eco canada

ENERGY EFFICIENCY AND RENEWABLE ENERGY TOOLKIT

ABOUT ECO CANADA

ECO Canada is a steward for the Canadian environmental workforce across all industries. From job creation and wage funding, to training and labour market research—we champion the end-to-end career of an environmental professional. Our aim is to promote and drive responsible, sustainable economic growth while also ensuring that environmental care and best practice is a priority.

We work alongside both government and policy makers, as well as industry and academia, to ensure we support Canada as a global leader in environmental innovation and jobs. We are thought leaders in the environmental labour market. Our leading research provides unmatched statistics and analysis on the economic and labour trends that identify workforce gaps within industry.

We support the environmental labour force from coast-to-coast. Our services hit every touch point within the environmental workforce from educational development, to certification and soft skills training—we serve our members to ensure they can build and grow their careers.

ENERGY EFFICIENCY AND RENEWABLE ENERGY TOOLKIT

WHAT IS THIS TOOLKIT?

This toolkit was designed to accompany ECO Canada's online training program, Managing Energy Efficiency and Renewable Energy Projects. It was developed in partnership with experts in energy audits, planning, and management to provide learners with practical information, tips, and resources that will support the implementation of sustainable energy projects.

HOW DO I USE THIS TOOLKIT?

The tools in this toolkit are categorized into two main sections:

1. Energy Efficiency and Retrofits:

   Learn how to reduce energy use in any home or building with energy audits, energy conservation techniques, thermostats, LED lighting, and more.

2. Renewable Resources and Generation:

   Learn how to identify renewable resources and technologies and conduct a preliminary site assessment.

REDUCING YOUR ECOLOGICAL FOOTPRINT

OUR ECOLOGICAL FOOTPRINT IS A MEASURE OF HOW MUCH WATER AND LAND IS NEEDED TO PRODUCE OUR FOOD, GENERATE OUR ENERGY, AND PROPERLY DEAL WITH OUR WASTE.

HOME ENERGY

The energy used in your home contributes to emissions released into the atmosphere.

Take steps to ensure your home is airtight. This reduces heat loss and limits heating fuel emissions.

Set your thermostat to a lower heating temperature set point when you are not home or sleeping. This reduces heating fuel use.

Use energy efficient LED light bulbs in your home to reduce electricity use and emissions.

WASTE

The waste you produce must be transported to landfills where it affects land and water.

Reduce water waste by installing low flow faucets, toilets, and reducing water spent on watering lawns and washing vehicles.

Reduce your waste by recycling paper, plastic, glass and cans and disposing of cigarette butts in an ashtray.

Use less food packaging, plastics, and other garbage that would otherwise end up in the landfill. This uses land and affects the quality of our water systems.

FOOD

Food affects land, water and emissions and is the biggest contributor to your Ecological Footprint.

Try eating more vegetarian meals with locally grown produce to reduce emissions caused by meat production and produce shipped over long distances.

Compost organic food scraps like coffee grounds, fruit and vegetable peels, eggshells and tea bags to divert food waste from landfills.

Eat locally grown and produced foods to reduce packaging waste and eliminate emissions that would be caused by long distance shipping.

CONDUCT AN ENERGY AUDIT

An energy audit is an inspection and analysis of energy, how it flows and how it can be conserved within a building.

Official energy audits are typically completed by an energy professional and are accompanied by a **Detailed Energy Assessment Report**. This report will analyze how the building uses, creates and wastes energy and will include a list of upgrades that can be completed to make the building more energy-efficient.

ECO TIP

Although a Detailed Energy Assessment Report can be a great way to learn how to make your building more energy-efficient, you can also use some of the same principles to perform a basic analysis of your own building!

WHEN ANALYZING A BUILDING, KEY IN ON THE FOLLOWING AREAS:

BUILDING ENVELOPE

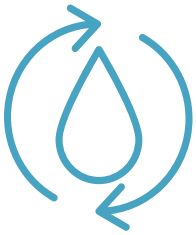
Heat leaks through doors, windows, walls and the roof.

Ensuring that your home is air tight is a great way to save energy!

LIGHTING

An LED light bulb uses ~70% less electricity than an incandescent bulb and lasts up to 50 times longer.

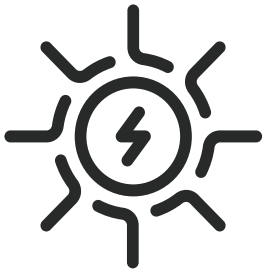
Switching to LED light bulbs will reduce your electricity bill



WATER

Water is a precious resource that also must be heated with fuel.

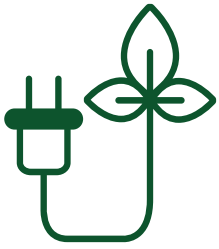
Reducing water use will save water and heating fuel.



HEATING SYSTEM

The heating system in your home uses fuel.

Choosing a high efficiency heating system (like a furnace or boiler) will reduce your heating bill.



PLUG LOADS

Anything that is plugged into a wall plug uses electricity.

Using a smart power bar or upgrading to high efficiency appliances will reduce your electricity bill.

HOW CAN I MAKE MY BUILDING MORE ENERGY EFFICIENT?

Once you have analyzed the current energy situation in your building, you are ready to identify where energy can be saved, and heat loss can be decreased. The effort for each upgrade shown below is based on cost, time and accessibility.

