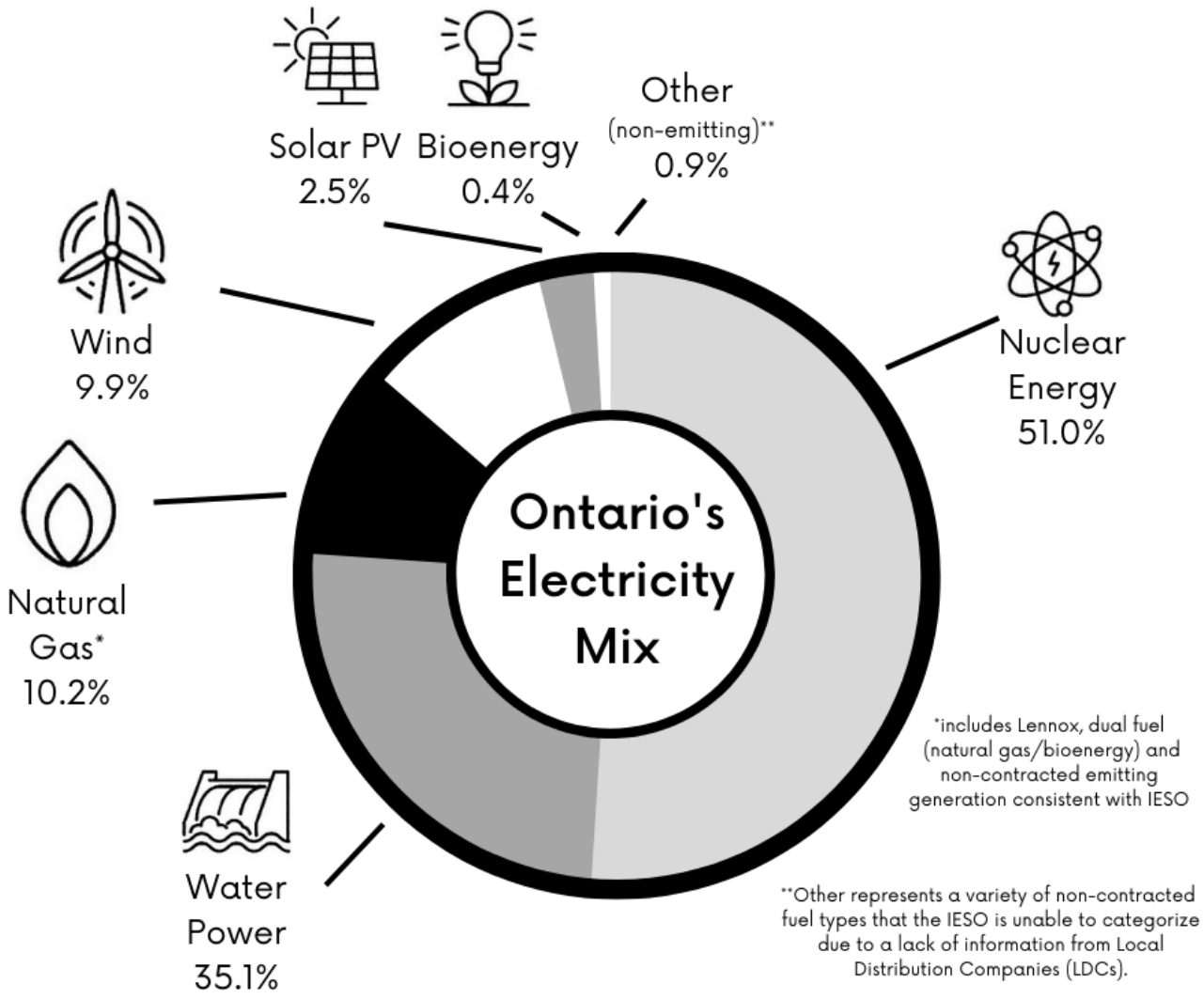
Reflect	**Learning Outcomes:** To allow members to elect an executive while applying the concept of voting using parliamentary procedure.
Apply	**Discuss The Following Prompts As A Group** • Why is it important to vote? • Was it easy or hard to make your choice? • How did it feel for the members chosen to represent the club?

Activity #3 – Where Does Electricity Come From?

Do	Time: 15 minutes **Materials/Resources:** • Whiteboard and marker or chart paper and a marker • Pages 12-13 of the Participant Record Book **Instructions:** 1. Share that the club will learn more about where energy comes from during the project. 2. State that for this activity, the group will focus on electricity and how it is generated in Ontario. 3. Ask members to share different ways that we use electricity. Record the responses on a whiteboard or piece of chart paper. Responses may include lighting our homes, charging our cell phones, running our gaming systems and others. 4. Direct members to page 12 of their Record Book. Look at Ontario's System-Wide Electricity Supply Mix. Talk about how our electricity comes from several different sources. 5. Direct members to page 13 of their Record Book. Follow each of the Coal, Hydro, Oil, and Nuclear Paths on the pages to explain how electricity is generated in Ontario.
Reflect	**Learning Outcomes:** Members will be aware of how electricity is generated in Ontario.
Apply	**Discuss The Following Prompts As A Group** • Why is it important to know how our electricity is generated? • Did any of these sources surprise you? • Are any of these types of electricity generated near where you live? • What would life be like if electricity was never discovered? • What would you miss the most if you didn't have electricity?

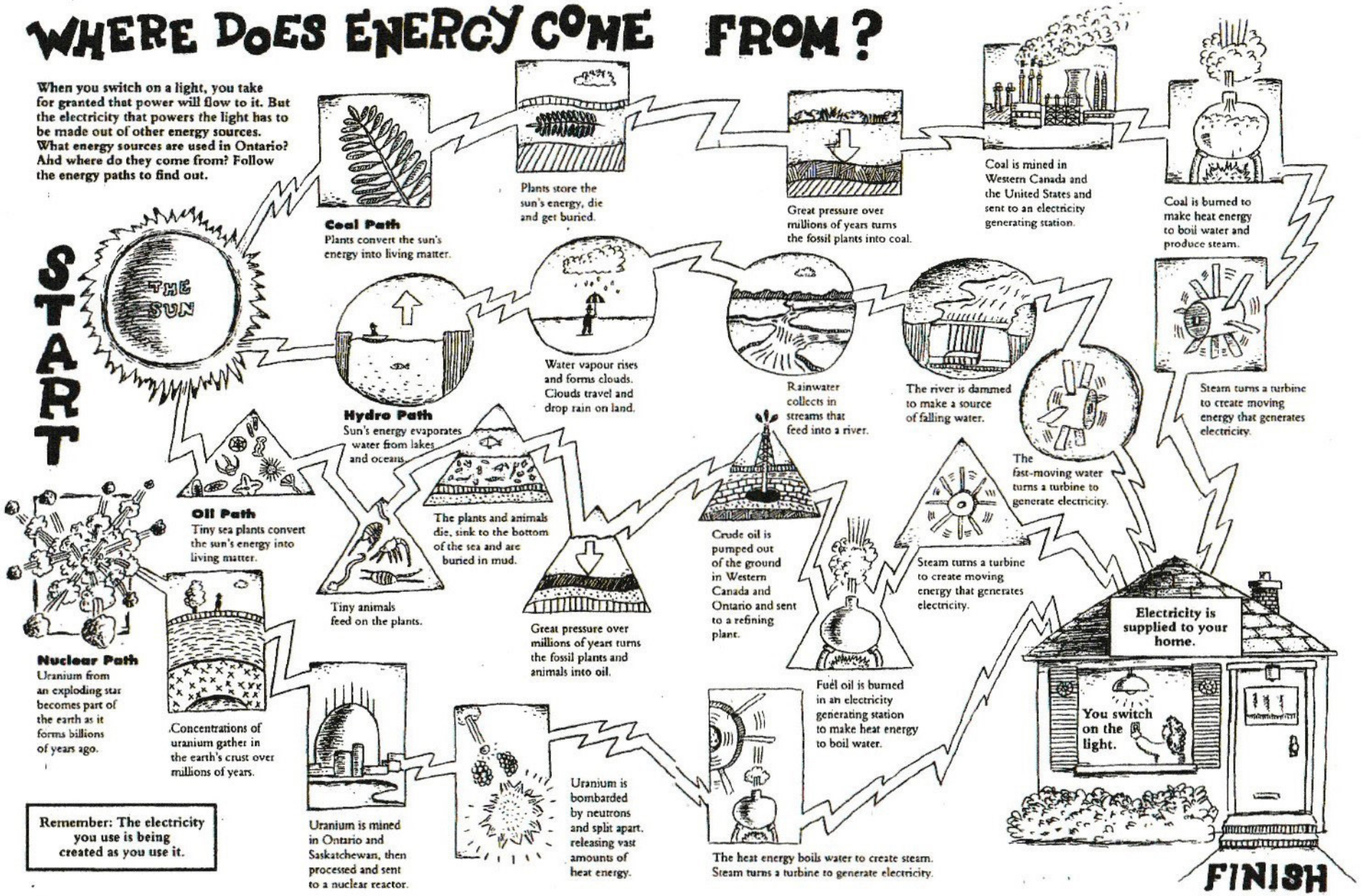
WHERE DOES ELECTRICITY COME FROM?

Ontario's System-Wide Electricity Supply Mix in 2022 looked like this:



Source: Electricity Retailing – Disclosure to Customers, O, Reg. 416-99, March 31, 2023, www.ontario.ca/laws/regulations

WHERE DOES ENERGY COME FROM?



Source: Energy Matters (Ontario Ministry of Energy, Owl Magazine, 1992, p. 6-7).

Activity #4 – Tracking Energy Use

Do

Time: 15 minutes

Materials/Resources:

- Whiteboard and marker or chart paper and a marker
- Pages 14 of the Participant Record Book

Instructions:

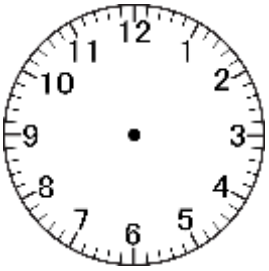
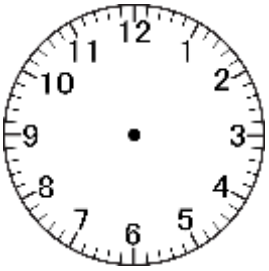
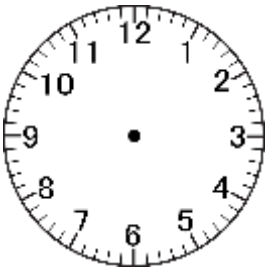
1. Ask the members if they are familiar with the 24-hour clock. If so, ask members to share examples of when the 24-hour clock is used. If not, explain that the 24-hour clock is used when time needs to be precise. Examples may include in the military, for airline flights, with train schedules, in hospitals for surgeries, and in university class schedules.
2. Direct members to page 14 of their Record Book. Use the examples given to illustrate how to determine different times of day. Fill in the blanks on the page as a group.
3. State that all of the electricity used in Ontario is tracked using the 24-hour clock.
4. Use a laptop or tablet to visit https://www.ieso.ca/en/Sector-Participants/Settlements/Peak-Tracker
5. Scroll down to the heading "Today's Ontario Demand Forecast" and point out the chart and that Ontario's electricity use is plotted on the 24-hour clock.
6. Explain that all of the electricity used in Ontario is measured in Megawatts, which is equal to one million watts. Share that an average light bulb is 60 watts. One megawatt can power 16,667 light bulbs!
7. Point out that the chart below the graph records the amount of electricity used by the hour. We will use this chart to learn more about how much electricity residents of Ontario use.
8. Practice identifying times with the group by asking members to determine various times of day: 1:00, 21:00, 14:00 (or 2:00 p.m.) and find the corresponding number of megawatts used at that time on the website.
9. Ask the members why they think the amount of electricity used varies at different times of day. Answers may include:
    - Most people are at work, and machines, lights, and heating/cooling systems are being used
    - Most people are asleep, and they aren't using as many devices
    - Most people are home from work or school and preparing dinner
10. Share that:
    - Ontario is generally a summer-peaking province, meaning the highest peak demand is usually during hot, humid days.
    - The times of highest demand in a day vary by season. For example, peaks in the winter tend to be in the early evening when electricity consumers across the province are turning their lights on and making dinner. In the summer, demand tends to be higher in the early to mid-afternoon when air conditioners are turned up.

Reflect	**Learning Outcomes:** • Members will be aware of how to track electricity use in Ontario. • Members will be aware that everyone uses energy and that we need to use energy responsibly.
Apply	**Discuss The Following Prompts As A Group** • Was this easy or hard to understand? • How can you use this information in the future? • Were you surprised about when the peak energy use times were? Why or why not ? • Were you surprised that Ontario uses more electricity in the summer rather than in the winter? • What did you find essential to know about electricity use in Ontario?

Source: The Bottom Line on Energy Management: Making Ontario's Electricity Market Work for Your Business, Independent Electricity System Operators, www.ieso.ca

TRACKING ENERGY USE

Worksheet: 24-Hour Clock

Time in Words	24 Hour Clock	12 Hour Clock	Analogue
Seven o'clock in the evening	19:00 hours	7:00 p.m.	
		1:00 a.m.	
	21:00 hours		
Two o'clock in the afternoon			

Activity #5 – Judging Sources of Electricity

Do	Time: 15 minutes **Materials/Resources:** • Pages 12 - 13 of the Participant Record Book • Pages Judging Worksheet (next page) **Instructions:** 1. Distribute Judging Worksheet to members or get members to turn to page 15 of their Record Book 2. Instruct members to review how electricity is generated on pages 12 and 13of their Record Book. Ask participants to rank the options from cleanest to the least clean source, giving reasons for their placings. 3. Give the members time to complete the judging. 4. Ask for 2-3 volunteers to share their responses. 5. Ask for additional responses from the group that either add to or differ from the points already given. **Additional Activity:** • Allow Senior Members to come up with another energy-related material to be judged.
Reflect	**Learning Outcomes:** Members will apply the concepts learned about judging and giving reasons for placements.
Apply	**Discuss The Following Prompts As A Group** • Was this easy or hard? • What did you like about this activity? • How did you come up with your reasons? • When could you use this process in the future ? • Did everyone agree on which was the cleanest source of electricity? If not, were the reasons given enough to change your mind?

JUDGING WORKSHEET

Subject Being Judged: Sources of Electricity
Qualities you are looking for:

- Cleanest source
- Least amount of processing required to generate electricity

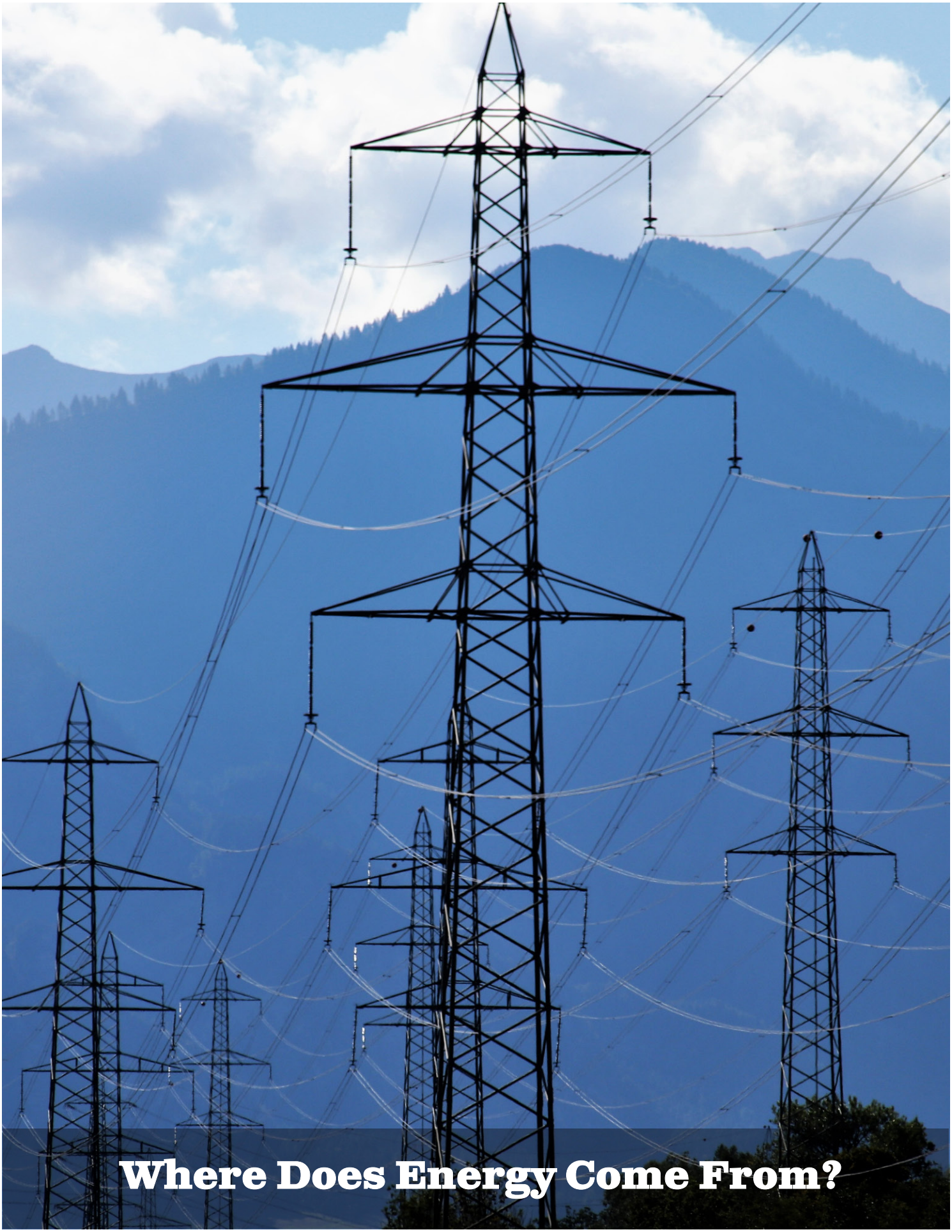
Item Being Judged/ Item Number/ Identifier	Placing	Reasons for Placing

Things to remember when judging:

1. Reasons should be short, clear and convincing.
2. Stand straight and look at the person you are speaking to.
3. Start by naming the class and giving the order of placement.
4. Explain why you placed the first over the second, the second over the third, and the third over the last.
5. Never go back. Say everything you want about one placing and then move on to the next one.
6. Keep a clear picture in your mind of what you are judging.
7. Be positive. Talk about the important points that were better in each exhibit.
8. Don't be too hard on the exhibit that was the last. Talk about two or three wrong things and then quit.
9. Speak loudly enough for the judge to hear you confidently.
10. Know the right words to use and use them correctly. Don't get stuck using the exact words over and over.
11. Always do your best.

Reference citations:

- Energy Efficiency, Government of Canada, Natural Resources Canada https://natural-resources.canada.ca/energy-efficiency/10832
- What is Energy Conservation? Inspire Clean Energy https://www.inspirecleanenergy.com/blog/sustainable-living/what-is-energy-conservation
- Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education, US Department of Energy www.energy.gov/eere/energyliteracy
- What is Energy? Smile and Learn https://youtu.be/aFpC1vAIgNc



Where Does Energy Come From?

Meeting 2 – Where Does Energy Come From?

Setting Objectives:

- To introduce our most common sources of energy.

Learning Outcomes:

- Members become familiar with the most common sources of energy.
- Members understand the difference between renewable and non-renewable sources of energy.
- Members understand that affordable and clean energy is part of Sustainable Development Goal 7 from the United Nations.

Reference Material in this Section:

- Powering Up – The Basics of Alternative and Clean Energy, Powered Up!, Pages 9-19
- Tracking SDG 7: The Energy Progress Report https://trackingsdg7.esmap.org/country/canada
- "What is Energy? Energy Types for Kids – Renewable and Non-Renewable Energy Sources" Smile and Learn – English March 24, 2020 https://youtu.be/aFpC1vAIgNc
- Create Your Own Wind Turbine (Clearway Community Solar) https://www.clearwaycommunitysolar.com/blog/science-center-home-experiments-for-kids/create-wind-turbine/
- 4-H Canada Powered UP! Page 7
- Renewable Energy, Enbridge.com https://www.enbridge.com/about-us/renewable-energy

Activities:

- Activity 6: The Positives and Negatives of Energy
- Activity 7: Build a Wind Turbine
- Activity 8: The Lazy Person's Guide to Saving the World

Preparation and Equipment:

- Laptop, tablet or computer with a monitor and access to the Internet

SAMPLE MEETING AGENDA Time: (generally) 2 hours 15 minutes

Welcome, Call to order, Pledge Review 4-H Code of Conduct	Welcome the club members to the project. Call the meeting to order or lead the members through reciting the 4-H Pledge.	5 minutes
Roll Call	Invite each member to share their name and response to the At Home Challenge you asked them to complete at the end of Meeting 1. • What did you notice about the way electricity use changes during the course of the day? • Would you say that energy use changes the same way at home?	10 minutes
Topic Information Discussion	Review Where Does Our Energy Come From? pg 37 Optional: Introduce the topic by showing "What is Energy? Energy Types for Kids – Renewable and Non-Renewable Energy Sources" (3:42) https://youtu.be/aFpC1vAIgNc	20 minutes

Activities Related to Topic	**Activity 6: The Positives and Negatives of Energy** **Activity 7: Build a Wind Turbine**	10 minutes 20 minutes
Topic Information Discussion	Sustainable Development Goal 7: Affordable and Clean Energy	10 minutes
Activities Related to Topic	**Activity 8: The Lazy Person's Guide to Saving the World** Follow Up: Take the action you identified in the Lazy Person's Guide to Change the World Activity and report to the next meeting to share your experience.	10 minutes
Wrap up, Social time and Adjournment	Recap topics covered in this meeting and review the At Home Challenge.	10 minutes
At Home Challenge	Make a list of all of the appliances that you have at your home. These appliances might include a washer, dryer, garbage disposal, microwave, clocks, electric blanket, computer, gaming system, toaster, air fryer, blender, hair dryer, etc. Write down how many you have of each kind. Ask your family for help and talk with them about ways to use less energy. Bring the list to the next meeting.	

Where Does Our Energy Come From?

Energy is created by two kinds of sources, renewable and non-renewable.

1. Non-Renewable Energy

- Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes.
- Non-renewable energy sources include fossil fuels like coal, petroleum (oil), natural gas, and nuclear.

Fossil Fuels

Video Resource

Fossil Fuels 101 (2:42) Student Energy
https://youtu.be/zaXBVYr9Ij0

All fossil fuels formed in a similar way. Hundreds of millions of years ago, even before the dinosaurs, planet Earth had a different landscape. It was covered with wide, shallow seas and swampy forests. Plants, algae, and plankton grew in these ancient wetlands. They absorbed sunlight and created energy through photosynthesis. The organisms drifted to the bottom of the sea or lake when they died. There was energy stored in the plants and animals when they died. Over time, the dead plants were crushed under the seabed. Rocks and other sediment piled on top of them, creating high heat and pressure underground. Dead plants and animals eventually turned into fossil fuels (coal, natural gas, and petroleum) in this environment. Today, there are huge underground pockets (called reservoirs) of these non-renewable sources of energy all over the world.

Advantages and Disadvantages of Fossil Fuels

- Fossil fuels are a valuable source of energy. They are relatively inexpensive to extract.
- They can also be stored, piped, or shipped anywhere worldwide.
- Burning fossil fuels is harmful to the environment. When coal and oil are burned, they release particles that can pollute the air, water, and land. Some particles are caught and set aside, but many are released into the air. Burning fossil fuel also upsets Earth's carbon balance in the oceans, earth, and air.
- When fossil fuels are combusted (heated), they release carbon dioxide into the atmosphere. Carbon dioxide is a gas that keeps heat in Earth's atmosphere, called the "greenhouse effect." The greenhouse effect is necessary for life on Earth but relies on a balanced carbon budget. The carbon in fossil fuels has been stored underground for millions of years. By removing this stored carbon from the earth and releasing it into the atmosphere, Earth's carbon budget is out of balance. This contributes to temperatures rising faster than living things on the Earth can adapt.

Coal

Video Resource

Coal 101 (2:49) Student Energy
https://youtu.be/iN6LvH_4Q3g

Coal is a black or brownish rock. We burn coal to create energy. Carbonization is the process that ancient organisms undergo to become coal. About 3 meters (10 feet) of solid vegetation crushed together into .3 meters (1 foot) of coal! We mine coal out of the ground to burn it for energy.

We can mine coal in two ways: underground mining and surface mining. Underground mining is used when the coal is located below the surface of the Earth, sometimes 300 meters (1,000 feet) deep—that's deeper than most of the Great Lakes! Miners take an elevator down a mineshaft. They operate heavy machinery that cuts the coal out of the Earth and brings it above ground. This can be dangerous work because cutting coal can release dangerous gases. The gases can cause explosions or make it hard for miners to breathe. Surface mining is used when the coal is located very near the surface of the earth. To get to the coal, companies must first clear the area of trees and soil. The coal can then be cut out of the ground more easily. Entire habitats are destroyed during this process.

About half the electricity in the United States comes from coal. When coal is burned, it leaves "by-products"

that are also valuable. We use the by-products to make cement, plastics, roads, and many other things.

Advantages and Disadvantages of Fossil Fuels

- Coal is a reliable source of energy. We can rely on it day and night, summer and winter, sunshine or rain, to provide fuel and electricity.
- Mining is one of the most dangerous jobs in the world. Coal miners are exposed to toxic dust and face the dangers of cave-ins and explosions at work.
- When coal is burned, it releases many toxic gases and pollutants into the atmosphere.
- Mining for coal can also cause the ground to cave in and create underground fires that burn for decades at a time.

Petroleum

Petroleum is a liquid fossil fuel. It is also called oil or crude oil. Underground rock formations trap petroleum. We drill through the earth to access the oil. Some deposits are on land, and others are under the ocean floor. Once oil companies begin drilling with a "drill rig," they can extract petroleum 24 hours a day, seven days a week, 365 days a year. Many successful oil sites have produced oil for about 30 years. Sometimes they can produce oil for much longer. When oil is under the ocean floor, companies drill offshore. They must build an oil platform. Oil platforms are some of the biggest manufactured structures in the world.

Video Resource

Oil 101 (2:16) Student Energy
https://youtu.be/UPAqfTNiais

Once the oil has been drilled, it must be refined. The oil contains many chemicals besides carbon, and refining the oil takes some of these chemicals out. We use oil for many things. About half of the world's petroleum is converted into gasoline. The rest can be processed and used in liquid products such as nail polish and rubbing alcohol or solid products such as water pipes, shoes, crayons, roofing, vitamin capsules, and thousands of other items.

Advantages and Disadvantages of Petroleum

- It is relatively inexpensive to extract. It is also a reliable energy source and income for the local community.
- In the form of gasoline, oil is a portable energy source that gives us the power to drive places.
- Petroleum is also an ingredient in many items that we depend on.
- Burning gasoline is harmful to the environment. It releases hazardous gases and fumes into the air that we breathe.
- The possibility of an oil spill is always present. If there is a problem with the drilling machinery, the oil can explode out of the well and spill into the ocean or surrounding land. Oil spills are environmental disasters, especially offshore spills. Oil floats on water, making it look like food to fish and ruining birds' feathers.

Video Resource

Oil Sands 101 (2:57) Student Energy
https://youtu.be/AuSJSRL4sjA

Natural Gas

Natural gas is another fossil fuel that is trapped underground in reservoirs. It is mainly made up of methane. The decomposing material in landfills also releases methane, which smells like rotten eggs. Natural gas is

found in deposits a few hundred meters underground. To get natural gas out of the ground, companies drill straight down. Natural gas does not form in big open pockets; it is trapped in rock formations stretching for kilometres. Some companies use "hydraulic fracturing," or fracking, to reach natural gas. Hydraulic means they use water, and fracturing means to "split apart." The process utilizes high-pressure water to split apart the rocks underground. This releases the natural gas that is trapped in rock formations. If the stone is too hard, the workers can send acid down the well to dissolve the rock. They can also use tiny grains of glass or sand to prop open the rock and let the gas escape. We use natural gas for heating and cooking. Natural gas can also be burned to generate electricity. We rely on natural gas to power our homes' lights, televisions, air conditioners, kitchen appliances and barns.

Video Resource

Natural Gas 101 (3:39) Student Energy
https://youtu.be/-njmj0diWu8

Natural gas can also be turned into a liquid form, called liquid natural gas (LNG). LNG is much cleaner than any other fossil fuel. Liquid natural gas takes up much less space than the gaseous form. The amount of natural gas that would fit into a giant beach ball would fit into a ping-pong ball as a liquid. LNG can be easily stored and used for different purposes. LNG can even be a replacement for gasoline.

Advantages and Disadvantages of Natural Gas

- Natural gas is relatively inexpensive to extract and is a "cleaner" fossil fuel than oil or coal.
- When natural gas is burned, it only releases carbon dioxide and water vapour (the same gases we breathe out when we exhale). This is healthier than burning coal.
- Extracting natural gas can cause environmental problems. Fracturing rocks can cause mini-earthquakes. The high-pressure water and chemicals forced underground can also leak into other water sources. The water sources used for drinking or bathing can become contaminated and unsafe.

Video Resource

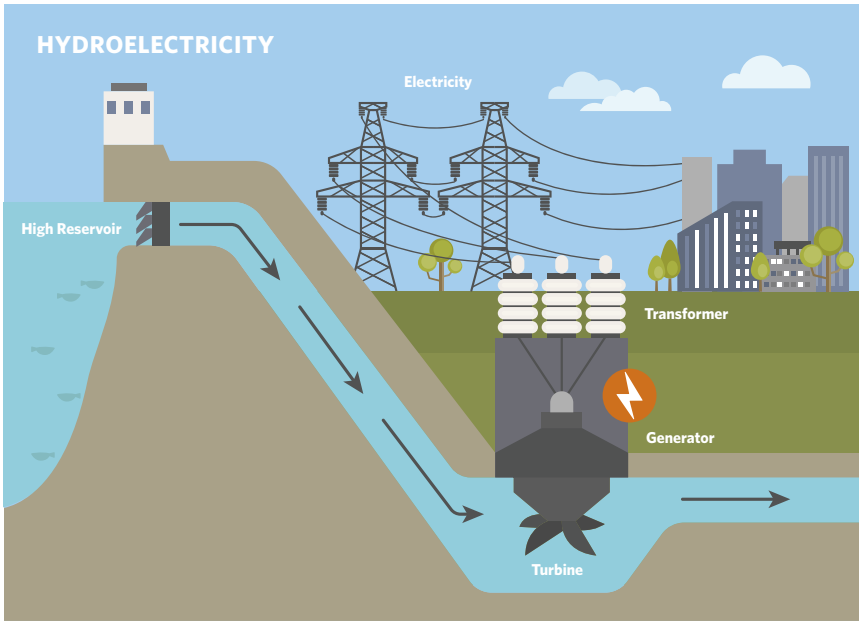
Renewable Energy 101 (1:32)
https://youtu.be/T4xKThjcKaE

2. Renewable Energy

- Renewable energy comes from natural sources that are replenished at a higher rate than consumed.
- Generating renewable energy creates far lower emissions than burning fossil fuels.

Hydropower (Water power)

Hydropower harnesses the energy of water moving from higher to lower elevations. It can be generated from rivers or manufactured lakes called reservoirs. Hydropower is currently the largest source of renewable energy in the electricity sector. The flowing water is passed through a turbine, spinning it, and generating electricity.



Graphic Source: https://4-h-canada.ca/programs/outreach-initiatives/powered-up

Tour/Speaker Idea!

Visit a hydro-electrical plant

Advantages and Disadvantages of Hydropower

- Large amounts of energy can be generated, and it is the world's most commonly used renewable energy source.
- Hydropower reservoirs often have multiple uses, like providing drinking water for a community, water for irrigation, flood and drought control, navigation services, and generating energy.
- Hydropower relies on generally stable rainfall patterns and can be negatively impacted by climate-induced droughts or changes in rainfall patterns.
- The physical structures necessary for creating hydropower can hurt the ecosystems of fish and wildlife and the communities surrounding the location. As a result, considerations need to be given to reduce the harm.
- Generally, small-scale hydro is an environmentally-friendly option.

Video Resource

Hydropower 101 (3:12) Student Energy
https://youtu.be/q8HmRLCgDAI

Solar

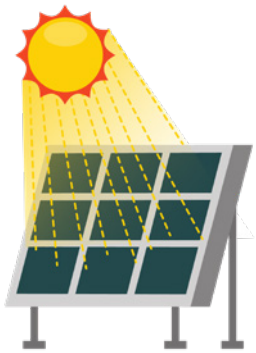
Video Resource

Solar 101 (1:00) Student Energy
https://youtu.be/yFwGpiCs3ss

Solar energy transfers the heat of the sun's rays into electrical energy. It is the most abundant of all energy resources and can be harnessed in cloudy weather. There are two ways that solar energy is harnessed. Thermal energy collects the sun's energy using black pipes to heat water running through the pipes and can be used to heat homes. Photovoltaic energy is captured in solar panels. The panels are made up of thin crystals that absorb the energy from the sun and turn that energy into electricity. The electricity then travels into a battery or to a power plant.

Advantages and Disadvantages of Solar

- Solar energy was once a costly source of energy. The cost of manufacturing solar panels has dropped drastically with new technology, and they generally have a lifespan of 30 years or more. Solar panels can also be tilted to follow the sun to gather energy throughout the day.
- The supply of solar power is abundant. The Earth receives more than enough energy from the sun to meet the world's current needs. Solar panels can be set up on a small scale, like your home or barn, or on large-scale businesses or land.
- This type of energy depends on the weather because solar panels generate more energy when sunny.



Video Resource

Solar Photovoltaics 101 (1:51) Student Energy https://youtu.be/gl5tY5Noacc

Video Resource

Solar Thermal 101 (2:48) Student Energy
https://youtu.be/FgjfJGfusdE

Wind

Wind energy harnesses the energy in moving air by using large wind turbines located on land (onshore) or in the sea (offshore). Turbines are tall metal fans that spin and turn wind energy into electricity. This energy has been used for thousands of years in windmills for grinding flour or pumping water. Technology has evolved recently to maximize the amount of electricity produced.

The Talbot Onshore Wind Project in Ridgetown, Ontario, has been in service since December 2010 and currently can serve 18,741 homes.

Tour/Speaker Idea!

Visit a wind turbine

Advantages and Disadvantages of Wind

- The potential to generate wind energy is found in most regions. Technological advances have maximized energy output. Wind turbines can be placed in different locations where the wind is the strongest.
- It isn't always windy, so wind isn't a constant energy source. Wind energy needs to be part of a system that includes other forms of energy generation.
- Wind turbines can cause harm to some wildlife like birds, bats and bees, so more research needs to be done to protect these animals.

Video Resource

Wind Power 101 (1:47) Student Energy
https://youtu.be/Z5c50-_hcD0

Geothermal

Geothermal energy utilizes thermal (heat) energy from the layers of melted rock below the Earth's surface. Volcanos and geysers are examples of where this heat energy is released. Once the hot fluids are at the Earth's surface, they can be used to generate electricity. Running water pipes close to this heat makes the water evaporate into steam. The steam is then used to spin turbines which generate electricity.

Advantages and Disadvantages of Geothermal

- Geothermal energy can be generated in any climate and at any time of year because the earth is constantly giving off heat.
- Current research is expanding the number of places where geothermal energy can be generated.
- Geothermal power plants can only be built where magma is close to the surface.
- The digging to connect with geothermal sources can release greenhouse gases from under the Earth's crust.
- Geothermal plants can be costly to build.

Video Resource

Geothermal 101 (2:08)
https://youtu.be/DFQrE91kZwk

Tidal

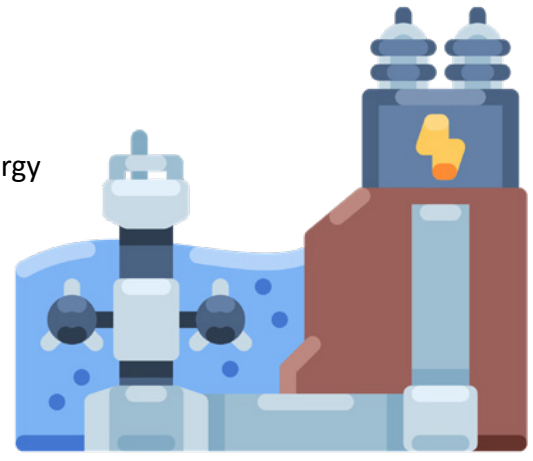
Ocean energy comes from using the waves or currents of ocean water to produce energy or heat. The tides rise and fall twice daily and are regulated by the moon as it orbits the Earth. The pull of gravity from the moon causes the oceans to rise and fall. Underwater turbines can generate energy. The turbines spin when the water passes through them, generating electricity.

Video Resource

Tidal Power 101 (2:15) Student Energy
https://youtu.be/VkTRcTyDSyk

Advantages and Disadvantages of Tidal

- Tidal energy systems are still at an early stage of development, with several methods and devices at a prototype stage, and they can be costly.
- There is always a tide, so it is a reliable energy source.
- No greenhouse gases are produced with this type of energy.
- There are limited locations where generators can be built.
- More research is needed to understand the effects of tidal energy generators on the ocean's ecosystems.



Biomass

Biomass energy is produced from energy found in plants and various organic materials such as wood (pellets), charcoal and agricultural by-products (manure) for heat and power production, and farming crops for liquid biofuels, including corn, soy and wood. Biomass systems include dedicated crops or trees, residues from agricultural and forestry, and various organic waste systems.

Advantages and Disadvantages of Biomass

- The energy created by burning biomass creates greenhouse gas emissions but at lower levels than burning fossil fuels like coal, oil or gas. There are also potential environmental impacts of large-scale deforestation and changes in land use if people do not replant biomass feedstocks as fast as they use them.

