A Clean Bill

Making the switch to clean energy cuts carbon and cost from household energy bills

September 2023

CLEAN ENERGY CANADA

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Saving the planet **and your pocketbook**

Inflation. Extreme weather. The cost of living and climate change are top of mind for Canadians as they grapple with rising prices amid a summer defined by wildfire smoke and heat waves.[1,2]

Fortunately, there is a common solution: clean energy. From electric vehicles to heat pumps, clean technologies have the power to fight climate change all while protecting your pocketbook.

In fact, a family living in a detached house in a Toronto suburb that adopts a few common clean energy solutions could knock $800 off their monthly energy bills, compared to one that remains largely reliant on fossil fuels, according to our calculations. That's even taking into account the costs of buying and installing the technology. Over a year, that adds up to almost $10,000 that can be saved, invested, or spent on literally anything else. **A condo owner who was able to make similar changes could pocket $5,500 a year.** And these savings don't include the value added to their properties in a market that is increasingly demanding fossil-fuel-free living or the health benefits of breathing cleaner air.[3,4]

By far, the single biggest money saver is an electric vehicle. Choosing a Chevrolet Bolt instead of a Toyota Corolla Hatchback would save $33,600 over a 10-year ownership period (that's including the upfront purchase cost and current rebates). Electric cars not only enable their owners to completely skip the gas pump, they are also a lot cheaper to maintain—you'll never need to do an oil change again. In fact, with current rebates, several EVs are already cheaper to buy than an equivalent gas car, meaning that owners start pocketing savings the moment they drive them off the lot.

Even in cases where the electric option costs more to buy, the EV will still work out cheaper overall. **Most of the EVs we compared broke even with their gas equivalents in under a year.**

When it comes to heating and cooling, the fossil-fuel-free options also pack the best cost savings. Specifically, air source heat pumps—which can cool as well as heat—are the cheapest option for many Canadian households, even when the costs of installation are included. Indeed, installing a heat pump instead of a new natural gas furnace and central air conditioning can cut around $55 (including upfront costs) off the monthly bill of a detached family home in Ontario, according to data in a new study.[5]

Meanwhile, a household that invested in energy efficiency upgrades, like new double-pane windows, could knock hundreds of dollars off their annual bills.[6]

Put simply, the energy transition isn't going to cost Canadians—quite the opposite. In fact, a recent study showed that Canadians will spend 12% less on energy overall in 2050 than they do today when they switch to clean electricity to power their homes, vehicles, and businesses.[7]

What's more, switching to clean energy insulates households from the price shocks that come with fossil fuels. The price of clean electricity is generally controlled by local market forces, while oil and gas prices have increased via a series of large price spikes driven largely by global geopolitics.[8]

It's clear that a continued reliance on fossil fuels is costing Canadians. And there are things that governments can do to make it easier for residents to make the shift.

For starters, they can continue to help reduce the often higher upfront costs of the technologies—something that many are already doing. The federal government offers $5,000 off the sticker price of the most popular electric vehicles. And seven provinces and territories, representing 43% of Canada's population, have additional rebates that can be stacked. The federal government also offers grants and zero-interest loans for home upgrades, including energy efficiency improvements or rooftop solar installation through its Canada Greener Homes Initiative.[9,10] And many provinces, municipalities, and utilities, have their own grants or loan programs, including for heat pumps.[11]

The next steps are to improve the accessibility of clean energy policies and programs so that all Canadians can benefit, regardless of their income or housing situation. That could include purchase incentives for used EVs and funding heating or EV-ready retrofits in multi-family buildings.

And finally, **governments should develop and expand on existing policies** that ready Canada's energy infrastructure, from the power grid to new and existing buildings.

> Clean energy is a win-win for climate and cost. It's time to bring the benefits home.

Neighbourly competition

There is a range of decisions that a homeowner can make to cut both carbon and costs from their energy bill. To illustrate the financial implications of various energy-related changes, we calculated the monthly energy bills of two sets of hypothetical neighbours, the first in detached houses and the second in condos. See the methodology for more details and a list of assumptions.

The three houses

These neighbours live in similar-sized detached houses on the same street in a Toronto suburb. Each family of four pays the Ontario average rate for their electricity and, for the gas car owners, pays the average 2022 gasoline price in the city to fill up their cars. Aside from the differences listed below, all also use comparable appliances (the rest of their bill, like power used for lights and other appliances, is based on an Ontario average).[12]

By eliminating fossil fuels from their lives, the clean energy family was able to save a huge $9,685 per year. Notably, the family that drives a gas-powered SUV and pickup truck pays almost three times more to fuel their vehicles than the family with two EVs. Pickup trucks make up a quarter of new cars sold in Canada, and the Ford F-150 has been the country's best-selling car for the last 12 years.[13] The most fossil-fuel-dependent household also pays 40% more than the clean energy family to heat and cool their home. Water heating and cooking with electricity instead of natural gas costs roughly the same and allows the clean energy family to eliminate their monthly gas utility service costs.

Even when the capital costs are included (the cost of buying and installing the technologies), the clean energy family is still pocketing considerable savings each month. And what they do pay is more consistent, unaffected by unpredictable prices at the gas pump.

But that's just the monetary gain. By cutting carbon they also improved indoor air quality—something that is shown to significantly reduce illnesses like asthma.[4]

HOUSE 1

Starting from zero

MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
VEHICLE COST	$1,118	$829	$1,947
HEATING & COOLING	$151	$40	$191
WATER HEATING	$16	$9	$25
COOKING	$2	$9	$11
REMAINING ELECTRICITY BILL	$126		$126
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(81)		$(81)
TOTAL	**$1,412**	**$888**	**$2,300**