LOW EFFORT	MEDIUM EFFORT	HIGH EFFORT
Programmable Thermostats	Condensing Furnace	Condensing Boilers
Door Seals and Sweeps	Automatic Flue Dampers	Window Upgrade
Pipe or Duct Insulation	LED Lighting + Sensors	High-Efficiency RTUs
High-Efficiency Air Filters	Door Upgrade	Wall Insulation
Plug Timers	Tankless Water Heater	Wind Turbine
Programmable Thermostats	Attic / Roof Insulation	Geo-Exchange
Smart Thermostats	AC Unit Upgrade	Solar PV

CASE STUDY

ENERGY EFFICIENCY RETROFIT PROJECT

A CANMET ENERGY AND NATURAL RESOURCES CANADA CASE STUDY

OUR LADY OF PEACE SCHOOL | LAVAL, QUEBEC

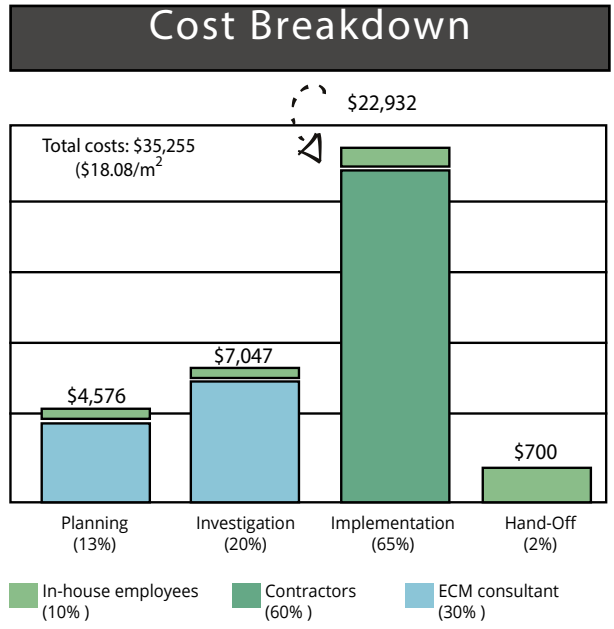
Our Lady of Peace Elementary School, built in 1968, comprises 1,950 m² of floor area on one single floor. The building accommodates children in kindergarten up to Grade 6. Before any energy retrofit upgrade, the annual energy bill was about $44,500. After completion in 2010, the retrofits reduced the bill by 17% and focused mainly on the following electromechanical systems: a natural gas boiler with 225 kW capacity (23 hp, an electric boiler with 150 kW capacity, a ventilation system with a capacity of 5,700 L/s (12,000 ft3 /min, and a cooling system with a capacity of 12 tonnes.

Monetary or energy savings?

Monetary and energy savings often go hand in hand, as demonstrated when the continuous operation of the ventilation system at Our Lady of Peace Elementary School was shut down. However, the decision as to whether or not to restart the electric boiler, which would result in a significant energy benefit, but at the same time generate a financial loss of 18%, was a more difficult choice.

Decision: The school board ultimately decided to give priority to an overall reduction in energy consumption and greenhouse gas emissions (GHGs) in order to meet the objectives set out at the start of the ECM project by the ministère de l'Éducation, du Loisir et du Sport du Québec (Quebec Department of Education, Recreation and Sport).

Results	
ENERGY SAVINGS	745 GJ / year (37%)
MONETARY SAVINGS	$7,515 / year
GHG REDUCTION	41 t CO2 e / year (equivalent to 7 cars)
SIMPLE PAYBACK PERIOD	4.7 years



"In addition to supporting the implementation of an improved preventive maintenance program, this project has helped us to inexpensively achieve the objectives set by the department. Thus, we are reducing our ecological footprint and ensuring that our buildings last longer." — Daniel Hogues, Director of Material Resources Sir Wilfrid Laurier School Board Laval (QC), Canada

ECM Winning Measures		Annual Savings
1	Optimization of stop/start commands for the ventilation unit and the main evacuators Operate the ventilation system and the main evacuators on a schedule rather than in continuous 24/7. Ensure that the fresh air flow is controlled based on the working evacuators. Annual savings of 36,113 kWh of electricity and 8,129 m^3 of natural gas. Cost: $10,700 | Payback: 1.5 year	438 GJ / year $7,000 / year
2	Restart electric boiler Restart the electric boiler for natural gas use savings. Resulted in a 178,500 kWh increase in electricity consumption and a 21,000 m^3 reduction in natural gas consumption. Cost: N/A | Payback: N/A	155 GJ / year -$1,665 / year
3	Decrease the temperature during unoccupied periods Decrease the temperature in rooms at night and on weekends (from 22°C to 18°C / 72°F to 64°F) using sensors in strategic rooms. Annual savings of 1,710 m^3 of natural gas Cost: N/A | Payback: N/A	65 GJ / year $1,065 / year
	Seven other ECM measures Cost: $5,380 | Payback: 4.8 years	87 GJ / year $1,115 / year

NB: Costs and payback periods include only implementation phase materials and labour.

CanmetENERGY and Natural Resources Canada. (2011). Recomissining (RCx) Case Study - Elementary School: Our Lady of Peace, Laval (QC). Varennes, Montreal: CanmetENERGY.

HOW TO PROGRAM YOUR THERMOSTAT IN UNDER FIVE MINUTES!

A programmable thermostat allows you to tell your furnace when you will be home, away and asleep so it can save energy by operating less while you are away and asleep. According to Energy Star, the proper use of a programmable thermostat can save about $180 year in energy costs.

WHAT DOES A PROGRAMMABLE THERMOSTAT LOOK LIKE?

Your thermostat has a small digital screen that displays the temperature and time.

Your thermostat has buttons including an up arrow, a down arrow as well as a "set" and/or "schedule" button.

WHAT IF I DON'T HAVE A PROGRAMMABLE THERMOSTAT?