Video Resource

Biomass 101 (3:39) Student Energy
https://youtu.be/yHWcddUZ35s

Video Resource

Biofuels 101 (3:09) Student Energy
https://youtu.be/ZGmwtDffc74

Nuclear

Nuclear energy is a renewable energy source, but the material used in nuclear power plants is not—nuclear energy harvests energy from a chemical reaction. Nuclear fission is a process where the particles in uranium (an element found in the Earth's crust) are split and release a lot of energy. Nuclear power plants are complex machines that control nuclear fission to produce electricity. Uranium is a non-renewable resource.

Advantages and Disadvantages of Nuclear

- Nuclear power plants do not pollute the air or emit greenhouse gases.
- They can be built in rural or urban areas and do not destroy the environment around them.
- Nuclear power plants are very complicated to build and run. Many communities do not have the scientists and engineers to develop a safe and reliable nuclear energy program.
- Nuclear energy also produces radioactive material. Radioactive waste can be highly toxic, causing burns and increasing the risk of cancers, blood diseases, and bone decay among people exposed to it. "All radioactive waste generated in Canada is safely managed. The Canadian Nuclear Safety Commission (CNSC) regulates all steps in the management of radioactive waste in order to protect the health, safety and security of persons and to protect the environment."
- Mining for uranium has environmental impacts.
- Nuclear energy generation requires much water to cool the reaction. This water absorbs the heat and is pumped back into waterways, causing them to warm over time and affecting the ecosystem.
- Nuclear power plants may become a strategic target during times of political unrest.

Video Resource

Nuclear Energy – A Kid's Guide (2:45) UK National Nuclear Lab
https://youtu.be/uvhi4vju1TY
Note: a Pop-It is like a sheet of bubble wrap

Video Resource

Nuclear 101 (2:56) Student Energy
https://youtu.be/44ovdxOvP_A

Reference citations:

- Powered Up! Activity Book, 4-H Canada, Melina Found, June 2022.
- The Evolution of Energy and its Impact on the World, Energy Ecosystem (10:40) https://youtu.be/4Zc0R8J5BAA
- Energy and its surprising role in your life, Energy Ecosystem (8:07) https://youtu.be/8aEWxUHeE1s
- Non-Renewable Energy, National Geographic, Retrieved May 9, 2023, https://education.nationalgeographic.org/resource/non-renewable-energy/
- What is renewable energy? Retrieved May 15, 2023 https://www.un.org/en/climatechange/what-is-renewable-energy
- The world's most used renewable power sources. Retrieved June 2, 2023, https://www.power-technology.com/features/featurethe-worlds-most-used-renewable-power-sources-4160168/
- Radioactive Waste. Retrieved September 21, 2023, https://nuclearsafety.gc.ca/eng/waste/index.cfm
- Renewable energy. Retrieved June 2, 2023, https://www.enbridge.com/about-us/renewable-energy
- Unicef Global Goals, Retrieved February 17, 2024, https://www.unicef.ca/en/global-goals-sustainable-development-for-every-child%E2%80%99s-future?ea.tracking.id=20DIAQ01OTE&19DIAQ02OTE=&gad_source=1&gclid=Cj0KCQiAz8GuBhCxARIsAOpzk8x7VWv62mncBYwYYmyBEv-9kAx9wE2qAfft4yQc4pdi5e1m1Y7iOkEaArkyEALw_wcB
- Reference Material – Sustainable Development Goal 7: Affordable and Clean Energy
  - The United Nations is an international organization founded in 1945 and includes 193 Member States, including Canada. The UN and its work are guided by the purposes and principles contained in its founding Charter. A charter is a set of rules, promises and guidelines that a group agrees to. The UN is where the world's nations can gather, discuss common problems and find solutions.
  - The 2030 Agenda for Sustainable Development is a document all United Nations Member States adopted in 2015. It provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs). The SDGs are an urgent call for action by all countries. Developed countries like Canada and the United States are part of this work, and developing countries, including Haiti and Kenya, are also in this global partnership.

The countries recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

Video Resource

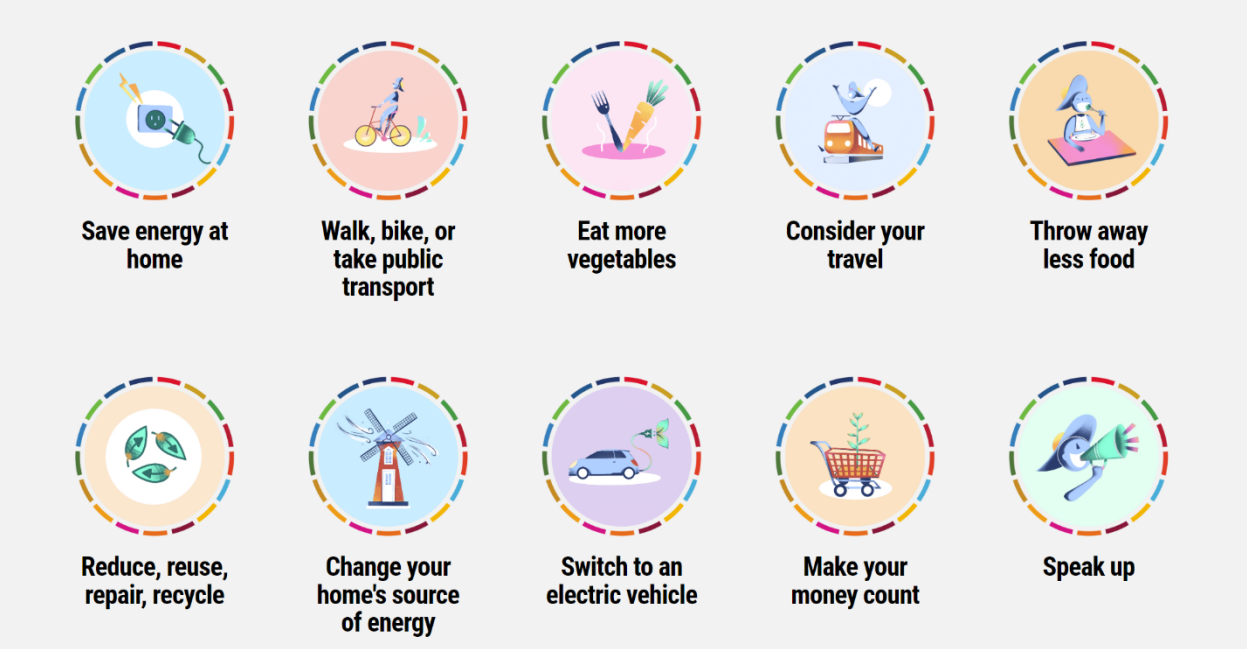
Energy Efficiency 101 (3:13) Student Energy https://youtu.be/D11iFUw_ImU

Sustainable Development Goal 7 (SDG7) ensures access to clean and affordable energy critical to developing agriculture, business, communications, education, healthcare and transportation. The lack of access to affordable and clean energy is a barrier to human and economic development. Progress towards achieving SDG7 is measured globally using these indicators:

- Access to Electricity – In Canada, 100% of citizens have access to electricity, and the global electricity access rate is 91% as of a 2020 report. However, one in five people still lack access to modern electricity.
- Access to Clean Cooking – In Canada, 100% of citizens have access to clean cooking, but in 2020 2.4 billion people rely on wood, charcoal or animal waste for cooking and eating, meaning they breathe smoke in when they cook every day.
- Renewable Energy – In Canada, 22% of total final energy consumption comes from renewable energy sources as of 2019. Ideally, the percentage of energy coming from renewable sources should be at least 30% to be on track for reaching our goals by 2050. Achieving the goal requires strengthening government policies and implementing practical tools.
- Energy Efficiency – In 2019, Canada's Country Value of energy efficiency was 6.9, while the global average was 4.7. The SDG target for all countries is 7.3. We are close to that goal, but we can still improve how efficiently we use our energy.

What Can We Do?

According to the United Nations: Act Now webpage, we can start with ten impactful actions. "Our lifestyles have a big impact on our planet. Our choices matter. Around two-thirds of global greenhouse gas emissions are linked to private households. The electricity we use, the food we eat, the way we travel, and the things we buy all contribute to a person's "carbon footprint," the amount of greenhouse gas emissions associated with an individual's actions. Start with these ten actions to help tackle the climate crisis."



Graphic Source: Transforming our world: the 2030 Agenda for Sustainable Development, https://sdgs.un.org/2030agenda

- **Energy campaign**
  Design an innovative renewable energy campaign to convince your school or family/friends to switch to renewable energy sources.

- **Equity in Access**
  Not everyone can afford to invest in renewable energy sources. How can people of all economic circumstances access renewable energy sources? Research this issue and share your findings.

- **Create a Message**
  Review the material and video resources in the Where Does Energy Come From? Resource material and choose one to make your own PSA (Public Service Announcement) to share with your club.

- **Energy System Map - https://studentenergy.org/map/**
  Explore the energy system on this interactive map created by Student Energy. It includes influences, sources, production, conversion, form, transport, distribution, use, and power. Share what you learn with the club in a display, video or PowerPoint presentation.

- **Be An Example**
  Living as an energy-wise example is often the best road to conquering energy waste. When your family and friends see that saving energy means not wasting and not going without, it will be easier for them to become an energy-wise example. Share your plans with at least three other people and record their reactions in a journal, in an audio clip, or in another way. Create a display that could be shared as part of the Achievement Program.

Tour/Speaker Idea!

Invite a representative from a natural gas supplier to speak.

Activity #6 – The Positives and Negatives of Energy

Do

Time: 15 minutes

Materials/Resources:

- Worksheet on page 17 of their Record Book
- Something that uses an AA, AAA or C battery and a battery

Instructions:

1. Ask the group if anyone knows how to change a battery. From the group that responds "yes," ask for a volunteer to show you how to change a battery.
2. Acknowledge that on a battery, there is an end that is a positive and a negative.
3. State that just as there is a positive and a negative on each battery, there are positives and negatives to the different energy sources.
4. Direct members to page 17 of their Participant Record Book and ask them to record one positive and one negative about each energy source discussed.
5. Use "Where Does Our Energy Come From?" on page 38 to explain the difference between renewable (resources that can naturally replenish themselves) and non-renewable sources (resources that are used up) of energy.
6. Share that everyone has a role in using energy responsibly. Ask the members to consider using energy responsibly as the various sources are shared.
7. Be sure to point out the positives (advantages/positives) and things to be aware of (disadvantages/negatives) for each type of energy.
8. Mention that most energy sources use a turbine to generate (harness) electricity.

Additional Activities:

- Use the videos listed to illustrate the different types and classifications of energy
- Insert local examples to illustrate the different types and classifications of energy
- Invite members to do research about the various sources of energy and share their findings with the group

Reflect

Learning Outcomes:

To introduce members to the positives and negatives of various sources of energy.

Apply

Discuss The Following Prompts As A Group

- Why is it important to use energy responsibly?
- What do we need to be mindful of when using energy?
- Was this easy or hard?
- How could you use energy more responsibly?
- Do you think how energy like electricity or gasoline is generated could be done more effectively? Do you have any ideas as to how this could happen?

THE POSITIVES AND NEGATIVES OF ENERGY

Where Does Our Energy Come From?

Energy is created by two kinds of sources, renewable and non-renewable.

Energy Source	Positive	Negative
Non-Renewable: Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes.		
Coal		
Oil/Petroleum		
Natural Gas		
Renewable: Renewable energy comes from natural sources that are replenished at a higher rate than consumed. Generating renewable energy creates far lower emissions than burning fossil fuels.		
Hydropower		
Solar		
Wind		
Geothermal		
Tidal		
Biomass		
Nuclear		

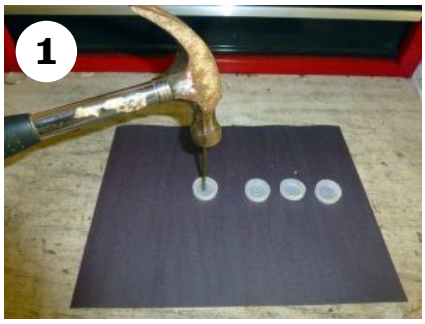
Activity #7 – Create Your Own Wind Turbine

Do

Time: 15 minutes

Materials/Resources:

- Dowel Rod (any size)
- 2 x 8" Wooden skewers
- Hammer and one large nail
- Hot glue gun and 1 x glue stick
- Marker
- 4 x 8 oz plastic water bottles
- Masking tape
- Empty thread spool



Instructions:

1. This experiment's first step is to remove all caps from your plastic bottles. Use a large nail to tap a hole into the center of each bottle cap. You should do this to all 4 of the plastic bottle caps. Place the lids back on the bottles. You may need help from your leader on this step.
2. You will create the blades for your wind turbine in this step. Use a marker and draw a rectangle on one side of your plastic bottle. Make sure to keep the bottle's end and neck intact (this rectangular shape will be used as your cutting line). Use your scissors to cut the rectangular section out of the middle of your bottle. Repeat this step for all four plastic bottles. You may need help from your leader on this step.
3. Using the tiny holes you nailed into your plastic bottle caps, place the bottles on the ends of the wooden skewers making sure a small part of the skewer pokes through the top of the bottle cap. You should now have two skewers with plastic bottles on both ends. You have successfully created the blades for your spinning turbine!
4. Tape the two skewers with the bottles on each end in a "+" pattern. You are taping the two skewers together in the middle.
5. Hot glue the center of your blades (the taped section) to the top of your thread spool. You may need help from your leader on this step.
6. Place a dowel rod into the opposite end of your thread spool. This step will allow the blades to spin. Align your 'cut-out' rectangles to face the same way.
7. Conclusions: As we finish our wind turbine, let's take a minute to review the essential parts.
   - Blades that catch the wind (the plastic bottles)
   - A spinning base (the thread spool)
   - A shaft to connect to the generator (our dowel rod)

Additional Activities:

- Create a pinwheel using paper, a pencil, and a push pin.
- Create a windmill design. Try a recyclable plastic container as the base and a popsicle stick with construction paper as the blades.

Reflect	**Learning Outcomes:** Members are familiar with how renewable energy sources work.
Apply	**Discuss The Following Prompts As A Group** • How does a wind turbine work? • What are the major elements needed to create a wind turbine? • Was this easy or hard? • How could you use a wind turbine in the real world? • Where would you find a wind turbine? • Do you think the size of the wind turbine makes a difference in how much electricity is produced?

Adapted from: Create Your Own Wind Turbine (Clearway Community Solar) https://www.clearwaycommunitysolar.com/blog/science-center-home-experiments-for-kids/create-wind-turbine/

Research It at Home

Create your unique wind turbine with items found around your house. Be sure to incorporate all the essential parts to make a wind turbine.

Activity #8 – The Lazy Person's Guide to Saving the World

Do

Time: 15 minutes

Materials/Resources:

- The Lazy Person's Guide to Saving the World Worksheet (https://www.un.org/sustainabledevelopment/wp-content/uploads/2018/10/LazyPersonGuide.pdf) on next page

Instructions:

1. Share that "The Lazy Person's Guide to Saving the World" was created by the United Nations to support the Sustainable Development Goals. Read the short introduction aloud to the group.
2. Divide the group into four groups.
    - To create the groups:
        - » Ask members to line up by the number of 4-H clubs they have completed. Count off 1,2,3,4,1,2,3,4… This method will ensure at least one more senior member in each group.
3. Share that Group 1 will look at the actions listed under Level 1, Group 2 will work with the list under Group 2, and so on.
4. Instruct groups to read through the actions listed at their level and choose one activity they think they could do.
5. Once they have identified the action, direct members to use their worksheets.
6. Point out the Things to think about section. Review the questions:
    - What supplies do I need?
    - Who do I need to talk to?
    - When would the best time be to take action?
7. Use the worksheet to break the action down into steps. Some activities may be easier to do than others, so if they choose a reasonably easy action and are done quickly, ask them to identify another possible action to try. Advise the groups that they should be prepared to share their activity and their plan with the group. The person who will be the presenter is the person with the birthday closest to the current day.
8. Give the groups 10 minutes to work. After 10 minutes, ask the groups to share their action and the steps they will take.

Additional Activity:

- Invite members to share the result of their action at a future meeting.

Reflect

Learning Outcomes:

Members are more familiar with Sustainable Development Goal 7 and actions they can adopt into their routines that will make a big difference.

Apply

Discuss The Following Prompts As A Group

- Why do small actions make a difference?
- What do we need to be mindful of when using energy?
- Was this easy or hard?

The LAZY PERSON'S guide to SAVING the WORLD

The Sustainable Development Goals are important, world-changing objectives that will require cooperation among governments, international organizations and world leaders. It seems impossible that the average person can make an impact. Should you just give up?

No! Change starts with you. Seriously. Every human on earth—even the most indifferent, laziest person among us—is part of the solution. Fortunately, there are some easy things we can adopt into our routines that, if we all do it, will make a big difference.

Have a look at just a few of the many things you can do to make an impact!

THINGS YOU CAN DO FROM YOUR COUCH

- Save electricity by plugging appliances into a power strip and turning them off completely when not in use, including your computer.
- Stop paper bank statements and pay your bills online or via mobile.
- Speak up! Ask your local and national authorities to engage in initiatives that don't harm people or the planet. You can also voice your support for the Paris Agreement and ask your country to ratify it or sign it if it hasn't yet.
- Turn off the lights. Your TV or computer screen provides a cosy glow, so turn off other lights if you don't need them.
- Do a bit of online research and buy only from companies that you know have sustainable practices and don't harm the environment.
- Report online bullies. If you notice harassment on a message board or in a chat room, flag that person.
- In addition to the above, offset your remaining carbon emissions! You can calculate your carbon footprint and purchase climate credits from Climate Neutral Now. In this way, you help reduce global emissions faster!"

THINGS YOU CAN DO FROM HOME

- Air dry. Let your hair and clothes dry naturally instead of running a machine. If you do wash your clothes, make sure the load is full.
- Take short showers. Bathtubs require gallons more water than a 5-10 minute shower.
- Eat less meat, poultry, and fish. More resources are used to provide meat than plants
- Compost—composting food scraps can reduce climate impact while also recycling nutrients.
- Recycling paper, plastic, glass & aluminium keeps landfills from growing.
- Buy minimally packaged goods.
- Plug air leaks in windows and doors to increase energy efficiency
- Adjust your thermostat, lower in winter, higher in summer
- Replace old appliances with energy efficient models and light bulbs

THINGS YOU CAN DO IN YOUR NEIGHBOURHOOD

- Shop local. Supporting neighbourhood businesses keeps people employed and helps prevent trucks from driving far distances.
- Let your favourite businesses know that ocean-friendly seafood is on your shopping list.
- Shop only for sustainable seafood. There are now many apps that will tell you what is safe to consume.
- Bike, walk or take public transport. Save the car trips for when you've got a big group.
- Use a refillable water bottle and coffee cup. Cut down on waste and maybe even save money at the coffee shop.
- Bring your own bag when you shop. Pass on the plastic bag and start carrying your own reusable totes.
- Take fewer napkins. You don't need a handful of napkins to eat your takeout. Take just what you need.
- Shop vintage. Brand-new isn't necessarily best. See what you can repurpose from second-hand shops.
- Donate what you don't use. Local charities will give your gently used clothes, books and furniture a new life.
- Take advantage of your right to elect the leaders in your country and local community

THINGS YOU COULD DO AT WORK

- Give fruits or snacks that you don't want to someone who needs and is asking for help.
- Does everyone at work have access to healthcare? Find out what your rights are to work. Fight against inequality.
- Mentor young people. It's a thoughtful, inspiring and a powerful way to guide someone towards a better future.
- Voice your support for equal pay for equal work.
- Lend your voice to talk about the lack of toilets in many communities around the world!
- Make sure your company uses energy efficient heating and cooling technology.
- Raise your voice against any type of discrimination in your office. Everyone is equal regardless of their gender, race, sexual orientation, social background and physical abilities.
- Bike, walk or take public transport to work.
- Save the car trips for when you've got a big group.
- Organize a No Impact Week at work.
- Learn to live more sustainably for at least a week: un.org/sustainabledevelopment/be-the-change.

Action:

Things to think about:

- What supplies do I need?
- Who do I need to talk to?
- When would the best time be to take action?

Steps to action:

1.

2.

3.

4.

Notes:

Reference citations:

- Transforming our world: the 2030 Agenda for Sustainable Development https://sdgs.un.org/2030agenda
- The United Nations: Peace, dignity and equality on a healthy plant https://www.un.org/en/about-us
- Tracking SDG 7, About Us https://trackingsdg7.esmap.org/about-us
- 7 Affordable and Clean Energy https://www.un.org/sustainabledevelopment/energy/#:~:text=Goal%207%20is%20about%20ensuring,hinders%20economic%20and%20human%20development.
- The United Nations: Act Now, https://www.un.org/en/actnow
- SDG7 Report 2022 – Executive Summary https://trackingsdg7.esmap.org/data/files/download-documents/sdg7-report2022-executive_summary.pdf

Energy Savings Begin at Home!

Meeting 3 – Energy Savings Begin at Home!

Setting Objectives:
- To learn how energy is used in the home and ways to save energy and money.

Suggested Learning Outcomes:
- Members recognize how energy is used in the home
- Members learn tips that can save energy and money

Reference Material in this Section:
- Energy Use at Home
- 12 Questions about Energy Use at Home
- Understanding Your Electricity Bill
- Net-Zero Homes

Activities:
- Activity 9: Test your knowledge of home energy consumption
- Activity 10: Insulate Windows for Cold Weather
- Activity 11: Build Your Own Aerator
- Activity 12: Judging Laundry Detergent
- Activity 13: Energy from Garbage – Part 1

SAMPLE MEETING AGENDA Time: (generally) 2 hours 15 minutes

Welcome, Call to order, Pledge		5 minutes
Roll Call	Invite each member to share their name and response to the At Home Challenge you asked them to complete at the end of Meeting 2. Looking at the list of appliances you brought from home, name one way your family can use less energy.	5 minutes
Topic Information Discussion	Energy use at home.	5 minutes
Activities Related to Topic	**Activity 9: Test your knowledge of home energy consumption** *Do this quiz before the 12 Questions about Energy Use at Home topic information discussion to understand what your members know about saving energy.	15 minutes
Topic Information Discussion	12 Questions about Energy at Home • Review the entire list or choose five questions that best fit your group and focus on them. • Demonstrate different aspects while sharing the information.	20 minutes
Activities Related to Topic	**Activity 10: Insulate Windows for Cold Weather** **Activity 11: Build Your Own Aerator**	20 minutes 20 minutes

Topic Information Discussion	Understanding Your Electricity Bill	5 minutes
Activities Related to Topic	**Activity 12: Judging Laundry Detergent**	15 minutes
Topic Information Discussion	Net-Zero Homes	10 minutes
Activities Related to Meeting 4	**Activity 13: Energy from Garbage – Part 1**	10 minutes
Wrap-Up, Adjournment & Social Time	Recap topics covered in this meeting and review the At Home Challenge	5 minutes
At Home Challenge	Focus on one day before the next meeting and list all the ways you use energy in a day. Be sure to include the energy used in the space around you (e.g., furnace or air conditioner, lights) and the activities you might be doing (e.g., using a computer, vacuuming). Or choose one of the At Home Activities found throughout the meeting.	

Notes to Leader:
You can demonstrate some of the concepts depending on where you are holding your meeting. Cues are included in the text. A visit to a hardware store or home improvement store provides an excellent venue for the content of this meeting. Ask local hardware stores, contractors, hydro services, etc., to donate material to use while demonstrating the concepts.

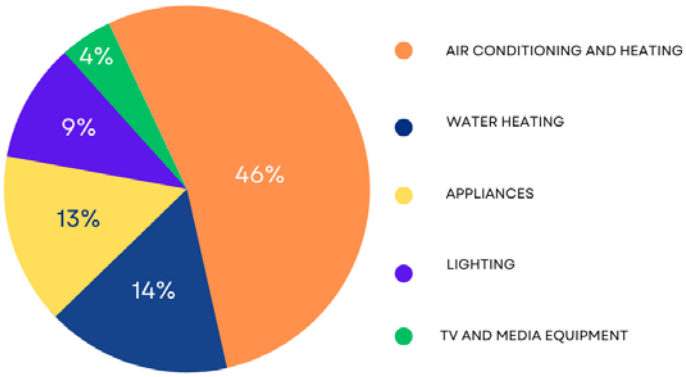
12 Questions About Energy at Home

The following 12 questions are about energy use at home. Canadian households spent $4,524 on average on energy in 2019.

What uses the most electricity in my home?

Here's a breakdown of the most significant energy use categories in the typical home:

1. Air conditioning and heating: 46 per cent
2. Water heating: 14 per cent
3. Appliances: 13 per cent
4. Lighting: 9 per cent
5. TV and Media Equipment: 4 per cent



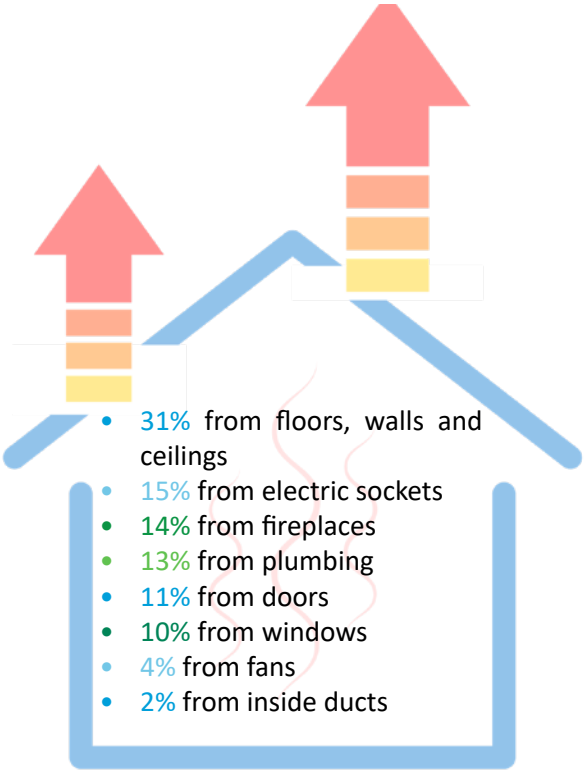
What Uses the Most Electricity in My Home?
https://www.directenergy.com/learning-center/what-uses-most-electricity-in-my-home

1. What's the big deal with drafts and heat escaping?

Heat losses in a home can quickly raise your energy bill.

But where does the heat escape from?

Of course, heat leaks can vary significantly from one house to another, depending on the specific characteristics of each home. However, it is generally noted that heat escapes from the following places:



Video Resource

How to Install Door Weatherstripping, The Home Depot Canada (2:07)
https://youtu.be/Vy0JtpvGdHA

What you can do:

- **Weatherstripping** – can cut the cost of heating and cooling up to 10%
  Weatherstripping is sealing openings around movable building components such as doors and windows to keep water out and interior air inside a structure. Weatherstripping can also reduce noise. Weatherstripping is generally made of felt, vinyl, rubber, silicone or foam.
- **Insulation**
  Insulation is a material used to reduce the heat flow in a building. It blocks heat from entering the home in the summer and holds the heat in during the winter. It is considered a homeowner's best defence against high fuel bills.

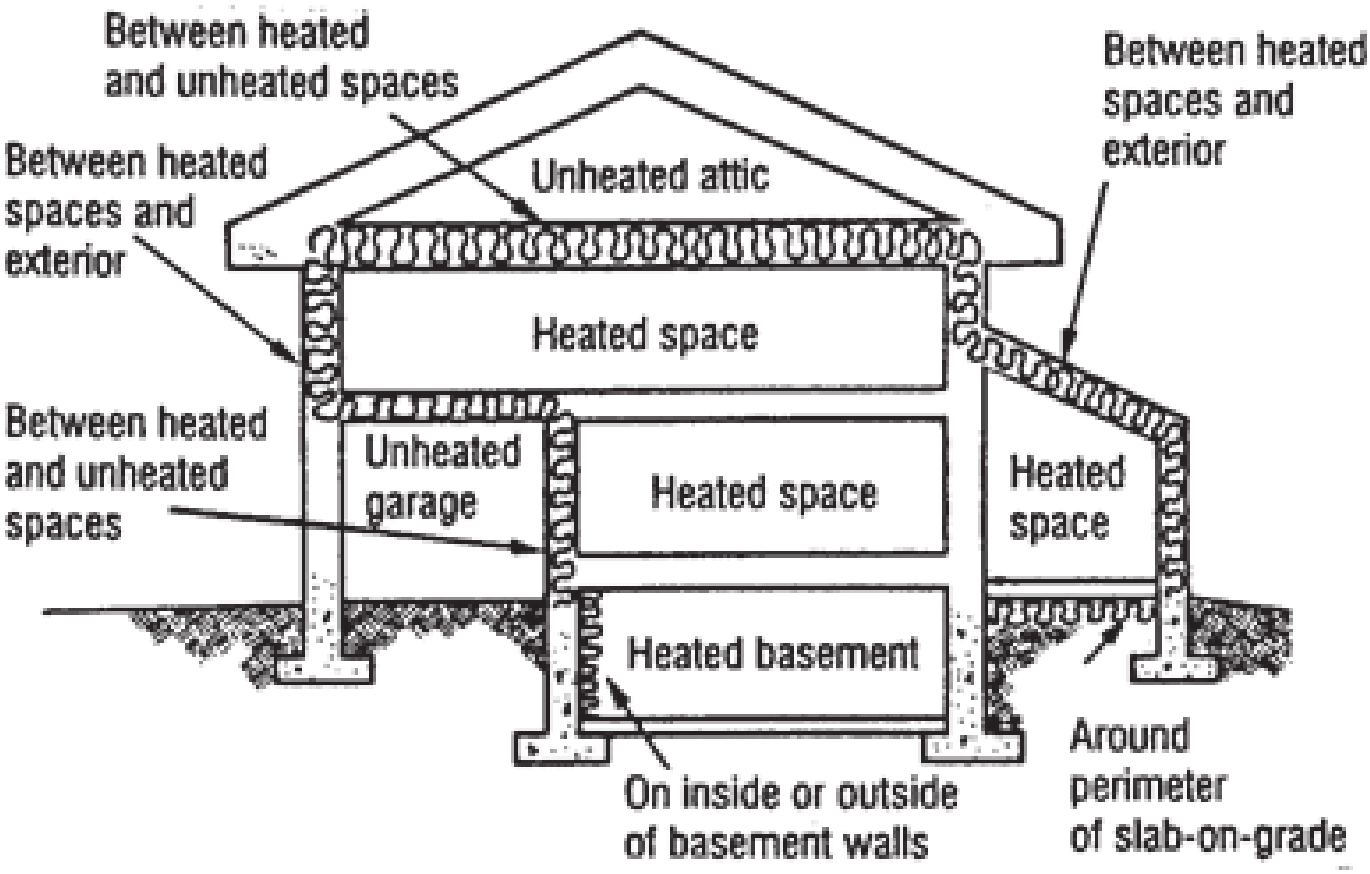
Show It!

Bring in different types of insulation to illustrate the different types as you speak about them.
Take the members to places in the building where the meeting is being held and show them where insulation is located.

TYPE	WHAT IS IT?	WHERE DOES IT GO?	WHY DO YOU NEED IT?	DIY TIPS
 BATTING	Glass fibers in puffy strips with or without a paper face.	Attics, walls, and between crawl space joists.	Stop heat loss into your attic. Wall insulation keeps out cold.	Don't compress or flatten the batting. It reduces the R-value.
 BLOWN-IN	Loose cellulose or fiberglass that's blown into attics.	Attics and some walls where there's no existing insulation.	Loose insulation fills in around odd shapes and cavities.	Ask a Lowe's associate about blowers to rent or borrow.
 SPRAY FOAM	Expanding foam enlarges as it cures; other types cure in the shape they're sprayed.	Where pipes or wires enter a house and around windows where batting can't reach.	Plugs hard-to-fill gaps.	Non-expanding foam around windows and doors prevents bowing the frames.
 RIGID FOAM	Sheets of extruded or expanded polystyrene.	Tuck between joists above the basement or crawlspace.	Foam boards insulate while providing a partial vapor barrier.	Seal rigid foam panels between foundation joists using spray foam.
 SPECIALTY	Pipe insulation, duct insulation, and water heater jackets.	Around objects that store or distribute hot water and indoor air.	Keeps water hot; insulates ducts that pass through cold attics.	Insulate pipes wherever condensation is a problem.

Source: Canadian Home Inspection Services
https://www.canadianhomeinspection.com/home-reference-library/attic-roof-space/insulation/

WHERE TO INSULATE



Source: Canadian Home Inspection Services
https://www.canadianhomeinspection.com/home-reference-library/attic-roof-space/insulation/

2. How does a programmable thermostat save energy?

Programmable thermostats, or smart thermostats, were designed to help save on energy by automatically cutting back on energy consumption via heating and cooling when they are the least likely to be in use. Ideally, they can help save on home energy costs by limiting the amount of energy that is consumed when the homeowners are at work; it can also help businesses save on energy costs by limiting the amount of energy that is consumed when the business is closed (for instance, overnight or on weekends).

Set your thermostat to 16 degrees C in the winter when you are away at work/school during the day or at night when you sleep.

The usual settings should be 21 degrees Celsius in the winter and 26 degrees Celsius in the summer.
Programmable thermostats can be programmed to turn the heat down (or raise the temperature on air cooling systems) during the hours it is least likely needed and to turn the heat back up (or the A/C back on) for when the homeowner gets home. It's an automated solution for individuals who often forget to adjust their heat settings before they leave or for those who want to participate in savings but still want to walk into a comfortable house when they get home from work. It's also an ideal solution for individuals on time-of-use (HOEP) rate plans.
In theory, programmable thermostats provide an excellent opportunity for home energy—and even workplace—savings.

On average, nearly half—42 percent—of home energy costs go to heating and cooling the home, and a lot of the time, those costs are being put towards heating empty or unused spaces; for instance, when the homeowners are at work, the kids are at school, or the household is sleeping. Programmable thermostats will automatically turn the heat down during those periods, which carries significant potential for savings. Research has shown that turning the thermostat down by one degree Fahrenheit (approximately 0.55 degrees Celsius) for around eight hours can reduce your energy consumption by 1 percent. Turning the heat down 10 degrees Fahrenheit (5.5 degrees Celsius) while you are at work for eight hours and asleep at night could reduce your energy consumption by 10 percent.

Installing a programmable thermostat has been suggested to have the potential to save homeowners between 10 and 30 percent on the heating and cooling portions of their energy bills; however, several consumers have reported much lower savings after installation, and some have even experienced an increase in energy use. While programmable thermostats help individuals save on energy when they are not at home, many set their thermostats higher than usual (or lower than average in the summer) for when they are home, causing the energy savings to be lower than anticipated.

Programmable thermostats can help you save up to 10% on your energy consumption compared to a conventional thermostat.

The bottom line is that programmable thermostats can help, but you must be proactive.
Other things you can do to save energy include:

- You can also close the air ducts to areas of your home that you are not using to experience heating and cooling savings.
- Draw your curtains during sunny summer days, but open them during the winter to get free heat from the sunshine.
- Don't block inside vents or outside units.
- Use blankets for extra wintertime warmth.

Video Resource

Programming your Thermostat – Natural Resources Canada (2:56)
https://youtu.be/izEcRomoetY

3. What is a heat pump, and how does it work?

Heat pumps are a proven technology used for decades in Canada and globally to provide heating, cooling efficiently, and sometimes hot water to buildings. You likely interact with heat pump technology daily: refrigerators and air conditioners operate using the same principles and techniques.

Heat Pump Basic Concepts

A heat pump is an electrically driven device that extracts heat from a low-temperature place (a source) and delivers it to a higher-temperature area (a sink).

To understand this process, think about a bicycle ride over a hill: no effort is required to go from the top of the hill to the bottom, as the bike and rider will naturally move from a high place to a lower one. However, going up the hill requires much more work as the bike moves against the natural direction of motion.

Similarly, heat naturally flows from places with higher temperatures to locations with lower temperatures (e.g., in the winter, heat from inside the building is lost to the outside). A heat pump uses additional electrical energy to counter the natural flow of heat and pump the energy available in a colder place to a warmer one.

So how does a heat pump heat or cool your home? The source's temperature is reduced as energy is extracted from a source. If the home is the source, thermal energy will be removed, cooling this space. This is how a heat pump operates in cooling mode and is the same principle used by air conditioners and refrigerators. Similarly, as energy is added to a sink, its temperature increases. If the home is used as a sink, thermal energy will be added, heating the space. A heat pump is fully reversible, meaning that it can both heat and cool your home, providing year-round comfort.

4. Keep up good habits with your air conditioner

Clean or replace your air conditioner filters once a year.

When it's very hot, limit your use of appliances that generate heat, like an oven. Use them during cooler periods when your air conditioner is turned off.
Rather than cranking up your air conditioner, use a ceiling fan to circulate cool air.

Video Resource

Adapting heat pumps to our Canadian climate, Natural Resources Canada (2:10)
https://youtu.be/-wTRGbDY7Kk

Remember:

- Run your ceiling fans counterclockwise in the summer to create a breeze.
- Run your ceiling fans clockwise in the winter to draw the hot air back into the room.

Try It!

Show how to change a ceiling fan's direction and feel the airflow change.

5. How can I save water in the bathroom?

Enjoy a nice hot shower, and lower your energy consumption at the same time by using an efficient showerhead and faucet aerators. You reduce your hot water consumption by about eighteen litres or 12% of a 150-litre hot water tank.

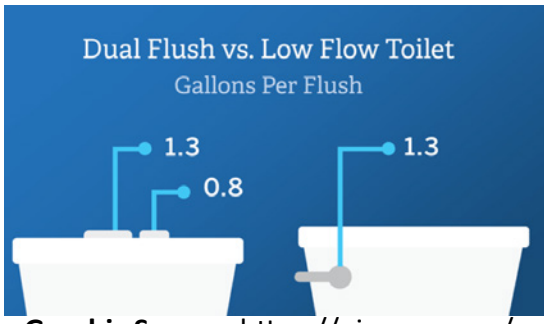
Set your water heater at 49 degrees Celsius to prevent the growth of harmful bacteria and scalding.
A shower with a regular shower head uses 7 litres of water per minute. That's the same amount as 3 ½ large bottles of pop.