$2,300
PER MONTH

$807
MORE
than the clean energy family

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

Most Canadians are better off under the carbon price

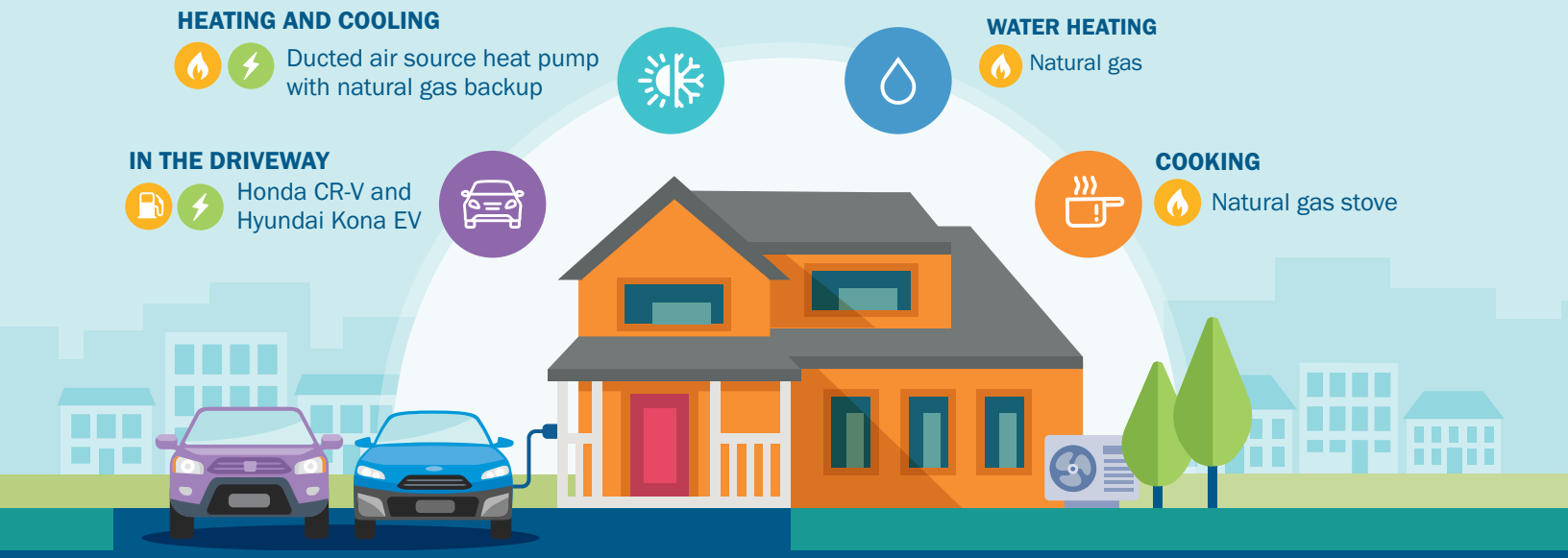
Under the federal government's system, the carbon price costs an average of $578 annually per household, while the average climate action incentive payment is $712 per yer. Put simply, most Canadians are actually better off, receiving more money back than they pay.

In Ontario, a household with two adults and two children received an annual rebate of $745 between July 2022 and July 2023.[30] This amount is higher for provinces in which households pay more on average in carbon pricing (like Alberta and Saskatchewan, where a family typically receives $1,079 and $1,101, respectively).

While most Canadians still get the money back from carbon pricing whether they switch to clean energy or not, those who rely the least on fossil fuels get to pocket every dollar saved. EV drivers, for example, can avoid paying the carbon price at the pump while still receiving their quarterly cheques.

HOUSE 2

Making some changes



MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
VEHICLE COST	$736	$723	$1,458
HEATING & COOLING	$133	$42	$175
WATER HEATING	$16	$9	$25
COOKING	$2	$9	$11
REMAINING ELECTRICITY BILL	$126		$126
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(81)		$(81)
TOTAL	**$1,011**	**$783**	**$1,794**

$1,794 PER MONTH

$301 MORE than the clean energy family

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

What about renters?

A third of Canadians rent their home, and that share is increasing—as is rent.[20] Tenants typically pay the energy bills but do not usually have a say in the installation of more efficient energy technologies, such as heat pumps.

Landlords, meanwhile, would bear the costs of an energy improvement, but they do not always benefit directly from the cost savings (as these usually go to tenants). What's more, incentivizing landlords to perform upgrades on buildings has been shown to sometimes have adverse effects, such as increasing rent costs or enabling "renovictions."[21] This "split incentive" problem hinders widespread adoption of clean energy solutions in rental units, and it needs to be addressed to ensure that all Canadians can benefit from clean energy. A number of jurisdictions globally have used regulations to address the issue, like the Netherlands, which sets minimum energy efficiency standards for residential rental properties.[22]

HOUSE 3

Living the clean energy life

HEATING AND COOLING
Ducted air source heat pump with electric furnace backup

WATER HEATING
Heat pump

IN THE DRIVEWAY
Chevrolet Bolt EV and Hyundai Kona EV

COOKING
Electric stove

MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
VEHICLE COST	$473	$720	$1,193
HEATING & COOLING	$102	$33	$136
WATER HEATING	$15	$12	$27
COOKING	$4	$7	$11
REMAINING ELECTRICITY BILL	$126		$126
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(81)		$(81)
TOTAL	**$720**	**$773**	**$1,493**

$1,493 PER MONTH

SAVINGS OF UP TO $807 compared to neighbours

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

The clean energy family was able to save nearly **$10,000 per year**

The three condos

These neighbours each own a similar 1,000-square-foot condo in twenty-unit buildings in the Toronto area. As with the detached houses, each have the same appliances and, outside the technologies below, spend the Ontario average on electricity.

The condo owners that swapped a small gas car for an EV while introducing a heat pump saved over $2,100 a year.

But by far the biggest winner was the household that was able to shift away from fossil fuels altogether, saving over $5,500 per year compared to the most fossil-fuel reliant one. Notably, the residents of this household also opted to ditch their car completely and instead use public transit, saving money on the upfront cost of buying and running a car altogether.

CONDO 1

Starting from zero

HEATING AND COOLING
Building central natural gas heating with radiator and window A/C

WATER HEATING
Natural gas

TRANSPORT
Toyota Corolla Hatchback

COOKING
Natural gas stove

MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
VEHICLE COST	$463	$290	$753
HEATING & COOLING	$100	$5	$106
WATER HEATING	$10	$9	$20
COOKING	$2	$9	$11
REMAINING ELECTRICITY BILL	$52		$52
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(61)		$(61)
TOTAL	**$628**	**$313**	**$941**

$941 PER MONTH

$459 MORE than the clean energy family

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

CONDO 2

Making some changes

HEATING AND COOLING

Ductless air source heat pump with natural gas furnace and radiator as backup

WATER HEATING

Natural gas

TRANSPORT

Chevrolet Bolt EV

COOKING

Natural gas stove

MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
VEHICLE COST	$237	$333	$570
HEATING & COOLING	$77	$36	$113
WATER HEATING	$10	$9	$20
COOKING	$2	$9	$11
REMAINING ELECTRICITY BILL	$52		$52
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(61)		$(61)
TOTAL	**$379**	**$388**	**$766**

$766 PER MONTH

$284 MORE than the clean energy family

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

The condo opportunity

According to the 2022 census, roughly half of dwellings in Canada were single-detached homes, while 29% of households were condos, townhouses, or duplexes.

In urban centres, like Vancouver and Toronto, the proportion is closer to 40%.[14] In short, not every Canadian has the ability to make clean energy upgrades that can save them money.

Indeed, it is often down to condo boards and property management companies to take steps to install EV charging or upgrade heating systems. Encouragingly, there are a growing number of examples of condo boards successfully implementing clean energy improvements.

One recent example is a 56-resident condo building on Merton Street in Toronto that was able to install resident charging relatively cheaply with the help of grants from the federal government.