Chances are you have a non-programmable or analog thermostat. If this is the case, you could consider getting a programmable thermostat to help you reduce your heating bill, energy use, and environmental impact.

Most programmable thermostats have four time periods (wake, leave, return, and sleep), as well as separate weekday and weekend periods. First you will need to determine your schedule and desired temperature. Track when you leave and return home as well as when you sleep and wakeup so you know when you can decrease your home's temperature. Determine what temperature you prefer your home to be at when you are home and the lowest acceptable temperature for when you are asleep or out of your home.

MYTH

FACT

MYTH: INCREASING THE SETPOINT OF YOUR THERMOSTAT WILL MAKE YOUR HOUSE HEAT UP FASTER.

FACT: Either way your furnace will operate at the same speed and heat your home to the desired temperature. A programmable thermostat is a great way to reduce energy use and keep your house warm while you're home. If you find that your home is too cold when you wake up or return home, set the time back one hour so that the house will warm up one hour before.

TO PROGRAM YOUR PROGRAMMABLE THERMOSTAT, FOLLOW THESE GENERAL STEPS:

1. Ensure that the current time and day of the week on your thermostat are correct.

2. Press the SET or PROGRAM button which will bring up the weekday wake time. Press the SET or PROGRAM button again to set the weekday wake temperature.

3. Continue to press the SET or PROGRAM to set the time and temperature for the leave, return and sleep periods.

4. Repeat steps 2 and 3 to set the weekends.

Use a table like the one below to record your wake, leave, return and sleep times.

	SAMPLE WEEKDAY	SAMPLE WEEKEND	YOUR WEEKDAY	YOUR WEEKEND
6:00 AM				
7:00 AM				
8:00 AM	WAKE • 21°C			
9:00 AM	LEAVE • 18°C	WAKE • 21°C		
10:00 AM				
11:00 AM				
12:00 PM		LEAVE • 18°C		
1:00 PM				
2:00 PM				
3:00 PM				
4:00 PM		RETURN • 21°C		
5:00 PM	RETURN • 21°C			
6:00 PM				
7:00 PM				
8:00 PM				
9:00 PM				
10:00 PM	SLEEP • 18°C			
11:00 PM		SLEEP • 18°C		
12:00 AM				
1:00 AM				
2:00 AM				
3:00 AM				
4:00 AM				

CALCULATING ENERGY AND COST SAVINGS FOR EFFICIENCY UPGRADES

FOLLOW THESE KEY STEPS

No matter what the upgrade, you can complete a few calculations to determine the decrease in electricity or fuel your building will consume and the cost savings of the reduced energy use.

1. Analyze current state.

- What is the equipment's energy consumption rating and how long does it run each day/year?
- How many Gigajoules or kWh per year?
- How many hours per day does it consumer energy?

2. Estimate how much energy is consumed by the original equipment each year.

Hours per day x 365 days per year x number of pieces of same equipment

3. What does it cost in electricity or fuel to run the equipment per year?

Hours ÷ year x unit price of fuel or electricity

4. Estimate how much energy will be consumed by the upgraded equipment each year.

What is the estimated Gj or kWh/year (manufacturers often provide the average annual energy consumption for newer appliances and equipment)?

5. Estimate the electricity or fuel costs for the upgrade.

Hours ÷ year x unit price of fuel or electricity

6. Calculate the cost of the upgrade.

7. Calculate the energy savings.

Original energy consumption ÷ year - upgrade energy consumption per year

8. Calculate cost savings.

Original energy costs ÷ year - upgrade energy costs per year

9. Calculate payback period by dividing the cost of the upgrade by the annual costs savings.

Cost of upgrade ÷ cost savings per year

HOW CAN I MAKE MY BUILDING MORE ENERGY EFFICIENT?

Using LED light bulbs instead of incandescent bulbs is an easy way to save electricity. Simply screw out old incandescent light bulbs and replace them with equivalent LED bulbs.

You can see an example of an upgrade energy and cost savings analysis here using an LED bulb upgrade:

1. Identify current state (energy consumption and energy costs). Use the following table to assess the total electricity costs associated with your current lighting. An example is shown in the first line for a small home with ten 60W incandescent bulbs that are on for eight hours per day, seven days a week.

ANALYSIS OF CURRENT LIGHTING					
	WATTAGE	# OF LIGHTS	ESTIMATED HOURS TURNED ON		ELECTRICITY USE PER YEAR
Units	W	L	Hours / Week	Hours / Year (H)	Kilowatt Hours (KWH)
Calculations				Hours / Week x 52 = H	W x L x H / 1000 = KWH
LIGHTING TYPE					
60W Incand.	60	10	56	2,912	1,747
					+
					+
					+
					+
					=
TOTAL CURRENT KILOWATT HOURS					KWH

2. Estimate energy consumption, energy costs, and purchase cost for the upgrade. Use the following table to assess what your new electricity costs and total upgrade cost would be if you completed an LED lighting upgrade. The example assumes that 9W LED equivalent bulbs cost $3.00 per bulb.

PROPOSED LED LIGHTING UPGRADE

	WATTAGE	# OF LIGHTS	ESTIMATED HOURS TURNED ON		ELECTRICITY USE PER YEAR	COST OF LED UPGRADE	
Units	W	L	Hours / Week	Hours / Year (H)	LED Kilowatt Hours (LED KWH)	Cost in $ (C)	Total
Calculations				Hours / Week x 52 = H	W x L x H / 1000 = LED KWH		L x C
LIGHTING TYPE							
LED Equivalent	9	10	56	2,912	262	$3.00	$30.00
							+
							+
							+
							+
							=
TOTAL CURRENT LED KILOWATT HOURS					LED KWH		C

LED Cost

CALCULATE ELECTRICITY AND COST SAVINGS

The example assumes a savings rate of $0.08 / kWh.