Other things that you can do in the bathroom:

- Use a low-flow toilet with 4.8 litres per flush to save water.
- Have the toilet repaired if it leaks. A leaky toilet can waste over 2000 litres of water in a week!
- Add a timer switch to your bathroom fan.
- Buy a faucet aerator to use less hot water.
- Repair leaky faucets and install a faucet aerator. One drop a second from a leaky faucet could waste enough water every month to fill 16 bathtubs!

Try It!

Next time you bathe, measure and record the water depth in the tub. Next time you shower, keep the plug in the drain and record the depth of water when you finish. Is there a difference? How long was your shower?



Graphic Source: https://pipespy.com/blog/low-flow-toilet-problems/

Show It!

Show what a low-flow shower head and a low-flow toilet tank look like and point out how water is saved.

6. How can I save money when doing the laundry?

- Cold water wash – Your washer uses about 75-90 percent of its energy heating water. Switching your temperature settings from hot to warm can cut energy consumption in half – and shifting from warm to cold can save even more. Detergents made for cold water washing have enzymes that can start to work in colder temperatures.
- Line dry – Air-drying your clothes spares your energy bill an extra dry cycle and adds to your favourite T-shirt's shelf life.
- Wash bigger loads – Your washing machine will use the same amount of mechanical energy whether you select "small" or "super." Take advantage of the electricity you're using by washing larger loads but don't overload your washer or dryer.
- Choose high-speed or extended spin – less water in the wet laundry reduces drying time.
- Clean the dryer's lint trap – When you use your dryer, remove the leftover lint after each cycle. This improves air circulation and allows your dryer to work faster, wasting less electricity.
- Don't overfill – ensure airflow in your dryers to reduce the strain on your dryer's motor.
- Dry on moisture sensor mode – Instead of setting your dryer for an exact time, try the moisture sensor mode, which automatically ends the cycle as soon as the clothes are dry. It saves time and can reduce your bill.

- Run your machines at night or early in the morning – Many energy companies charge extra for electricity during their peak hours between 7 am and 7 pm when they see increased energy use. Check your local electricity provider's website to find the peak hours locally.

7. How can I ensure my natural gas appliances are properly maintained?

Annual maintenance performed by a qualified professional will help maintain your appliances' efficiency and prevent energy loss. Here are a few steps you can do yourself:

Hot air heater

- Wash or change the air filters during the cold season.
- Clean the air vents at the front of the unit to prevent dust from clogging the burner.
- Use latex sealants to seal hot air leaks at duct joints.

Radiators

- Vacuum the radiator fins regularly for better air circulation.

Hot water tank

- Make sure the temperature is at its optimal level, 49 degrees Celsius.
- Insulate the hot water pipes, especially those located in unheated areas.
- Install flow reducers. Flow reducers are placed into the water line to reduce the space that the water can flow through.

Show It!

Show what a low-flow shower head and a low-flow toilet tank look like and point out how water is saved.

8. What are some ways to save energy in the kitchen?

Our kitchens are full of ways we can reduce our energy consumption. Our sink, dishwasher, oven, and kitchen appliances consume over 13 percent of our household energy.

- Purchasing Energy Star-certified refrigerators, dishwashers, and stoves will ensure you use the most energy-efficient appliances.
- Set your refrigerator to 4 degrees Celsius and your freezer to -18 degrees Celsius.
- Allow the air to flow, don't overfill your fridge.
- Keep your fridge away from heat sources like vents, the oven, and a window that gets a lot of sun.
- Use the microwave or air fryer instead of the oven as much as possible. A microwave or air fryer can

often do the same job as an oven in less time.

- Keep the doors of your refrigerator and freezer airtight.
- Fill up your dishwasher before running it, but don't overfill it. If it is too full, you may not get your dishes clean.
- Run your dishwasher at night to save money because the energy rates are lower.
- Use your dishwasher's air-dry cycle, saving up to 50% of your dishwasher's energy usage.
- Scrape dishes, don't rinse: let the dishwasher do the rest.
- Keep your oven door closed so the hot air doesn't escape.
- Install an Energy Star-certified range hood to use 50% less energy than a standard one
- Match your pots and pans to the appropriately sized burner. Using a large burner for a small pan wastes about 40% of the heat it creates.

Show It!

Point out where the temperature controls are on a refrigerator or freezer.
Examine the different settings on a dishwasher and emphasize the power-saving options.
Provide three different sizes of pots and ask members to choose the best pot for each burner.

9. What is the best kind of lightbulb to use?

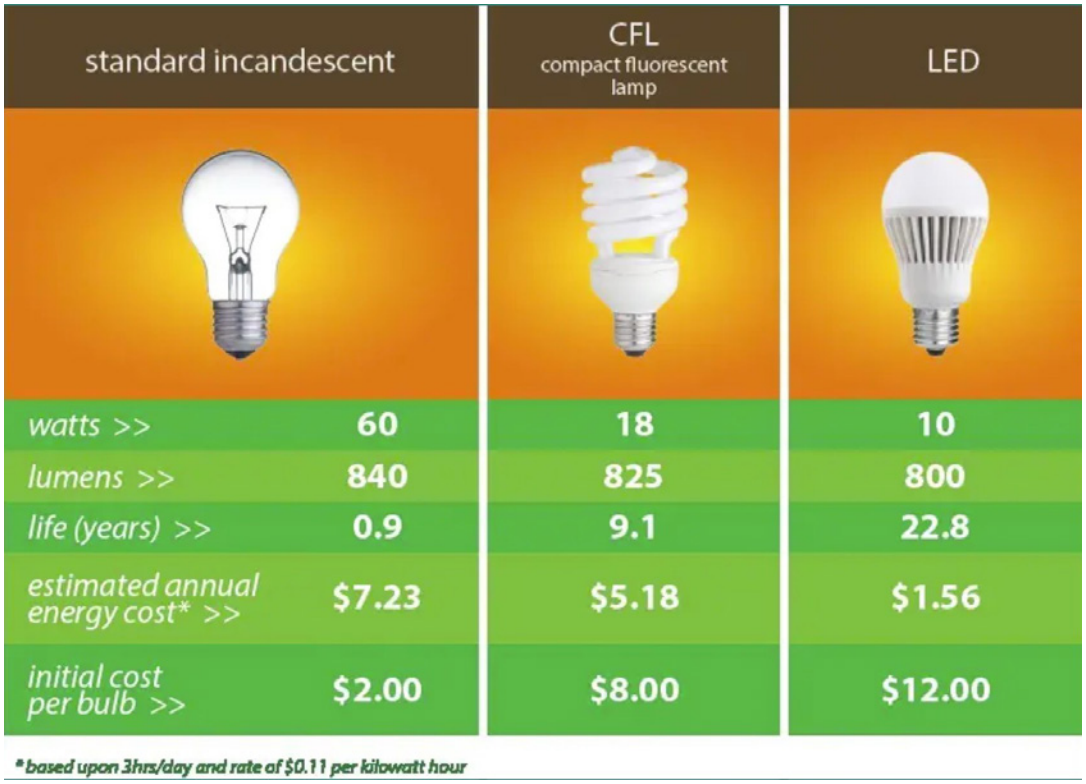
Incandescent lightbulbs are traditional lightbulbs with a wire filament that is heated using electricity until it glows. The filament is enclosed in a glass bulb holding a vacuum or inert gas to protect the filament from oxidation.

Video Resource

LED Explained, Full Spectrum Solutions (3:19)
https://youtu.be/XvRXrAiv3pY

Compact fluorescent lightbulbs have a coating of a fluorescent material within them. When an electric current energizes this layer, it emits light. These bulbs are more energy efficient than incandescent bulbs.

LED bulbs are replacing the traditional incandescent and fluorescent lightbulbs. LED lightbulbs use 80% less energy and last 25 times longer than conventional lightbulbs.



Graphic Source: Consumer Energy Solutions https://consumerenergysolutions.com/commercial-energy/

Compare It!

Provide three different types of light bulbs, ideally incandescent, compact fluorescent and LED, in their original packaging. Let members examine the different types and discuss the strength and qualities of each type.

10. What is phantom power loss?

Video Resource

How Modern Light Bulbs Work, MinutePhysics (2:57)
https://youtu.be/oCEKMEeZXug

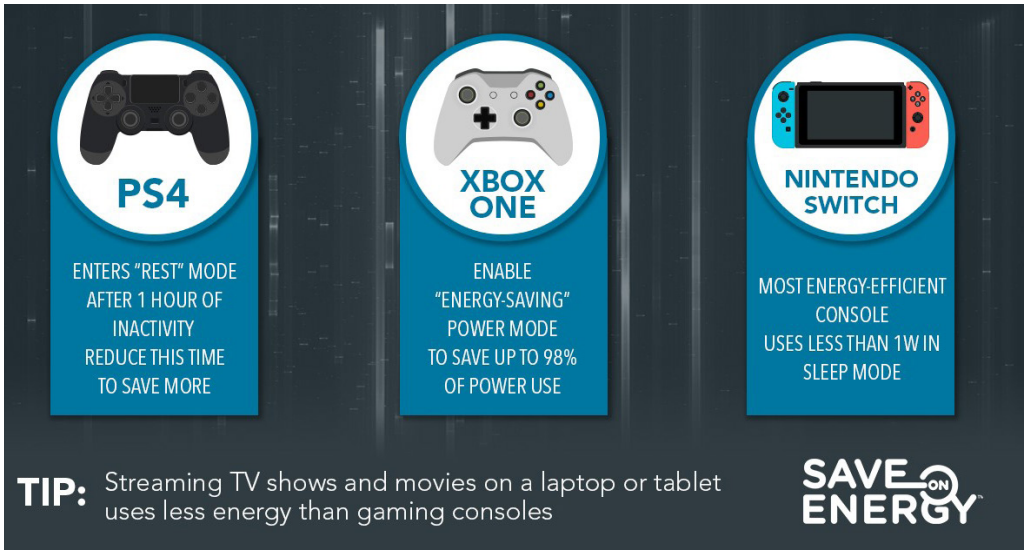
Did you know that when your appliances or electronic devices are plugged in, they drain energy – even if they're not in use?

Phantom power, vampire energy or it is also called standby power, refers to the energy that's wasted around your home when devices are plugged in and using power, but you're not actively using them.

Think about all the devices currently plugged in at home: laptops, gaming consoles, coffee makers, DVD players, cellphone chargers, TVs, kitchen appliances, alarm clocks, and even electric toothbrushes. The average home has dozens of items plugged in at any given time. Moreover, 75 percent of these devices' electricity is used when they aren't even on. That's a lot of energy. All that phantom power can add up to 10 percent of a home's energy costs.

Depending on the model and its settings, some gaming consoles use significant energy in standby mode when you're not enjoying them. Wouldn't you rather spend money on a new game instead of keeping your console running when you're not around?

The same is true for other appliances you might not think about, including small kitchen appliances. With increasingly more smart devices connected to your network, phantom power is likely more of an issue than just five years ago.



Graphic Source: https://www.saveonenergy.ca/

So, how can I save?

Unplug - The easiest way to save on phantom power is to unplug your devices when not in use. You can use power bars to manage what's on for devices that aren't easy to unplug.

Get a power bar – Plug devices into a power bar. Switch the power bar off when you are not using them, and they won't use any more energy. You can even find power bars with built-in timers or auto shut-off capabilities, motion sensors, and infrared (IR) sensors (which automatically cut power when they've been out of use for a certain length of time) to ensure you're not falling victim to phantom power.

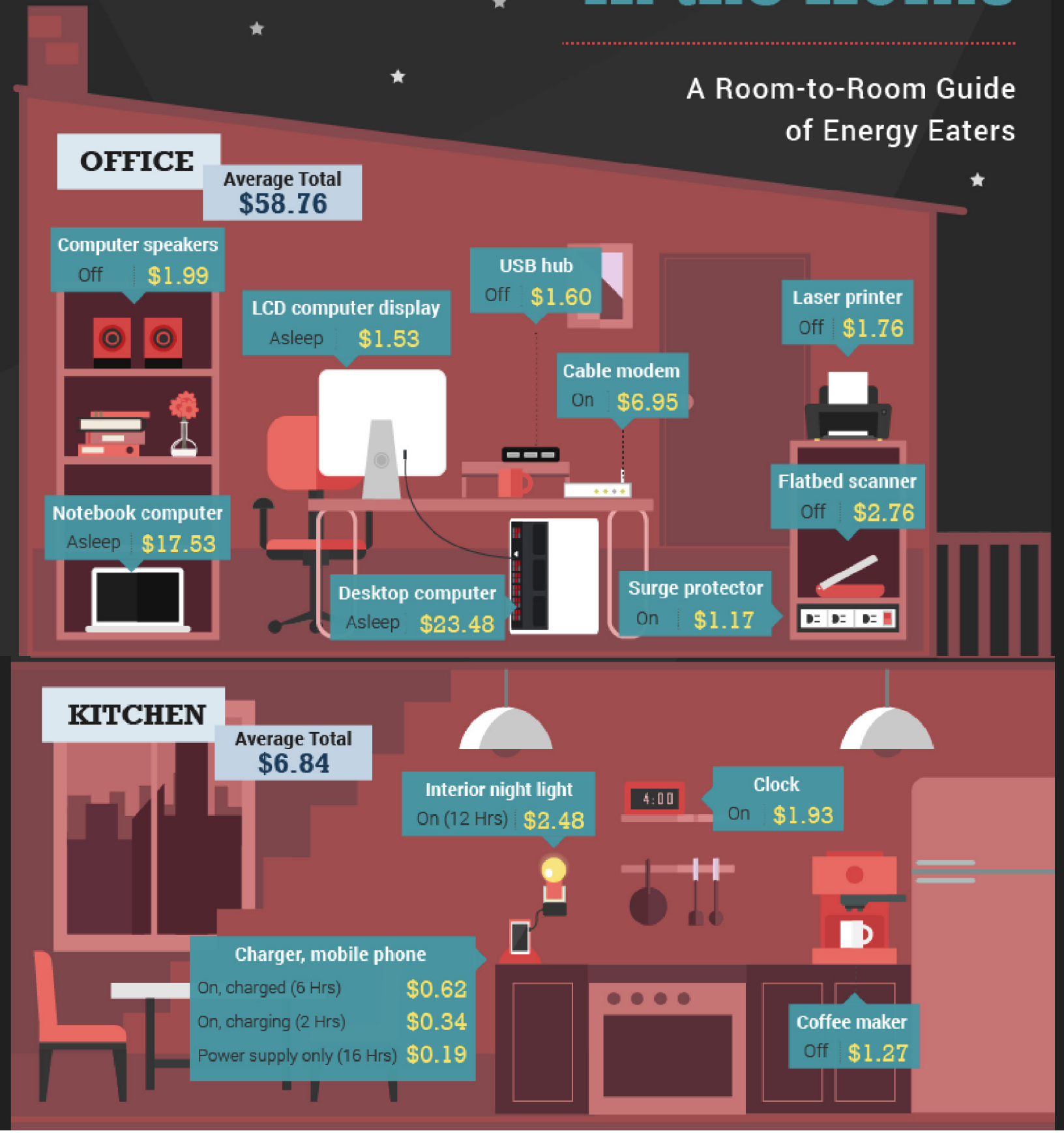
Look for power-saving settings - Game consoles and other entertainment equipment often have power-saving settings and settings that limit automatic updates. That way, even if plugged in, they may use less phantom power.

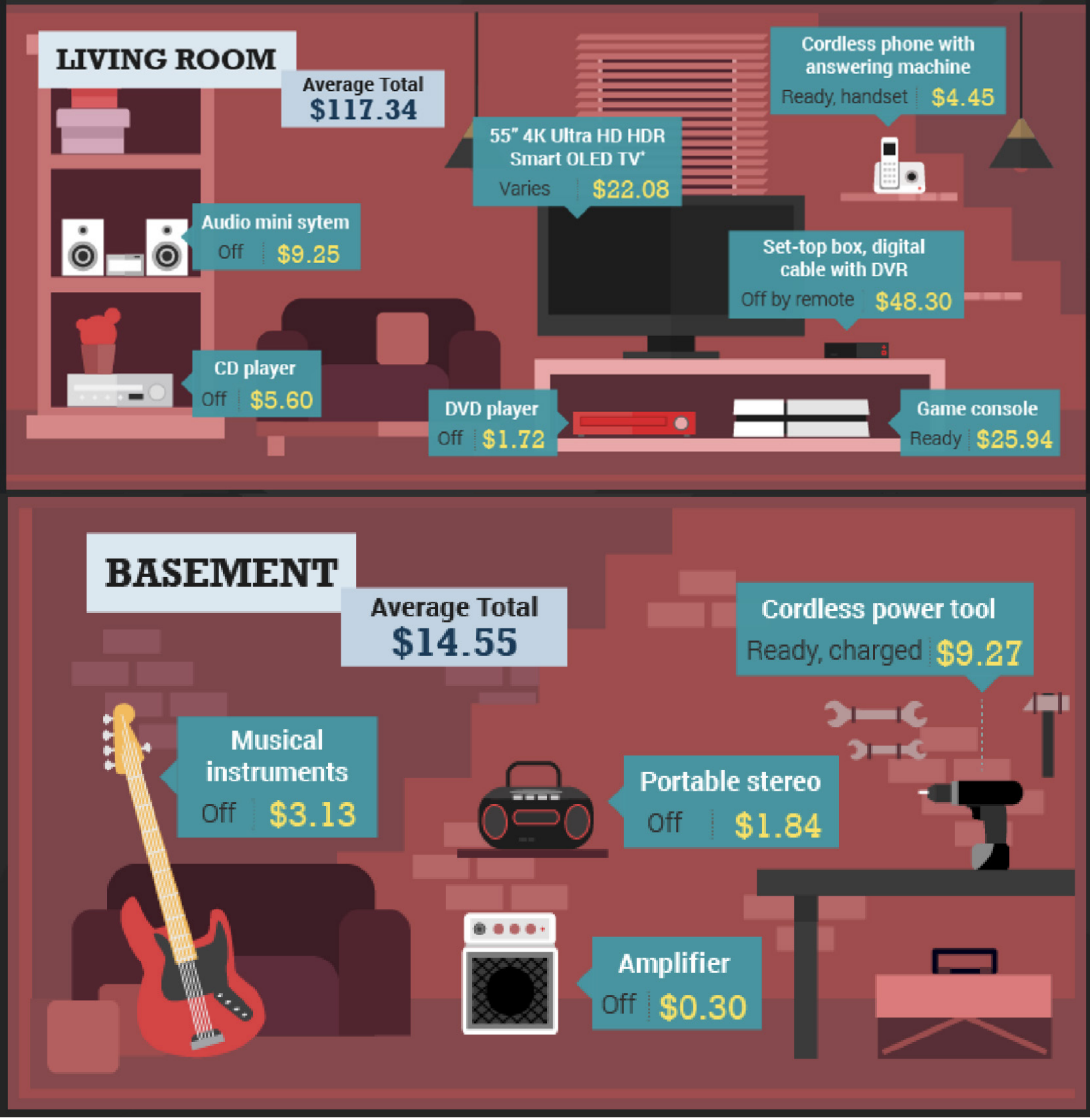
Turn your devices off rather than leaving them on idle or in sleep mode – Turning electronics off will decrease costs.

Replace old appliances with those from energy-saving brands - look for the Energy Star when shopping for any electronic device. Make sure that you're buying Energy Star-certified products. Using less phantom power is a criterion for becoming certified as Energy Star.

Vampire Energy in the Home

A Room-to-Room Guide of Energy Eaters





Graphic Source: Mapping Vampire Energy: The Hidden Costs of Unused Electricity in Your Home, https://www.saveonenergy.com/resources/mapping-vampire-energy/

Note: Unless otherwise noted, all costs were estimated based on the device being in the stated mode for 24 hours daily. Average phone charging time was estimated using average charging times for Apple iPhone 6 and Samsung Galaxy 7 from phonearena.com

Estimated cost based on LG 55 Class 216p 4K Ultra HD HDR Smart OLED TV – OLED55B7A
Costs are calculated per year by the device.

11. How do you read an EnerGuide label?

The black-and-white EnerGuide label shows how much energy a product uses and how it compares to similar models. It helps you make informed decisions about the energy-using products you buy – from big-ticket items like dishwashers to simple light bulbs.

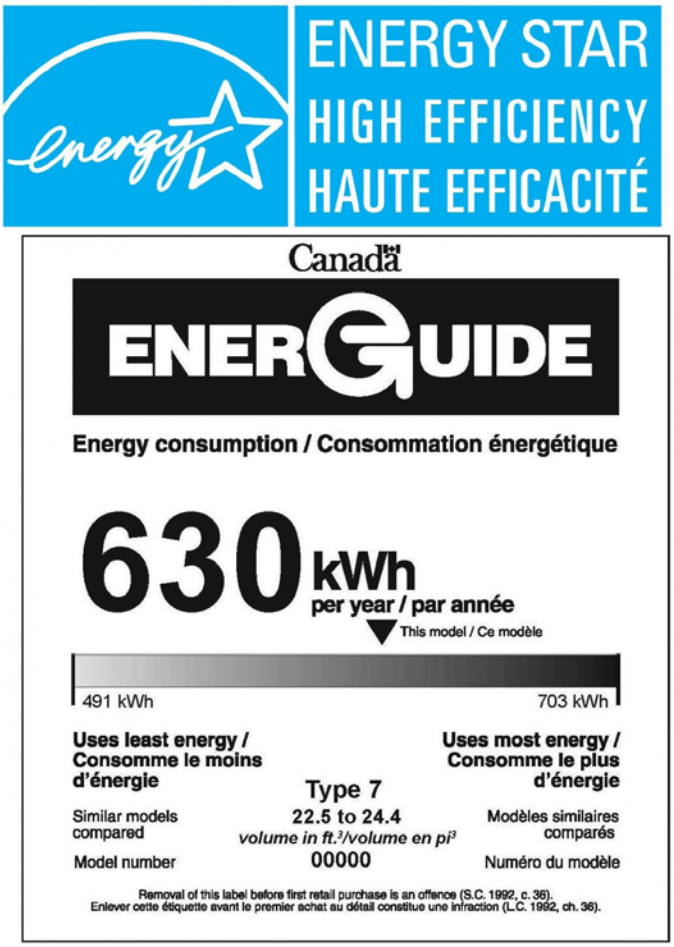
The EnerGuide label on some regulated products – such as major appliances, heating and cooling equipment, windows, doors and skylights – may include an ENERGY STAR® logo. This symbol is reserved for the most energy-efficient models in each product class.

Energy Star Canada is a voluntary partnership between the Government of Canada and industry to make high-efficiency products readily available and visible to Canadians.

Some significant appliances may have a Canadian EnerGuide (black and white) label and an American EnergyGuide label (black and yellow). Canada and the United States use similar methods to rate energy efficiency. However, the scales may differ due to the number and types of models available in each country.

The Canadian EnerGuide label shows:

- annual energy consumption in kilowatt-hours (kWh)
- an arrow indicating the model's performance compared with the most and least efficient models in the same class
- the type and capacity of models in the same class
- the model number
- an ENERGY STAR® logo, if applicable



Graphic Source: What does the EnerGuide label mean? https://natural-resources.canada.ca/energy-efficiency/homes/what-energy-efficient-home/what-does-energuide-label-mean/20562

Understanding Your Electricity Bill

Your electricity bill

Your electricity utility delivers electricity to your home or business and issues your bill. The bill includes the electricity you use, the services your local utility provides and some other costs, as outlined in the example.

With Time-of-Use, the price depends on when you use the electricity. This means you can help manage your electricity costs by shifting your usage to lower price periods when possible.

Find It!

If you are meeting at a hardware store, challenge members to find appliances with the Energy Star or EnerGuide sticker. Once they have found a device with the Energy Star or EnerGuide sticker, challenge members to determine the group's most energy-efficient appliance.

The cost of delivering electricity from generating stations across the province to your home or business through power lines. Regulatory Charges include various fees to manage the power system and operate the electricity market in Ontario.

Monthly Bill Statement

FOR ILLUSTRATIVE PURPOSES ONLY

TIME-OF-USE (TOU) PRICING

Account Number:
000 000 000 000 0000 0

Meter Number:
0000000

Your Electricity Charges **Electricity** 1

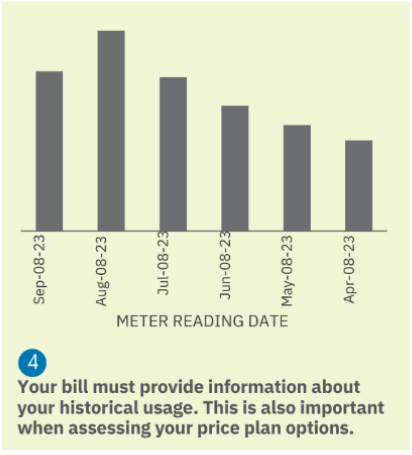
This is the Electricity line of the bill. It shows what you are paying for the electricity that you use based on your price plan. This bill shows Time-Of-Use pricing.

Time-of-Use Pricing 2	
133 kWh On-peak @ X.X¢/kWh	$0.00
126 kWh Mid-peak @ X.X¢/kWh	$0.00
441 kWh Off-peak @ X.X¢/kWh	$0.00
Delivery	$0.00
Regulatory Charges	$0.00
	$0.00
Your Total Electricity Charges	
H.S.T.	
Ontario Electricity Rebate	$00CR
Total Amount	$0.00

Your consumption is broken down by the amount you use in each TOU price period: On-, Mid- and Off-peak.

This is the meter reading period, also known as the billing period. Your bill covers all the electricity charges you have to pay for in this period. A billing period is generally around 30 days, but that can vary.

Meter Reading Period 3	Number of Days
September 09, 2023 to October 08, 2023	30



4 Your bill must provide information about your historical usage. This is also important when assessing your price plan options.

Total Ontario support: $00. To learn more about the Province's electricity support programs, Ontario.ca/yourelectricitybill.

Graphic Source: Understanding your electricity bill, https://www.oeb.ca/consumer-information-and-protection/electricity-rates/understanding-your-electricity-bill

Talk About It!

Share a copy of a local electricity bill with the group and point out the different sections. *Be sure to blank out any identifying information before sharing.

Net-Zero Homes

A net-zero home generates as much energy as it uses, so the net amount of energy it purchases from the local hydro company is zero.

The key to maintaining a net-zero home is to keep energy consumption low so that you can generate enough power to meet your needs. It's challenging but achievable:

- Net-zero homes are designed to be up to 80 percent more efficient than conventional homes, so they require less energy, to begin with.
- They can be oriented to take advantage of warmth and light from the sun, known as passive heating.
- They are also built to be exceptionally airtight and insulated with additional layers to retain heat in the winter and keep it out in the summer.
- High-efficiency HVAC systems, appliances and other electrical devices help decrease energy use.
- Homeowners also manage their energy use carefully, being mindful of how energy is used around the house.

Net-zero homes also feature on-site energy generation capable of producing as much power as the household uses in a year. Many net-zero homes use solar photovoltaic panels that can typically produce energy for lighting, heating and cooling systems, hot water and appliances. Energy from solar panels can be stored in a battery for use later or sent into the local electricity distribution system and sold to the local hydro company.

Net-zero homes also use highly efficient heating and cooling systems, such as air-source and ground-source heat pumps. Air-source heat pumps draw in outside air and warm it during the winter and pull warm air outside the house during the summer to keep it cool. Ground-source (also known as geothermal) heat pumps use thermal heat from underground to warm a home during the colder seasons and pump heat outside during the summer.

Net-zero homes also incorporate high-insulation wall systems, highly energy-efficient windows, and mechanical systems.

Provinces, including British Columbia, require that by 2032 all new buildings be constructed with the highest level of insulation systems, efficient solar power systems, energy recovery and storage systems, heat recovery systems, renewable energy systems, and mechanical systems.

In Kelowna, British Columbia, a new net-zero home has been built by the University of British Columbia – Okanagan with community partners. The public is encouraged to tour the house and explore the interactive displays. Except for the appliances, the elements of a net-zero home are often invisible to the homebuyer, according to Dr. Andrew Hay, Provost and Vice President Academic of Okanagan College.

Video Resource

Terra View – Building net-zero and only net-zero homes, (5:27), Green Energy Futures https://youtu.be/jfdGxkztr1s

Features of a Net Zero Home

Passive Heat

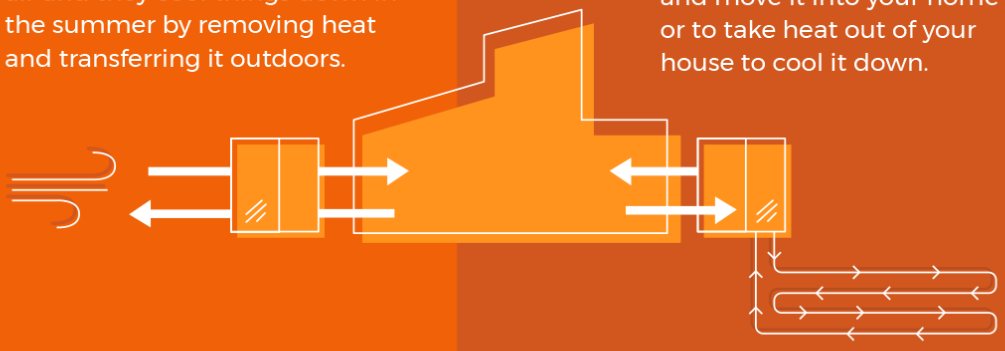
Homes take advantage of warmth and light from the sun.

Air-Source Heat Pumps

They keep your home warm by extracting heat from the outside air and they cool things down in the summer by removing heat and transferring it outdoors.

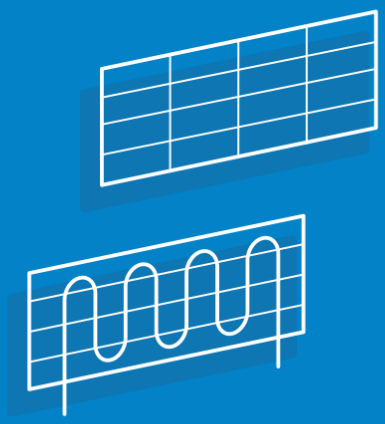
Ground-Source Heat Pumps

They use the thermal mass of the earth to extract heat and move it into your home or to take heat out of your house to cool it down.



Solar Panels

Solar panels are used to produce renewable energy for lighting, heating and cooling systems, hot water and appliances.



Appliances

High-efficiency HVAC systems, appliances and other electrical systems help keep energy use down.

Graphic Source: https://saveonenergy.ca/For-Your-Home/Advice-and-Tips/Net-zero-homes

DIGGING DEEPER For Senior Members

- **Insulate a Window for Cold Weather**
  Follow the steps in Activity 10: How to Insulate Windows in Cold Weather and insulate a window at home. Take a video of the process and share it with the group. Explain why you chose the method that you did.

Tour/Speaker Idea!
Hardware or Home Improvement Store

- **Insulation Model**
  Create a model of a house using cardboard or building blocks (e.g., Lego) and use cotton balls to illustrate where insulation should be located.
- **How to Save Energy in a Barn**
  Research ways to save energy in a barn and share them with the group. Make a model showing how heat normally wasted from a barn can be used to heat a house. Describe how it is collected, delivered, stored, and used.
- **Compare a Home and Farm Energy Bill**
  What is the same, and what is different about each location?
- **Find phantom energy being used in your home**
  How many can you find? What can you do to stop the power loss? How are you communicating that to your family?
- **Take an Energy Tour - Home**
  Take an energy tour of your home. With your family to help you, work through your energy checklist, noting and making changes that will help save energy and money.
- **Share Energy Ideas**
  Share your energy ideas with your school or other clubs. Suggest using energy repair jobs for class or club activities. Set up an energy information booth in your school. Demonstrate window caulking and display standard energy-saving tools (e.g., energy-saving showerhead).
- **Net-Zero Homes**
  Investigate whether net-zero homes are being built in your community. If they are, contact a local net-zero home builder to learn more about the process. If they are not yet, ask local home builders about their perspective on net-zero homes.
- **Interview an Official**
  Interview a municipal official to find out what energy conservation measures are used in your municipality. How have they changed in the last 10 years?
- **Family Action Plan**
  Develop a family action plan to save energy in your home. Describe your plan under the heat, light, water and fuel headings.
- **Energy Conservation Design**
  Make a home or farm building model showing the optimum use of energy conservation measures and design including orientation, solar panels, heating and cooling systems, insulation, windows and landscaping.

Activity #9 – Test Your Knowledge of Home Energy Consumption

Do	Time: 15 minutes **Materials/Resources:** • A cellphone, tablet or laptop with access to the internet • If an internet connection is impossible, a hard copy of the quiz is supplied following the instructions **Instructions:** 1. Share that the group will test their knowledge of how energy is used in our homes. 2. Visit https://blogue.energir.com/blogue/en/at-home/test/ 3. State that you will discuss which response will be chosen for each question as a group. 4. Review the additional information provided when the group's response is shared **Additional Activities:** • Instruct the members to complete the quiz independently or in small groups and compare results. • Try another/a different online quiz – Test your knowledge with our quiz http://www.hydroquebec.com/quiz.html
Reflect	**Learning Outcomes:** Members recognize how energy is used in the home.
Apply	**Discuss The Following Prompts As A Group** • Did the group get more answers right or wrong? • Why is it important to know the most efficient energy consumption methods? • Was this easy or hard? • Did any of the answers surprise you?

Home Energy Consumption Quiz

This quiz will test your knowledge of energy consumption and energy efficiency.

1. Which is the best glazing for your home's windows?
   a. Triple glazing
   b. Windows without glass to let the breeze in
   c. Single glazing
   d. Gas-filled double glazing

Answer: Regarding performance, double-glazed windows, filled with gas and covered with a low-emissivity (low-e) coating, offer the best value for money. Single glazing does not provide sufficient insulation, while triple glazing reduces brightness but is at least 15% more expensive. The inert gas between the panes acts as an insulator. A low-emissivity (low-e) coating is a metal oxide layer that allows sunlight to pass through but prevents heat loss by radiation.

2. What drives up your home energy bill the most?
   a. Hot water
   b. Household appliances and electronics
   c. Heating and air conditioning
   d. Lighting

Answer: Heating and air conditioning are the most significant contributors to energy consumption (approximately 54% of the total) because of the cold winters and summer heat waves. Whether you heat your home using baseboard heaters, a heat pump, a forced-air furnace or a central or wall-mounted air-conditioning unit, your consumption habits significantly impact your energy bill. Several grants are available from energy providers to help you upgrade your heating system to a natural gas central heating and hot water system and to purchase high-efficiency devices. These investments generate significant savings and provide added comfort when used correctly.

3. What are the most effective ways to reduce your hot water bill?
   a. Insulate your pipes, collect rainwater, and shower every other day.
   b. Wash your clothes in cold water, and install a low-flow showerhead and faucet aerator.
   c. Install a low-flush toilet, a drain water recovery system and an electronic thermostat.

Answer: About 90% of the energy used by your washing machine goes towards heating the water. Most detergents clean just as well in cold water as in hot. So this is an excellent way to save regularly! Also, conventional faucets have a flow rate of 13 litres per minute (LPM). Installing aerators (or flow restrictors) allows you to reduce this rate to 5.7 LPM without losing anything. Showers account for 17% of a household's hot water use. Low-flow showerheads (6.6 LPM compared with 9.5 LPM for a standard showerhead) can save up to 42,000 litres of water a year for a family of four and cut your energy bill by $100 without sacrificing comfort.

4. How much hot water can you save by taking a five-minute shower instead of a bath?
   a. 100 litres each time
   b. 50 litres each time
   c. 75 litres or more each time

Answer: A bath uses about 150 litres of hot water, whereas a five-minute shower uses 75 litres or less. Use a low-flow showerhead (6.6 LPM); you can cut your water use by another 50% and save even more!

5. How much hot water will be lost if a leaky faucet drips at one drop per second?
   a. 15 litres a day
   b. 27 litres a day
   c. 9 litres a day

Answer: 27 litres per day; it's surprising how much water we can waste if we're not careful! You could fill the equivalent of a bathtub each week at a rate of one drop per second. Think about this the next time you see a faucet leaking, then do the right thing and turn it off or replace the parts.

6. Which of the following does NOT save energy at home?
   a. Turning off the lights when you leave a room
   b. Drying your clothes on the clothesline
   c. Using a good old-fashioned thermostat
   d. Plugging your electronics into power bars and turning them off when not used

Answer: Good old-fashioned thermostats don't help you save energy. Instead, install a programmable or smart thermostat. With a smart thermostat, you can save money because it automatically lowers the temperature that your heating equipment is set at and reduces the operation of cooling systems at night or when nobody is at home. Once the thermostat is installed, you must set it to the appropriate temperature. For instance, lowering the temperature from 24 °C to 21 °C'll save 10% on your heating bill. And if you'd like to control the temperature remotely, choose a smart thermostat. It'll make life even more accessible.

7. At what temperature should you set your thermostat during the day in winter to reduce your energy bill without sacrificing comfort?
   a. Between 15°C and 18 °C
   b. Between 18 °C and 21 °C
   c. Between 21 °C and 24 °C

Answer: At 18°C to 21°C, occupied rooms will be warm enough to be comfortable. You should know that for every degree over 20°C, you increase your heating energy consumption by 2% to 5%. At night, program your thermostat to lower the temperature by 2°C to 4°C. If you're away for an extended period, set your thermostat to about 15°C to save money and prevent your pipes from freezing. Think about installing a smart thermostat in your home to optimize your energy savings. Most thermostats of this type can "learn" and adjust to your habits. You enter your data for a week, and they program themselves automatically. For example, if you lower the temperature before bed and increase it when you get up, the thermostat takes note and programs itself accordingly. It can also detect when you leave the house and automatically lower the temperature. Some smart thermostats even have a programmable vacation mode.