In fact, many residents opted to install charge points in their parking spaces even if they didn't yet own an EV.[15]

Continued on following page ❯

CONDO 3

Living the clean energy life

HEATING AND COOLING
Ductless air source heat pump with electric baseboard backup

WATER HEATING
Heat pump

TRANSPORT
Two Toronto Transit Commission passes

COOKING
Electric stove

MONTHLY BILL

	ENERGY COSTS	EQUIPMENT COSTS* (excludes resale value for cars)	TOTAL
TRANSPORT	$286		$286
HEATING & COOLING	$71	$40	$111
WATER HEATING	$10	$12	$22
COOKING	$4	$7	$11
REMAINING ELECTRICITY BILL	$52		$52
CLIMATE ACTION INCENTIVE PAYMENT (carbon price rebate)	$(61)		$(61)
TOTAL	**$423**	**$59**	**$482**

*Monthly equipment costs do not include any interest rates given that financing is optional and highly variable. Upfront purchase costs are spread out over the ownership period of the technology to ensure all costs are captured in the monthly comparison.

$482
PER MONTH

SAVINGS OF UP TO
$459
compared to neighbours

The clean energy family was able to save over **$5,500 per year**

What's more, a number of municipalities are introducing rules that encourage or require clean energy technologies in new and existing condo buildings. Municipalities in Metro Vancouver, for example, have introduced EV-readiness rules for new multi-unit residential buildings (which makes future EV infrastructure installation cheaper) as well as requirements for zero-emission space and water heating.[16–18]

As we navigate the transition, it's key that all households, regardless of size, type, and location, can access the savings that come with ditching fossil fuels.[19]

Affordable housing and **affordable energy**

Energy makes up a big share of household spending. In 2019, Canadians, on average, saw almost 5% of their household spending go to energy.[23]

That's things like electricity, household heating and cooling, hot water, cooking, and fuel for vehicles. This is highest in Atlantic Canada, where energy makes up 7% of household expenditures.

With between 6% and 19% of Canadians experiencing energy poverty in 2017, it's clear that high energy costs are a problem in need of a solution.[24,25]

It's therefore not surprising that affordable housing providers are increasingly opting to build energy-efficient buildings, knowing that this will not only save emissions but also costs.[26]

A number of initiatives are already underway:

- In June 2023, the Canada Mortgage and Housing Corporation launched the **Canada Greener Affordable Housing program** to provide funding for deep energy retrofits of certain housing units.[27] The program is specifically designed for affordable housing, such as community housing, and non-profit affordable housing (as opposed to private rental units). **The corporation will fund 100% of eligible retrofit costs.**
- Similar programs exist at the provincial level. B.C.'s Social Housing Incentives program (which is part of the province's climate plan, CleanBC) **offers up to $200,000 for retrofits** for non-profit housing societies.[28]
- **Efficiency Nova Scotia provides rebates of up to 80% of the cost of upgrading qualifying multi-unit residential rental properties**, on specific conditions that rental rates stay within certain thresholds and are not raised in the first year.[28,29]

Save as you drive

Every day that goes by, more Canadians are getting behind the wheel of an electric vehicle. EVs now make up more than 10% of new car sales in Canada, representing a doubling in popularity in just the last year.[31] In B.C. and Quebec, the two provinces with strong EV policies, it's 21% and 18%, respectively. Ontario, meanwhile (which has no provincial policies in place to encourage adoption), is at 7%, just behind the Yukon.[32,33]

EVs pack all kinds of advantages, from an exciting driving experience to better air quality. But perhaps most crucially in a world of rising costs, they save money.

When Clean Energy Canada analyzed a number of the most popular EV models for this report, comparing their total ownership costs (including the upfront purchase and rebates) with that of gas equivalents, every car analyzed was less expensive than the gas version.

Specifically, we analyzed the cost comparisons in all provinces and territories, finding that EVs were cheaper over a 10-year ownership period (assuming 20,000 kilometres driven per year) everywhere in Canada—even in places without a provincial rebate.

Looking at the Canada-wide average under current rebates, a driver who opts to buy a Chevrolet Bolt rather than a Toyota Corolla Hatchback would save a total of $33,600 over a 10-year ownership period. That's an average of over $3,300 a year that an EV driver can avoid spending at the gas pump or the repair shop. Similarly, buying a Tesla Model 3 instead of a Lexus ES saves an average of $4,300 per year over a 10-year period.

What's more, the upfront cost of an EV is nearing price parity with a gas car, even without any EV rebates. Once the upfront cost is the same, EVs start putting money back in your pocket the very moment you drive them off the lot because their costs for fuel and maintenance are so much lower.

Total ownership cost: includes the upfront price of the car, any applicable rebates, and the cost of operation and maintenance, minus its resale value after 10 years.

Sedans and Hatchbacks

ELECTRIC

2023 Chevrolet Bolt EV

Retail price: **$38,943**
Rebate-adjusted price: **$30,479**
Battery range: 417 kilometres

Total ownership cost: $48,943

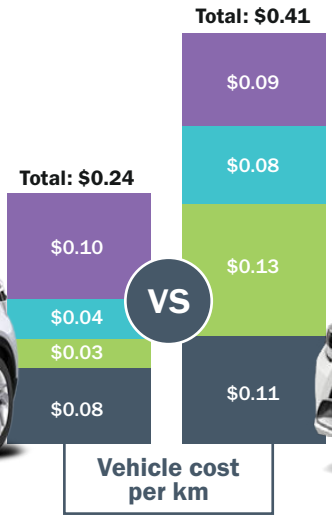
Break even point
8 months

GAS

2023 Toyota Corolla Hatchback XSE

Retail price: **$29,890**

Total ownership cost: $82,515



2022 Nissan Leaf S Plus*

Retail price: **$40,098**
Rebate-adjusted price: **$31,634**
Battery range: 363 kilometres

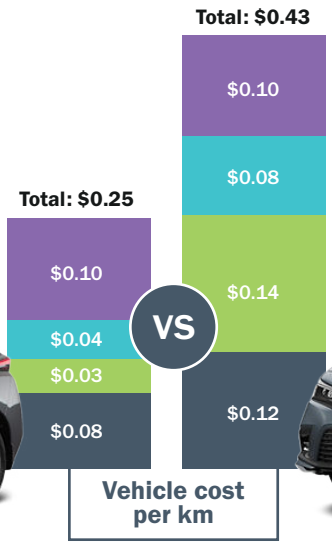
Total ownership cost: $50,145

Break even point
already cheaper

2023 Honda Civic Hatchback Sport Touring

Retail price: **$37,130**

Total ownership cost: $86,279



* Most recent model year available at NRCan's fuel consumption database.

Cost of car (depreciation) | Fuel | Maintenance and repairs | Taxes, insurance, and other costs

All break even points include rebates (a Canada average) and exclude depreciation.

Rebates are based on model eligibility and include both the federal rebate and a provincial average rebate (based on availability and amount of rebates, and weighted by EV sales in each province and territory). Actual rebate amounts could be higher or lower, depending on the province or territory and eligibility. This represents a Canadian average. As applicable sales taxes are added to MSRP before any rebates are deducted, the rebate-adjusted price represents an approximation.