• Electricity Savings: kWh Current - kWh LED = Electricity Saved per Year
1,747.2 - 262 = 1,485 kWh Saved per Year

• Cost Savings: Electricity Savings Rate x Electricity Saved = Money Saved Per Year
$0.08 / kWh x 1,485 = $119 Saved per Year

Calculate the payback period. Using your purchase price of the upgrade and your cost savings data, you can determine the payback of your LED lighting upgrade.

• Payback: Cost LED ÷ Money Saved Per Year = Payback Period
$30 ÷ $119 = 0.25 Years

It will take 3 months to return your initial $30 investment!

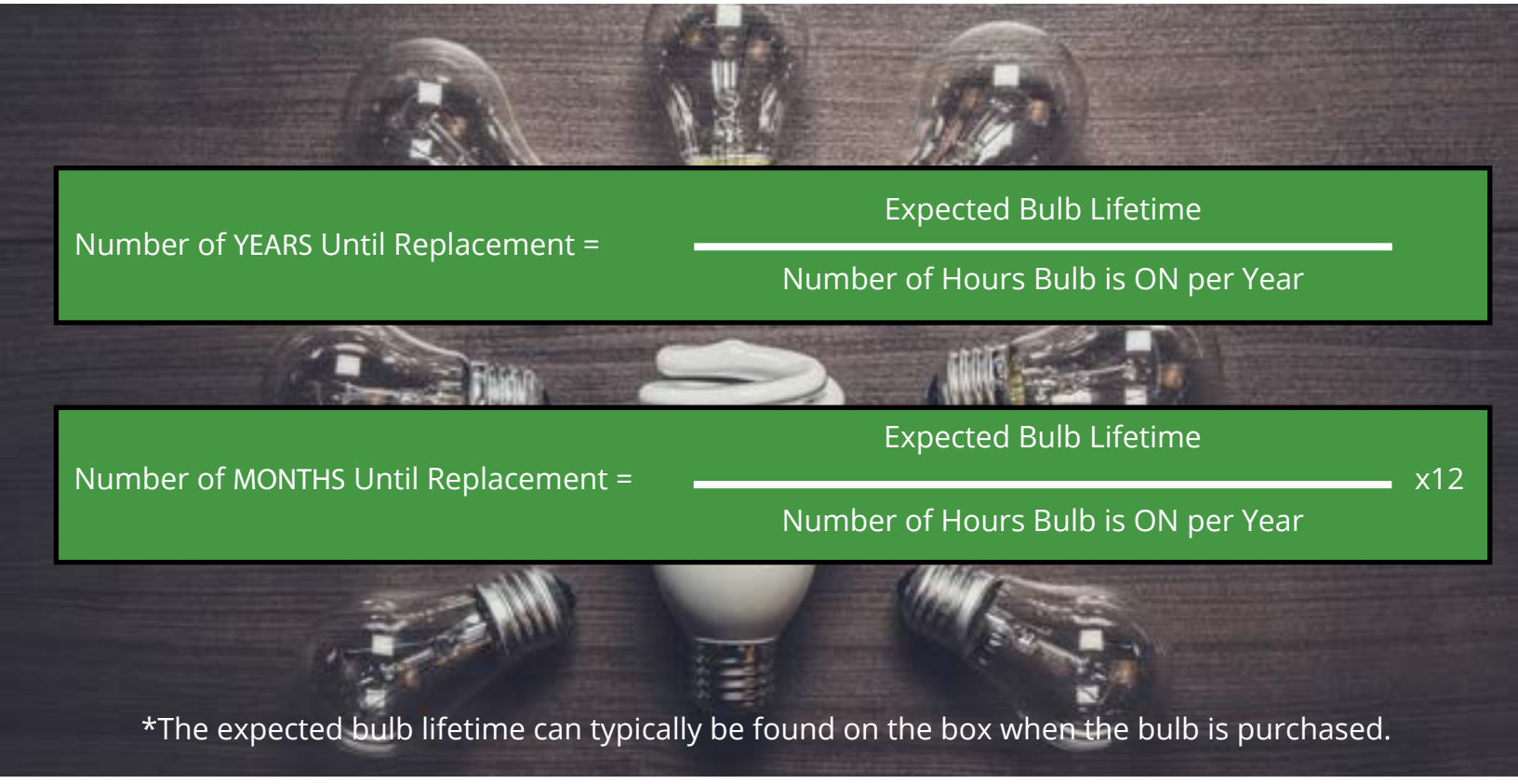
CALCULATING REPLACEMENT COSTS AND NET PRESENT VALUE

In addition to analyzing energy and cost savings, you can also calculate replacement costs and the payback period using the Net Present Value (NPV). NPV is a useful calculation as it provides the return on investment in terms of currency while payback period refers to the period of time required for the return on an investment to repay the total initial investment.

Example calculations for replacement costs and NPV using the LED bulb upgrade are presented here.

REPLACEMENT COSTS

LED bulbs also lasts longer than incandescent and fluorescent bulbs. This leads to additional cost savings since LED bulbs must be purchased less frequently. So, the switch to LED lighting not only saves on electricity costs, as shown above, but also saves on replacement costs. The formula to determine how frequently you must replace your lights can be estimated using:



$$\text{Number of YEARS Until Replacement} = \frac{\text{Expected Bulb Lifetime}}{\text{Number of Hours Bulb is ON per Year}}$$

$$\text{Number of MONTHS Until Replacement} = \frac{\text{Expected Bulb Lifetime}}{\text{Number of Hours Bulb is ON per Year}} \times 12$$

*The expected bulb lifetime can typically be found on the box when the bulb is purchased.