8. True or false: The internet, home automation, and smart homes are trendy and don't change how we use energy.
   a. False
   b. True

Answer: False. Today, there are over 8.3 billion smart products in homes—and the numbers continue to grow. What's their purpose? They make life easier because you can control heat remotely, set the alarm system or switch on the lights with your smartphone, turn on the pressure cooker, do the vacuuming without lifting a finger or start the washing machine. As well as improving our daily activities, they save energy, time and money. But all of these products need energy to work. And this increases our overall consumption.

Source: Test your knowledge of home energy consumption https://blogue.energir.com/blogue/en/at-home/test/

Activity #10 – Insulate Windows for Cold Weather

Do

Time: 20 minutes

Materials/Resources:

- A window to demonstrate with
- Caulking
- Caulking gun
- Utility knife
- Rag
- Insulation Film
- Scissors
- Hair Dryer
- Weatherstripping
- Measuring tape

Instructions:

- Caulking a Window:
  - Scrape off any old caulking or peeling paint with a knife.
  - Clean away debris.
  - Fill the caulking gun with silicone caulking.
  - Apply caulk between the window frame and siding or trim.
  - Allow to dry and cure.
- Applying Weather Stripping:
  - Measure window frames
  - Cut strips of weather stripping according to window dimensions.
  - Peel adhesive off the strip.
  - Align rubber down frames to cover gaps.
- Installing Insulation Film:
  - Apply adhesive tape to the entire window. Leave 1 inch of space from the window frame border.
  - Cut plastic film sheet to window size + up to 5 inches of excess on each side.
  - Press the plastic sheet firmly onto the taped frame from top to bottom. Leave no gaps.
  - Use a hairdryer on high heat to run over the plastic to smooth wrinkles.

Additional Activities:

- If a window is not available to demonstrate with the show this video:
- How to insulate windows in cold weather | The Home Depot (2:46) https://youtu.be/GTPASSjZW34
- Have a senior member(s) demonstrate one or more of the methods.
- Provide enough windows to allow members to practice the methods. Possible sources include local builders, demolition companies, or members' families to obtain suitable windows.

Reflect

Learning Outcomes:

Members recognize how energy is used in the home.

Apply

Discuss The Following Prompts As A Group

- Why is it essential to keep warm air in during the winter and warm air out during the summer?
- Was this easy or hard?
- Are you aware of windows in your home, garage or barn that could be insulated? Which method (caulking, weather stripping or insulation film) would be most suitable? Be sure to ask your parents before attempting to insulate the window.

Activity #11 – Build Your Own Aerator

Do

Time: 20 minutes

Materials/Resources:

- A plastic bottle cap – This is the base of the aerator. Choose a cap based on the size of your faucet; it should fit without any open edges. The height of the cap should be just more than the base of the faucet.
- Mesh – This is the filter of the aerator. Plastic or metal will be inserted in the base. You will use 4-5 layers, so have enough.
- Elastic bands – The elastic band's size depends on the faucet's size.
- A flat-head screwdriver will make a hole in the bottle cap from where the water will flow. You can also use a flat-headed tip of a detachable screwdriver.
- A Hammer- The cap will be cut by hammering the screwdriver inside the lid to make the hole.
- A sharp, pointed object- This will be used to make tiny holes in the side of the bottle cap through which the rubber band will be inserted. You can use a needle or a pointed nail.
- Scissors- Used for cutting the rubber band and the mesh.
- A permanent marker- This will be used for marking the mesh and the cap. A permanent marker is preferred because it is difficult to write on mesh otherwise.
- A tube of waterproof adhesive.

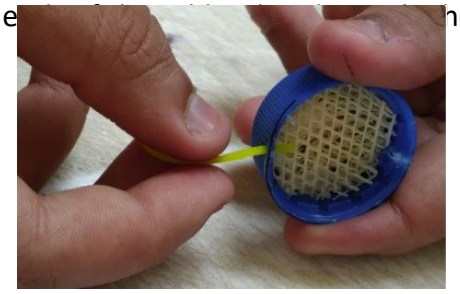
Instructions:

1. State that water is wasted by faucets every day. Most faucets are not efficient and use more water than necessary. Aerators are screens at the end of a tap. Aerators reduce the amount of water that comes out of a faucet and controls the stream.
2. Unscrew the bottle cap and place it face up on the ground. Use a marker to trace a circle around the top of the cap, leaving a rim of 2 mm.
3. Take the screwdriver and place the point on the edge of the traced circle. Take the hammer and hammer directly on top of the screwdriver until it digs into the cap.
4. Keep shifting the screwdriver around the traced circle and hammering until the inside of the cap is punched out.
5. If you look inside the cap, a thin liner or covering may be inside. Pull the liner out because it might come loose and block the water from flowing through the hole.
6. Smooth out the hole you've created using the edge of the screwdriver.

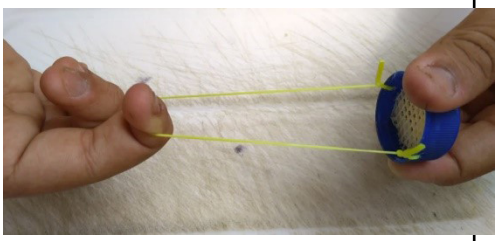
Do

7. Use the needle or pointed nail to pierce the cap's side toward the outer edge. This will be the hole where you will attach the elastic band. Make the hole just big enough for the elastic band to feed through. Make another hole on the opposite side of the cap.
8. Place the cap on the mesh and trace the edge with the marker. Repeat four times.
9. Cut the circles out of the mesh.
10. Turn the cap upside down and press one piece of mesh into the hole. Be gentle and make sure that there are no gaps or extra mesh around the edge.

11. Press the second mesh piece on top and press it into the cap. Make a criss-cross pattern to get the maximum aeration. Add the third piece of mesh to the lid.
12. Add adhesive to seal the edge where the mesh meets the edge of the bottle cap. Be sure to keep the glue to the edge so it doesn't cover up the openings in the mesh. Also, be sure not to cover up the holes for the rubber band. Let the adhesive dry.
13. Cut the rubber band so it becomes one long piece.
14. Insert the e holes in the cap and tie a knot.



15. Place your aerator over the faucet and tighten the rubber band if necessary to create a tight fit. You're done! Your aerator will decrease the water flow rate by approximately 2 litres a minute.



Additional Activity:

- Create your aerator at home.

Reflect	**Learning Outcomes:** To allow members to learn tips that they can do to save energy and money.
Apply	**Discuss The Following Prompts As A Group** • Why is it essential to reduce the amount of water we use? • Was this easy or hard? Why? • Are there other ways that we could conserve water? • What did you like about this activity?

Source: DIY Faucet Aerator, https://www.instructables.com/DIY-Faucet-Aerator/

Activity #12 – Judging Laundry Detergent

Do	Time: 15 minutes **Materials/Resources:** • Four different types of laundry detergent • Judging Worksheet **Instructions:** 1. Distribute Worksheet to members or get members to turn to page 22 of the Participant Record Book 2. Instruct members to review the different types of laundry detergent and ask them to rank the options giving reasons for their placings. 3. Give the members time to complete the judging. 4. Ask for 2-3 volunteers to share their responses. 5. Ask for additional responses from the group that either add to or differ from the points already given. **Additional Activity**: • Allow Senior Members to prepare the items to be judged.
Reflect	**Learning Outcomes:** Allow Senior Members to prepare the items to be judged.
Apply	**Discuss The Following Prompts As A Group** • Was this easy or hard? • What did you like about this activity? • How did you come up with your reasons? • When could you use this process in the future? • When listening to reasons, did you learn something about laundry detergents and how they can affect energy usage?

Activity #13 – Energy from Garbage – Part 1

Do	Time: 15 minutes **Materials/Resources:** • Packet of dried beans or peas • Six airtight clear zip closure plastic bags • Measuring cup • Water **Instructions:** 1. Share that this activity will be done in two parts. The first is being prepared now. The second part will happen as part of the Roll Call in Meeting 5. 2. Soak the beans or peas in water overnight before the meeting. 3. During the meeting, ask for six volunteers. Give each volunteer a clear plastic bag. 4. Distribute ten beans or peas to each volunteer. Ask the volunteers to place in each bag and squeeze out all the air before they seal them. *Note: Because we are looking at how the beans break down in various conditions, we will be sealing the bags versus other bean-growing experiments where it is important to leave the bag open a little bit to allow for airflow. 5. Share with the members that you will be putting two bags in a warm, sunny place, two bags in a warm, shady place and two bags in a totally dark place for a week and next week, we will observe what happens. **Additional Activity:** • Allow Senior Members to take the bags home and place them in their respective locations (a warm, sunny place, two in a warm, shady spot and two in a totally dark place).
Reflect	**Learning Outcomes:** Members understand the link between waste and energy.
Apply	**Discuss The Following Prompts As A Group** • What do you think will happen? • Do you think the bags' placement will make a difference?

Source: Energy from Garbage, NEED Student Science Fair Projects, https://www.need.org/need-students/science-fair-projects/

Reference citations:

- Heat escapes …but from where? https://www.energir.com/blogue/en/theme/at-home/
- Three tips to lower your energy bill https://www.energir.com/blogue/en/at-home/three-tips-to-lower-your-energy-bill/
- Test your knowledge of home energy consumption https://www.energir.com/blogue/en/at-home/test/
- Do Programmable Thermostats Save Energy? https://energyrates.ca/programmable-thermostats-save-energy/
- What Temperature Should I Set My Thermostat in the Summer? https://www.directenergy.com/learning-center/recommended-thermostat-settings-summer
- Your Average House Temperature https://www.directenergy.ca/learn/recommended-thermostat-settings-winter
- Heating and Cooling With a Heat Pump, Government of Canada, Energy Star announcements https://natural-resources.canada.ca/energy-efficiency/energy-star-canada/about/energy-star-announcements/publications/heating-and-cooling-heat-pump/6817
- 6 Reasons to Cold-Water Wash – and 3 Not To https://www.geappliances.com/ge/lifestyles/6-reasons-to-cold-water-wash.htm#:~:text=Cold%20water%20is%20fine%20for,do%20best%20in%20cold%20water.
- Save Energy on Laundry Day, https://www.saveonenergy.com/resources/save-energy-on-laundry-day/
- Water temperature and burns/scalds, https://www.canada.ca/en/public-health/services/water-temperature-burns-scalds.html
- Three tips to lower your energy bill! https://blogue.energir.com/blogue/en/at-home/three-tips-to-lower-your-energy-bill/
- How to save energy at home https://www.saveonenergy.com/resources/how-to-save-energy-at-home/
- Make small changes that add up https://natural-resources.canada.ca/energy-efficiency/homes/make-small-changes-add/21850
- How to save energy at home https://www.saveonenergy.com/resources/how-to-save-energy-at-home/
- Make Sustainable Lighting Lessons for Your Kids Super Fun, Maureen Wise in Thinking Sustainably https://www.tomsofmaine.com/good-matters/thinking-sustainably/make-sustainable-lighting-lessons-for-your-kids-super-fun
- Mapping Vampire Energy: The Hidden Costs of Unused Electricity in Your Home https://www.saveonenergy.com/resources/mapping-vampire-energy/
- What's phantom power, and how can you track it? https://saveonenergy.ca/For-Your-Home/Advice-and-Tips/Phantom-power
- Scare the phantom power out of your home https://natural-resources.canada.ca/energy-efficiency/spotlight-energy-efficiency/2020/10/19/scare-the-phantom-power-out-your-home/23085
- What does the EnerGuide label mean? https://natural-resources.canada.ca/energy-efficiency/homes/what-energy-efficient-home/what-does-energuide-label-mean/20562
- Understanding your electricity bill https://www.oeb.ca/consumer-information-and-protection/electricity-rates/understanding-your-electricity-bill
- What is a net-zero home? Save on Energy https://saveonenergy.ca/For-Your-Home/Advice-and-Tips/Net-zero-homes
- New net zero home is ready to be explored, The University of British Columbia – Okanagan Campus https://news.ok.ubc.ca/2022/11/15/new-net-zero-home-is-ready-to-be-explored/
- Test your knowledge of home energy consumption https://blogue.energir.com/blogue/en/at-home/test/
- DIY Faucet Aerator https://www.instructables.com/DIY-Faucet-Aerator/
- Energy from Garbage, NEED Student Science Fair Projects https://www.need.org/need-students/science-fair-projects/

Our Choices Matter

Meeting 4 – Our Choices Matter

Setting Objectives:

- To demonstrate how energy generation and use impact the environment.

Suggested Learning Outcomes:

- Members understand what greenhouse gases are and their impact on the environment
- Members understand the link between waste (including food waste) and how to affect energy conversation positively.
- Members recognize the connection between consuming products and energy use – Life Cycle Thinking
- Members are aware that they have a role to play in using energy responsibly in big and small ways now and that our energy habits affect more than just ourselves (social implications)

Reference Material in this Section:

- What are Greenhouse Gases?
- What are Food Loss and Waste?
- Fast Fashion
- Energy and Waste Management
- Become Energy Literate! Understand the Social Implications of Energy Use

Activities:

- Activity 14: Energy from Garbage – Part 2
- Activity 15: The Greenhouse Effect
- Activity 16: Plant a Terrarium Mini-Garden Activity
- Activity 17: From Scraps to Scrumptious! Solutions to Food Waste
- Activity 18: Simple Questions: Powerful Results
- Activity 19: The Life Cycle of a Product

SAMPLE MEETING AGENDA Time: (generally) 2 hours 15 minutes

Welcome, Call to order, Pledge	Welcome members. Call the meeting to order or lead the members through reciting the 4-H Pledge.	5 minutes
Roll Call	Invite each member to share their name and response to the At Home Challenge you asked them to complete at the end of Meeting 3. Looking at the list of activities connected to using energy that you brought from home, name one way your family can use less energy.	5 minutes
Activities Related to Topic	**Activity 14: Energy from Garbage – Part 2**	10 minutes
Topic Information Discussion	Energy from Garbage What are Greenhouse Gases?	5 minutes 10 minutes
Activities Related to Topic	**Activity 15: The Greenhouse Effect** **Activity 16: Plant a Terrarium Mini-Garden**	10 minutes 15 minutes

Topic Information Discussion	Fast Fashion	10 minutes
Activities Related to Topic	**Activity 18: Simple Questions – Powerful Results**	15 minutes
Topic Information Discussion	Energy and Waste Management Become Energy Literate! Understand the Social Implications of Energy Use	10 minutes
Activities Related to Topic	**Activity 19: The Life Cycle of a Product**	15 minutes
Wrap up, Social time and Adjournment	Recap topics covered in this meeting and review the At Home Challenge	5 minutes
At Home Challenge	Does your family have a grocery list for shopping? If so, find out how it is created. Do they keep a list on the refrigerator and add items as they think of them? Do they use local flyers or email notifications to make a grocery list or another method? Having a realistic shopping list reduces impulse buys and allows better control over how much you spend. Work with your family to create a grocery list this week. Be sure to "shop" your pantry and freezer to use the items you have on hand before you buy more. Or choose one of the At Home Activities found throughout the meeting.	

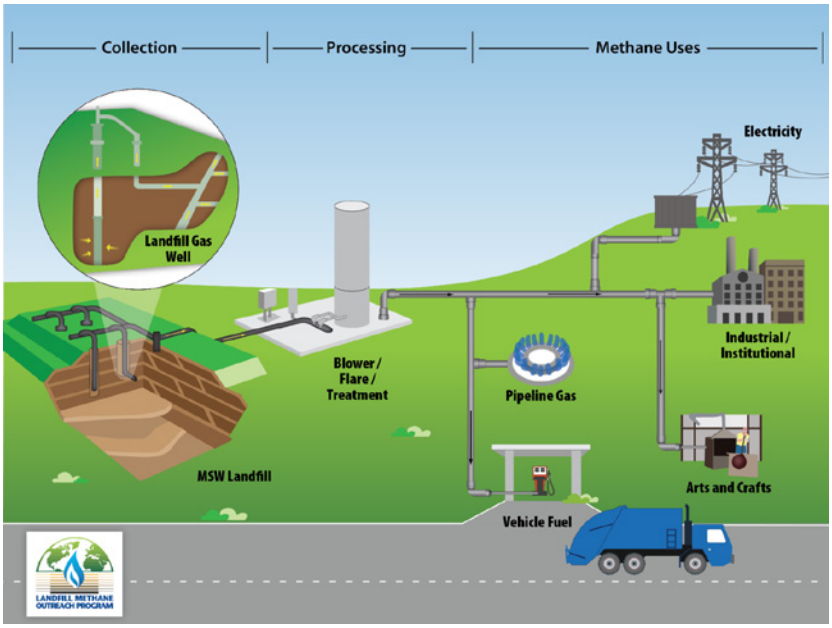
Energy From Garbage

Renewable Natural Gas Recovery: Turning Waste into Fuel

Renewable Natural Gas (RNG) is a carbon-neutral energy source because it does not contribute any net carbon dioxide into the atmosphere. RNG is derived from biogas when organic waste like food scraps, grass clippings and leaves decompose inside a landfill without oxygen. Biogas is produced from decomposing organic waste from landfills, agricultural waste and wastewater from treatment facilities. The biogas is captured and cleaned to create carbon-neutral RNG. Landfill gas is produced. It is a mixture of approximately 50% methane and 50% carbon dioxide and other trace gases. One tonne of organic waste can produce 125 cubic metres of methane, the energy equivalent of one barrel of oil. The methane in landfill gas is poisonous, flammable and lighter than air.

Currently, 64 facilities across Canada recover landfill gas. Some 27 million metric tonnes of carbon dioxide equivalent methane from landfill gas is generated in Canada from landfills annually. These reduce greenhouse gas emissions from landfills by some 6.9 million tonnes of carbon dioxide equivalent yearly.

The graphic illustrates the collection and processing of Landfill Gas to produce methane for multiple uses. First, Landfill Gas is collected through vertical and horizontal piping buried in a Municipal Solid Waste landfill. The Landfill Gas is then processed and treated for use. The graphic shows potential end uses of Landfill Gas, including industrial/institutional uses, pipeline gas, and vehicle fuel.



Graphic Source: Basic Information about Landfill Gas, Environmental Protection Agency, https://www.epa.gov/lmop/basic-information-about-landfill-gas

Edmonton, Alberta

Since 1992, the City of Edmonton has captured enough gas yearly to satisfy the electricity demands of approximately 4,600 homes. Over 101 gas wells have been drilled into the city landfill's decomposing waste.

Surrey, British Columbia

FortisBC, the City of Surrey and the Government of Canada partnered to open North America's first closed-loop waste management system. The facility converts curbside organic waste into renewable biofuel (Renewable Natural Gas - RNG) to fuel the City's natural gas-powered waste collection and service vehicles.

Under this closed-loop system, waste collection trucks collect their fuel source curbside. Excess fuel goes to the district energy system that heats and cools Surrey's City Centre.

Renewable Natural Gas is a critical source of renewable energy that is helping the province of British Columbia achieve its Greenhouse gas (GHG) emission reduction target. Farms, landfills and other suppliers like the City of Surrey have teamed up with FortisBC to capture methane (CH4) from organic waste, which would otherwise escape into the atmosphere. This methane, also known as biogas, is purified to make RNG.

What Are Greenhouse Gases?

Most of the earth's atmosphere is made of nitrogen and oxygen and small amounts of other gases. Much like the glass of a greenhouse, gases in Earth's atmosphere sustain life by trapping the sun's heat. These "greenhouse gases" allow the sun's rays to pass through and warm the planet but prevent this warmth from escaping the atmosphere into space. Without them, Earth would be too cold to sustain life as we know it.

However, our use of fossil fuels like gasoline and coal in transportation and electricity production has given the atmosphere more greenhouse gases than it can manage.

When we talk about greenhouse gases, we're referring to carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

How are greenhouse gases changing the climate?

For thousands of years, the global greenhouse gas supply was essentially stable. Natural processes remove as much carbon from the atmosphere as they release.

Human activities like burning fossil fuels have added vast quantities of carbon dioxide, methane and nitrous oxide to our atmosphere, creating a "greenhouse effect" that traps energy from the sun and causes Earth's temperature to rise. Deforestation and intensive agriculture also contribute to greenhouse gas emissions, but not nearly as much as fossil fuel production, which accounts for 75 percent of greenhouse gas emissions in North America.

As a result, the climate is changing worldwide. That change has increased the severity and frequency of storms, heat waves, wildfires and heavy rains. Climate disruption is also causing sea levels to rise , ocean acidification, plant and animal species extinction, and permafrost melting. As the level of greenhouse gas pollution in Earth's atmosphere continues to increase, these effects will worsen.

It's clear that climate change is here — the last decade has been the hottest on record. We've known about it for over a century but have delayed taking action repeatedly.

We must act now.

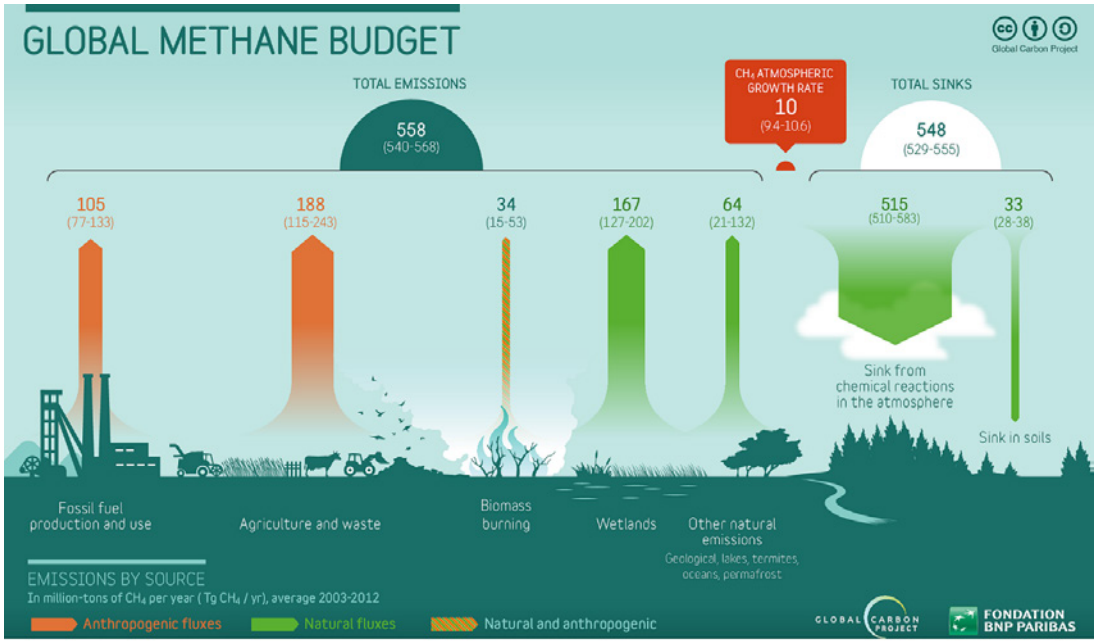
If we can cut our emissions in half this decade and reach net-zero emissions by mid-century, we still have a chance to avoid the most catastrophic impacts of climate change.

How can we reduce greenhouse gas emissions?

To reduce our greenhouse gas emissions, we need to:

- Stop wasting energy.
- Make buildings (new and existing) more efficient.
- Emphasize public transit over private vehicles and use technologies such as electric motors to reduce wasted energy and decrease overall energy demand.
- Choose cycling or walking over driving whenever possible.
- Support local agriculture, including farmers' markets and community-supported agriculture.
- Electrify everything so that the building, transportation and industrial sectors run on electricity instead of fossil fuels.
- Clean up electricity grids. Phase out the use of coal, oil and natural gas to generate electricity and use forms of energy like solar, wind and hydro.
- Choose to measure prosperity through the well-being of people and the planet.

- Find ways to remove carbon emissions from the atmosphere (also known as “sequestering carbon”). Wetlands, forests and other ecosystems can absorb and store carbon dioxide if they are healthy and intact, so we must protect and restore them.
- Nature-based solutions reduce emissions and protect communities from flooding and drought.
- Retrain workers in fossil fuel and related industries so they can thrive in the new, low-carbon economy.
- Support a strong clean fuel standard. Since most of today’s gas-powered cars and trucks will be on the road for another decade, the government must implement a clean fuel standard that requires fossil fuel companies to reduce the carbon intensity of their fuels. This will help advance low-carbon fuel sources like biofuels and electrification.



Graphic Source: Environmental Impact of Beef Production, https://www.beefresearch.ca/topics/environmental-footprint-of-beef-production/

TRIVIA

ENERGY

Did you know?

Of the six greenhouse gases, three are of primary concern because they’re closely associated with human activities:

- Carbon dioxide is the main contributor to climate change, especially by burning fossil fuels.
- Methane is produced naturally when vegetation is burned, digested or rotted without oxygen. Oil and gas production, cattle farming , waste dumps, and rice farming release large amounts of methane.
- Nitrous oxide, released by chemical fertilizers and burning fossil fuels, has a global warming potential of 310 times that of carbon dioxide.

Video Resources

- What is the Greenhouse Effect? (2:29), NASA Space Place, https://youtu.be/SN5-DnOHQmE
- What is the Greenhouse Effect – The Environment for Kids (Updated Version) (4:03), Smile and Learn – English, https://youtu.be/7IwPFXzLH8c
- How Do We Know Earth is Changing? (5:11), NASA Space Place, https://youtu.be/wzPUm-Ytpz4

What Are Food Loss And Waste?

Food grown, raised, caught, or harvested but never eaten is food loss and waste. Nearly half of all food produced worldwide is wasted after production and discarded in processing, transport, supermarkets and kitchens.

Some examples include:
- A piece of fruit that is damaged during transport
- Food items in grocery stores that spoil before they can be sold
- Leftovers from a meal prepared at home that are not eaten
- Food dishes prepared in a restaurant that are never served and are instead discarded

Food loss applies from the point of maturity of a crop, finishing, catch, or harvest up to, but excluding the retail stage. Food waste is applied to the retail and final food preparation and consumption stages.

When food loss or waste is disposed of in landfills, it degrades over time to form methane, a greenhouse gas 25 times more potent than carbon dioxide. Reducing food loss and waste prevents methane generation and ensures that the energy, water, and land resources that go into growing our food are not wasted.

Ontario residents generate a lot of food and organic waste – about 3.5 million tonnes yearly. It is equivalent to filling up the Rogers Centre in Toronto nearly five times. It comes from our homes, our offices and our businesses. When it ends up in a landfill, it creates greenhouse gas pollution as it breaks down. 4% of Ontario's greenhouse gas emissions come from waste.

It's important to make the most out of food scraps. Throwing out food wastes all the resources that go into its production. Upcycle and get creative.

Learn how to compost to divert organic waste. Food in a landfill will decompose without oxygen and produce methane, a potent greenhouse gas.

Why does food loss happen?

During production:
- Throwing out food to meet quality and cosmetic standards for produce
- Seasonal fluctuations in supply and demand
- Ordering too much inventory
- Not enough employees to harvest and handle produce
- Inadequate storage, handling, and transportation facilities
- Cancelled orders
- Producing too much inventory

During transport and storage:
- Challenges with temperature and humidity control
- Mishandling and compression
- Spillage during transfers
- Delivery delays
- Rodents and other pests
- Damage during transport

During packaging, processing and manufacturing:

- Problems with equipment working properly
- Strict requirements
- Rejection due to quality standards
- Poor quality work
- Trimming and selecting

Look It Up!

Learn the difference between "sell by," "use by," "best before," and "expiration" date labels.

During wholesale and distribution:

- Travel time and distance
- Being handled too many times
- Packaging type
- Problems with temperature and humidity control
- Inventory management
- Rejection of produce that does not meet visual quality standards

During retail sales:

- Rejection of produce that does not meet visual quality standards
- Inadequate storage on-site
- Goods damaged upon receipt
- Poor inventory management leading to oversupply
- No networks for food rescue and redistribution
- Taking products off the shelf that are approaching or exceeding date labels

In restaurants and other food services:

- Losses in the kitchen result from:
- Food prepared but not served
- Buying too much inventory of ingredients
- Inadequate storage
- Losses occur after serving customers when:
- Uneaten food is returned to the kitchen and must be disposed

Learn More About It!

Find out why countries like the United Kingdom are getting rid of "best before" dates.

In households and with consumers:

- Over-purchasing, lack of meal planning, and limited use of grocery lists
- Spoilage due to improper storage
- Concern for food safety and freshness - poor understanding of shelf life; confusing "sell by," "use by," "best before," and "expiration" date labels
- Eating preferences - willingness to store and eat leftovers and the acceptability of eating food past peak freshness
- Uninformed decisions - limited awareness of the costs and impacts of food waste
- Lack of knowledge of how to prepare certain foods properly, leading to the foods not being consumed

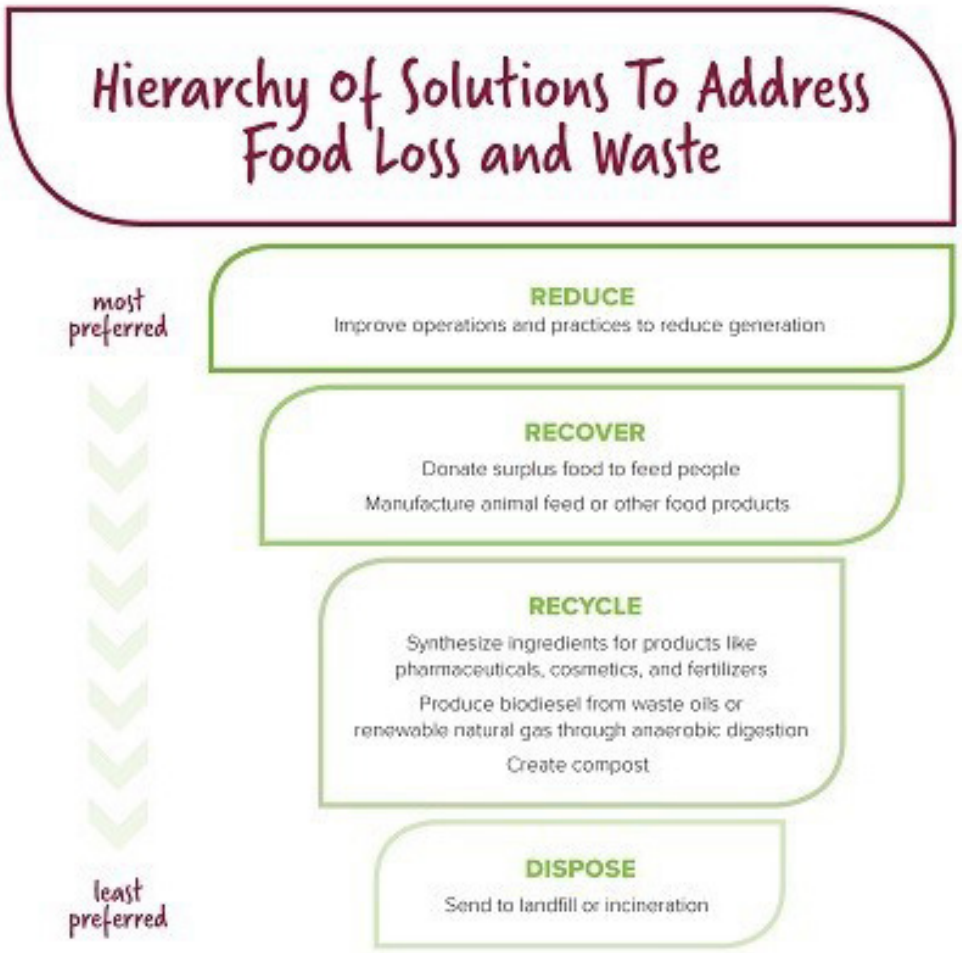
Hierarchy of Solutions

The food recovery hierarchy describes food loss and waste solutions that maximize environmental, economic, and social benefits by prioritizing waste reduction and food recovery over recycling and disposal. The hierarchy helps consumers decide how to handle household food waste, and the government develops local, regional, and national policies.

Recovery of surplus food to feed people recognize s that food's highest value is maintained when people consume it. Recovery of extra food can involve both donations to food banks or use in commercial operations to create new food products.

Look It Up!

Check out the advances being made with Electric Composters. Several municipalities are involved in pilot projects to bring this technology into our kitchens.



Graphic Source: Taking stock: Reducing food loss and waste in Canada, https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/food-loss-waste/taking-stock.html#toc1

Fast Fashion

The fashion industry is the third most polluting industry in the world. The throwaway habits of consumers have had a significant impact on the fashion industry in the last decade. These habits affect the environment with actions like the emissions created, the energy used, and the water consumed. The economy is also affected by purchasing habits, manufacturing costs and the depletion of raw materials.

What you can do:

- Educate yourself about sustainable clothing.
- "Shop" your closet and see what you already have before buying more clothing.
- Buy less and shop for quality over quantity.
- Choose natural materials – organic cotton, linen, or hemp.
- Buy 100% recycled fabrics – 100% recycled polyester, viscose (rayon), etc.
- Research brands to identify ethical ones and practice transparency and sustainability.
- Post a picture of yourself wearing a sustainable garment, explaining its attributes and why you like it on social media.
- Choose brands manufactured in their community and connected to the place, people behind them, local economy, and environment.
- Shop at thrift and consignment stores.
- Swap clothes with a clothes swap group or start a swap yourself.
- Learn how to repair your clothes yourself. The longer clothes are kept, the lower their emissions footprint.

Video Resources

- The life cycle of a t-shirt – Angel Chang, TED-Ed (6:03) https://youtu.be/BiSYoeqb_VY
- Recycling fashion: The town turning waste into clothes – BBC News, BBC News (3:52) https://youtu.be/7i0QMnz4ExY
- The life cycle of a t-shirt – Angel Chang, TED-Ed (6:03) https://youtu.be/BiSYoeqb_VY

Think About It!

Research suggests that extending the active life of clothing by just nine months can significantly reduce its environmental impact. You'll play a part in reducing toxins in the water and reducing your carbon footprint.

Caring for Clothes:

1. Think twice about washing. Wash clothing only when necessary (many items can be worn multiple times before they need to be washed). Each washing shortens the life of a garment. Clothes will suffer less wear and tear from overwashing.
2. Washing Tips:
   - First, sort clothes and then observe care labels. Get to know the fabrics you wear.
   - When washing synthetics – remember they shed microplastics, so wash less frequently. Use a guppy bag to capture the microplastics and micro fibres from your synthetics or a Cora Ball to reduce the fibre breaking off your clothes.
   - For more fragile fabrics like silk and linen, wash on a delicate cycle.
   - Wash with cold water and on shorter cycles to save energy. About 90% of the washing machine's energy is heating the water. According to the Sierra Club, every household that switches to cold water washing could eliminate about 1,600 pounds of carbon dioxide a year. Washing clothes on a hot cycle uses 75% more energy than cold water, and warm water is also more likely to break down dyes and cause shrinkage.
   - Wash shirts less often if you wear them with a layer between them and your skin.
   - Brush suits after every wear to eliminate dust and grime, which can damage the fabric.
   - Wash clothing, especially jeans, inside out to prevent colour fading.
   - Avoid dryer sheets full of chemicals such as toluene styrene.
   - Use less detergent. You can use half the prescribed amount with ½ a cup of baking soda to get clothes just as clean.
   - To avoid using chlorine bleach, substitute one half-cup of vinegar to the final rinse. Vinegar is a natural

brightener that won't wear out the fibres of your clothing.

3. Use earth-friendly detergents. Use laundry detergent without chemicals that come from petroleum. Switch to minimal packaging laundry products and cleaning solutions. For stains, follow these eco-friendly guides (on next page).
4. Avoid ironing. Hanging clothes in the bathroom during a hot shower will help reshape them.
5. Drip dry. Hang clothes to dry outdoors on a clothing line or a drying rack (or on a drying rack in the bathtub).
6. Hang clothes in your closet correctly. Hang on wooden hangers to avoid misshapen shoulders. Fold arms crosswise over the shoulders. For woollens, avoid hanging and fold instead to prevent sagging.
7. Think twice about dry-cleaning. Traditional dry cleaning means soaking clothes in a petroleum-based solvent called Perchloroethylene ("PERC"), which is highly toxic to human health and the environment. If it's necessary to dry-clean your clothing, choose a dry cleaner that uses environmentally friendly cleaning solutions. Bring your reusable bag and return your hangers to reduce your impact further.
8. Rotate your clothing. Change your clothing rotation to reduce wear and tear on individual pieces.
9. Reuse and repurpose worn or unwanted clothing. Use old t-shirts and other worn items as rags.
10. Repair shoes and use shoe trees. Shoe trees will prevent creases and cracking and help retain the shape of your shoes. Repairing heels and soles as soon as they are worn out will extend the life of shoes.
11. Store your clothing correctly. At the end of the season, store clean clothes in a cool, dry environment to avoid bacteria and mould. Make sure to give proper aeration and provide adequate space between hangers to keep clothes fresh. Using wooden or fabric-padded hangers will avoid stretching the shoulders of garments. Fold heavy sweaters on a shelf to keep them from stretching. When storing clothes, make sure to avoid direct sunlight to prevent fading. Clothes can also be stored in vacuum-sealed bags for space efficiency or garment-storage bags that protect clothes but allow the fabric to breathe.

Do It!

Hanging clothes to dry will save energy and money while your clothes suffer less wear and tear from the dryer.

Talk About It!

You can play a part in keeping toxins from the environment and reducing plastic pollution.

Think About It!

You'll divert waste from landfills and save paper.