"Cost of car" calculates depreciation from the full MSRP (not the rebate-adjusted price). While depreciation rates are applied equally across powertrains, because EVs are discounted via rebates, EV drivers essentially acquire a more valuable asset for less money and benefit from this when reselling the vehicle.

SUVs and Crossovers

ELECTRIC

2023 Hyundai Kona Electric Preferred

Retail price: **$44,599**
Rebate-adjusted price: **$36,135**
Battery range: 415 kilometres

Total ownership cost: $50,632

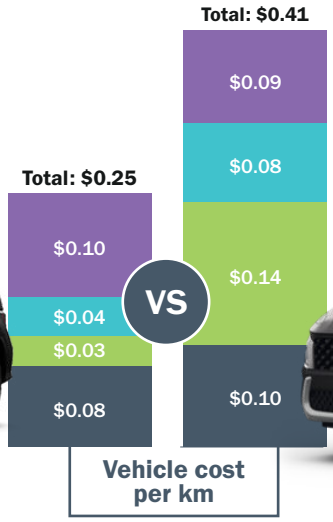
Break even point
4 years 10 months

GAS

2023 Hyundai Kona Preferred

Retail price: **$24,999**

Total ownership cost: $82,951



2023 Volkswagen ID.4 Pro

Retail price: **$50,495**
Rebate-adjusted price: **$42,031**
Battery range: 443 kilometres

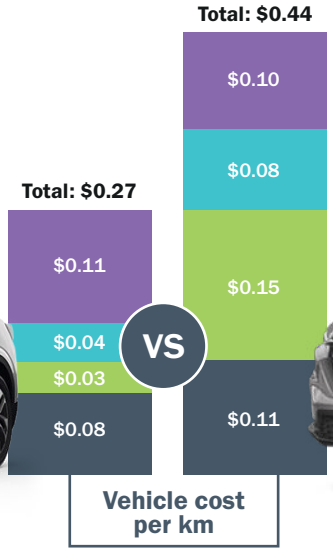
Total ownership cost: $53,121

Break even point
3 years 1 month

2023 Honda CR-V LX 2WD

Retail price: **$34,790**

Total ownership cost: $88,671



Cost of car (depreciation) | Fuel | Maintenance and repairs | Taxes, insurance, and other costs

All break even points include rebates (a Canada average) and exclude depreciation.

Rebates are based on model eligibility and include both the federal rebate and a provincial average rebate (based on availability and amount of rebates, and weighted by EV sales in each province and territory). Actual rebate amounts could be higher or lower, depending on the province or territory and eligibility. This represents a Canadian average. As applicable sales taxes are added to MSRP before any rebates are deducted, the rebate-adjusted price represents an approximation.

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Premium Vehicles

ELECTRIC

2023 Tesla Model 3 RWD

Retail price: **$54,990**
Rebate-adjusted price: **$46,526**
Battery range: 438 kilometres

Total ownership cost: $52,670

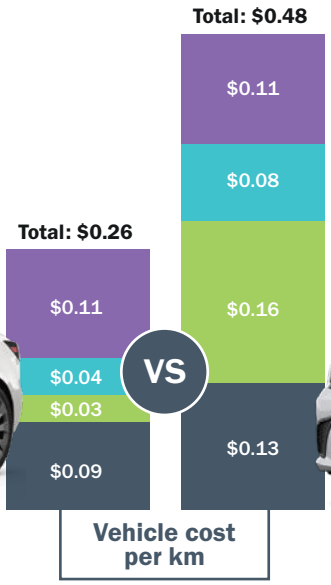
Break even point
already cheaper

GAS

2024 Lexus ES 250 AWD

Retail price: **$51,425**

Total ownership cost: $95,977



2023 Ford F-150 Lightning XLT Standard Range

Retail price: **$69,000**
Rebate-adjusted price: **$62,955***
Battery range: 386 kilometres

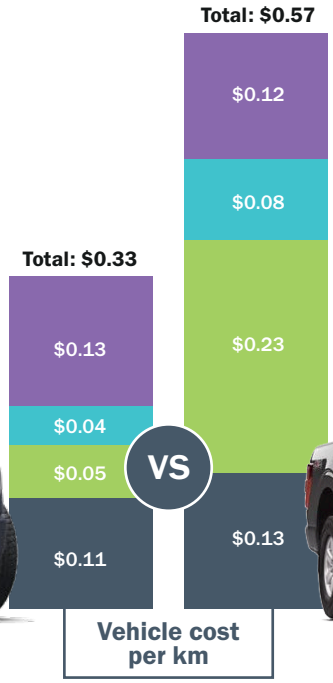
Total ownership cost: $65,694

Break even point
7 months

2023 Ford F-150 XLT SuperCrew 4x4 Mid

Retail price: **$61,305**

Total ownership cost: $113,103



* Ineligible for Quebec rebate but eligible for the federal rebate.

Cost of car (depreciation) | Fuel | Maintenance and repairs | Taxes, insurance, and other costs

All break even points include rebates (a Canada average) and exclude depreciation.

Rebates are based on model eligibility and include both the federal rebate and a provincial average rebate (based on availability and amount of rebates, and weighted by EV sales in each province and territory). Actual rebate amounts could be higher or lower, depending on the province or territory and eligibility. This represents a Canadian average. As applicable sales taxes are added to MSRP before any rebates are deducted, the rebate-adjusted price represents an approximation.

"Cost of car" calculates depreciation from the full MSRP (not the rebate-adjusted price). While depreciation rates are applied equally across powertrains, because EVs are discounted via rebates, EV drivers essentially acquire a more valuable asset for less money and benefit from this when reselling the vehicle.

The cross-Canada comparison

The map below offers an overview of federal and provincial rebates available for EVs in Canada. EVs are cheaper to own in every province, usually significantly so.