EXAMPLE: LED Replacement Cost Savings

LED lighting will not only save electricity costs, but also save replacement costs since LED light bulbs last longer than incandescent ones. Let's calculate the additional replacement cost savings from switching the 10 incandescent bulbs to LEDs.

- You read the box of the old incandescent bulbs which says that the bulbs are meant to last 3,000 hours. Since they operate for 2,920 hours per year (based on lights being on for 8 hours a day, 365 days per year), the incandescent bulbs last about one year.

  The incandescent bulbs cost $2 each ($20 for 10). Each year it costs $20 to replace the bulbs in the residential buildings.

- The LED light bulbs cost $5 each ($50 for 10) and last for 50,000 hours. To calculate how frequently they must be replaced:
  50,000 hours ÷ 2,920 hours/year = 17 years
  So, every 17 years you must spend $50.
  If averaged, that translates to $50 ÷ 17 years = $2.94 per year
  $20 per year - $2.94 per year = $17.06 per year in additional savings

- Although the LED bulbs cost 2.5 times more than the incandescent bulbs, they can last up to 50 times longer, depending on the lifespan of the incandescent bulb. In this example, LEDs would last 17 times longer.

- LED light bulbs make financial sense not only because of the electricity savings, but also be cause of the replacement cost savings.

CALCULATING PAYBACK AND NET PRESENT VALUE

Let's look at the difference between calculating the payback period and the Net Present Value (NPV) of an LED replacement.

Example: LED Replacement Cost Savings

To complete this calculation, you must know:

- The cost of the upgrade
- The cost savings of the upgrade
- The replacement cost of the upgrade

For this example, we will assume:

- Replacing the 10 incandescent bulbs with LEDs will cost $50
- The LEDs will save $121 in electricity costs each year
- The LEDs will save $17 in replacement costs each year

Payback Period

Let's calculate the payback period of the initial costs:

$$\text{Payback Period} = \frac{\text{Upfront Cost}}{\text{Annual Savings}} = \frac{\$50}{\$121 + \$17} = 0.36 \text{ years}$$

The initial $50 investment needed to buy the LED bulbs will pay-back in less than half of one year.

Net Present Value

Let's use the Present Value of Cash Flows Calculator to calculate the net

https://www.calculatorsoup.com/calculators/financial/present-value-cash-flows-calculator.php

The present value of the cash flows is $1,817. Knowing that the cost is $50

NPV = Present Value - Cost = $1,817 - $50 = $1767

If you implement this LED lighting upgrade, you will be creating $1,767 of value over the 17-year life of the LED bulbs. Since the NPV is positive, you should proceed with the LED Upgrade.

For more information on a quick start guide to track energy savings in a commercial building visit here:https://www.energystar.gov/sites/default/files/tools/Portfolio%20Manager%20Quick%20Start%20Guide_May%202019_Final_508.pdf

More information about energy building management can be found here: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/learn-how-portfolio-manager

CALCULATE ELECTRICITY AND COST SAVINGS

We can measure the exact amount of greenhouse gas (GHG emissions that an energy efficiency or renewable energy project offsets to ensure we make choices that are best for the environment. This is done by finding the difference in energy use before and after the energy efficiency or renewable energy upgrade and assigning an emission factor to the fuel source.

In this exercise, we will perform the emission calculation from the LED Replacement Cost Savings example.

Energy Use Before - Energy Use After = Energy Saved

1747 kWh - 262 kWh = 1,485 kWh

Once we know how much energy is saved, we can calculate the emissions that the upgrade reduces by applying the appropriate emission factor:

Emission Factors		
Fuel Type	Factor	Units
Electricity	0.0006400	tCO2e/kWh
Natural Gas	0.0512834	tCO2e/GJ
Propane	0.0015070	tCO2e/L
Diesel	0.0026630	tCO2e/L
Gasoline	0.0022890	tCO2e/L

Energy Saved x Emissions Factor = Emissions Displaced

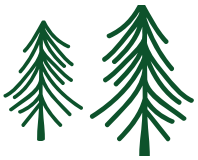
An online calculator like this can translate an amount of energy displaced into the number of cars taken off the road or miles driven: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

SUSTAINABILITY THROUGH RENEWABLE ENERGY

Renewable energy technologies work with nature rather than against it.
The processes used in these systems often mimic processes that occur naturally.

Composting food waste is a similar chemical process to biodegradation in nature, in which biomass (waste or deadfall) is decomposed and returned to the ground where the nutrients are reused.

Beavers dam the flow of water in a river to create a safer home for themselves. The pond that the dam creates becomes an ecosystem for new wildlife.



Plants use the sun to complete the process of photosynthesis which produces food and energy that they need to grow and survive.

Plants also use the wind to carry their pollen to new places which helps them reproduce in new areas.

In the same way that these plants and animals use renewable energy without harming the earth, we want to do the same. On the next page are five common types of renewable energy types and some examples of how they can become useful in your community.

MYTH FACT

MYTH: RENEWABLE ENERGY SOURCES CAN NOT REPLACE FOSSIL FUELS.

FACT: It is not realistic to expect that fossil fuels can be 100% replaced, however, renewable energy can replace some fossil fuel use and is part of what is needed to help the earth.

MYTH: RENEWABLES AREN'T VIABLE WITHOUT GOVERNMENT SUBSIDIES.