Energy And Waste Management

How we extract, use, and dispose of resources puts pressure on our natural systems, communities, and public health. This is a linear economy—it moves in a straight line from resource extraction to waste disposal. Efforts are being made to promote a Circular Economy model. In a circular economy, nothing is wasted. The circular economy retains and recovers as much value as possible from resources by reusing, repairing, refurbishing, remanufacturing, repurposing, or recycling products and materials.

This approach will:

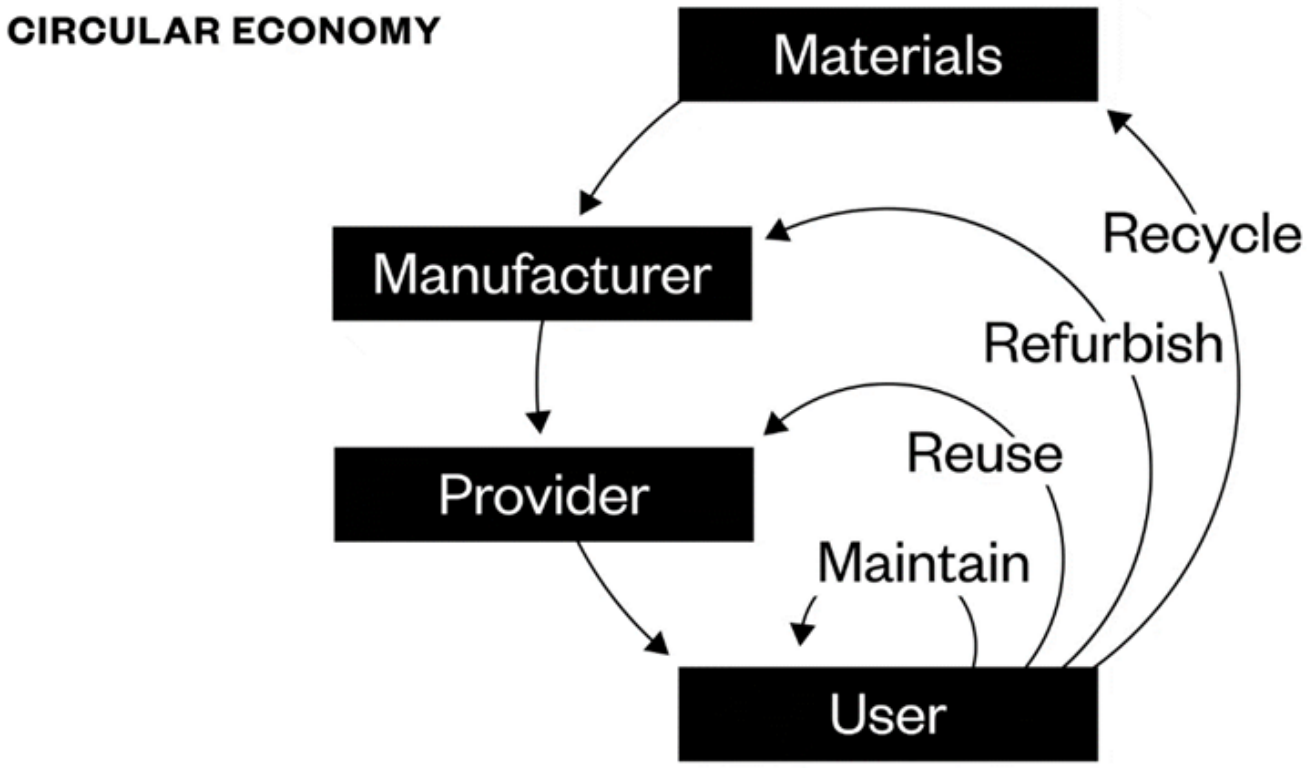
- reduce litter and waste in our communities
- transfer the costs for Blue Box Programs from the municipal taxpayers to making producers of products and packaging fully responsible for the litter they create
- standardize what goes into the blue box across the province
- protect the environment
- transition the accountability for hazardous and special waste to make the producers accountable and financially responsible, keeping them out of landfills
- drive innovation, performance and competitiveness
- divert waste by implementing programs for products like tires, electrical and electronic equipment, batteries, and bottles
- stimulate economic growth and development

Video Resource

Fashion's Crippling Impact on the Environment is Only Getting Worse (HBO), VICE News (3:39)
https://youtu.be/ECkLgq2W9RU

Graphic Source: Environmental Impact of Beef Production, https://www.beefresearch.ca/topics/environmental-footprint-of-beef-production/

As individuals, we can use circular economy principles to cut our waste and save money by reusing or repairing items or using sharing services like tool libraries or car sharing. This movement has been building momentum as governments, businesses and individuals embrace more circular approaches.

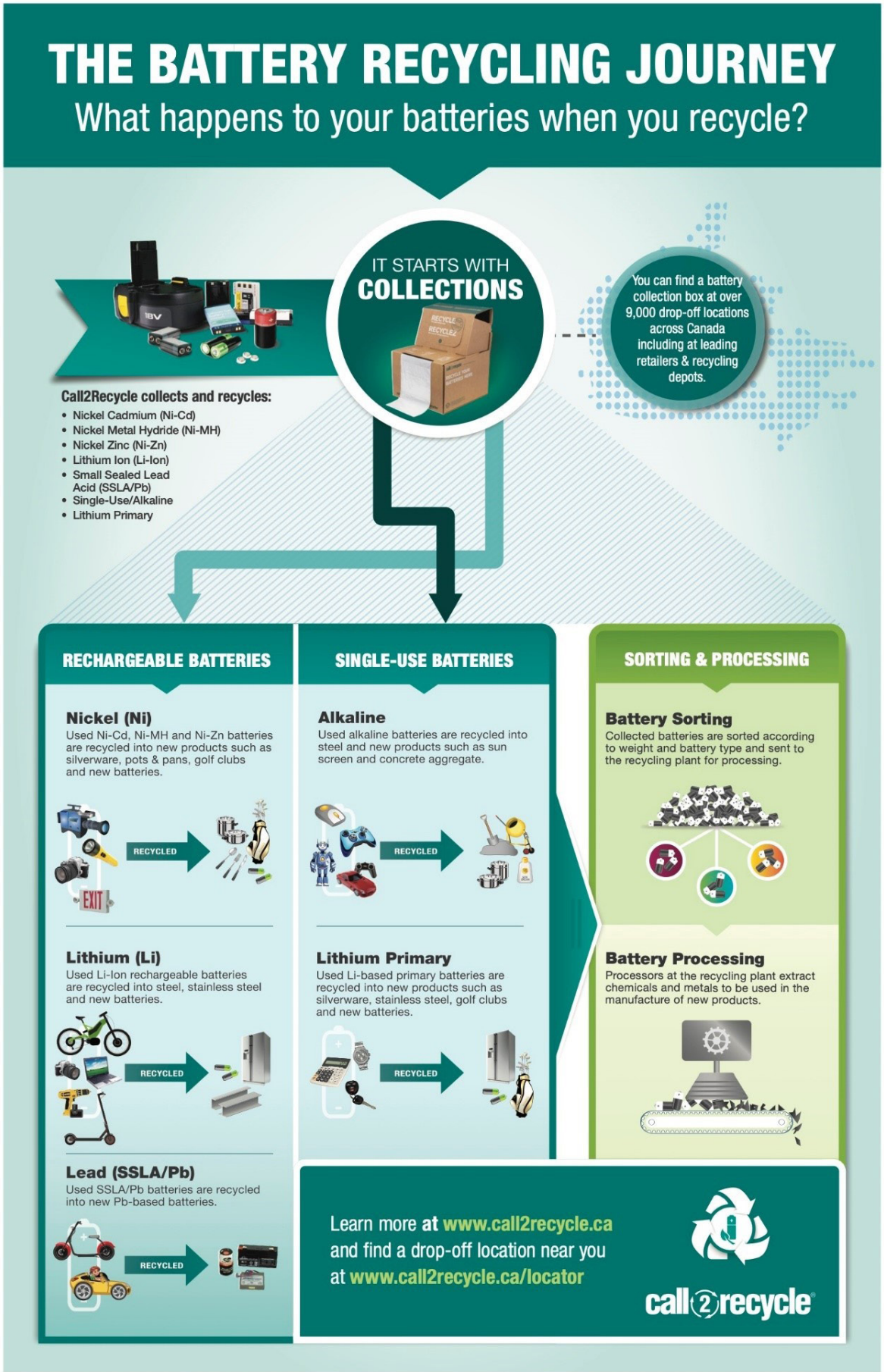


Check It Out At Home!

Learn more about what happens when you recycle your batteries.

Video Resources

- What is the circular economy? Environment and Climate Change Canada (1:18) https://youtu.be/a0pzwgYvk3Q
- The circular economy: more value, less waste, Environment and Climate Change Canada (1:20) https://youtu.be/m9k8A957srw



Graphic Source: The Battery Recycling Journey, Call2Recycle.ca https://www.call2recycle.ca/the-battery-recycling-journey/

Become Energy Literate! Understand the Social Implications of Energy Use

By developing Energy Literacy, we can better understand the social implications of energy use. According to the Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education, Energy Literacy is defined as "an understanding of the nature and role of energy in the world and daily lives accompanied by the ability to apply this understanding to answer questions and solve problems.

An energy-literate person:

- Can trace energy flows and think in terms of energy systems.
- Knows how much energy they use, for what purpose, and where it comes from.
- Can assess the credibility of energy information.
- Can communicate about energy and energy use in meaningful ways.
- Can make informed energy use decisions based on understanding impacts and consequences.

By understanding:

- Utility Costs
- Knowing where the consumer goods and food come from
- Understanding energy efficiency as it relates to home, work, and transportation

Conservation in Society:

- Reducing wasteful energy use
- Using energy for a given purpose more effectively
- Making strategic choices for sources of energy
- Reducing energy use altogether

Human demand is increasing:

- Population is growing
- Industrialization
- Socioeconomic development

The Earth has limited energy resources:

- Social and technological innovation affects the amount of energy used
- Behaviour and design affect the amount of energy used
- Products and services use energy

Energy choices affect the economy:

- Energy choices made by humans have environmental consequences.
- Fossil fuel supplies are limited, and we must transition to other energy sources before they are completely depleted.
- Access to energy resources affects the quality of life, health, socioeconomic status, equity and the environment. Poor and marginalized populations feel these effects at a higher rate.
- Energy choices impact national security – if a country has diverse sources of energy that come from within its borders, it is more secure than a country that relies on other countries to supply energy.

- **Convincing Consumers**
  The role of consumers – how can consumers be persuaded to install solar panels on their roofs? What support is needed to incentivize them and help the industry grow (e.g., financial support, political support)? Write a letter to a local official and share what you have learned.

- **Learn More About the Life Cycle of Clothing**

- **Host a Clothing Swap**
  - Encourage members to clean out their closets.
  - A good rule as you gather your swap items: Don't contribute anything you wouldn't give to a close friend.
  - This also means no:
    - tattered tees (unless they're the trendy kind!)
    - missing buttons
    - broken zippers
    - stains
  - Let members know that all wearable items are up for swapping, including apparel, accessories, shoes, bags, and jewelry.
  - Remind guests only to bring clean items.
  - To keep the swap as fair as possible, encourage members to bring in a minimum and a maximum number of items to participate—at least five items and no more than 10.
  - Whether planning on a smaller group and hosting in a living room or growing your guest list to fill up a local community center, be sure you have a few basic supplies for the swap day.
    - Depending on how many items you're expecting to collect, you'll want to have enough tables or clear surfaces for displaying folded sweaters and shirts, clothing racks for hanging up dresses and skirts, hangers, shoe racks, and smaller jewelry stands for displaying necklaces, earrings, and other accessories.
    - Having at least one full-sized mirror and a smaller one for trying on jewelry will also be essential.
    - Remind your guests to bring a tote bag for shopping and any spares they may have in case someone forgets theirs.
  - Decide how you'd like to organize your items (size, colour, or style).
  - Create an upbeat playlist.
  - Be sure to designate a changing area, whether a spare room, guest bathroom, or curtain hung around a corner.
  - To avoid one group getting all of the “good stuff,” try dividing the larger group into three smaller groups (depending on how many guests you have) and having groups draw numbers for who gets to “shop” when.
  - You may also want to set a time for each group to shop and allow each attendee to take a maximum number of items.
  - Donate any unclaimed clothes to a local charity.
  - Source: How to Host a Clothing Swap, Martha Stewart, https://www.marthastewart.com/1530634/how-host-clothing-swap

- **Investigate Ways We Conserve or Recycle to Save Energy in Agriculture**
  Investigate ways farm operations can be as energy efficient as possible. Consider practices including harvesting effectively, consistent wheel traffic patterns, minimizing turning time, using optimal gear to rotations per minute (RPM), not over-tilling, machinery and energy maintenance, equipment modifications, technology for precision agriculture, optimizing wheel slip, efficient draw implement selection and use and managing tractor size.

- **Challenge Members to Learn More About Landfill Gas Recovery**

- **Managing Plastics Responsibly**
  Research how responsible plastic management on farms can reduce greenhouse gas emissions.

- **Follow the Life Cycle of Disposable Diapers (Nappies)**

- **Promote reusability on social media (coffee cups, shopping bags, drink bottles, cutlery, and other items)**

- **Reuse and Recycle**
  Collect and display ten or more items that would normally be thrown away. Explain how they can be used for other purposes.

- **Pack Smart**
  Develop an energy-conscious package for a product that usually requires a large amount of wrapping and packaging.

- **Solar Cooker**
  Build and demonstrate a solar cooker.

- **Disposal Check**
  Investigate the production, use and disposal of fast food or food processing outlet-generated garbage.

- **One Bag Challenge**
  If each home was required to limit the amount of garbage leaving the curb to only one bag per month, describe how you would alter your lifestyle to accommodate that change.

Tour/Speaker Idea!

- Municipal Waste Management Operations
- Municipal Wastewater Operations
- Local grocery store to learn more about their policies surrounding food waste
- A municipal official (mayor, counsellor, staff) to learn more about how decisions are made related to waste management and energy

Activity #14 – Energy from Garbage – Part 2

Do

Time: 10 minutes

Materials/Resources:

- Six bags of seeds prepared during Meeting 3
- Three cue cards and a marker

Instructions:

1. Before the meeting:
   a. Write the following words on the cue cards and lay them out on the table where you are meeting.
      » Warm, Sunny Place
      » Warm Shady Place
      » Totally Dark Place
   b. Using the marker number the bags 1-6
2. During the meeting, place the six packets of seeds on the table before the members.
3. Ask the group to inspect the bags by looking at them and then not touching them. Invite them to think about where the bags may have been placed during the week between meetings.
4. Point out that the cue cards list each location where the bags were placed.
5. Hold up each bag individually and have the group vote on where they think it was placed. Ask the members to share why they made their decision. Responses may include:
   a. Warm Sunny Place – beans will be sprouted or decayed, and the bag will be full of gases
   b. Warm Shady Place – beans may be sprouted or decayed, and the bag may have some gas
   c. Totally Dark Place – beans will look similar to what they looked like when placed in the bag
6. Tell the group that the average Canadian produces an average of 673 kg of waste per person annually. That's the same weight as five full-sized refrigerators! Waste includes materials like aluminum, plastic, paper, food and yard waste. Some of these materials break down at the landfill. Have you ever driven by a dump? Why do you think it smells? Decaying garbage creates an odour because gas is being developed as trash decays. You can't see the gas, but you can smell it. That trash, even when it is decaying, contains energy.
7. Share that the warm and sunny conditions encourage the decaying process. When the beans decay, they produce a gas. Some municipalities are working to capture the gases to produce electricity.

Additional Activities:

- Allow Senior Members to take the bags home and place them in their respective locations (a warm, sunny place, two in a warm, shady spot and two in a totally dark place).
- Challenge members to learn more about Landfill Gas Recovery

Reflect	**Learning Outcomes:** Members understand the link between waste and energy.
Apply	**Discuss The Following Prompts As A Group** • What do you think will happen? • Do you think the bags' placement will make a difference? • Why is it important to consider using the gases from garbage to create energy/fuel?

Sources:

- Energy from Garbage, NEED Student Science Fair Projects, https://www.need.org/need-students/science-fair-projects/
- Canada among worst waste-producing countries: study, Radio Canada International https://www.rcinet.ca/en/2019/10/15/canada-global-waste-index-8th-place/
- 9 Things That Weigh 1000 Pounds, Measuring Stuff, https://measuringstuff.com/9-things-that-weigh-1000-pounds-9-is-shocking/
- Landfill Gas Recovery, https://www.edmonton.ca/programs_services/garbage_waste/landfill-gas-recovery

Activity #15 – Greenhouse Effect

Do	Time: 10 minutes + 1 hour **Materials/Resources:** • Two identical glass jars • 4 cups cold water • Ten ice cubes • One clear plastic bag • Thermometer **Instructions:** 1. Take two identical glass jars containing 2 cups of cold water. 2. Add five ice cubes to each jar. 3. Wrap one in a plastic bag (this is the greenhouse glass). 4. Leave both jars in the sun for one hour. 5. Measure the temperature of the water in each jar. 6. Explain that in bright sunshine, the air inside a greenhouse becomes warm. The greenhouse glass lets in the sun's light energy and some of its heat energy. This heat builds up inside the greenhouse. You just showed a small greenhouse effect. **Additional Activity:** • Another version of a greenhouse is what happens inside an automobile parked in the sun. The sun's light and heat get into the vehicle and are trapped inside, like the plastic bag around the jar. The temperature outside the car may only be 25 degrees Celsius; the air inside a vehicle can get over 49 degrees Celsius. Use a thermometer to measure the temperature inside and outside a car with closed windows sitting in the sun and compare. Does it make a difference if you open the windows for 5 minutes to create airflow?
Reflect	**Learning Outcomes:** Members understand what greenhouse gases are and their impact on the environment
Apply	**Discuss The Following Prompts As A Group** • Why is it important to understand what happens with the Greenhouse Effect? • Was this easy or hard? • Did you realize how powerful the sun's energy can be? • What might you do in the future to reduce the Greenhouse Effect?

Source: Greenhouse Effect, https://www.education.com/science-fair/article/greenhouse-effect/

Activity #16 – Plant A Terrarium Mini-Garden

Do

Time: 15 minutes

Materials/Resources:

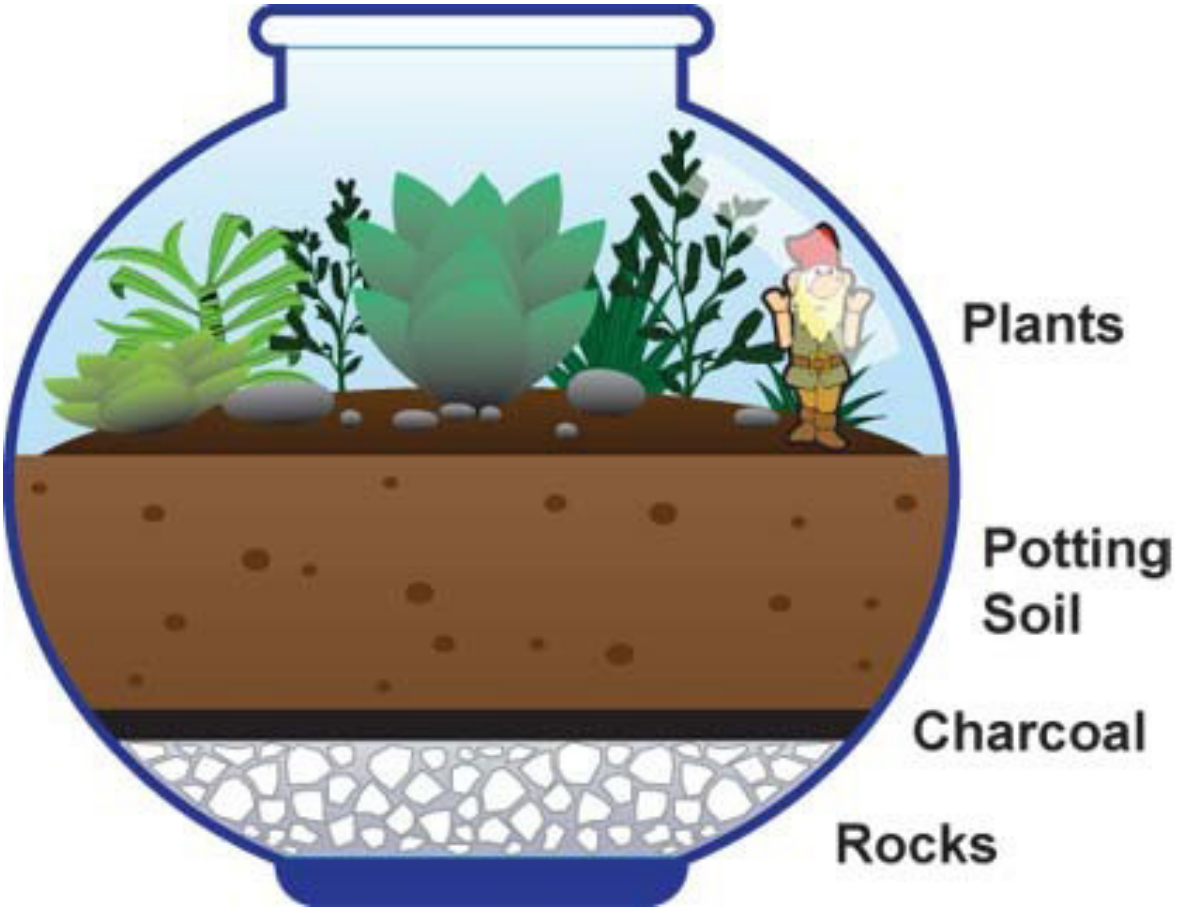
- Clear glass container. For example, an aquarium of any size, goldfish bowl, cookie jar, pickle jar, vase with a broad bottom, brandy snifter, or even a shallow dish with a glass bowl turned upside-down over it.
- Rocks (around marble-sized, depending on the size of the container)
- Activated charcoal to filter the water and help prevent the growth of fungi
- Potting Soil (sterilized)
- Small plants of different colours, shapes, & textures. Try to get miniature plants that aren't going to grow too big for the container.
- Optional:
  - Moss
  - Decorative rocks or pebbles, or both
  - Fun décors, like tiny pine cones, shells, ceramic animals, or a garden gnome.

Instructions:

1. Explain that a terrarium is warm like Earth's atmosphere. A terrarium has its own mini-climate. The container has just a tiny opening or sometimes even a lid to enclose the container completely. That makes a terrarium like a greenhouse. Sunlight enters through the glass and warms the air, soil and plants like sunlight from the atmosphere warms Earth's surface. The glass holds in some of the warmth, just as Earth's atmosphere does.
2. Choose plants that will thrive in the same kind of environment. For example, you could plant all succulents (including cactus) because they need very little water. Or you could plant all ferns because they like it moist. You could put moss with the ferns because moss likes it wet too. If you put a fern with a cactus, one or the other might not do well (the fern if it gets too dry, the cactus if it gets too wet).
3. You can use an open container or a closed container. An open container is best for succulents and cacti. They like lots of air. A sealed container (with a lid) might be best for ferns, ivies, and begonias. They like it humid. But if you see a lot of water condensing on the top, remove it for a while, then replace it.
4. Make sure your glass container is clean and shiny.
5. The rock and soil layers are part of your terrarium's beauty. Start with a layer of rocks, about 2-3 centimetres, at the bottom of your container. These will help with soil drainage, so the roots of your plants won't get water-logged.
6. Add a 1-centimetre-thick layer of charcoal.
7. Fill the container up to half-full with potting soil.
8. Plant your plants. When you remove them from their little pots, carefully tease the roots apart and remove some of the old soil so they will fit nicely in the terrarium. Arrange them to look nice. Leave some space for them to breathe and grow. Pat down the soil so they don't get uprooted easily.

Do	9. Add decorative pebbles, rocks, pine cones, or whatever to make your terrarium look like a little garden world. 10. Water the plants, but only a little. 11. Place in indirect light.
Reflect	**Learning Outcomes:** Members understand the concept of what greenhouse gases are.
Apply	**Discuss The Following Prompts As A Group** • How is a terrarium like a greenhouse? • Was this easy or hard? • What is climate change? • Why is the earth warming? • Do you think the earth is warming up compared to years ago? Look at the average temperature for the last 100 years for a given date and plot it on a graph.

Source: Make a Terrarium Mini-Garden, https://climatekids.nasa.gov/mini-garden/



Activity #17 – From Scraps to Scrumptious! Solutions For Food Waste

Do

Time: 15 minutes

Materials/Resources:

- Large glass jars
- Water
- Base of a head of iceberg lettuce, a green onion, or the bottom of a heart of celery
- Pot with potting soil
- Base of onion or clove of garlic
- Seeds from strawberries, raspberries or lemons

Instructions:

1. Explain that it is possible to grow vegetables from scraps. Scrap growing is excellent because plenty of scraps multiply, giving members a big-picture view of the life cycle of food. Many easy-to-grow fruits and vegetables are likely already on your grocery list or kitchen.
2. Place the base of a head of iceberg lettuce, a green onion, or the bottom of a celery heart in a jar with water and watch it sprout in days.
3. Plant the base of an onion or garlic clove in wet soil.
4. Remove the seeds from strawberries, raspberries, or lemons and place them in wet soil

Additional Activities:

- Make Your Own Potato Skins: Roast potato skins that have been emptied for mashed or baked potatoes
- Bake zucchini bread/banana bread/carrot cake or muffins from over-ripe produce
- Use citrus peels for making tea or homemade surface cleaner.
- For a homemade orange cleaner, in a small saucepan, combine the peel of one orange for every 1 cup [120 ml] of water. Bring this to a boil and then simmer for 15 minutes. Once it cools, transfer it to a clean spray bottle. It will keep for up to one month. Use throughout the kitchen and on wood.
- Make vegetable soup from vegetables found in the refrigerator and add leftover parmesan rinds into the soup for added flavour.
- Turn leftover bread into croutons, French toast, or bread pudding.

Reflect

Learning Outcomes:

Members understand the link between waste (including food waste) and how to affect energy conversation positively.

Apply

Discuss The Following Prompts As A Group

- Why is it important to use as much of our food as possible?
- Was this easy or hard?
- Did you try a food for the first time?
- Which one of these methods are you likely to try at home?
- Do you know any other ways to turn food scraps into something that can be used again?

Sources:

- Teaching Kids About Food Waste, Three O'Clock Project, https://www.threeoclockproject.org/post/teaching-kids-about-food-waste
- How to Make Orange Peel Cleaning Spray, Real Simple, https://www.realsimple.com/home-organizing/cleaning/how-to-make-homemade-cleaning-spray-out-of-orange-peels

Activity #18 – Simple Questions – Powerful Results

Do

Time: 15 minutes

Materials/Resources:

- Worksheet on page 23-24
- Cell phone or tablets for each group connected to the internet

Instructions:

1. Explain that garbage wastes energy. The things we throw out need energy for transportation and disposal, landfilling and producing replacement goods.
2. Have members use the worksheet on page 23 to write down all the items they threw out that day.
3. Have them categorize their "garbage" according to what could be recycled, reused (how?), and composted.
4. Encourage members to strive to go to zero waste and commit to as many R's as they can:
    - Reduce – carefully consider how many items you purchase
    - Reuse – think of ways to use an item in several different ways, and share an article with friends or family members once you are finished with it
    - Recycle – use an item again
    - Repair – fix an item to keep using it
    - Refuse – avoid unneeded packaging or items that need to travel long distances
    - Renew – maintain the item to keep it working well
    - Return – bottles and containers that may have had a recycling deposit, e.g. alcohol bottles, pop bottles, milk jugs
    - Restore – return the item to its original state
    - Revitalize – refresh an item to give it a new life
    - Redesign – use the whole or parts of an item to make it useful in a different way
    - Add any other ideas you may come up with
5. Discuss ways that members can trim their e-waste. Consider the life cycle of your electronic products and make the most of responsible choices. Seek opportunities to donate to local groups collecting e-waste, like eco-clubs at high schools, churches or service organizations.
6. Break the group into groups of 3-4 members. Using a cell phone, laptop or tablet, challenge the groups to find as many yard sales, auctions, second-hand, vintage, consignment and thrift stores in your area. Be sure to record the dates, locations and contact information.
7. Regroup as a large group and compile a list of opportunities. Create a flyer, social media post or campaign to share the contact information.

Do

- Educated Consumer
  - Next time you shop, ask yourself a few simple questions:
    - » Do I really need this? If I need this, is it a high-quality, durable quality that will last?
    - » Can it be used more than once?
    - » Will a preowned option work?
    - » When I finish it, can it be put to other uses?
    - » When I'm finished, can someone else use it?
    - » Can it be recycled?
    - » Can I borrow or rent this product from someone else instead of buying it?
    - » For larger purchases, research the energy efficiency of the item.
    - » If you ask these questions often enough, you should find your shopping time and expenses reduced.
  - Make a short list of what you need versus the available options. Is there an alternative that would meet your needs? What kind of support does each seller offer? Don't buy on impulse.
  - Learn as much as possible about what you want before buying.
  - Consult sources like Consumer Reports (an unbiased ranking of products in all categories) or the Better Business Bureau (more applicable for services).
  - Shop around. Prices vary.
  - Watch for sales.
  - If you don't need something immediately, it may be worth waiting.
  - Watch for differences in quality.
  - Consider the maintenance required.
  - Know prices and other term definitions such as free delivery, return policies, and service availability.

Reflect

Learning Outcomes:
Members know that they have a role to play in using energy responsibly in big and small ways now and that our energy habits affect more than just ourselves (social implications).

Apply

Discuss The Following Prompts As A Group

- Why is it essential to be an educated consumer?
- Was this easy or hard?
- Why do the decisions we make when we purchase things make a difference?
- What will be easy to do again?

Sources:

- Four ways to cut your carbon emissions, David Suzuki Foundation, https://davidsuzuki.org/what-you-can-do/four-ways-to-cut-your-carbon-emissions/
- Consumer Decision Making, Texas 4-H, https://texas4-h.tamu.edu/projects/consumer-education/

Activity #19 – The Life Cycle Of a Product

Do

Time: 15 minutes

Materials/Resources:

- Worksheet (next page)
- Aluminum can
- A tablet or cell phone for each pair to use for researching

Instructions:

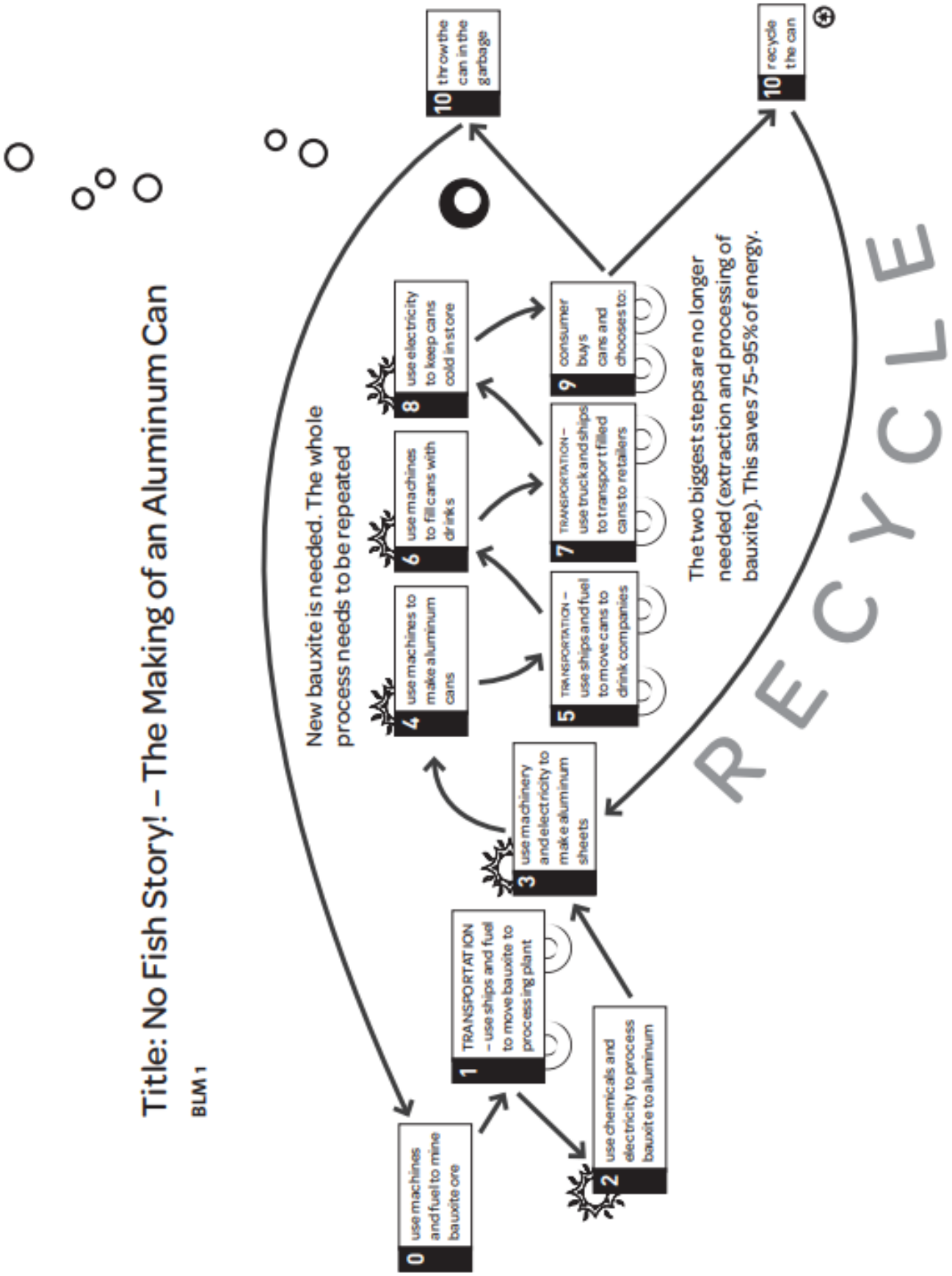
1. Direct members to No Fish Story! The Making of an Aluminum Can on page 25-26 of their Record Books. Use the illustration to explain the basic process of making an aluminum can. Emphasize that there is the consumption of fossil fuels for transportation between each stage since each manufacturing stage occurs in a different place.
2. Highlight that products have a life cycle.
    - Materials Extraction – products are made up of raw materials like oil and minerals
    - Materials Processing – raw materials are processed; for example, crude oil is processed into plastic, copper is used to make circuit boards
    - Manufacturing – plastics and metals are used to create the product
    - Packaging & Transportation – finished products are packaged and transported from the manufacturing facility to the user
    - Useful Life – The time that the consumer is using the product
    - End-of-Life – Donating or recycling products when you no longer need or want them extends their useful lives and prevents them from ending up in the landfill, where they can potentially cause environmental damage.
3. Point out that most of the damage to Earth is done during the first two stages: mining the bauxite and processing the ore. Explain that energy, water, and chemicals are inputs at each stage. At each stage, wastewater and waste heat output are produced.
4. Share that Embedded Energy is when you buy a product, you are not only purchasing the materials used to make the product, you are also buying all the energy that was used to create and assemble the parts of the product, as well as the energy used to transport all the parts and final product to the store. The energy that you are buying is called embedded energy.
5. Assign pairs or small groups of members to study the poster more closely. Have the groups map out the product's life cycle stages on paper and identify the energy inputs (machines, transportation, storage, etc.) and the energy outputs (waste heat). With their partner or group, have members answer the question, What is embedded energy? Have them compare their responses with another pair or group.
6. Have members work in partners or small groups to research a product of their choice. This activity will help solidify their understanding of matter and materials, how energy is part of the production process, and their awareness of these processes.

Do	7. Use the following guiding questions to help members organize their information for their research: o What product (matter) have you chosen to learn more about? o What natural resource or raw material is needed to make this product? o Where is energy needed in the life cycle of this product? o What is the effect of taking this raw material from the environment? o Can this product be recycled? How is it done? o What is the recycled product made into after recycling? What are the benefits of recycling this product? 8. Have the teams/groups share their product, the materials, where energy is needed, if the product can be recycled, and what happens if it can be recycled with the group.
Reflect	**Learning Outcomes:** Members recognize the connection between consuming products and energy use – Life Cycle Thinking
Apply	**Discuss The Following Prompts As A Group** • Why is it important to recycle? • Was this easy or hard? • What would make it easier to recycle items?

Sources:

- Energy Conservation Learning Activities by Grade 1-8, Ecological Literacy Resource, Revised 2011-12, www.ontarioecoshools.org
- The Life Cycle of a Cell Phone, National Service Center for Environmental Publications (NSCEP), 2004.