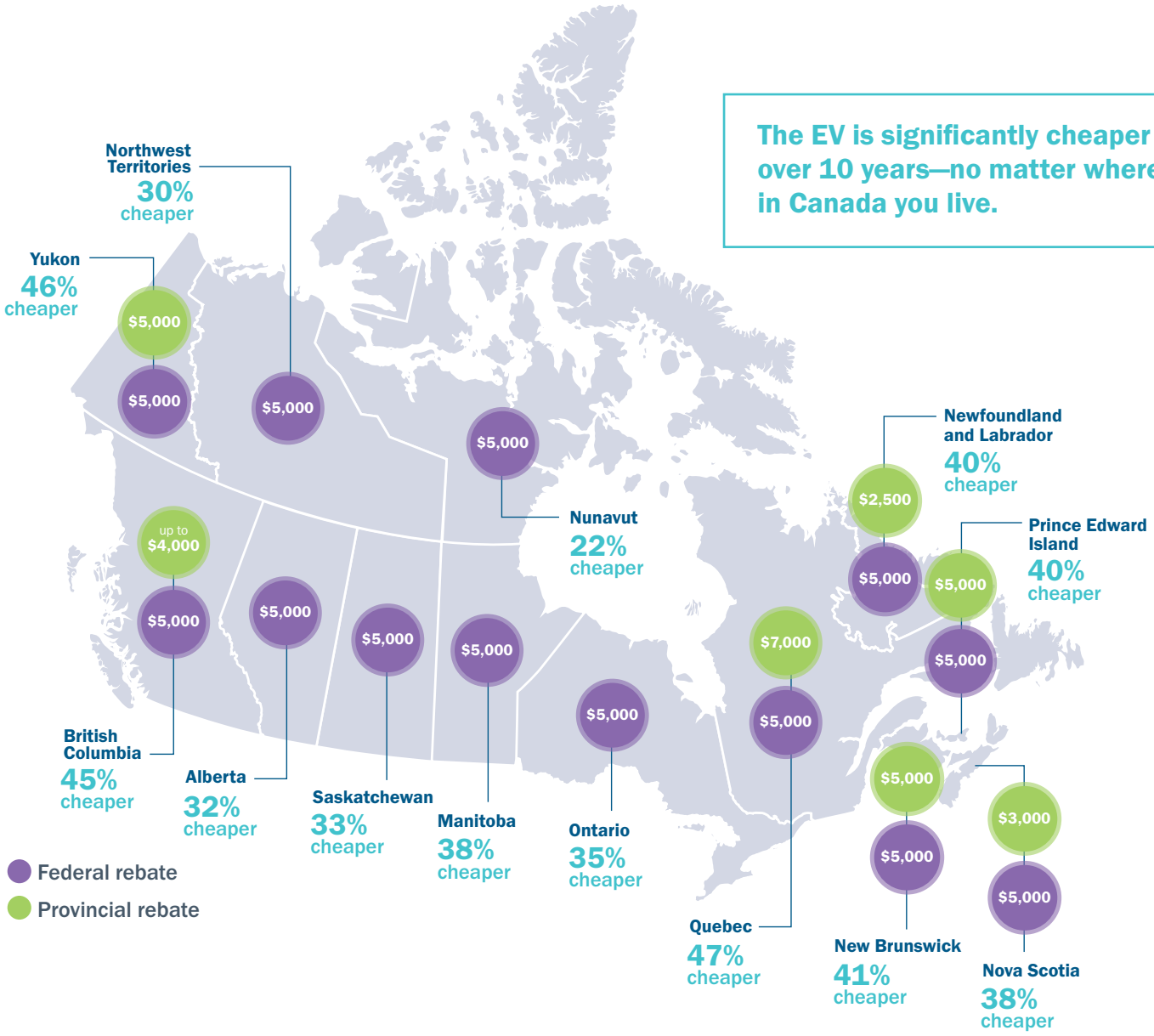
VS

Vehicle comparison

ELECTRIC
2023 Chevrolet Bolt EV

GAS
2023 Toyota Corolla Hatchback XSE

The EV is significantly cheaper over 10 years—no matter where in Canada you live.



EV myth **busting**

1 "EVs have greater lifecycle emissions than gas cars"

Globally, electric vehicles have been shown repeatedly to have lower lifecycle emissions than traditional gas-powered vehicles even in regions with fossil-fuel-dependent electricity grids. Specifically, studies have shown that EVs emit up to 89% less carbon pollution than gas cars—that includes pollution from mining, manufacturing, and driving.[34,35] What's more, EVs are especially clean when battery recycling is included (up to 95% of material from an EV battery can be recycled).[36]

2 "EV batteries need replacing before the vehicle's end of life"

All EVs sold today include a battery warranty of at least eight years and 160,000 kilometres.[37] **A recent study indicated that, out of 15,000 cars studied, only 1.5% have required a battery replacement, and most have occurred under warranty**.[38] Tesla has claimed that the range on its Model S and X vehicles decreased by just 12% after 321,000 kilometers of driving (these models are older and therefore offer insights based on real-world data).[39,40]

3 "EVs do not have enough range"

The average range of new EVs sold in the U.S. last year was 468 kilometres.[41] Most Canadians drive less than 60 kilometres per day, while the average EV driver does between 80% to 90% of charging at home, usually just plugging in overnight for convenience.[42,43] As Canada's fast-charging network grows, range and charging will become less of a concern for longer trips. By the end of 2023, there will be fast chargers at all ONroute rest stops in Ontario, while PetroCanada has already installed chargers at least every 250 kilometers across the TransCanada highway from Halifax to Victoria.[44] The Government of Canada has committed to deploy 84,500 chargers by 2029.[45]

4 "The electricity grid can't handle EVs"

While the switch to EVs will require provinces to plan for EV growth, other countries around the world (EVs account for some 80% of new cars sold in Norway) have not experienced grid-related issues as a result of high EV adoption.[46] A Canadian government study on the anticipated electricity demand from EVs found that they would represent 3%, 16%, and 22% of the electrical power demand in 2030, 2040, and 2050, respectively. As the study states, "This number is significant, but since the growth is spread over 30 years, with most happening during the 2030 to 2050 timeframe, Canadian utilities have 10 years to refine the load forecast and plan for grid expansion."[47]

A powerful **solution**

Electricity underpins the energy transition. The ability to power our lives with clean electricity instead of fossil fuels is the mainstay of our future energy system. **While Canada's power grid is already 84% non-emitting, electricity demand is estimated to double between now and 2050, and generation capacity could need to triple.**[51,52]

Planning and investment are essential to meeting this demand. It's one of the reasons the federal government recently released its draft Clean Electricity Regulations, which will be key in helping Canada create a net-zero electricity system by 2035.[53] More than just a climate policy, the new regulations will ensure energy remains affordable and accessible to all Canadians throughout the energy transition.

A recent Clean Energy Canada report, *A Renewables Powerhouse,* found that, in Alberta and Ontario (the two provinces studied), wind can now produce electricity at lower costs than natural-gas-fired power—with even more cost reductions on the horizon.[54]