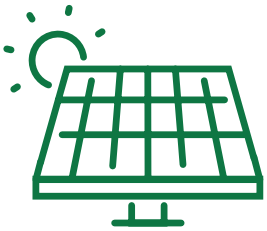
FACT: All forms of energy receive government subsidies, even oil and gas. Renewable energy is not the only energy source that the government subsidizes.

WIND

Wind spins the blades of a turbine to generate electricity.

Works best where wind is strong and consistent.

SOLAR



Solar Photovoltaic (PV) panels use sunlight to generate electricity.

Can be installed on rooftops or at a larger scale on the ground.

The largest solar system in Canada is in Ontario, it produces 100MW of usable electricity.

BIO

Use of natural materials like wood, farm waste, landfill gas, etc to produce heat or electricity.

Bio fuels can even be used to power cars

Approximately five percent of the gasoline we use is renewable.

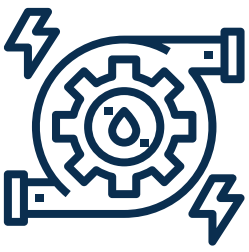
GEO

Uses the earth's naturally hot core to generate electricity.

Can also be used to heat your home.

Three percent of electricity in Nova Scotia is provided by geothermal energy from abandoned mines.

HYDRO



Flowing water spins a turbine to generate electricity.

Sometimes a dam is used but can operate in a flowing river too.

In Canada, hydroelectric plants generate enough electricity to heat and power over 40,000 houses.

SHOULD MY COMMUNITY DO A SOLAR OR WIND PROJECT?

Choosing between solar and wind projects depends on site conditions, goals, community resources and many other factors. The chart below outlines some key characteristics between rooftop solar, community solar and wind to help with the decision:

	ROOFTOP SOLAR	COMMUNITY-SCALE SOLAR	COMMUNITY-SCALE WIND
SITE REQUIREMENTS	Roof must be: in good condition, mostly unshaded, facing south, east or west.	Land and environment must be studied to endure it is fit for solar. Power lines must have capacity.	Land and environment must be studied to endure it is fit for turbines. Power lines must have capacity.
SIZE OF SYSTEM	Less than 1MW Depends on Roof Space. Limited to Microgen.	1MW – 5MW May take up significant space on the land depending on size.	5MW – 50MW Land will still be usable, but turbines will reach high into the sky.
COST (INSTALLED)	$2,000 - $3,000 / kW	$2,500 - $3,500 / kW	
PROJECT LENGTH	1 month – 1 year	2 years - 5 years	2 years - 5 years
WHERE DOES ENERGY GO?	The electricity is used inside the building first. If too much is being produced, excess will be sent to the electrical grid.	The electricity produced is carried by transmission wires directly onto the electrical grid. The utility company that owns and operates these wired must be consulted in detail on projects like these.	
WHAT TO CONSIDER BEFORE INITIATING THE PROJECT	◇ Solar resource (shading, orientation) ◇ Structural assessment (age & type of roof) ◇ Electrical assessment ◇ Financial assessment	◇ Solar resource ◇ Glare/glint analysis ◇ Community engagement ◇ Environmental study ◇ Geotechnical study ◇ Interconnection study (ability to connect to the grid) ◇ Financial assessment	◇ Wind resource (speed) ◇ Flicker/visual assessments ◇ Noise assessment
LAND USE	None. Since it is installed on rooftop, no land is used.	Depending on size, large amount of land can be needed.	Land can still be used where wind turbines are installed.
PROJECT-SPECIFIC CHALLENGES	May require new roof. May be Shaded. Only powers one building.	Total cost is high. May need line upgrades. More regulations. Must consult utility. Environmental risks.	
NEXT STEPS	Site assessment and initial quote from multiple professional contractors.	Interconnection study by utility, site studies, quotes.	Install wind meter (anemometer) for one year to collect wind data.

IS MY ROOFTOP GOOD FOR SOLAR PANELS?

You've decided that rooftop solar is something you want to explore further for your home or community building! What's next? Before engaging a solar contractor for quotes, you can gather some basic information to decide whether to move forward with solar.

Start by answering the following questions about the rooftop:

IS THE ROOF IN POOR CONDITION, LEAKING OR WEATHERED?	IS THE ROOF OLDER THAN 10 YEARS OLD?	ARE THERE LARGE CHIMNEYS, SKYLIGHTS OR OTHER OBSTRUCTIONS?	ARE THERE LARGE TREES, BUILDINGS, OR STRUCTURES THAT COULD SHADE THE ROOF?
✓ ✗	✓ ✗	✓ ✗	✓ ✗

If you answered "yes" to any of the above, it is important to let the solar contractor know as this could change the design and feasibility of the project. You can use the checklist below to complete a basic preliminary solar site assessment on any rooftop you think would be fit for solar.

BASIC SOLAR SITE VISIT CHECKLIST

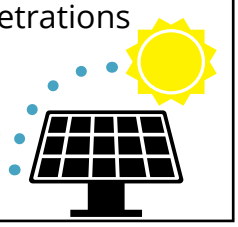
LOCATION:

Roof (gain access if possible):

Estimated Roof Pitch: 4/12, flat, etc

Roof Type: Asphalt, metal, standing seam, cedar shakes, graveled rubber membrane, etc

Take pictures:
- ___ of entire building
- ___ of entire building pm solar mounting side
- ___ of roofing material
- ___ of entire potential mounting area
- ___ of entire potential mounting area
- ___ from centre to show all penetrations
- ___ to the south of the site
- ___ to the south east of the site
- ___ to the south west of the site