THE LIFE CYCLE OF A PRODUCT



Source: Energy Conservation Learning Activities by Grade 1-8, Ecological Literacy Resource, Revised 2011-12, www.ontarioecoshools.org

Reference citations:

- Clean Growth Pathway to 2050, Fortis BC, February 2022.
- Basic Information about Landfill Gas, Environmental Protection Agency https://www.epa.gov/lmop/basic-information-about-landfill-gas
- What are greenhouse gases? https://davidsuzuki.org/what-you-can-do/greenhouse-gases/
- Taking stock: Reducing food loss and waste in Canada https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/food-loss-waste/taking-stock.html#toc1
- Waste management, Ontario.ca https://www.ontario.ca/page/waste-management#section-3
- 5 Easy Eco-Friendly Stain Removal Hacks to Wash Your Clothes https://sustainablelivingassociation.org/5-easy-eco-friendly-stain-removal-hacks-to-wash-your-clothes/
- Fashion for the Earth, Earth Day https://www.earthday.org/campaign/sustainable-fashion/
- Toolkit: How to care for your clothes, Earth Day https://www.earthday.org/toolkit-how-to-care-for-your-clothes/
- Textile waste in the concept of circularity, May 2023, Laboratory of Chemical Engineering and Engineering Sustainability, Faculty of Pure and Applied Sciences, Open University of Cyprus, Giannou Kranidioti 33, Latsia, 2220, Nicosia, Cyprus, Department of Agrochemistry and Environment, University Miguel Hernandez of Elche, Avd. de la Universidad s/n, 03202 Elche, Alicante, SpainSustainable Chemistry and Pharmacy, Iliana Papamicheal, Irene Voukkali, Pantelista Loizia, others.
- Circular Economy, Government of Canada https://www.canada.ca/en/services/environment/conservation/sustainability/circular-economy.html
- The Battery Recycling Journey, Call2Recycle.ca https://www.call2recycle.ca/the-battery-recycling-journey/
- What is the Greenhouse Effect? https://youtu.be/SN5-DnOHQmE
- How Do We Know Earth is Changing? https://youtu.be/wzPUm-Ytpz4
- Recycling 101 – Waste Management https://www.wm.com/ca/en/recycle-right/recycling-101
- SDG 7: Affordable and Clean Energy and the Fashion Industry https://www.threadingchange.org/blog/sdg-7
- Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education, US Department of Energy, https://www.energy.gov/eere/education/energy-literacy-essential-principles-energy-education
- The Life Cycle of a T-Shirt – Angel Chang (6:03), TED-Ed https://youtu.be/BiSYoeqb_VY
- How to Host a Clothing Swap, Martha Stewart https://www.marthastewart.com/1530634/how-host-clothing-swap
- Top 10 Ways Field Crop Farms Can Save Energy, Penn State Extension https://extension.psu.edu/top-10-ways-field-crop-farms-can-save-energy
- Energy Conservation Opportunities in Agriculture, A National Association of Conservation Districts Report, National Association of Conservation Districts www.nacdnet.org
- Landfill Gas Recovery, City of Edmonton https://www.edmonton.ca/programs_services/garbage_waste/landfill-gas-recovery
- Cleanfarms https://cleanfarms.ca/
- Agricultural Plastics Recycling Group https://www.aprg.ca/faq
- Recycling Farm Plastic Films, OMAFRA http://omafra.gov.on.ca/english/engineer/facts/95-019.htm
- A Life Cycle Assessment of NAPPIES: single-use vs. reusables https://youtu.be/GXfxvqPgVwc
- Which bag should you use? - Luka Seamus Wright and Imogen Ellen Napper https://youtu.be/3_fjE-c4aQVk
- Energy from Garbage, NEED Student Science Fair Projects https://www.need.org/need-students/science-fair-projects/
- Canada among worst waste-producing countries: study, Radio Canada International https://www.rcinet.ca/en/2019/10/15/canada-global-waste-index-8th-place/

- 9 Things That Weigh 1000 Pounds, Measuring Stuff https://measuringstuff.com/9-things-that-weigh-1000-pounds-9-is-shocking/
- Greenhouse Effect https://www.education.com/science-fair/article/greenhouse-effect/
- Make a Terrarium Mini-Garden https://climatekids.nasa.gov/mini-garden/
- Teaching Kids About Food Waste, Three O'Clock Project https://www.threeoclockproject.org/post/teaching-kids-about-food-waste
- How to Make Orange Peel Cleaning Spray, Real Simple https://www.realsimple.com/home-organizing/cleaning/how-to-make-homemade-cleaning-spray-out-of-orange-peels
- Four ways to cut your carbon emissions, David Suzuki Foundation https://davidsuzuki.org/what-you-can-do/four-ways-to-cut-your-carbon-emissions/
- Consumer Decision Making, Texas 4-H https://texas4-h.tamu.edu/projects/consumer-education/
- Energy Conservation Learning Activities by Grade 1-8, Ecological Literacy Resource, Revised 2011-12 www.ontarioecoshools.org
- The Life Cycle of a Cell Phone, National Service Center for Environmental Publications (NSCEP), 2004.
- Energy Conservation Learning Activities by Grade 1-8, Ecological Literacy Resource, Revised 2011-12 www.ontarioecoshools.org

On The Move

Meeting 5 – On The Move

Setting Objectives:
- To understand transportation options, their energy use, and their impact on the environment.

Learning Outcomes:
- Members understand how transportation uses energy.
- Members consider how they travel and how it impacts energy use.
- Members are familiar with how decisions related to energy use are made by local government.
- Members understand the process and importance of advocating for efficient energy use.

Reference Material in this Section:
- Energy Impact of Transportation in Canada
- Efficient Automobile Travel
- Tips for buying a fuel-efficient vehicle
- Myths About Electric Vehicles
- Who Makes Decisions About Energy?
- Advocacy Letters 101

Activities:
- Activity 20: Let's Talk About Transportation
- Activity 21: Planes, Trains and Automobiles
- Activity 22: Auto$mart: Driving and the Environment
- Activity 23: Advocacy in Action

SAMPLE MEETING AGENDA Time: (generally) 2 hours 15 minutes

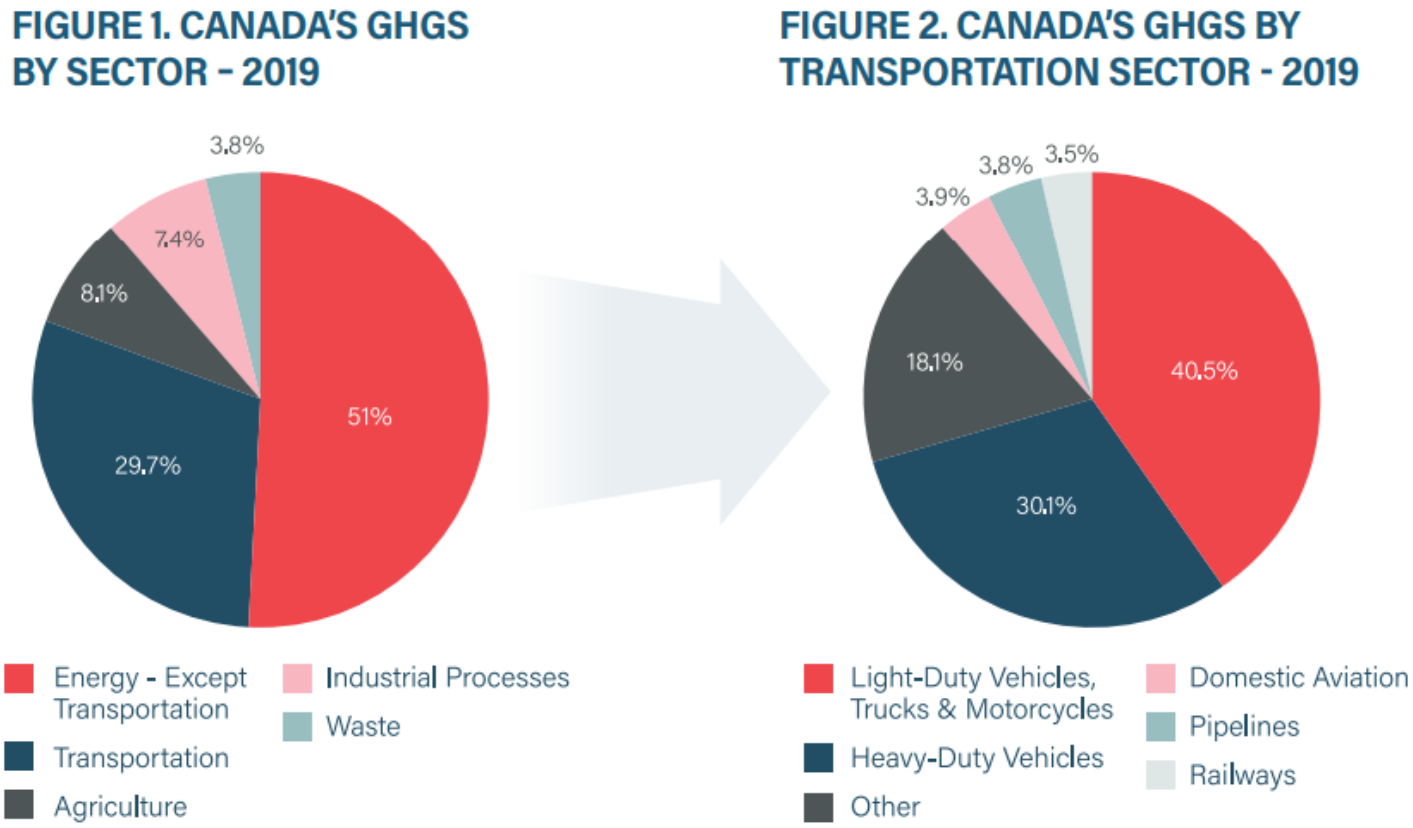
Welcome, Call to order, Pledge		5 minutes
Roll Call	Invite each member to share their name and response to the At Home Challenge you asked them to complete at the end of Meeting 4. Share your experience with the Grocery List challenge. Or ask members to name one way transportation uses energy.	5 minutes
Activities Related to Topic	**Activity 20: Let's Talk About Transportation**	15 minutes
Topic Information Discussion	Energy Impact of Transportation in Canada	10 minutes
Activities Related to Topic	Activity 21: Planes, trains and automobiles	15 minutes
Topic Information Discussion	Efficient Automobile Travel Alternative Fuels Myths About Electric Vehicles Clean On-Road Transportation	15 minutes 10 minutes
Activities Related to Topic	**Activity 22: Auto$mart: Driving and the environment**	20 minutes
Topic Information Discussion	Who Makes Decisions About Energy? Who Needs to Hear from You?	15 minutes

Activities Related to Topic	**Activity 23: Advocacy in Action**	20 minutes
Wrap-Up, Adjournment & Social Time	Recap topics covered in this meeting and review the At Home Challenge	5 minutes
At Home Challenge	Choose one of the At Home Activities found throughout the meeting.	

Energy Impact of Transportation in Canada

Greenhouse Gases in Canada's Transportation Sector

The transportation sector is responsible for approximately 30% percent of greenhouse gas emissions in Canada. Light-duty vehicles – the cars, vans and trucks we drive - are responsible for almost half that total. Although light-duty vehicles are more fuel efficient than in the 1970s, there are many more vehicles on the road today, and we're driving them further than before, thus using more fuel. While much of the energy use in Canada is necessary, there are times when we could use energy more wisely. This graph compares the different percentages of Greenhouse Gases created.



Graphic Source: Policy Changes to Support Canadian Rail Sector Sustainability, Railway Association of Canada, March 2022

Aviation - Air Transportation - Airplanes

Air transportation is fast, easy to track and accessible to just about any location with an airport nearby. Still, air travel and shipping come with a high price tag and low carrying capacity.

Flights are energy-intensive and depend on fossil fuels. Because aircraft emissions are released high in the atmosphere, they have a potent climate impact, triggering chemical reactions and atmospheric effects that heat the planet.

Five ways to fly smarter:

- Fly less often.
- Fly economy instead of business class to improve efficiency. More passengers are carried in economy class, resulting in a lower carbon impact per seat than airlines that have business class seats on the same type of plane – simply because there are more seats on that plane.
- Take direct, non-stop flights to avoid high emissions during takeoff and landing.
- Take daytime flights (due to the heat-trapping effect of contrails and cirrus clouds at night, sunlight reflecting during the day).
- Choose airlines carefully. (Some airlines do a better job of ensuring they have a full passenger load and fly more efficient planes.)
- Buy fares that have a carbon offset. A carbon offset is a credit for emissions reductions given to one party that can be sold to another party to compensate for its emissions. These projects encourage a shift from fossil fuel use and carry inherently low environmental risks.

Marine - Water Transportation – Ships and Ferries

- Developments and practices in water transportation are contributing to more efficient energy practices, including:
- Coatings on the boats to minimize the resistance of ships in the water and their fuel consumption.
- Improving the efficiency of older engines by upgrading and adding technologies such as blades, vanes, ducts and turbulence devices to increase fuel efficiency and reduce GHG emissions.
- Use of waste heat from engines to drive turbines to produce electricity. Thus, less fuel is needed for electricity production.
- Replace fossil fuels with neutral or low-carbon fuels, such as biofuel, hydrogen, ammonia, fuel cells, and wind power.
- Improved original design specifications such as beam, draft, size and speed to increase the ship's energy efficiency.

Rail transportation – Trains and rapid transit

The rail network, for both passengers and freight, produces lower GHG emissions than roadway and air transportation, which means that shifting trips from road and air to rail in locations where it makes sense can reduce overall transportation emissions. Rail relies on diesel fuel, creating a challenge in reducing GHG emissions from the rail industry. In 2019 Canada's rail sector accounted for only 3.5% of total transportation emissions. The integration of electric power options will improve the efficiency of rail travel.

Urban Rail Transit in Canada – Subways, light rail and streetcars

Urban rail transit in Canada encompasses a broad range of rail mass transit systems, including commuter rail, rapid transit, light rail, and streetcar systems.

Commuter rail refers to urban passenger train service between a central city and its suburbs. GO Transit in Toronto is an example of this system.

Subway refers to a rapid transit system using heavy rail with steel wheels. The Toronto subway is the only such system in Canada.

Light rail refers to a rail transit system using light rail vehicles in a dedicated right-of-way. Toronto, Waterloo Region, Ottawa, Calgary and Edmonton have these systems.

Streetcar refers to a rail transit system using light rail vehicles entirely or mainly on streets providing local service in mixed traffic. The Toronto streetcar is the only such system in Canada.

Talk About It!

The average amount spent on transportation per Canadian annually in 2022 was $2,422.
Source: Energy Fact Book 2022-2023, Natural Resources Canada

Efficient Automobile Travel

The less gasoline your family car burns, the less carbon dioxide and other harmful gases it pumps into the air.

What Makes A Car Energy Efficient?

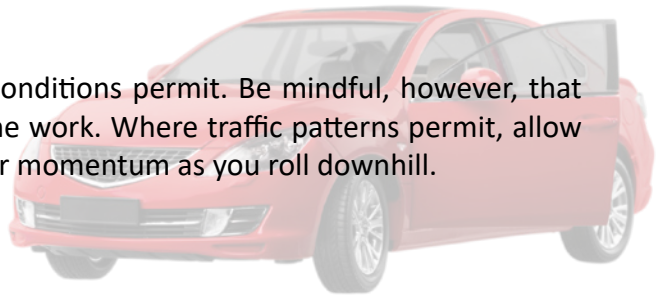
Fuel-efficient driving techniques

Fuel-efficient driving can save you hundreds of dollars in fuel each year, improve road safety and prevent wear on your vehicle. Adopt these five fuel-efficient driving techniques to lower your vehicle's fuel consumption and carbon dioxide emissions by as much as 25%.

- **Accelerate gently**
  Avoid jackrabbit starts (when drivers push down hard on their accelerators so that they can shoot forward with speed). The harder you accelerate, the more fuel you use. You can use less fuel in the city by gently easing onto the accelerator pedal. To be as fuel-efficient as possible, take 5 seconds to accelerate your vehicle up to 20 kilometres per hour from a stop. Imagine an open cup of coffee on the dashboard. Don't spill it!

- **Maintain a steady speed**
  When your speed dips and bursts, you use more fuel and spend more money than you need to. Tests have shown that varying your speed up and down between 75 km and 85 km per hour every 18 seconds can increase your fuel use by 20%.

  Consider using cruise control for highway driving where conditions permit. Be mindful, however, that little variations in speed can be good when gravity does the work. Where traffic patterns permit, allow your speed to drop when you travel uphill, then regain your momentum as you roll downhill.



- **Anticipate traffic**
  Look ahead while you're driving to see what is coming up. Keep a comfortable distance between your vehicle and the one in front. By looking closely at what pedestrians and other cars are doing and imagining what they'll do next, you can keep your speed steady and use less fuel. It's also safer to drive this way.

- **Avoid high speeds**
  Keep to the speed limit and save on fuel! Most cars, vans, pickup trucks and SUVs are fuel-efficient when travelling between 50 and 80 km per hour. Above this speed zone, vehicles use increasingly more fuel the faster they go.

  For example, at 120 km per hour, a vehicle uses about 20% more fuel at 100 km per hour. On a 25-km trip, this speed and fuel consumption spike would cut just two minutes from your travel time.

- **Coast to decelerate**
  Every time you use your brakes, you waste your forward momentum. By looking ahead at how traffic is behaving, you can often see well in advance when it's time to slow down. You will conserve fuel and save money by taking your foot off the accelerator and coasting to slow down instead of using your brakes.

  Take the free online driving course to learn more about how fuel-efficient driving can help you save money and reduce greenhouse gas emissions.

More Ways to Use Less Fuel

Here are more easy ways you can reduce your fuel consumption and costs:

- **Avoid idling your vehicle**
  Turn off your engine when stopped for more than 60 seconds, except when in traffic. The average vehicle with a 3-litre engine wastes 300 millilitres (over 1 cup) of fuel every 10 minutes it idles.

- **Maintain the vehicle**
  Measure your tire pressure every month. Driving a vehicle with tires under-inflated by 56 kilopascals (8 pounds per square inch) can increase fuel consumption by up to 4%. It can also reduce the life of your tires by more than 10,000 kilometres. Find the correct tire pressure for your vehicle on the tire information placard. It's usually on the edge of the driver's door or doorpost. Learn more about tire maintenance. Maintain the car. A well-tuned engine can cut fuel consumption by over 10 percent.

- **Use a manual transmission properly**
  Pay attention to the tachometer, which shows engine speed. Use it to know when to shift a manual transmission for the best fuel efficiency. The higher the rpm, the more fuel the engine is burning. So, shift through the lower gears smoothly and quickly and build up speed in the higher gears.

- **Don't carry unnecessary weight**
  Remove items such as salt, sand and sports equipment from your vehicle. The less it weighs, the less fuel your vehicle will use. The fuel consumption of a mid-size car increases by about 1% for every 25 kilograms of weight it carries. Empty the trunk of junk. For every 300 km driven, the car releases carbon dioxide equal to its weight.

- **Remove roof or bicycle racks**
  Streamline your vehicle by removing the racks when you're not using them. Aerodynamic drag can increase fuel consumption by as much as 20% on the highway.

- **Use air conditioning sparingly and look for air conditioning options**
  Air conditioning can increase a vehicle's fuel consumption by as much as 20%. Open the windows when driving in the city, and use the flow-through ventilation system with the windows up on the highway. If you do use air conditioning, use the re-circulate option. It will minimize the impact. Air conditioning can increase fuel consumption by over 20% under city-driving conditions. Look for a system with an "economy" mode to help minimize the impact of air conditioning use.

Share It!

If Canadian motorists avoided unnecessary idling for just three minutes every day of the year, it would prevent 630 million litres of fuel from being wasted and 1.4 million tonnes of carbon dioxide from being needlessly pumped into the environment. Annually, that would be equivalent to taking 320,000 cars off the road!

- **Use a fuel consumption display**
  See the impact of the five fuel-efficient driving techniques firsthand with the help of a fuel consumption display, a feature now standard on many vehicles. (Some newer vehicles come equipped with even more sophisticated displays that analyze speed variations, shift points for manual transmissions, and driving behaviours such as acceleration and braking times.) Many drivers consume 15% less fuel by acting on the feedback that fuel consumption displays provide.

- **Buy the smallest vehicle**
  Generally, the smaller the vehicle, the less fuel it consumes and the less carbon dioxide it produces. Narrow your options to the smallest type of vehicle that meets your everyday needs, and you'll save money not only in the showroom but also on the road.

- **Bypass the remote car starter**
  Remote car starters encourage people to start their cars before they are ready to drive them. Doing this wastes fuel.

- **Track your fuel consumption**.
  How long can you go without filling your tank? Two weeks? A month? Challenge yourself to refill seldom, and your monthly costs will decrease.

- **Plan ahead**
  - Map out your route, especially if it's long
  - Listen to traffic reports and avoid accidents, road construction and other trouble spots
  - Avoid roads that cut through major cities and are dotted with stoplights, intersections and pedestrians
  - Use four-lane highways when you can

- **Combine trips**
  Longer excursions let your vehicle's engine warm to its most fuel-efficient temperature.
  - Car pool, sharing a ride saves energy and money
  - Run your errands one after the other
  - Plan your route to avoid backtracking and rush-hour traffic
  - Encourage your family to combine car trips and place limits on the number of times the car is used every week.

- **Drive less**
  The best way to reduce fuel consumption is to drive less.
  - Walk or bike to your destination. You'll use no fuel and have a healthier lifestyle

Tips for Buying a Fuel-Efficient Vehicle

Here are some energy-efficient features to look for when your family buys a new car, along with some simple energy-saving tips:

- Lightweight, compact cars are more energy efficient than heavy, full-sized cars.
- The tinted glass keeps the car cooler in the sun, which can reduce the need for air conditioning. However, it also reduces visibility at night.
- A flow-through ventilation system helps you avoid turning on the air-conditioner.
- Electronically controlled fuel injection systems give the engine the right amount of fuel for efficient running.
- A small, 2.2-litre engine uses less fuel than a 5.0 or 4.0 engine.
- A small, turbocharged engine provides better fuel economy than a large, non-turbocharged
- Ask for fuel-efficient features

Several inexpensive options can help you reduce fuel consumption:

- **Aluminum wheels**
  Aluminum wheels are lighter than regular wheels. As a result, a vehicle doesn't need to use as much energy to move them.

- **Block heater**
  A block heater heats a vehicle's engine block. This means you start a semi-warm engine and improve your vehicle's overall winter fuel efficiency.

- **Cruise control**
  Cruise control helps keep a vehicle's speed constant on the highway. This avoids unintended slowdowns and accelerations that increase the amount of fuel a car uses.

- **Navigation system**
  Navigation systems show you the most direct route to your destination. That saves you from wasting fuel on detours.

- **Removable roof rack**
  Removable roof racks are more fuel-efficient than permanent racks because you can remove them and eliminate resistance when you're not using them.

- **Sunroof**
  Open windows or sunroofs are more fuel-efficient than air conditioning at city speeds. But on highways, they increase drag and fuel consumption. Look for a sunroof with a tilt function that boosts ventilation without increasing drag.

- **Tachometer**
  Tachometers show engine speed. They let you know when to shift a manual transmission for the best fuel efficiency.

- **Tinted windows**
  Tinted glass blocks some of the sun's heat from entering your vehicle. This keeps you cool without air conditioning. You can install tinted glass on any vehicle, new or used.

- **Trip computer**
  Trip computers show the amount of fuel you use and challenge you to consume less.

Three Tips When Buying a Vehicle

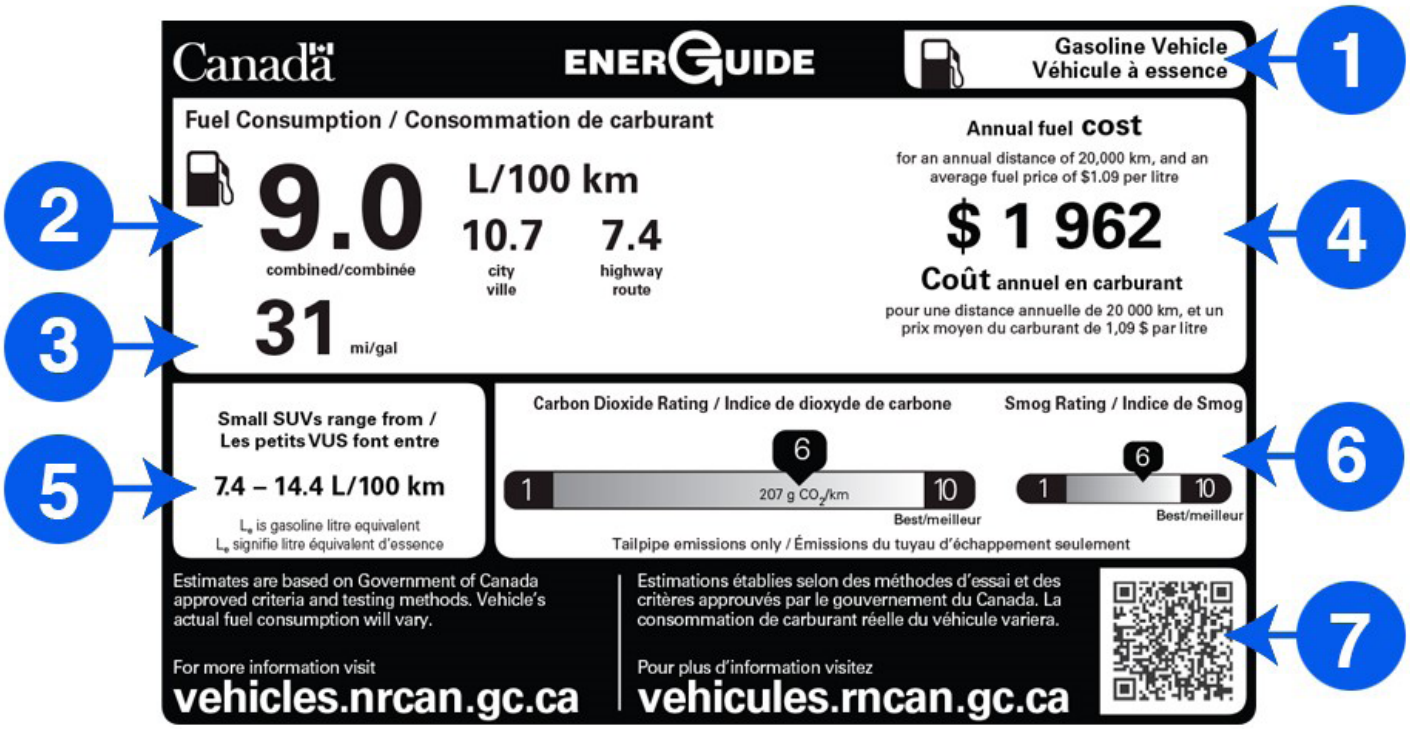
1. **Analyze your driving lifestyle**
   - Who are you? Where do you live? What do you do?
   - How do you spend your time?
   - How many people and things will you carry along with you?
   - How much travelling will you do?
2. **Analyze your choice**s
   - Battery Electric Vehicles have onboard batteries that power one or more electric motors. The vehicle is plugged into the electricity grid to recharge and produce no exhaust emissions while on the road.
   - An internal combustion engine and an electric motor power Plug-in Hybrid Electric Vehicles. The vehicle is plugged into the grid to charge.
   - Hybrid Electric Vehicles combine an internal combustion gasoline or diesel engine with an electric motor. The batteries are charged from the vehicle's operation and are not plugged into the grid to charge. Every time you press the brakes on the car, energy is lost in the form of heat. A hybrid will absorb this energy back into the battery, which means you use less fuel because you recycle energy. Hybrids have low fuel consumption. These vehicles automatically shut off when you are idling and restart when you are ready to go, which adds to their efficiency.
   - Fuel-cell Electric Vehicles generate electricity by combining oxygen and hydrogen.
   - Diesel-powered vehicles typically get 30% more distance from a fuel tank than the same-size gasoline vehicle.
   - Smaller conventional gasoline-powered vehicles can be fuel efficient, depending on your engine and transmission choice. They're capable of delivering fantastic fuel economy.
3. **Do the math**
   - Keep your money in your pocket, not in your fuel tank. Keep your CO2 emissions low.

For New Cars:

EnerGuide labels

The EnerGuide label gives model-specific fuel consumption information for new light-duty vehicles available for sale in Canada. This includes passenger cars, vans, pickup trucks and SUVs. Using EnerGuide labels, you can compare vehicles and find the most fuel-efficient one that meets your everyday needs.

EnerGuide labels should remain on new vehicles until they are sold. If a new vehicle has no label, ask the dealer to give you the manufacturer's fuel consumption information for the vehicle.
Here is a sample EnerGuide label for a gasoline vehicle. Use the links below to see the sample labels for vehicles that use other fuel types.



1. Vehicle technology and fuel – The text and related icons identify the type of fuel used by the vehicle.
2. Fuel consumption – This is a prominent combined fuel consumption rating and separate city and highway fuel consumption ratings in litres per 100 kilometres (L/100 km). The combined rating reflects 55% city and 45% highway driving.
3. Fuel economy – The combined rating is expressed in miles per imperial gallon (mi/gal).
4. Annual fuel cost – This estimate is based on the combined fuel consumption rating, 20,000 km driven, and the fuel price indicated.
5. Vehicle class range – This shows the best and worst combined fuel consumption ratings of vehicles in the same class.
6. CO2 and smog ratings – Here are the vehicle's tailpipe emissions of carbon dioxide (CO2) and smog-forming pollutants rated on a scale from 1 (worst) to 10 (best). The CO2 emissions, in grams per km driven, are shown on the CO2 bar.
7. QR code – The quick-response code links smartphone users to Natural Resources Canada's fuel consumption ratings search tool.

EnerGuide Labels for Plug-in Hybrid Electric Vehicles

Below are sample labels for the plug-in hybrid electric vehicles (PHEVs) types: series and blended. For PHEVs, consumption values are provided for electric-only or blended electric and gasoline mode and gasoline-only operation. Annual fuel cost and carbon dioxide (CO2) emissions values reflect a mix of electric mode and gasoline-only operation.

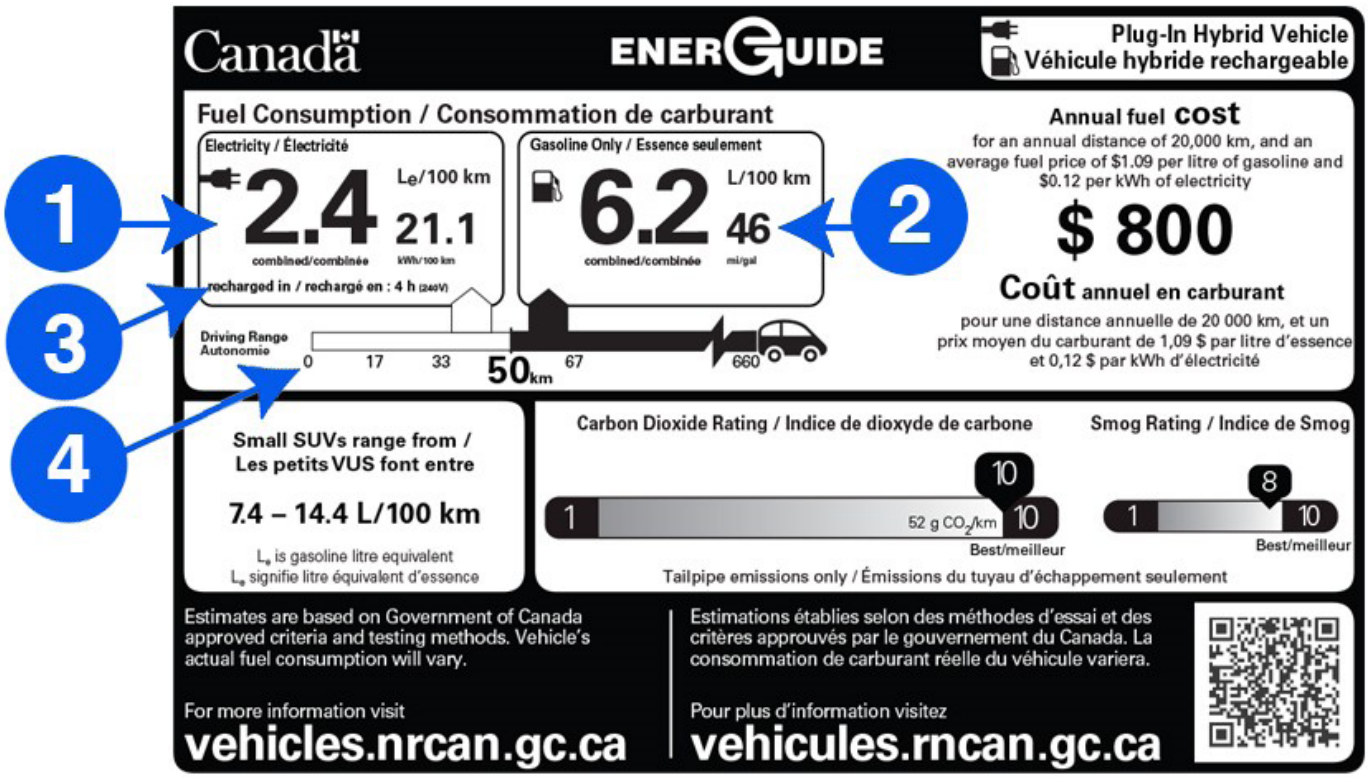
To help you compare vehicles that use electricity, a conversion factor is used to convert electrical energy consumption values, expressed in kilowatt-hours per 100 kilometres (kWh/100 km), into gasoline litres equivalent per 100 kilometres (Le/100 km). One litre of gasoline contains the energy equivalent to 8.9 kWh of electricity.

ENERGY TRIVIA

Did you know?

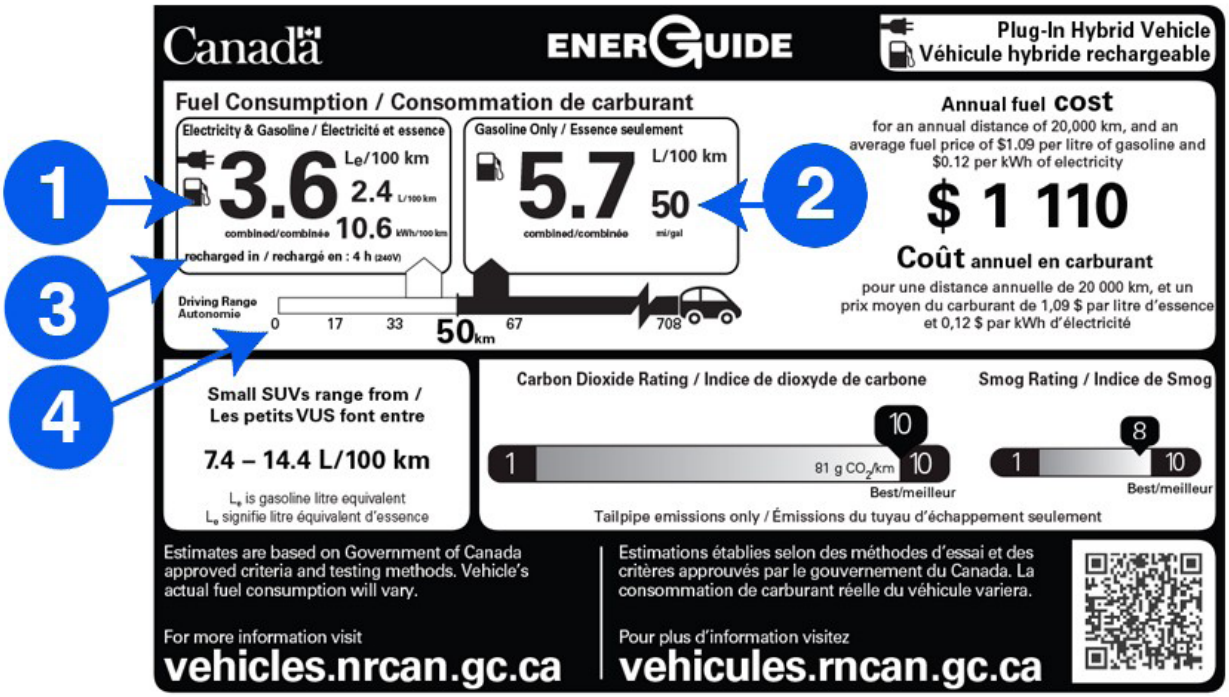
In 2021, electric vehicle registrations comprised 5.4% of total vehicle registrations.

Source: Energy Fact Book 2022-2023, Ministry of Natural Resources.



1. Fuel consumption (electric-only mode) – This is a prominent combined fuel consumption rating in Le/100 km and the combined rating expressed in kWh/100 km. The combined rating reflects 55% city and 45% highway driving.
2. Fuel consumption (gasoline-only operation) – This is a prominent combined fuel consumption rating in litres per 100 kilometres (L/100 km) and the combined rating expressed in miles per imperial gallon (mi/gal).
3. Recharge time – This shows the estimated time (in hours) to fully recharge the battery at 240 volts.
4. Driving range – This shows the estimated distance (in kilometres) between a fully charged battery and a full gasoline tank.

Blended plug-in Hybrid Electric Vehicle



1. Fuel consumption (blended electric and gasoline mode) – This is a prominent combined fuel consumption rating in Le/100 km, composed of the gasoline consumption rating in L/100 km and the electricity consumption rating in kWh/100 km.
2. Fuel consumption (gasoline-only operation) – This is a prominent combined fuel consumption rating in L/100 km, and the combined rating expressed in miles per imperial gallon (mi/gal).
3. Recharge time – This shows the estimated time (in hours) to fully recharge the battery at 240 volts.
4. Driving Range – This shows the estimated distance (in kilometres) between a fully charged battery and a full gasoline tank.

Alternative Fuels

Alternative fuels are becoming more accessible and less damaging to the environment.

Electricity – Electric Vehicles are cheaper to operate because electricity costs less than fuel, and fewer moving and wearable parts in EVs mean less maintenance. Savings can add up to thousands of dollars over a vehicle's lifetime.

Hydrogen – electricity separates water into hydrogen and oxygen. When the hydrogen is burned as fuel, it recombines with oxygen to become water. This form of energy is entirely renewable and non-polluting.

Propane - Propane burns more cleanly than gasoline or diesel fuel. Propane produces fewer greenhouse gas emissions, contributing to climate change on a per-unit energy use basis. Propane as an alternative fuel in factory-built vehicles can reduce greenhouse gas emissions by 20 – 25 percent in light-duty vehicles over the vehicle's life cycle compared with gasoline. Propane also contains fewer toxic pollutants.

Natural gas is a cleaner, more affordable transportation fuel option. Today, natural gas vehicles operate in Canada in various applications, including marine, rail, medium and heavy-duty trucks, light-duty transit and off-road.

Ethanol - Ethanol is an alcohol which is suitable for use with gasoline in spark ignition engines. It's produced through the fermentation of starches and sugars from such food crops as corn, sugar cane and wheat, and a secondary product can even be made from switchgrass, wood waste and rice straw. As a transportation fuel, ethanol is blended with gasoline. E10, which contains 10 percent ethanol, is suitable for most cars on the road today.