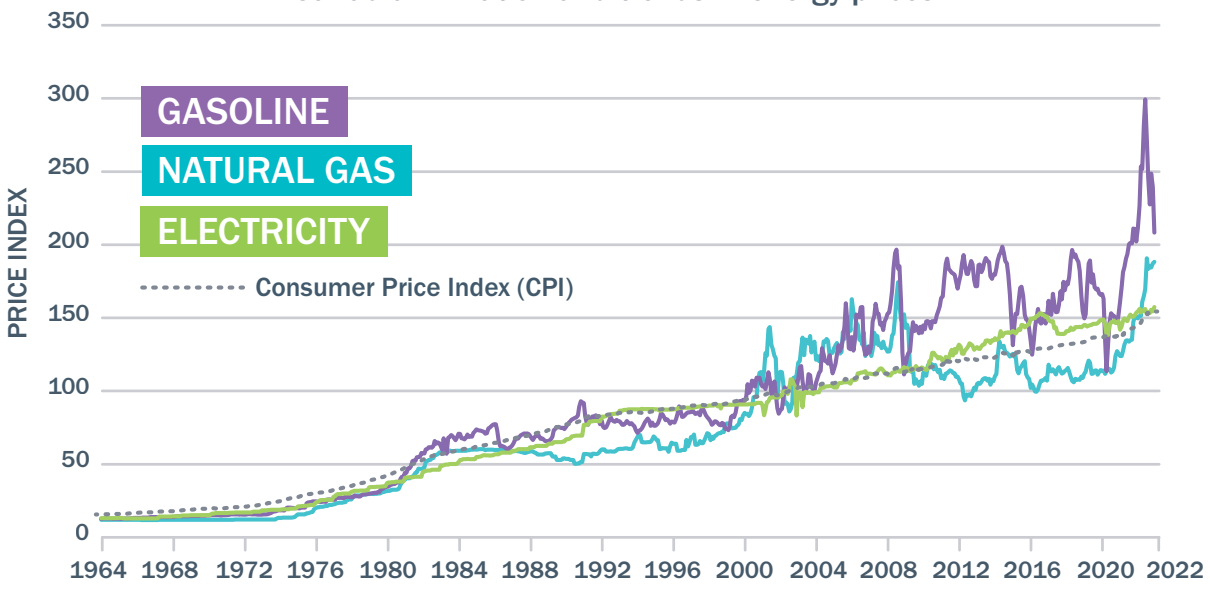
Solar power is already cheaper than natural gas power in Alberta and is on track to be 16% less expensive by the end of the decade. And even when the costs of battery storage are included, both wind and solar are cost-competitive in many scenarios. In fact, the provinces with the lowest proportion of fossil fuels in the electricity mix (like Quebec, B.C., and Manitoba) already spend the least on electricity.[55]

A recent study also showed that Canadians will spend 12% less on energy overall in 2050 than they do today when they switch to clean electricity to power their homes, vehicles, and businesses.[7]

Ditching fossil fuels also means ditching the accompanying price shocks. The price of clean power is largely controlled by local market forces and is therefore subject to fewer fluctuations than power produced from fossil fuels (which is exposed to the geopolitics surrounding global oil and gas prices). Over the last few decades, electricity prices have hovered around inflation, while oil and gas prices have seen huge volatility.[8,56]

Electrification is our opportunity to build a better energy system, but it will require planning and investment, from coast to coast to coast.

Canadian inflation and trends in energy prices



Charging **on the cheap**

With demand for power going up, utilities are employing smart solutions to help even out the daily electricity load. It's a money-saving opportunity for the smart consumer.

In Ontario, instead of paying a flat rate for electricity, users can choose between two kinds of pricing: time-of-use or tiered pricing. With time-of-use pricing, customers pay less at times when fewer people are using electricity (like at night) and more at peak electricity use times (like when most people come home from work).[48] With tiered pricing, you pay less for your use up until a certain threshold (600 kWh in summer and 1,000 kWh in winter).[49]

More recently, the Ontario government launched a new time-of-use option, called the **"Ultra-low Overnight" price plan**. All utilities in Ontario will be required to offer this option later this year, which includes **an overnight rate of just 2.4 cents per kWh**.[48,50] To balance it out, this pricing plan increases on-peak pricing (from 15.1 cents to 24 cents).

The ultra-low overnight rate is a particularly cost-effective choice for households with an EV, as the car can easily be charged when it is least likely to be driven. The owner of a Hyundai Kona EV that switches from the standard time-of-use plan to the ultra-low overnight plan could save over $150 a year on their charging.

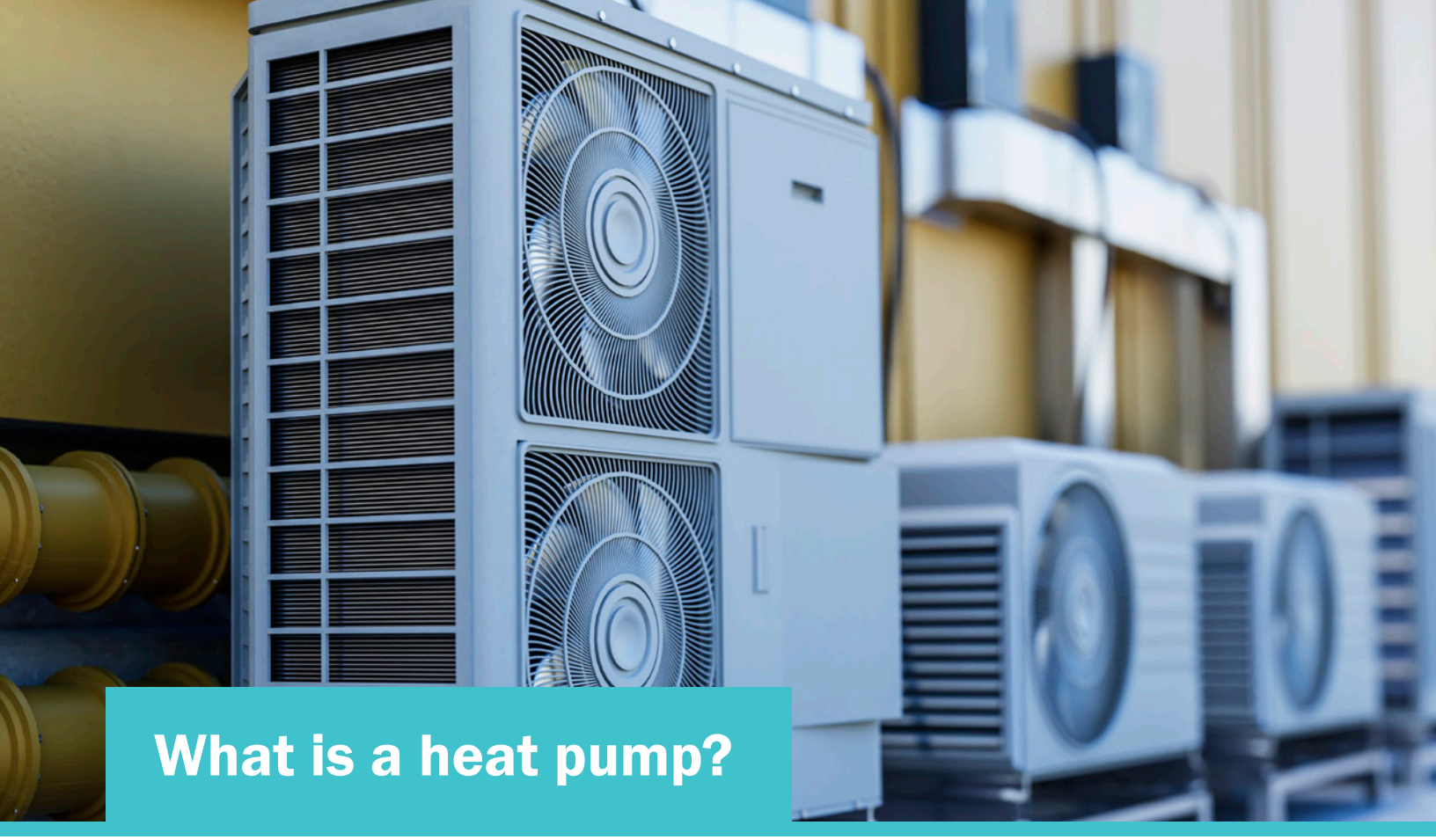
Heating and cooling

Heat has defined the summer of 2023. And as climate change drives our weather to new extremes, it similarly drives utility bills. The season's record-breaking wildfires and heatwaves have seen Canadians reaching for power-hungry air conditioning units and air purifiers to maintain a liveable home environment.