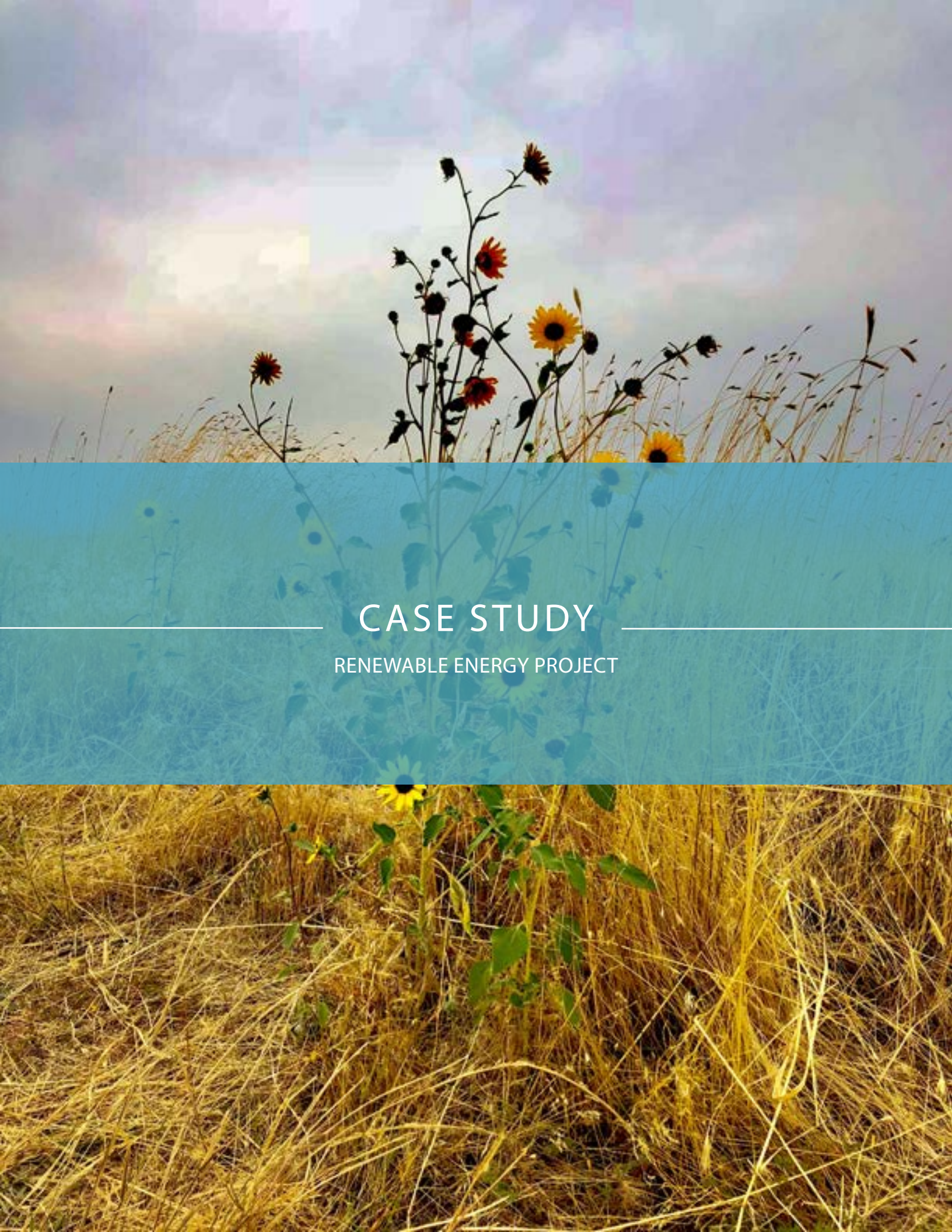


Electrical (gain access to main electrical room):

Rating of breaker in largest panel (amps):

Take pictures:
- ___ of entire electrical room (all components)
- ___ of disconnect specifications
- ___ of main breaker panel
- ___ of electric meter (including specifications)
- ___ of panel specifications
- ___ of location where the meter is mounted
- ___ of any (all) disconnects

Draw the roof and take approximate measurements, including roof penetrations like chimneys.