Myths About Electric Vehicles

Consumers are curious and also have questions about electric vehicles and how they work. Here's your chance to learn more!

Myth: Both traditional (internal combustion engines) and electric vehicles have the same environmental impact.
An electric vehicle will emit lower levels of greenhouse gases over the vehicle's lifetime compared to a similar traditional vehicle. When the life cycle of emissions for the vehicle (raw material extraction, fabrication, delivery, useful life, end of life) is considered, an electric vehicle powered by wind-generated electricity emits 73 percent less CO2e than its traditional equivalent.

Myth: Manufacturing electric vehicles are cleaner than manufacturing traditional cars.
Manufacturing the batteries for electric vehicles is a carbon-intensive process; the production emissions are approximately 40 percent more than the traditional equivalent. The battery can be responsible for 10 to 30

percent of the vehicle's carbon footprint. As technology practices improve for the production of batteries, the positive impact will be felt in electric cars.

Myth: Charging stations are easy to find.
There is a need for more commercial charging stations. The network of stations is growing, and most electric vehicle owners have charging stations in their homes. A home charger costs between $800 and $1,600 to install, and installation requires an electrician. Most travel happens within a small range of electric vehicle owners' homes, which must be considered. The recommendation is one public charger per 10 electric vehicles, and Canada currently sits at one public charger per 16.5 electric vehicles.

Myth: Electric vehicle batteries don't last.
Electric vehicles are designed to last longer than most owners keep their vehicles. Most batteries carry a warranty for 160,000 kilometres. Early batteries for electric vehicles did have a smaller range of 200 to 250 kilometres, but currently, most electric vehicles have a 400-to-800-kilometre range per charge.

Myth: Charging takes too long.
Drivers typically recharge their vehicles at home overnight, so they are fully charged daily. When charging needs to happen during a trip, the common type of public chargers can replenish a battery from near empty to 80% in 30 to 40 minutes.

Myth: Electric vehicles are boring to drive.
The handling and capabilities of most electric vehicles are comparable to traditional vehicles. The big difference is how quiet electric vehicles are versus conventional internal combustion engines.

Myth: Electric vehicles don't work in a climate like Canada.
Cold weather affects an electric vehicle's range because the battery has to power the car and heat the cabin. Doing the following will help:

- Making sure your tires are at the correct pressure
- Using tires specifically designed for electric vehicles.
- Using seat and steering wheel heaters to keep passengers warm uses less power than the car heating system.
- Pre-heat the car while it's plugged in.
- Plan your stops and know where the charging stations are along your route.
- Adapt your driving to accelerate more slowly, avoid harsh breaking, and watch your speed will all help preserve the battery.

Myth: Farms won't be using electric tractors in the next five years.
Electric tractors are much more efficient since all the energy goes into work. Maximum power is available immediately rather than at the rated engine speed. Finally, since the power source has just one moving part, it requires little maintenance. Even the batteries are projected to last ten years, pending operating cycles and depth of discharge. Brands like Kubota, Case IH and John Deere are working on prototypes.

Adapted from:
The Truth about EVs, Matt Bubbers, CAA Magazine, Summer 2023 www.caa.ca
Can an Electric Car Handle the Canadian Weather? Royal Bank of Canada, https://discover.rbcroyalbank.com/can-an-electric-car-handle-the-canadian-weather/
An electric tractor may be in your future, Successful Farming, https://www.agriculture.com/machinery/tractors/an-electric-tractor-may-be-in-your-future

Clean On-Road Transportation

The transportation sector is responsible for around 25% of Canada's annual greenhouse gas emissions, making it the second-largest contributing sector to Canada's overall emissions. Most emissions come from on-road transportation, including light-duty vehicles (like cars, sport-utility vehicles, and pickup trucks) and medium- and heavy-duty vehicles (larger pickup trucks, cargo vans, buses, and freight trucks).

Significantly reducing emissions from on-road vehicles is critical to achieving net-zero emissions by 2050.

“Decarbonizing” means reducing carbon emissions by using zero-carbon power sources. To meet Canada's climate change targets, we need to decarbonize on-road transportation through a broad approach.

1. New vehicles need to be zero-emission vehicles. This will take over a decade (10 years) to achieve.
2. Ensure current gas and diesel vehicles operate as cleanly as possible. This includes initiatives to retrofit older trucks with more fuel-efficient technologies and increase the availability of cleaner fuels.

Make sure zero-emission vehicles are available. Many Canadians and businesses who want to buy a zero-emission vehicle face limited availability at dealerships or long wait times. Others need help finding a model that suits their needs. Zero-emission vehicle inventory across Canada is also uneven as jurisdictions with incentive programs and zero-emission vehicle sale regulations are prioritized over others for the limited supply of zero-emission vehicles. Disruptions in manufacturing supply chains, including semiconductor and critical mineral shortages, further complicate the current supply situation.

Make zero-emission vehicles more affordable. Zero-emission vehicles have higher purchase prices than comparable internal combustion engine vehicles. On top of short-term inflation, high demand for the minerals used to build batteries has increased costs. Despite lower operating and maintenance costs, incentives will be vital in offsetting the upfront cost differences between zero-emission vehicles and gas or diesel vehicles.

Build charging and refuelling stations. Canadians want to know that they can get where they need to go and charge or refuel their zero-emission vehicle in a way that fits their lifestyle or business needs. Uncertainty about adequate access to charging and refuelling stations, their reliability and ease of use have been a concern for some potential buyers.

Build public awareness and confidence in zero-emission vehicles. Canadians still need to learn more about zero-emission vehicles and have limited exposure. Awareness, training and education programs aimed at seeing and experiencing these technologies will help consumers discover the benefits of adopting these vehicles.

Support research, development, and demonstration (RD&D). Despite significant technological progress in recent years, there's more work needed to accelerate innovative technologies to support the commercialization and uptake of zero-emission vehicles across most vehicle segments, particularly medium- and heavy-duty vehicles.

Lead by example. The Government of Canada continues to build a cleaner on-road transportation system while influencing others to follow suit through green procurement.

Act on clean growth opportunities. It is making investments to support a vehicle manufacturing sector in Canada that is innovative and competitive while also protecting jobs as the automotive sector transitions.

Switching to zero-emission vehicles (vehicles with no tailpipe emissions, including battery, plug-in hybrid, and fuel cell electric vehicles) will decrease Canada's transportation emissions.
The Government of Canada is taking a comprehensive approach to support this transition by investing in purchase incentives and charging stations.

Canada aims to reach 35% of total new medium- and heavy-duty vehicle sales being zero-emission vehicles by 2030. The Government will develop a medium- and heavy-duty zero-emission vehicle regulation to require 100% of new medium- and heavy-duty vehicle sales to be zero-emission vehicles by 2040.

While active transportation and greater use of public transit will play a critical role in decreasing emissions from the on-road sector by taking vehicles off the road and reducing vehicle trips with few occupants, High-Occupancy Vehicle (HOV) lanes are designated lanes that can only be used by vehicles carrying two or more passengers or other specific types of vehicles, such as licensed taxis and motorcycles. HOV lanes help to encourage carpooling, manage congestion and reduce transportation-related emissions.

This is an opportunity for Canada because the country contains critical minerals, a skilled workforce, advanced manufacturing capability, and a low-emitting electricity grid. The Government of Canada is taking steps to cultivate a business environment where Canada is a destination of choice for investments in zero-emission vehicle manufacturing and battery value chains. The government is also partnering with the auto sector and private sector partners to encourage development in this area.

Low-carbon fuels, like renewable diesel and ethanol, will play a role in decarbonizing today's internal combustion engine vehicles. In some areas, like long-distance trucking, until new technologies and fuels of the future are scaled up, the primary fuel source will continue to be diesel fuel or low-carbon-intensive bio-derived diesel fuels.

Decarbonization of Transit

The decarbonization of the transportation sector will require:

- cleaner transportation systems, including increased investment in fuelling infrastructure, clean trade corridors
- displacing high-carbon fuels with cleaner fuels like natural gas, RNG, biofuels or hydrogen
- cleaner vehicles that use alternative fuels, electric power or hybrid technologies

Who Makes the Decisions About Energy?

There are three types of government in Canada:

- The Government of Canada, also called the Federal Government
- The Government of Ontario, also called the Provincial Government
- Municipal Government is the order of government responsible for most community affairs.

Each level of government is responsible for providing certain services.

The federal government has the power “to make laws for the peace, order and good government of Canada” except for subjects where the provinces are given exclusive powers. Among the many exclusive powers of the federal government are:

- Citizenship
- Criminal Law
- Copyright
- Employment Insurance
- Foreign Policy
- Money and Banking
- National Defence
- Regulation of Trade and Commerce
- The Post Office
- The Census

Through the provincial legislature, the provincial government has the power to enact or amend laws and programs related to:

- Administration of Justice
- Education
- Hospitals
- Natural Resources and Environment
- Maintenance of the Provincial Highway System
- Property and Civil Rights in Ontario
- Social Services

The provincial government determines the powers of municipal governments. Municipal governments in Ontario are responsible for providing many of the services within their local boundaries that you rely on daily, such as:

- Airports
- Ambulance
- Animal Control and By-law Enforcement
- Arts and Culture
- Child Care
- Economic Development
- Fire Services
- Garbage Collection and Recycling
- Electric Utilities
- Library Services
- Long Term Care and Senior Housing
- Maintenance of the Local Road Network
- Parks and Recreation
- Public Transit
- Planning New Community Developments and Enhancing Existing Neighbourhoods
- Police Services
- Property Assessment
- Provincial Offences Administration
- Public Health
- Side Walks
- Snow Removal
- Social Services
- Social Housing
- Storm Sewers
- Tax Collection
- Water and Sewage

The Ontario Energy Board (OEB) oversees the electricity and natural gas sectors. The Board protects consumers and makes decisions that serve the public interest. The goal of the Board is to promote a sustainable, affordable and efficient energy sector for today and tomorrow.

The Ontario Energy Board:

- Sets the delivery rates energy utilities can charge
- Approves major new electricity transmission lines and natural gas pipelines
- Approves corporate changes by energy utilities
- Establishes and enforces the rules for energy companies operating in Ontario
- Monitors the electricity market and how the utilities run
- Develop new energy policies and provide unbiased advice to the government
- Licenses energy companies in the electricity sector and natural gas marketers
- Provides information and tools to help consumers understand the rules that protect them and their responsibilities

A stakeholder is a person with an interest or concern in something. The OEB consults with several stakeholders, including:

- Customers
- Governments, including federal, provincial, municipal and Indigenous
- Associations and interest groups – opinion leaders, special interests, academics
- Regulated entities and partners – electricity and gas distributors, generators, transmitters, electricity storage, retailers, The Independent Electricity System Operator (IESO)

The OEB consults with the stakeholders in several ways, including formal committees, informal interactions, and strategic planning. The Consumer Panel is made up of a large and diverse group of residential and small business consumers from all parts of Ontario. It provides an opportunity to:

- Discuss issues that are important to consumers
- Gather ideas and provide feedback on the solutions and tools that the OEB is developing
- Help assess the effectiveness of the OEB's outreach and communications activities

The input of the Consumer Panel helps the OEB strengthen the rules that apply to energy companies to protect consumers better.

Video Resources

- Ipsos OEB Consumer Panel Overview, Ontario Energy Board (2:43) https://youtu.be/1-Zqwpl-oU4
- Ontario Energy Board at the Royal Agricultural Winter Fair (3:29) https://youtu.be/XD0gAJo4PKc

Who Needs to Hear from You?

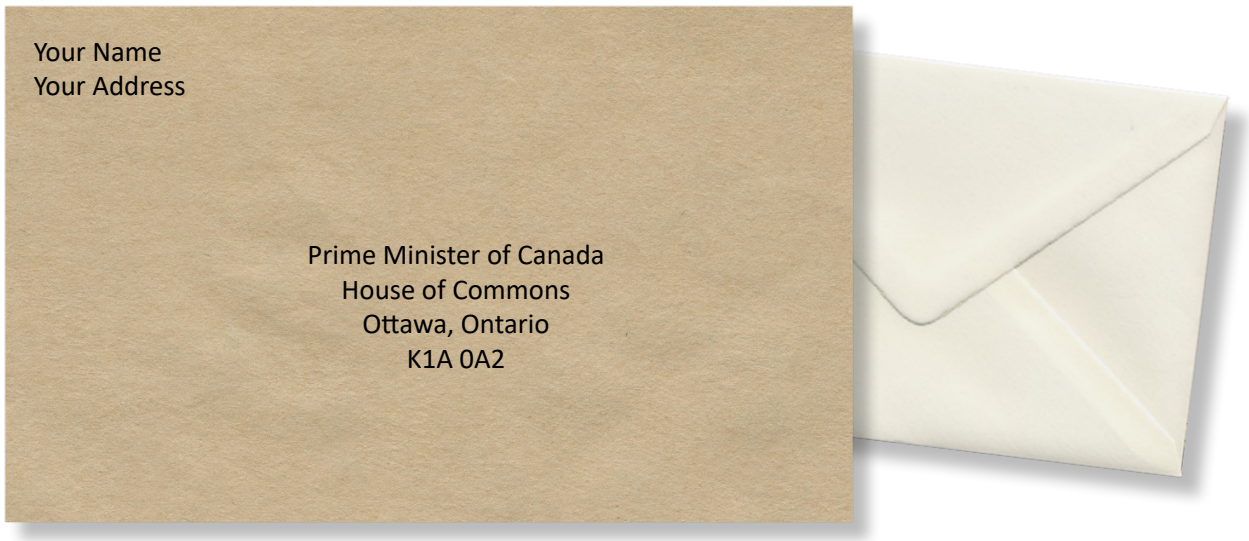
Advocacy for Responsible Use of Energy

Talk to members about the importance of writing a letter. Describe and discuss the different methods of reaching out – letter, email, online feedback/forums, town hall meetings, telephone calls.

Companies that make and sell products need feedback on what a Canadian consumer will buy. Tell them what you think of their product and suggest how they could use less energy to produce it (e.g., reduce packaging, use recyclable materials). Look for the address on the product's packaging or website.

Politicians need your input about what Canadians oppose and support. Write your local municipal officials, your MPP (Member of Provincial Parliament), MP (Member of Parliament), or Prime Minister and let them know what voters (or voters-to-be) are thinking.

These letters do not need a stamp and can be addressed as follows:



The names and addresses of local officials can be found online.
Please keep a copy of your letter and save it until you get a reply.

Advocacy Letters 101

The Purpose of an Advocacy Letter

Writing a letter can be a great way to advocate for an issue that impacts people. Whether the issue you're supporting affects an individual or a community, the same basic steps to self-advocacy apply.

An advocacy letter aims to present the issue and invite the recipient to collaborate with you to find a solution. It is always best to assume that the recipient of your letter is interested in finding a solution to the issue but doesn't know how to do so. This will help ensure that you enter the letter-writing process with a respectful tone and a willingness to work together toward a solution.

The Anatomy of an Effective Advocacy Letter

An effective advocacy letter can be broken down into the following distinct sections:
1. The salutation
2. The introduction
3. The issue
4. The solution
5. The conclusion

1. The Salutation
The salutation of your letter is the opening greeting. Salutations often pair a word of greeting with a person's name and title, such as "Dear James" or "Attention Councillor Leung."

The salutation is the first thing your recipient will read. It sets the tone for what follows and lets your reader know you've done your homework. For this reason, it's essential to think carefully about your salutation.

When writing a letter to an elected official, you should always use a formal greeting.
If the recipient of your letter is not an elected official, you don't need to use these formal titles, but you should still identify a senior representative by title. For example, "Attention James Leung, President and Chief Executive Officer."

A Note About Gender Pronouns
Pronouns are the words we use in place of a person's name. You may have noticed that people share their pronouns in introductions, email signatures, and name tags. We share pronouns to avoid assuming someone's pronouns based on appearance. By sharing our pronouns, we encourage others to do the same. Using someone's correct pronouns is essential to affirm who they are and is a fundamental part of being an ally. Allyship helps to build more welcoming spaces for everyone.

When addressing a letter to a person whose pronouns you are unsure of, it's best to avoid gender-specific pronouns or use gender-neutral language to avoid misgendering someone. You can address the person with their name, title, or a combination of their name and title instead of using gendered titles like Mr., Mrs., Ms., Miss, Madam, or Sir. If addressing a letter to a group, you can use neutral language like Committee Members or Councillors instead of gender-specific language like Ladies and Gentlemen.

2. The Introduction
Your letter's first line(s) should explain who you are and why you are writing the letter. This is the bridge between your salutation and the body of your letter, giving your reader a snapshot of you and the issue.

If you are writing the letter on your behalf, you should share your name and who you are in relation to the recipient. For example, you may want to share that you are a young person learning about energy efficiency in a 4-H project.

Next, you'll want to provide a snapshot of the issue that you're writing about. Your explanation of the issue should be clear and concise. You'll have plenty of space to expand on the issue in the next section of the letter. In this section, your goal is to state the problem in as few words or sentences as possible while still communicating the issue's core.

The Anatomy of an Introduction
- State your name
- State your role, if applicable
- Provide a snapshot of the issue

Examples
- My name is Tanvi Patel, and I'm a Brant 4-H Eye On Energy Club member. I'm writing to share my concerns about the availability of public transit in my area.
- I am Jen Cash, and I volunteer with the Rockton Agricultural Society. We want to share our concerns about electronic waste recycling in our community

3. The Issue
In the next part of your letter, you'll provide more detail about the issue you presented in your introduction. Your main goal in this section of the letter is to explain the issue in a way that is easy to understand. Those with the power to create change must understand the issue and how it impacts their voters, constituents, customers, etc.

While explaining the issue may sound straightforward, remember that the person or organization you're writing about may be hearing about the issue for the first time. When presenting the issue, you must choose words your audience will understand.

When you are presenting the issue, it is also important to include any pertinent dates, times, or names relating to your issue. For example, suppose you've previously contacted the organization about the issue. In that case, you should include the name of the person you got, the date you contacted them, and a summary of any response you received.

Remember that you are providing detail s to paint a picture of the issue for your recipient. Stick to the facts.

4. The Solution
When engaging in any advocacy, coming prepared with potential solutions is essential. Presenting issues without considering solutions is complaining.

Here are some examples:
- Statement 1: Your transit service does not honour student cards during the summer months. Discounted summer rates would encourage more young people to take public transit during their holidays.
- Statement 2: Your bylaws do not allow my organization to host a bin to recycle electronic waste in my community. Reviewing the bylaws could allow for more opportunities to impact the environment positively.

The Anatomy of the Solution

- Be prepared
- Be specific
- Be realistic
- Consider multiple solutions, depending on the issue

5. The Conclusion

You have found the appropriate salutation, crafted a concise introduction, presented the issue, and offered solutions. While it may seem as though all the work is done, you shouldn't disregard the conclusion of your letter. This is where you'll wrap it all up by reiterating the issue's importance, connecting it to the broader community, detailing any follow-up items, and signing off.

There is no need to provide an exhaustive summary of everything you've stated in your letter. However, it would be best if you took this opportunity to restate the issue's importance so that the message stays with your recipient after they've finished reading. If you haven't already done so in your letter, you can use this space to highlight the issue's impact on the broader community.

In your closing remarks, you should outline any action items the recipient should know. This could include dates and times of any upcoming meetings to address the issue or a date or timeframe in which you will follow up.

Finally, you'll want to sign off and include your relevant contact details so the recipient can contact you. Your sign-off should be concise and respectful, just like the rest of your letter.

The Anatomy of The Conclusion

- Restate the importance of the issue
- Explain how the issue impacts the broader community
- Summarize action items
- Sign off

Adapted from:

Advocacy Letters 101: The Purpose of an Advocacy Letter, Canadian National Institute for the Blind, www.cnib.ca

DIGGING DEEPER For Senior Members

- **Air travel**
  Learn more about what carbon offsets in air travel and how travellers can pay to 'offset' or make up for the emissions their flights produce.

- **Marine travel**
  Check out advances in ship design that contribute to improved energy efficiency.

- **EnerGuide labels**
  Compare EnerGuide labels on three types of vehicles. Which vehicle is the most fuel-efficient? Which vehicle is the most useful/practical for you or your family's situation? Why?

- **ecoDriving Course**
  Complete the 25-minute course to learn strategies that will help you save up to 25% in fuel costs, cut down on vehicle maintenance, and reduce your greenhouse gas emissions. https://solutions.ca/ecodriving/en/story.html

- **Auto$mart Driver Training**
  The Auto$mart driver education program can help them learn about fuel efficiency and environmental responsibility while helping them to become the next generation of safe, informed Canadian drivers. This course comes packaged in four learning modules. They provide key information about how driving affects the environment, how to drive more efficiently and how to buy a first car. The fourth module is a review of what you have learned. https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/automart-driver-training/21042

- **Canadians for Affordable Energy**
  Learn more about how this advocacy group addresses energy pricing and saves Canadians money through accurate price forecasts. https://www.affordableenergy.ca/

- **Ethanol in Gasoline**
  Learn more about why ethanol is added to gasoline and its effect on the environment.

- **Automobile Advertising**
  Research how it influences our decisions and opinions related to the environment.

- **Solar Powered Cars**
  Learn more about this emerging concept.

- **Three Types of Electric Vehicles**
  Compare the differences between battery-electric, plug-in hybrid, and fuel-cell electric vehicles.

- **Buying an Electric Vehicle**
  Would you buy an electric vehicle? Why or why not? Share your thoughts.

- **Learn More About Buying a Used Car**
  Natural Resources Canada has great online tools to help you decide what vehicle to purchase.

- **EnerGuide for vehicles**
  Learn how the fuel consumption label for vehicles can help you make a fuel-efficient choice.

- **Fuel-efficient driving techniques**
  Learn ways to reduce fuel consumption and costs, improve road safety, and prevent wear on your vehicle.

- **Design a new, energy-conserving transportation alternative.**

- **Saving Farm Fuel**
  Chart the possible savings in fuel and time by using reduced tillage or energy-efficient combines.

- **New Alternatives**
  Design a new, energy-conserving transportation alternative.

- **Keeping Track**
  For two weeks, keep a log charting the use of a vehicle and the amount and cost of fuel used, distance travelled, purpose of trips and number of people per trip. Comment on the energy efficiency of private vehicle use.

Tour/Speaker Idea!

- Tour a local public transportation service and learn how they make decisions and maintain their vehicles, trends and plans for the service.
- Visit a local auto shop and learn how to maintain your vehicle for improved energy use, e.g., checking tire pressure, what they check during a tune-up, etc.
- Invite a representative to visit or plan a visit to a car or implement dealership and examine the EnerGuide labels on the various vehicles. Learn more about energy efficiency and trends in cars.
- Visit your local Safety Village and learn about safe interactions with energy in transportation.

Activity #20 – Let's Talk About Transportation

Do

Time: 15 minutes

Materials/Resources:

- A whiteboard and marker or a large piece of paper and marker

Instructions:

1. Ask the group to brainstorm different modes of transportation. Record the responses. Encourage the group to get creative! Once you have a list of 8-10 modes of transportation, ask the group to add how each of the modes is powered, for example:
   - walking = food
   - cars = gasoline, electricity, natural gas
   - trains = diesel, electricity
   - if you are unsure, look it up online
2. Ask the group the following questions and facilitate a conversation about their answers, focusing on the similarities and differences in the responses:
   - How do you get to school?
   - What different types of transportation have you used?
   - How often do you use public transportation? Is it available in your community?
   - What is your favourite way to travel?
   - What way would you like to try?

Focus the conversation on how we can be more aware of the different types of transportation available and how we can use less energy.

Share that we will be learning more about this during this meeting.

Additional Activities:

- Divide the group into pairs.
- Ask each pair to choose a transportation mode from the list created to act out.
- Pairs can use sound effects but not words.
- Other members guess the mode.
- Show Transportation 101, Student Energy (2:47) https://youtu.be/c4iVCJ00BYA to introduce the topic.

Reflect

Learning Outcomes:

- Members will understand how transportation uses energy.
- Members consider how they travel and how it impacts energy use

Apply

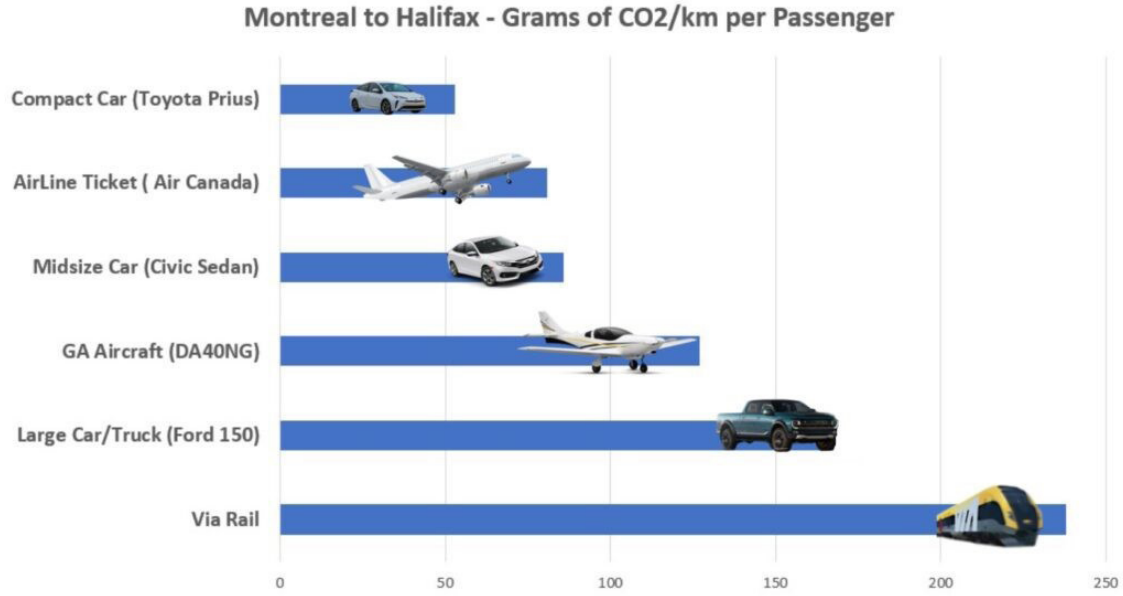
Discuss The Following Prompts As A Group

- Was it easy or hard to come up with modes of transportation?
- Did you know how all of the modes of transportation are fueled?
- Why is it essential to think about the modes of transportation that we use?

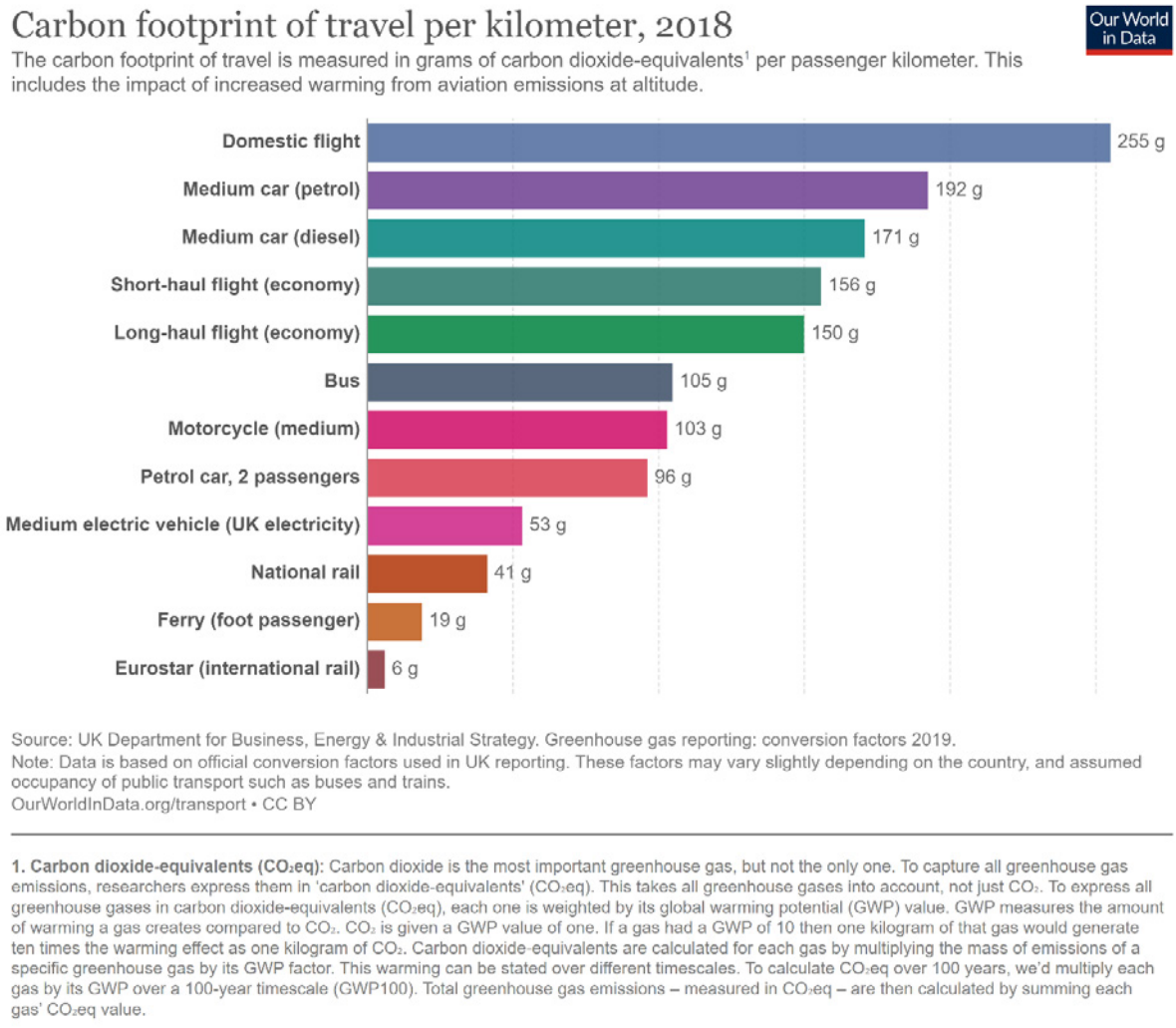
Activity #21 – Planes, Trains and Automobiles

Do	Time: 15 minutes **Materials/Resources:** • Handout - Planes, Trains and Automobiles, page Participant Record Book 27 • Copy of the scenarios and cut them into strips page 139 (next few pages) **Instructions:** 1. Divide group small groups of 3-4 people 2. Direct members to page Participant Record Book 27 3. Assign a scenario to each group. Use the scenarios provided or create ones that are suitable for your members. Multiple groups can work on the same scenario if you have a large group. It is interesting to hear the different ideas that each group comes up with. 4. Instruct members to review their scenarios as a group. 5. Tell members to use the worksheet to brainstorm transportation options, consult the graphs provided to determine the most energy-efficient transportation method, and then make a decision that works for most of the group. 6. Groups should be prepared to share their responses and reasons with the large group. 7. The spokesperson will be the person who most recently received their driver's licence. If the members of your group are not old enough yet to have their driver's licence, the reporter will be the member who will be the first one to be old enough to get their driver's licence. **Additional Activity:** • Instruct the Senior Members to create the scenarios.
Reflect	**Learning Outcomes:** • Members will understand how transportation uses energy. • Members consider how they travel and how it impacts energy use.
Apply	**Discuss The Following Prompts As A Group** • Why is it important to consider energy use when travelling? • Was this easy or hard? • When can the most energy-efficient travel method not always be the best choice?

PLANES, TRAINS AND AUTOMOBILES



Graphic Source: Comparing the Carbon Footprint of Transportation in Canada, https://pickeringairport.org/comparing-the-carbon-footprint-of-transportation-in-canada/



Graphic Source: Which form of transport has the smallest carbon footprint? https://ourworldindata.org/travel-carbon-footprint

PLANES, TRAINS AND AUTOMOBILES

Our group's scenario –

Brainstorm all of the methods of travel.

What way is the most energy efficient?

What considerations should be kept in mind when choosing the way to travel?

What way of travelling makes the most sense for your scenario? Why?

Scenarios for Leader - Planes, Trains and Automobiles

Scenario One – Diya is going to school. She lives in a small town with a population of 1,200 people. Her school is 3 kilometres away from her home. Her mom is driving her car to work and is leaving around the same time.

Scenario Two – Boyd's family plans to visit the family in Halifax. Boyd lives near Napanee, Ontario. There are four people in Boyd's family.

Scenario Three – Ali, Dan and Lily are 4-H members heading to their weekly meeting. They all live in different homes about 1 kilometre away from each other. Ali is 18 years old and has their full driver's licence.

Scenario Four – Victor lives in Woodstock, Ontario. He is meeting his friend Bo at the Blue Jays game in Toronto.

Scenario Five – Henni lives in Alliston, Ontario. She has a summer job in Ottawa.

Scenario Six –

Scenario Seven -

Activity #22 – Planes, Trains and Automobiles

Do	Time: 15 minutes **Materials/Resources:** • A television or laptop with an internet connection • A large piece of paper and a marker **Instructions:** 1. As a group, watch Module 1: Driving and the environment (4:19) https://youtu.be/orIWTd3tiho?si=Od-CQ4-h7ILPqR5A 2. Brainstorm ideas to reduce the number of kilometres people drive that make sense for your community. The ideas could come from the video's suggestions or other sources. 3. If applicable, point out that some of the ideas shared in the video are more applicable to people who live in larger towns/cities. 4. Is there public transit or shared ride programs in your community? 5. Is there a need for more transportation options in your area? If so, what would the members like to have available? (Hold on to this idea for the advocacy activity later in the meeting.) **Additional Activity:** • Complete the Auto$mart Driver Training. The Auto$mart driver education program is a program to learn about fuel eff iciency and environmental responsibility while helping them to become the next generation of safe, informed Canadian drivers. This course comes packaged in four learning modules. They provide key information about how driving affects the environment, how to drive more efficiently and how to buy a first car. The fourth module is a review of what you have learned. https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/automart-driver-training/21042
Reflect	**Learning Outcomes:** • Members will understand how transportation uses energy. • Members consider how they travel and how it impacts energy use.
Apply	**Discuss The Following Prompts As A Group** • Why is it important to consider the environment when you are driving? • Was this easy or hard? • What simple actions can have a significant impact on the environment? • Did you learn new information? If so, what stuck with you?

Activity #23 – Advocacy in Action

Do	Time: 15 minutes **Materials/Resources:** • Worksheet on page Participant Guide 28-29 (and next page) **Instructions:** **Part 1 - How decisions are made** 1. What are some of the points (criteria) you use when making a decision as an individual? Responses might include cost/benefit, investment, time, resources, ability, others 2. What additional considerations would you need to remember if you are a community or municipality? Responses might include political factors, government structures, environmental costs and consequences, social factors, ethics, social norms **Part 2 - Communicating with officials** 1. Talk to members about the importance of voicing your concerns to officials. 2. Describe and discuss the different formats for connecting with officials. o Phone call o Email o Letter o In-Person 1:1 meeting o Official response portal (e.g. Toronto 311 – Toronto at Your Service) o Delegation to a meeting **Part 3 - Review the elements of a compelling message in the reference material** • Option 1 - Ask members to write a message about an issue related to energy use that is important to them. • Option 2 – Create a social media campaign to convince people to choose environmentally-friendly transportation. **Additional Activities:** • Send a message to local officials and track your progress. • Launch the social media campaign and track the response
Reflect	**Learning Outcomes:** • Members understand the process and importance of advocating for efficient energy use.
Apply	**Discuss The Following Prompts As A Group** • Why is it important to express your concerns? • Was this easy or hard? • Why do elected officials need to listen to people in their community (voters)? • Is there another issue that you would advocate for? • What did you like about this activity?

ADVOCACY IN ACTION

Part 1 - How decisions are made.

- What points (criteria) do you use when deciding as an individual?

- What additional considerations would you need to remember if you are a community or municipality?

Part 2 - Communicating with officials.

- Phone call
- Email
- Letter
- In-Person 1:1 meeting
- Official response portal (e.g., Toronto 311 – Toronto at Your Service)
- Delegation to a meeting

Part 3 - Elements of an effective message.

1. The salutation

2. The introduction

- State your name

- State your role, if applicable

- Provide a snapshot of the issue

3. The issue

4. The solution

The Anatomy of the Solution

- Be prepared
- Be specific
- Be realistic
- Consider multiple solutions, depending on the issue

5. The conclusion

The Anatomy of The Conclusion

- Restate the importance of the issue
- Explain how the issue impacts the broader community
- Summarize action items
- Sign off

Option 1 - Ask members to write a message about an issue related to energy use that is important to them.

Option 2 – Create a social media campaign to convince people to choose environmentally-friendly transportation.

Example:
Dear ABC Company, Packaging Department:

I am writing to express my concern about your packaging. My family has always used your product, but recently, you have started wrapping it with excessive plastic and cardboard. This packaging serves no use and is not accepted for recycling. The packaging must be sent to our already overflowing landfill site. We ask you to eliminate this wasteful packaging so our family can continue buying your product. Your company was very successful in the past with its switch to recycled product materials. We wish you the same success in eliminating this new type of packaging you have started to use. I am enclosing your packaging as it is useless to me or my family.

I appreciate your consideration. I await your reply.