As we navigate the changes demanded by our new reality, heat pumps are emerging as a go-to, multi-solution technology that helps both your home's climate and the planet's.

Despite their name, heat pumps can cool as well as heat, offering year-round utility and an alternative to running separate heating and air conditioning systems—something that the vast majority of residents in Ontario, at least, are currently doing. In fact, 84% of households in Canada's most populous province used an air conditioner in 2021 (and 69% did so with a central air conditioning system).[57] And as typically more temperate climates, like Canada's West Coast, are subject to more heatwaves, heat pumps offer another option for households that are considering installing cooling systems for the first time.

Additionally, while many British Columbians have become accustomed to bouts of lingering summer wildfire smoke, the worsening fire season across the country has brought air quality concerns to the forefront of many in the East as well. **Luckily, most heat pumps also contain air filtration systems, providing relief from smoke as well as sweltering heat**. And unlike residents using multiple heating and cooling systems with portable air purifiers, heat pump owners need only manage one filter for the whole home.[58]



What is a heat pump?

Heat pumps use technology similar to that in a refrigerator or air conditioner. They function by transferring and compressing heat, which can be used in the form of hot air for forced air heating or to heat up water (either for hot water use or for central heating systems that use hot water).[59]

There are two kinds of heat pumps: air source and ground source. The former are the most common and take heat from the ambient air. **Even when the air outside feels cold, there is still heat energy present that a heat pump can leverage**.[59] Ground source heat pumps take heat from underground, where geothermal energy provides a never-ending source.

Because heat pumps make use of existing heat (whereas natural gas furnaces create heat by burning fuel), they can deliver 2 to 5.4 kWh of energy for every 1 kWh of electricity they use, meaning **they are two to five times more efficient than a natural gas furnace**.[60]

While this report focuses on heat pumps in residential buildings, they can also be used in commercial and industrial applications.

What are the savings?

While there is some variation by housing type, **installing a heat pump is already the most cost-effective option for most Canadian households over the lifetime of the system**, according to a new study by the Canadian Climate Institute.[5] Specifically, standard air source heat pumps with a backup are generally more cost-effective than gas-fired heating with air conditioning.

In fact, even when the costs of financing are included, owners of both detatched homes and townhouses save money every month with a heat pump, according to the Canadian Climate Institute Study.

What's more, by moving away from gas altogether (like the clean energy family profiled in this report was able to do), you can save $328 on average a year by eliminating a home's natural gas hook up. Indeed, our Ontario clean energy household was able to save $55 a month by opting to upgrade their heating and cooling system to a heat pump with an electric backup heating option (as opposed to a new gas furnace and central air conditioning). That's factoring in purchasing, installation, and government incentives.

Additionally, heat pumps make particular sense for homes that use heating oil instead of natural gas, both practically (because these homes are often off the natural gas grid but on the power grid) and financially (oil heating is expensive to run). In fact, a household in St. John's, Newfoundland, that switched from oil to a cold climate air source heat pump could knock $160 a month off their bill.[61]

What about the Canadian winter?

Since air source heat pumps work through compressing heat from the outside air, they are less efficient in cold weather. However, this does not prevent air source heat pumps from lowering emissions and costs even in cold climates. In fact, heat pumps are most popular in some of the coldest countries: Finland, Norway, and Sweden.[62]

Currently, most heat pumps in cold climates are combined with a backup system (electric or natural gas) that is activated on the chilliest of days or are specially designed to work at cold temperatures.

Indeed, there are a range of new models of "cold climate" air source heat pumps that can withstand winters like those seen in parts of Canada. Studies in Finland found several heat pump models that maintained heating efficiency at outside temperatures as low as -30°C.[63] In a government-led trial in the Yukon, heat pumps were successfully used at temperatures down to -29°C.[64] Other studies in the U.S. found many heat pumps had efficiencies over 100% at temperatures as low as -17°C.[65,66] To put this in context, Toronto only saw temperatures below -20°C on 16 days between 2018 and 2023.[67]

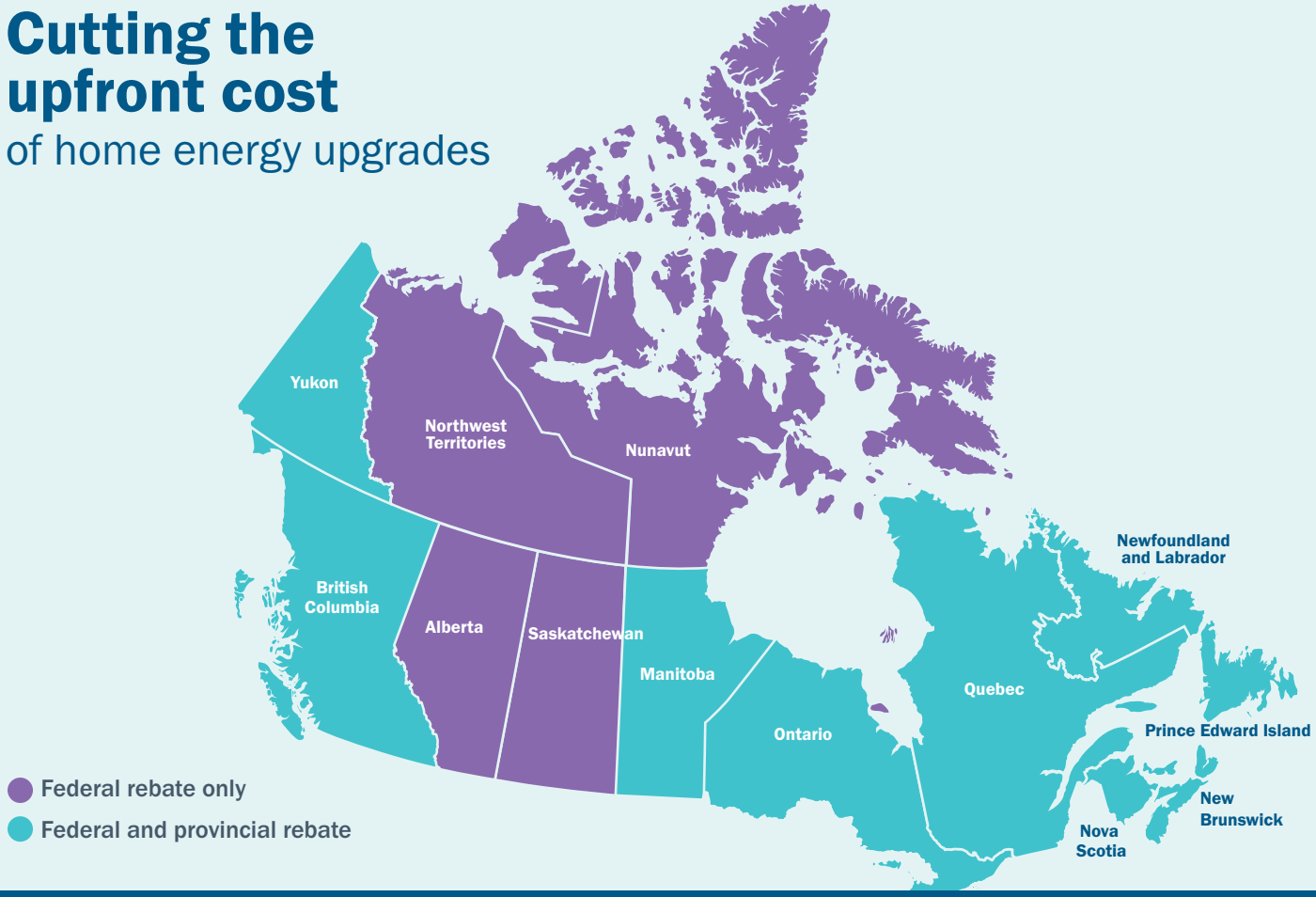
For places that do require specific cold climate heat pumps, higher capital costs make them a pricier option for some households. But with the technology improving, it is likely that they will become more cost competitive.