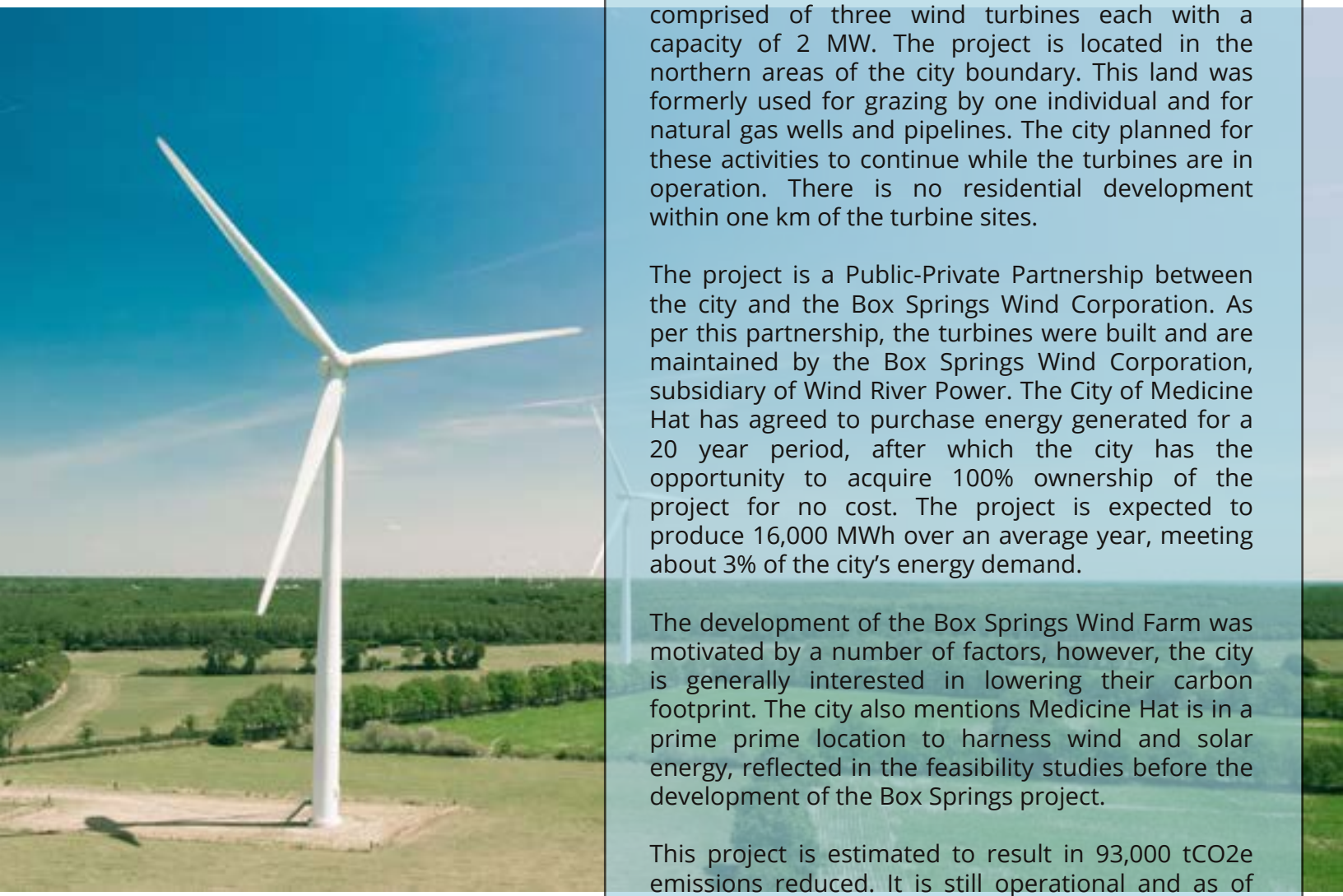
CASE STUDY

RENEWABLE ENERGY PROJECT

A UNIVERSITY OF ALBERTA CASE STUDY

BOX SPRINGS WIND FARM | MEDICINE HAT, ALBERTA

The City of Medicine Hat is becoming a nexus of renewable energy.



The Box Springs Wind Farm, completed in 2014, is comprised of three wind turbines each with a capacity of 2 MW. The project is located in the northern areas of the city boundary. This land was formerly used for grazing by one individual and for natural gas wells and pipelines. The city planned for these activities to continue while the turbines are in operation. There is no residential development within one km of the turbine sites.

The project is a Public-Private Partnership between the city and the Box Springs Wind Corporation. As per this partnership, the turbines were built and are maintained by the Box Springs Wind Corporation, subsidiary of Wind River Power. The City of Medicine Hat has agreed to purchase energy generated for a 20 year period, after which the city has the opportunity to acquire 100% ownership of the project for no cost. The project is expected to produce 16,000 MWh over an average year, meeting about 3% of the city's energy demand.

The development of the Box Springs Wind Farm was motivated by a number of factors, however, the city is generally interested in lowering their carbon footprint. The city also mentions Medicine Hat is in a prime prime location to harness wind and solar energy, reflected in the feasibility studies before the development of the Box Springs project.

This project is estimated to result in 93,000 tCO2e emissions reduced. It is still operational and as of May 2019, the project had generated 1,828,981 kWh of electricity.

University of Alberta. (2019). Community Energy in Western Canada: Insights from Case Studies on Small-Scale Renewable Energy Development. Edmonton, Alberta: University of Alberta.

HOW CAN MY COMMUNITY IMPLEMENT A RENEWABLE ENERGY PROJECT?

The chart below outlines the framework of steps that are needed to complete a renewable energy project. For further information, click here to check out the International Renewable Energy Agency's (IRENA) Project Navigator.

SITE SELECTION	■ Conduct a preliminary site assessment and initial research. ■ Select several different possible locations for the project. ■ Collect necessary data and assess site specific conditions. ■ What is the current energy source on site? How will renewable energy benefit us?
PRE-DEVELOPMENT	■ Pre-development will further study land rights, grid connection, and site characteristics. ■ Preliminary design, estimated production, grid connection study ■ Financial: Installation, operating, and financing costs, incentives, revenue model ■ Regulatory: land rights, interconnection, environmental, bylaws and land use
DEVELOPMENT	■ Site acquisition: legal documents, insurance, liability ■ Detailed technical design and studies: environmental, geotechnical, resource ■ Detailed financials, permits, and business plan
ENGINEERING, PROCUREMENT & CONSTRUCTION	■ Engineering: Final design, site layout, drawings, documentation ■ Procurement: Managing bidding and suppliers for material and equipment ■ Construction: Prepare and build all civil work and energy system ■ Commissioning and handover: Complete install, all requirements are met
OPERATION & MAINTENANCE	■ Will ensure that equipment functioning the way they should ■ Will assess for repairs if needed ■ Maintenance: Preventative, corrective, scheduled, predictive
DECOMMISSIONING	■ How to dispose of the material? ■ Can they be reused? ■ How to return the site to its original conditions?

For questions, feedback, or more information, please reach out to the ECO Canada Training Team.

eco.ca/training

training@eco.ca

403-233-0748