Yours sincerely,

E. Conserver

Reference citations:

- Links between fuel consumption, climate change, our environment and health, Natural Resources Canada, https://natural-resources.canada.ca/energy/efficiency/communities-infrastructure/transportation/idling/4419
- Pros & Cons of Freight Shipping Modes: Truck, Rail, Water & Air Compared, Union Pacific Railroad https://www.up.com/customers/track-record/tr091019-transportation-modes-all.htm
- Does flying economy reduce the carbon footprint of your flight? https://oncarbon.app/articles/flying-economy-carbon-footprint
- Air travel and climate change, David Suzuki Foundation https://davidsuzuki.org/living-green/air-travel-climate-change/
- Rail Climate Considerations, U.S. Department of Transportation, Federal Railroad Administration https://railroads.dot.gov/rail-network-development/environment/rail-climate-considerations
- Air travel emits a lot of carbon, but there are ways to fly more responsibly, CBC https://www.cbc.ca/news/science/what-on-earth-newsletter-air-travel-green-1.5240306
- 5 ways to make air travel greener, CBC https://www.cbc.ca/news/science/climate-change-aviation-emissions-1.5244130
- Why the train may not be the greenest way to travel across Canada, CBC https://www.cbc.ca/news/science/what-on-earth-green-travel-train-1.6396327
- Energy Fact Book 2022-2023, Natural Resources Canada
- EnerGuide for vehicles, Government of Canada https://natural-resources.canada.ca/energy-efficiency/energuide-canada/energuide-vehicles/21010
- EnerGuide labels for plug-in hybrid electric vehicles, Government of Canada https://natural-resources.canada.ca/energy/efficiency/energy-efficiency-transportation-and-alternative-fuels/choosing-right-vehicle/tips-buying-fuel-efficient-vehicle/energuide-vehicles/energuide-labels-plug-hybrid-electric-vehicles
- Electric Vehicles Available in Canada, Canadian Automobile Association https://www.caa.ca/sustainability/electric-vehicles/electric-vehicles-available-in-canada/
- Propane, Government of Canada – Natural Resources Canada https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/propane/21611
- Go With Natural Gas Vehicles, Canadian Natural Gas Vehicle Alliance https://cngva.org/go-natural-gas/vehicles/
- Alternative Fuels, Canadian Fuels Association https://www.canadianfuels.ca/our-industry/alternative-fuels/
- Fuel-efficient driving techniques, Government of Canada https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/fuel-efficient-driving-techniques/21038
- Tips for buying a fuel-efficient vehicle, Government of Canada https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/choosing-right-vehicle/tips-buying-fuel-efficient-vehicle/21000
- But what type of EV is right for me? Canadian Automobile Association https://evbuyersguide.caa.ca/content/owning
- An EV might be right for you, Canadian Automobile Association https://evbuyersguide.caa.ca/
- The Truth about EVs, Matt Bubbers, CAA Magazine, Summer 2023 www.caa.ca
- Can an Electric Car Handle the Canadian Weather? Royal Bank of Canada https://discover.rbcroyalbank.com/can-an-electric-car-handle-the-canadian-weather/
- An electric tractor may be in your future, Successful Farming https://www.agriculture.com/machinery/tractors/an-electric-tractor-may-be-in-your-future
- Clean Growth Pathway to 2050, Fortis BC, February 2022
- Canada's Action Plan for Clean On-Road Transportation, Government of Canada, Transportation Canada, 2022, https://tc.canada.ca/en/road-transportation/publications/canada-s-action-plan-clean-

road-transportation

- High Occupancy Vehicle (HOV) lanes, Government of Ontario, https://www.ontario.ca/page/high-occupancy-vehicle-hov-lanes
- Municipal 101, Association of Municipalities of Ontario https://www.amo.on.ca/about-us/municipal-101
- About the OEB, Ontario Energy Board https://www.oeb.ca/about-oeb/who-we-are
- Consumer Panel, Ontario Energy Board https://www.oeb.ca/stakeholder-engagement/stakeholder-engagement/consumer-panel
- Pros and Cons of Electric Vehicles https://www.koehnechevy.com/electric/why-electric-vehicles-evs
- How do Electric Cars Work? https://youtu.be/uyNaWBl4OXg
- Advocacy Letters 101: The Purpose of an Advocacy Letter, Canadian National Institute for the Blind www.cnib.ca

Energy For The Future: Options And Choices

Meeting 6 – Energy For The Future: Options And Choices

Setting Objectives:

- To consider their personal energy use, how they make choices about energy use, and how these choices impact the environment.

Suggested Learning Outcomes:

- Members consider their daily personal energy use, how they make choices about energy use, and how these choices impact the environment and the future.
- Members learn about what Innovations connected to energy are emerging, including hydrogen, carbon capture, liquid biofuels, ethanol, biodiesel, renewable natural gas, high-speed rail, solar windshield collectors to power cars, and what's happening in other countries related to energy use like Norway.
- Members compare energy sources in a judging activity.

Reference Material in this Section:

- Energy Innovation
- Biogas/Anaerobic Digestion
- Learning from Norway
- Managing Energy More Efficiently in Dairy Farming
- Encouraging Innovative People

Activities:

- Activity 24: Let's Make Hydrogen
- Activity 25: Judging Our Energy
- Activity 26: What Can I Do? Encouraging Innovation

SAMPLE MEETING AGENDA Time: (generally) 2 hours 15 minutes

Welcome, Call to order, Pledge		5 minutes
Roll Call	Invite each member to share their name and response to the At Home Challenge you asked them to complete at the end of Meeting 5.	5 minutes
Topic Information Discussion	Energy Innovation Biogas/Anaerobic Digestion	20 minutes
Activities Related to Topic	**Activity 24: Let's Make Hydrogen**	20 minutes
Topic Information Discussion	Learning from Norway	15 minutes
Activities Related to Topic	**Activity 25: Judging Our Energy**	15 minutes
Topic Information Discussion	Managing Energy More Efficiently in Dairy Farming	10 minutes
Activities Related to Topic	**Activity 26: What Can I Do? Encouraging Innovation**	20 minutes
Wrap-Up, Adjournment & Social Time	Recap topics covered in this meeting and review the At Home Challenge	10 minutes
At Home Challenge	Choose one of the At Home Activities found throughout the meeting.	

Energy Innovation

Biogas – a Cleaner Fuel

A biogas plant or biodigester provides an oxygen-free environment for a process known as "anaerobic digestion." The biogas plant works like a giant concrete stomach, mixing organic waste continually. Meanwhile, bacteria inside the biogas plant digest the waste, releasing methane, carbon dioxide and other gases. Instead of letting these greenhouse gases escape into the atmosphere, where they contribute to global warming, the biogas plant captures the gas. It stores it until it can be used to generate renewable power. An additional benefit of biogas production is a by-product of nutrients & microbes that can be added to the soil. Anaerobic digestion (AD) of manure and agri-food by-products is becoming more common in Ontario. There are several reasons farmers and developers consider building AD systems, including:

- production of renewable energy
- reduced odour and pathogen levels in the manure
- reduced greenhouse gas production from the farmstead
- improved fertilizer value of the manure
- use of existing or purpose-grown crops for energy production

AD systems also benefit others, including creating new destinations for managing food waste and creating economic opportunities in rural areas.

Anaerobic digester (AD) systems treat manure and other materials to produce biogas, a mixture of methane, carbon dioxide and other gases. Depending on the system design, biogas is combusted to run a generator producing electricity and heat (called a co-generation system), burned as fuel in a boiler or furnace, or cleaned (called "upgrading") and used as a natural gas replacement. Pipeline-quality upgraded biogas is often called renewable natural gas (RNG) or biomethane.

The biogas can generate electricity and heat or be upgraded into a natural gas replacement. Farm-based biogas systems represent a significant opportunity for the agricultural industry to treat manure to replace odour and pathogens while capturing new value from agrifood products and byproducts. As farm-based clean energy becomes a new on-farm product, more farmers may be looking for ways to finance and build biogas systems.

Photo Caption: A load of vegetable by-products is received at a farm-based AD system.

Photo Source: Anaerobic digestion basics, Ontario Ministry of Agriculture, Food and Rural Affairs, February 09, 2023, https://www.ontario.ca/page/anaerobic-digestion-basics

Ontario has a growing biogas marketplace, with anaerobic digestion (AD) systems on farms and urban areas. While most farm-based AD systems are located on large dairy farms, a number of systems have been built at other livestock farms and greenhouses. In addition, several large non-manure digesters have been made in urban areas to handle primarily food processing waste and some post-consumer food waste. Most Ontario AD systems produce electricity for sale to the electrical grid. Most agricultural AD systems return their digested nutrients to the land as agricultural nutrients. In contrast, heat from AD systems located in urban centres can be used at other nearby commercial or industrial facilities.

Suitable input material

- Manure - animal feed that was not fully digested, plus additional water and bedding. It contains energy that can be harvested in an anaerobic digester.
- Food by-products and food products that do not make it to market - Mixing off-farm feedstocks with manure in an "on-farm mixed anaerobic digester" may increase biogas production and make the economics more attractive. Various off-farm source feedstocks are received at farm-based AD systems in Ontario, including fats, oils and greases, pre-and post-consumer food wastes, grease trap waste and other food-processing products or by-products.
- Energy crops - corn silage, haylage and grasses require on-site storage (conventional ensiling systems).

Stanton Farms, Ilderton, Ontario

Stanton Farms built one of the country's first on-farm digestion systems for biogas, a move that has helped supply the town of Ilderton with renewable electricity. The project, completed in partnership with pipeline operator Enbridge Gas, marked the five-generation family farm as the only farm-based renewable natural gas supplier to plug into the provincial power grid.

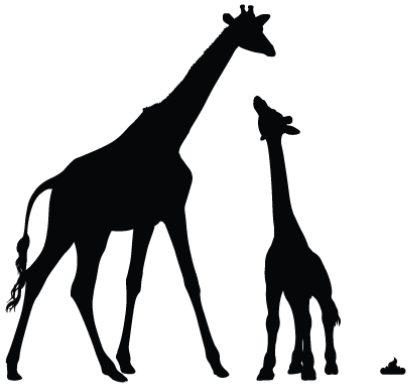
With its second biodigester, the farm will produce more than three million cubic meters of renewable natural gas (RNG) each year to be plugged into the Enbridge natural gas distribution system. That's enough energy to heat more than 1,300 homes, industry officials said in a statement.

The expanded Stanton Farms biogas plant will have the following annual impact:

- 60,000 tonnes of organic waste will be diverted from landfill
- 11,000 tonnes of methane will be captured for use as energy
- Represents the equivalent of taking 2,200 vehicles off the road

The Toronto Zoo is using its animal waste well to fuel a 500kW biogas facility. As of 2021, the ZooShare biogas facility, built on three hectares of land east of Meadowvale Road, combines Zoo waste and food waste from local grocery retailers and restaurants and converts it into electricity, heat and fertilizer.

The heat and power required for operating the biogas plant are produced within this system. They recycle 2,000 tonnes of manure from the Toronto Zoo and 15,000 tonnes of inedible local food waste to create renewable energy for over 250 Ontario homes annually. The 500kW facility produces the equivalent of a third of the Zoo's electricity demand and provides it to the Ontario hydro grid adding clean renewable energy for all Ontarians. It also helps the Zoo to reduce their CO2 emissions by 333 tonnes per year. Using renewable energy sources, such as biogas, helps in the fight against climate change by reducing greenhouse gas emissions into the atmosphere.



ZOOSHARE

biogas co-operative

Try It!

Follow the instructions in one of these YouTube videos:

- How to make a working mini biodigester using parts from Home Depot, Thomas H. Culhane, (22:53) https://youtu.be/3SQ26MVbT2w
- Science of Biogas & Build Your Own Digestor, Dickinson College Farm, (34:11) https://youtu.be/YvQAg838xGs

Low-Carbon Innovation

Canada is well-positioned to identify innovation investments to reduce the carbon footprint of Canada's energy system. This includes hydrogen production technologies and measures to reduce the carbon intensity of natural gas, such as carbon capture and storage.

Hydrogen

Canada is one of the largest hydrogen producers in the world. Canadian hydrogen and fuel cells foster the cleaner and more efficient use of fossil fuels. Canadian firms have developed the technologies to produce hydrogen cleanly and economically using fossil fuels, methanol, biomass, and renewable energy sources such as solar, wind, hydroelectric or industrial by-product waste hydrogen capture. To improve renewable energy sources, Canadian-developed technology uses excess wind, solar or hydropower to produce hydrogen. The hydrogen may then power a fuel cell when renewables are unavailable or be fed into the natural gas grid for use beyond the generation site.

Power-to-gas, the process of converting electric power into carbon-neutral hydrogen, presents a further opportunity and could account for between five and 15 percent of annual demand by 2036. It is believed that hydrogen can be a key driver towards reducing carbon emissions, not only as an alternative fuel to enable the decarbonization of heating, but as a means of storing renewable power (hydroelectric, solar and wind) and, through this, linking together the decarbonization of the building, industry and transport sectors. Hydrogen is a technology that could be integrated into electric and gas systems by acting as a high-capacity storage medium for carbon-free power generation and a carbon-free fuel for heat and transport.

The Canadian Hydrogen Safety Centre has been created to provide timely, technical solutions to address safe growth and provide education and training to help develop and implement codes, standards and regulations, and support governments, regulators, policymakers and industry on safety-related issues and solutions.

ENERGY TRIVIA

Did you know?

The energy in 1 kg of hydrogen is the same as approximately 2.8 kg of gasoline.

Hydrogen Fuel Cells

Fuel cells work like batteries, but they do not run down or need recharging. They produce electricity and heat as long as fuel is supplied. A fuel cell consists of two electrodes—a negative electrode (or anode) and a positive electrode (or cathode)—sandwiched around a component that transfers ions — charge-carrying particles — back and forth between the battery's two electrodes, causing the battery to charge and discharge. A fuel, such as hydrogen, is fed to the anode, and air is provided to the cathode. The electrons go through an external circuit, creating a flow of electricity.

Watch It!

How Does a Hydrogen Fuel Cell Work? | Simple Explanation, College and Career Ready Labs, (1:21) https://youtu.be/Ni7ZczyolHY

Carbon Capture and Storage

Carbon capture and storage (CCS) is a clean energy technology that aims to capture emissions of carbon dioxide (CO2), a greenhouse gas (GHG), before they are released into the atmosphere from fossil-fuelled power plants and industrial facilities. Reducing oil and gas emissions with carbon capture can cost ten times more than cutting the same emissions using wind and solar.

Find It!

Look around your home to identify anything fueled by a fuel cell.

CCS can be considered a system that integrates three sets of technology: CO2 capture, transport and geologic storage. Currently, CCS is applied mainly to facilities that produce energy and process fuels from coal and natural gas. There are also opportunities to integrate CCS in other CO2-emitting energy production and industrial facilities such as power plants, bitumen uberaders, oil refineries and steel, cement and fertilizer production plants.

Show It!

Bring a Fuel Cell to the meeting to show an example to the members.

Canada is a world leader in CCS and is committed to exploring this technology. According to the International Energy Agency (IEA), CCS is the only technology to mitigate GHG emissions from large-scale fossil fuel use. The IEA suggests that CCS could account for about 20 percent of the global GHG reductions needed by 2050.

Soil Carbon Sequestration

Soil carbon sequestration, also known as “carbon farming” or “regenerative agriculture,” includes various ways of managing land, especially farmland, so that soils absorb and hold more carbon. Increasing soil carbon is accomplished in various ways, including (1) reducing soil disturbance by switching to low-till or no-till practices or planting perennial crops; (2) changing planting schedules or rotations, such as by planting cover crops or double crops instead of leaving fields fallow; (3) managed grazing of livestock; and (4) applying compost or crop residues to fields. In addition to providing local environmental and economic benefits, these practices can capture carbon dioxide (CO2) from the atmosphere and store it in soils, making them a form of carbon removal.

Watch It!

How it works: Carbon Capture and Storage, Shell (1:30) https://youtu.be/EyPI20h9kx0

Co-Benefits and Concerns

- Improved soil health: soil carbon sequestration helps restore degraded soils, improving agricultural productivity.
- Increased climate resilience: healthier soils make farms more resilient against both droughts and heavy rainfall.

- Reduced fertilizer use: healthier soils require less fertilizer, saving farmers money and reducing environmental impacts
- Saturation: soils can only hold a finite amount of carbon; once they are saturated, societies can no longer capture more carbon using soil carbon sequestration.
- Reversibility: the carbon captured via soil carbon sequestration can be released if the soils are disturbed; societies would need to maintain appropriate soil management practices indefinitely.
- Difficulty of measurement: monitoring and verifying carbon removal via soil carbon sequestration is problematic and costly

Soils hold three times the carbon currently in the atmosphere or almost four times the amount held in living matter. But, over the last 10,000 years, agriculture and land conversion have decreased soil carbon. Because soils have such a large storage capacity, enhancing soil storage by even a few percentage points makes a big difference.

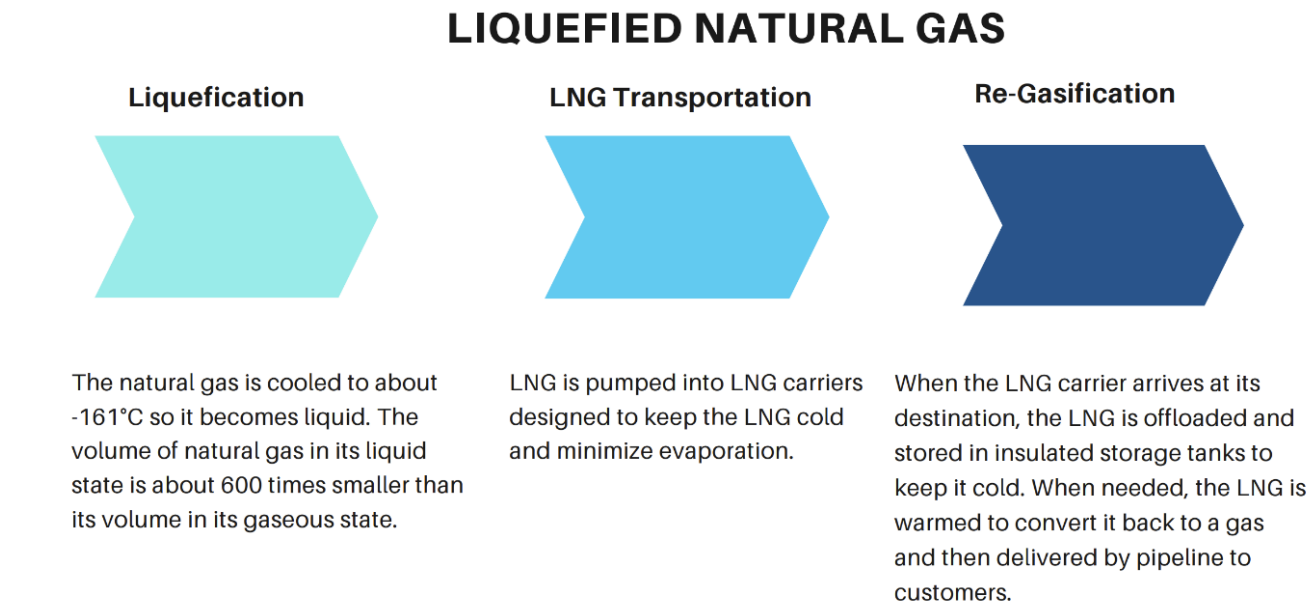
Liquefied Natural Gas - LNG

Liquefied Natural Gas (LNG) is created when Natural Gas in its gas form is cooled to -162 degrees Celsius to collapse the gas vapour back into its liquid form. LNG is not flammable in its liquid form, making LNG a safe and effective way to transport Natural Gas to customers and around the world. LNG needs to be heated to become the gas form used to heat our homes, hot water tanks and cooking.

There is international demand for LNG as countries are working to find lower carbon-emitting energy sources, and Canada is one of the world's largest sources of Natural Gas. Natural Gas is the cleanest burning hydrocarbon fuel. It produces 40% lower GHG emissions than coal when used to generate electricity. Natural Gas can help to reduce emissions in countries like China and India that still rely heavily on coal to generate their power, and it can serve as a backup for sources like wind and solar.

Watch It!

The Soil Story, Kiss the Ground for Regeneration, https://youtu.be/nvAoZ14cP7Q



Liquefied Natural Gas, Canada's Oil and Natural Gas Producers, https://www.capp.ca/natural-gas/lng

An example of how LNG can make a difference is BC Ferries. This organization has succeeded early in advancing liquefied natural gas (LNG). For example, the organization expects to reduce their fuel costs by millions of dollars and CO2 emissions by 21,500 tonnes annually, equivalent to taking approximately 4,400 vehicles off the road annually. To put that in perspective, that's more than double the 2,200 battery-electric vehicles that were purchased in all of BC in 2017.

Ethanol

Ethanol is a liquid alcohol made of oxygen, hydrogen and carbon obtained from the fermentation of sugar or converted starch contained in grains like corn and wheat and other agricultural or agri-forest feedstocks. Ethanol can be produced for different applications, such as industrial or fuel-grade ethanol.

Fuel ethanol, which is sometimes referred to as "gasohol," has been distilled and dehydrated to create a high-octane, water-free alcohol. Ethanol is blended with gasoline to produce a fuel with environmental advantages when compared with gasoline and can be used in gasoline-powered vehicles manufactured since the 1980s. Most gasoline-powered vehicles can run on a blend of gasoline and up to 10 percent ethanol, available at some regular service stations across Canada.

Some vehicles are specially manufactured to operate on an ethanol blend that contains up to 85 percent ethanol and at least 15 percent gasoline. The 15 percent gasoline is needed to assist in engine starting because pure ethanol is difficult to ignite in cold weather.

Ethanol is a renewable fuel because it is produced from biomass. Ethanol also burns more cleanly and completely than gasoline or diesel fuel.

Ethanol reduces greenhouse gas (GHG) emissions because the grain or other biomass used to make the ethanol absorbs carbon dioxide as it grows. Although the conversion of biomass to ethanol and the burning of ethanol produces emissions, the net effect can be a large reduction in GHG emissions compared with fossil fuels such as gasoline.

Canadian farmers are becoming increasingly aware of this new market opportunity. Some have formed cooperatives to grow crops intended specifically as feedstock for ethanol production.

Learning from Norway

Norway was experiencing very expensive electricity rates due to political and environmental factors. To address the soaring electricity rates, the government provided subsidies to Norwegians to encourage the responsible use of electricity as well as the use of alternative energy sources.

The country has committed to reducing its greenhouse gas emissions by 50-55 percent compared to 1990s levels by 2030, largely through the actions of its citizens. Norway is the world leader in electric vehicle sales. By 2025, all new cars sold will be zero-emission vehicles. Only 3.3 percent of passenger vehicles sold in Canada during the first half of 2020 were electric.

Norway became the first country in the world where the sale of electric cars overtook those powered by gasoline, diesel and hybrid engines in 2020. Battery electric vehicles (BEVs) made up 54.3% of all new cars sold in the country in 2020, a global record, up from 42.4% in 2019 and from a mere 1% in 2009. Norway seeks to become the first nation to end the sale of gasoline and diesel cars by 2025.

Other efforts to reduce emissions that Norway participates in include:

- Emission trading systems to encourage emission reductions by manufacturers.
- Promoting the role of conservation, sustainable forest management and enhancement of forests through Norway's International Climate and Forest Initiative (NICFI).
- The government and a state-controlled company determine climate policy that stays consistent regardless of what party is in power.
- A fund established in 1996 with the proceeds from the country's oil and gas extraction now funds the energy-efficient transitions.

The country's electricity and heating are supplied mainly by hydropower. Transportation and oil and gas extraction and processing are the largest carbon emitters in Norway.

Some of the initiatives Norway has encouraged include:

- Investing in solar panels.
- Repurposing batteries from electric vehicles for home use.
- Offering Off-peak electricity rates.
- Supplying natural gas to other European countries.
- Promoting coordinated, efficient and targeted efforts in research and technology for the energy sector.
- Ensuring long-term development of knowledge and technology.
- Promoting competitiveness and greater value creation in the Norwegian energy industry.
- Contributing solutions that lay the foundation for a low-emission society.

Managing Energy More Efficiently in Dairy Farming

Dairy Farmers of Canada has committed the dairy farm sector to reaching net-zero greenhouse gas emissions by the year 2050. Net-zero emissions for dairy farms means reaching a balance between greenhouse gas (GHG) emissions from farms and GHG removed from the atmosphere.

Canadian dairy farms are committed to smart energy management. Actions include equipping barns with energy-efficient lighting, ventilation, and milk-cooling equipment. Energy-saving initiatives also extend out to the fields, including reducing tillage to lower fuel usage.

Creating a comfortable environment for cows is a priority with the fluctuations in weather throughout the

year. Various automated ventilation systems manage and balance temperature and airflow to keep cows comfortable year-round.

Switching to LED lights cuts on electricity use and provides proper lighting inside the barn, helping with cow comfort and safety at night. Many barns also use translucent curtains or skylights that optimize natural daylight inside the barn.

Cooling milk rapidly is important to ensure its quality, but it can use up a significant amount of electricity on a dairy farm unless a "plate cooler" is used. This simple machine puts pipes of cold water in contact with pipes of warm milk, cooling the milk faster and warming the water to a temperature cows like to drink. The efficient heat exchange between the pipes helps a majority of farmers significantly reduce their electricity needs.

Several dairy farmers have opted to produce and use renewable energy sources on their farms, which reduces or replaces the need for fossil fuel-based energy.

The Canadian dairy sector's investments in research are driving meaningful progress. Examples include:

- Biodigesters: Emissions from manure can be reduced through a process called anaerobic digestion, with the added benefit of producing a form of green fertilizer and renewable energy. A typical farm's biodigester can produce enough electricity for 11 houses.
- Carbon Sequestration: Canadian farms, with their crops, grasses, and woodlands, are part of the climate solution, as they actively sequester carbon from the atmosphere into the soil through the natural process of photosynthesis in plants that support animals and the local ecosystem.
- Improved Animal Nutrition: By improving cow diets, we can reduce the methane emissions they give off. Research is already underway into new feeding strategies.
- Breeding Strategies: Selectively breeding cows who process feed more efficiently.
- Renewable Energy: In addition to anaerobic digestors, many farmers are installing solar panels or wind turbines on their land (where weather conditions permit).
- Water Conservation: Canadian dairy farmers have reduced the amount of water needed to produce a kilogram of milk by 6% in recent years.
- Manure Management: Dairy farms have an abundant source of natural fertilizer in cow manure. Farmers carefully manage manure and test soils to make the best use of it in their fields. Cow manure favours microbial activity in the soil and reduces the need for petroleum-based fertilizers. Other practices, such as fully emptying manure storage and covering liquid manure with straw, can also significantly reduce methane emissions.
- Tillage: Many farms have adopted reduced or no tillage practices, such as leaving stubs and roots of a previous year's crop in the soil, capturing more carbon in the ground and reducing topsoil erosion.
- Crop Rotations: Diverse and strategic crop rotations lead to better soil health, meaning the soil retains more water (requiring less irrigation), more nutrients (requiring less fertilizer), and more carbon (reducing

Graphic Source: Net Zero by 2050: Best Management Practices Guide to Mitigate Emissions on Dairy Farms, Dairy Farmers of Canada, https://dairyfarmersofcanada.ca/sites/default/files/2023-03/DFC_BMP%20Guide_FINAL_WEB_0.pdf

greenhouse gases in the atmosphere).

- Cover crops: Many farmers also plant a secondary crop in their fields to help minimize potential soil erosion, increase fertility and moisture, and control weeds, pests, and diseases – all while supporting biodiversity.

Encouraging Innovative People

Innovative and creative people drive developments in how we generate and use energy.

Meet Naila Moloo – Young Energy Innovator

Naila is an innovator who is passionate about leveraging technology to address our global consumption of fossil fuels.

Her journey began with an assignment in Grade 5 to research clean energy. She developed her passion for renewables because of this experience. As a result of her work created for a national science fair in Grade 8, she connected with The Knowledge Society. TKS is a globally recognized 10-month innovation program for ambitious high school students ages 13-17. TKS was started by two brothers in 2016. They wanted to build an incubator to encourage creative mindsets, develop real-world skills, and build a community of like-minded people. What started as a passion project has now become a globally recognized institution for ambitious young people to maximize their probability of making a significant impact.

Naila is passionate about solar energy, and she has designed a transparent and flexible solar cell small enough that it can be connected to a cell phone to generate energy. She is currently working for Carleton University, where she is developing an eco-friendly Bioplastic from duckweed.

At 15-years-old Naila delivered a TEDxTalk about the numerous projects that she is working on to combat the climate crisis, including the duckweed bioplastics and flexible solar cells.

Currently, Naila also hosts The Curiosity Podcast with Kristina Arezina. The duo realized that a lot of the time, the potential and talent of young people go undiscovered until later on in life. Their goal is to equip future change-makers by exposing them to exponential technologies, mindsets, and frameworks.

Her latest area of exploration is machine learning. In an article prepared for CAA Magazine, she shared her message,

- Start working on projects.
- Look for opportunities in your community.
- Start talking to experts.
- Formulate your own ideas.

Listen Up!

Check out other innovators on the Curiosity podcast at https://open.spotify.com/show/1KsSkJdNKLTnjsFDngKNxO

Watch It!

Learn more about The Knowledge Society by visiting www.tks.world

Watch It!

See Naila's TedxTalk at https://youtu.be/M7i-9RrrsUg

DIGGING DEEPER For Senior Members

- **Explore land management best practices for energy efficiencies**
- **Members explore careers related to energy**
- **Innovation around the world**
  Research various innovative renewable energy solutions worldwide and share your findings.
- **Energy Innovators**
  Learn about people who are researching environmentally-friendly innovations with energy.
- **Carbon Capture & Storage in Canadian Agriculture**
  Learn about Zero-Till Agriculture in regenerative gardening and how the management of cattle can contribute to carbon capture.
- **Heating Systems from Pelletized Native Grasses**
  Understand how prairie grasses can represent a new valuable cash crop
- **Veggie Oil Furnaces**
  Learn how waste fryer oil from restaurants and grocers can be used to fuel a boiler and provide heat.
- **Energy Conservation Opportunities in Agriculture**
  Research ways how energy can be conserved in agriculture.
- **Plan an energy-efficient community of the future complete with roads, recreation facilities, homes, commercial and industrial areas, public transit, parks, waste management systems, etc.**

Tour/Speaker Idea!

- Speaker - Invite a speaker from the Canadian Bio Gas Association or a local representative
- Speaker - a local innovator or project manager connected to innovative energy sources
- Tour - an Anaerobic Digester - http://omafra.gov.on.ca/english/engineer/biogas/incentives.htm
- Tour - a local farm that has adopted efficient energy practices

Activity #24 – Let's Make Hydrogen!

Do

Time: 15 minutes

Materials/Resources:

- Plastic cup
- 2 metal thumbtacks
- 9V Battery
- Distilled Water (2 cups)
- Baking Soda (1 pinch)
- Lemon Juice (1/2 tsp)
- Tap water (1 cup)
- Handout and pen

Instructions:

1. Share that using the process of electrolysis, electricity can be used to split water into hydrogen gas. This process is referred to as water splitting. The hydrogen produced by water splitting can then be stored and used later to power homes and cars when needed.
2. Push the thumbtacks into the bottom of the plastic cup so that the points push up into the cup. Space them so that they're the same distance apart as the two terminals of the 9V battery. Be careful when inserting the thumbtacks.
3. Fill the cup with distilled water so that the points of the thumbtacks are completely submerged.
4. Add a pinch of baking soda to the water.
5. Place the plastic cup on the terminals of the battery. The bottom of the thumbtacks needs to touch both terminals.
6. Note: it can take up to one minute for the bubbles to form.
7. Record your observations on the worksheet for each of the solutions.
8. Discard the solution, and repeat the process three more times with the following solutions:
   - Add lemon juice instead of baking soda
   - Don't add anything but distilled water
   - Use tap water instead of distilled water
9. Point out that there is a positive and a negative terminal on the 9V battery. Share that water is made up of hydrogen and oxygen. Explain that when the thumbtack comes in contact with the negative terminal on the battery, the point of the thumbtack in the water creates hydrogen gas. When the other thumbtack comes in contact with the positive terminal on the battery, the point of the thumbtack in the water creates oxygen. Observe that the chemical reaction of water splitting results in more hydrogen gas being produced by the reaction.

Additional Activity:

- Have the Senior Members organize and deliver the activity.

Reflect

Learning Outcomes:

- Members learn about innovative energy sources, like how hydrogen is made.

Apply	Discuss The Following Prompts As A Group • How did water splitting change with the different solutions? **Some solutions worked better than others** • Were some solutions better than others? B**aking soda and lemon juice worked the best. There was some reaction with tap water and no reaction with only distilled water.** • Based on this experiment, what do we need to make hydrogen? **Water with something in it like lemon juice or baking soda, metal and electricity.** • Why do you think no bubbles were formed with the distilled water? **There aren't any ions in distilled water to create the gas (complete the circuit).** • What happens when the bubbles reach the surface? They become part of the air. **There are no carbon emissions.** • Was this easy or hard?

Source: Hydrogen Fuel in Class – a Hands-on Lesson, Science Journal for Kids and Teens, https://www.sciencejournalforkids.org/articles/lesson-ideas/hydrogen-fuel-hands-on-lesson/

LET'S MAKE HYDROGEN

	What happened?	Rank the number of bubbles from most (4) to least (1)
Distilled Water + Baking Soda		
Distilled Water + Lemon Juice		
Distilled Water		
Tap Water		

Activity #25 – Judging Our Energy

Do	Time: 15 minutes **Materials/Resources:** • Sticky notes or cue cards with masking tape • Marker • 4-H Judging Handbook **Instructions:** 1. Refer to the 4-H Judging Handbook for details regarding how to organize a judging class. 2. Write each energy source from this list on a sticky note or cue card. Wind energy, solar energy, geothermal energy, biogas, coal, oil, nuclear power, hydroelectricity, natural gas, hydrogen, Liquefied Natural Gas – LNG, ethanol 3. Place the sticky notes or cue cards on a wall where all members can see them. 4. Working in pairs, members choose the top 4 forms of energy. 5. Have them present their selection and give reasons why they chose these three.
Reflect	**Learning Outcomes:** • Members compare energy sources in a judging activity.
Apply	**Discuss The Following Prompts As A Group** • Why did you rank the energy sources the way you did? • Is there another source of energy that you feel could be added to the list? • Was this easy or hard?

Reference citations:

- Why carbon capture and storage is not a real climate solution https://davidsuzuki.org/what-you-can-do/why-carbon-capture-and-storage-is-not-a-real-climate-solution/
- Canada a Global Leader in Hydrogen Production, The Government of Canada: Trade Commissioner Service, https://www.chfca.ca/wp-content/uploads/2019/09/GOC-HydrogenProduction_en_WEB.pdf
- Fuel Cell Basics, The Office of Energy Efficiency and Renewable Energy https://www.energy.gov/eere/fuelcells/fuel-cell-basics
- Anaerobic digestion basics, Ontario Ministry of Agriculture, Food and Rural Affairs, February 09, 2023 https://www.ontario.ca/page/anaerobic-digestion-basics
- Clean Growth Pathway to 2050, Fortis BC, February 2022.
- Biogas Incentives and Requirements: Building a Farm-Based Biogas System in Ontario, Ontario Ministry of Agriculture, Food and Rural Affairs.
- The Problem: Food Waste, Zooshare Biogas Co-operative https://zooshare.ca/about-zooshare/
- Zooshare explains energy, food systems, and how biogas works, Zooshare (11:34) https://youtu.be/dv_rUXqeIJU
- Going Green: Zoo Poo to Biogas Energy; great potential Now Producing Clean Renewable Energy For Ontario!, Toronto Zoo https://www.torontozoo.com/tz/biogas
- Area dairy farm first in Ontario to produce renewable natural gas, The London Free Press, Oct 15, 2022, https://lfpress.com/news/local-news/area-dairy-farm-first-in-the-province-to-produce-renewable-natural-gas
- What is Soil Carbon Sequestration?, American University https://www.american.edu/sis/centers/carbon-removal/fact-sheet-soil-carbon-sequestration.cfm
- Liquefied Natural Gas, Canada's Oil and Natural Gas Producers https://www.capp.ca/natural-gas/lng/
- Clean Growth Pathway to 2050, Fortis BC, February 2022.
- Ethanol, The Government of Canada https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/biofuels/ethanol/3493
- Clean Growth Pathway to 2050, Fortis BC, February 2022.
- Canada's Action Plan for Clean On-Road Transportation, Government of Canada, Transportation Canada, 2022, https://tc.canada.ca/en/road-transportation/publications/canada-s-action-plan-clean-road-transportation
- Norwegians, shocked by raising hydro bills, change old habits and rethink what to do with oil wealth. Paul Waldie, The Globe and Mail, 3 February 2023
- Emissions Trading Systems, The Organisation for Economic Co-operation and Development (OECD), https://www.oecd.org/environment/tools-evaluation/emissiontradingsystems.htm
- 4 Ways Norway leads and Canada lags on Climate Action, The Conversation, 9 February 2021, https://theconversation.com/5-ways-norway-leads-and-canada-lags-on-climate-action-153179
- Norway's International Climate and Forest Initiative, https://www.oecd.org/dac/evaluation/Norad-Factsheet-interactive-final.pdf
- Norway: Carbon-neutral as soon as 2030, Nordic Energy Research, https://www.nordicenergy.org/figure/ambitious-climate-targets-and-visions-for-all-nordic-countries/carbon-neutral-as-soon-as-2030/
- Net Zero by 2050: Best Management Practices Guide to Mitigate Emissions on Dairy Farms, Dairy Farmers of Canada, https://dairyfarmersofcanada.ca/sites/default/files/2023-03/DFC_BMP%20Guide_FINAL_WEB_0.pdf
- Naila Moloo https://nailamoloo.com/
- The Knowledge Society https://www.tks.world/story
- World Class by Sean Deasy, CAA Magazine, Spring 2023.
- How 16-year-old Naila Moloo is making waves as an environmental innovator by Mathew Silver, Macleans Magazine, December 20, 2022. https://macleans.ca/society/environment/prospect-climate-change-solar-panel/?utm_source=newsletter&utm_medium=email&utm_campaign=electrospinning_flexible_

substrates_cookies&utm_term=2023-01-01
- Hydrogen as Fuel – Teacher's Guide, Hydrogen Fuel Cell Partnership www.h2fcp.org, https://h2fcp.org/sites/default/files/Hydrogen%20Lesson.pdf