Ground source heat pumps, which use heat from the ground rather than outside air, could also be a good option in some places in Canada, offering very high heating efficiencies in the coldest winter months—even when the mercury drops below -30°C.[60] However, these can be more expensive than their air source counterparts.[68]

Heat pumps are most popular in some of the coldest countries: Finland, Norway, and Sweden.[62]

Cutting the upfront cost

of home energy upgrades



Federal: Up to **$10,000** to switch from oil heating to a cold climate air source heat pump for low-income households.[79] Up to **$5,000** off clean energy home upgrades and supplementary interest-free loans of up to **$40,000**.[80,10]

Municipal grants are also available in many cities.[78] Rebates listed below are all aimed at homeowners who live in their homes year-round.

British Columbia

Up to $6,000 in rebates for an air source heat pump.[85]

Enhanced rebates of up to $9,500 for income-qualifying households.[86]

Alberta

Federal rebates only.

Saskatchewan

Federal rebates only.

Manitoba

Up to $1.65 per square foot of heated area for air source and $2.50 per square foot for ground source heat pumps.[87]

7.5%, 10%, or 15% off capital cost of geothermal or solar heating systems (technology dependent).[88]

Yukon

40% of heat pump rebate project costs, up to a maximum of $8,000.[93]

Northwest Territories

Federal rebates only.

Nunavut

Federal rebates only.

Ontario

Customers of Enbridge Gas are eligible for a rebate top-up of up to $1,500.[81]

Quebec

Up to $6,720 for the installation of a high-performance heat pump.[91]

Rénoclimat program: $5,365 for installation of a geothermal system and $50 per thousand BTUs in heating output at -8°C.[92]

Newfoundland and Labrador

Up to $9,000 to switch from oil heating to a central heat pump and up to $17,000 for income-qualified households (not stackable with federal grant).[90]

Prince Edward Island

Free Heat Pump program for low-income homeowners.[84]

Up to $2,500 for air source heat pumps and up to $4,000 for ground source heat pumps ($4,500 and $7,500, respectively, for low-income households).

New Brunswick

Up to $1,500 rebate for an air source and up to $2,000 for a ground source heat pump.[89]

Nova Scotia

Free heat pumps for low-income homeowners.[82]

Up to $1,600 rebate for heat pumps in other households.[83]

Efficiency gains

Perhaps the most obvious way to cut energy bills is to simply use less energy. And by making your home more energy efficient, you can do that while maintaining the quality of life inside it.

In fact, a Canadian study found that if the government introduced best-in-class energy efficiency policies, the average family would save more than $150 annually.[6] Across the Canadian economy more broadly, the measures would add up to $1.8 billion in net residential savings and $4.9 billion in net commercial and industrial savings.

At a household level, the savings vary depending on the home type and the kinds of retrofits needed. A detached single family home in Toronto, for example, could save $193 annually by adding better insulation and an additional $97 a year by making air tightness improvements. Although these retrofits come at a cost, they typically pay off within their lifetime.[69]

What's more, energy-efficient technologies can also pack some savings. Adding a smart thermostat, which optimizes a home's heating and cooling, could save a household between 5% and 12% on energy bills.[70,71] And switching to LED light bulbs, which are 90% more efficient and last 15 times longer than incandescent ones, could further reduce energy use. In fact, some jurisdictions around the world, including Canada, have already begun phasing out incandescent light bulbs.[72,73]

In short, the less energy wasted, the more dollars saved.

Powered **by sunshine**

As more of your life gets plugged into the grid, it naturally follows that your electricity bills will increase (as you'll simply be using more electricity). In fact, electrification could more than double a typical household's electricity consumption. And while your overall spending on energy will go down with a reduced reliance on fossil fuels, it may nevertheless present a strong value proposition for creating your own electricity.

Rooftop solar panels, once installed, can provide ongoing, low-cost power to your home during daylight hours. They can charge your car up, keep the lights on during a power outage, and increase the resale value of your home. In some cases, studies have shown that rooftop solar could completely eliminate a home's power bill and even allow the owner to sell power back to the grid.[74]

Installing rooftop solar can have high upfront costs, with the payback time varying. Importantly, any payback timeline can be shortened with the addition of the federal government's Greener Homes Grant, which offers $5,000 toward solar installation and a $40,000 interest-free loan. Some Canadian municipalities are also willing to pitch in. For instance, Toronto residents can apply for a loan of up to $125,000 under the Home Energy Loan Program.

One thing is certain: the cost of solar installations is coming down all the time. The cost of residential solar, including both installation and operation, decreased from over US$0.50 per kWh in 2010 to US$0.11 per kWh in 2022.[75] And new technologies like Tesla's powerwall make it even easier for residents to integrate solar into their homes.[76,77]

Recommendations

The shift to clean energy isn't just a way to fight climate change——it will also make life cheaper and healthier for Canadians. While governments are already taking important steps to encourage households to lower their carbon footprint, a number of additional moves could make clean energy solutions even more accessible and affordable for all Canadians.

Improve affordability

In addition to extending the life of existing programs that help bring down the upfront cost of clean energy technologies, there is more that Canadian governments can do:

- Initiate consumer-facing purchase incentives for new and used EVs, heat pumps, solar panels, and other home energy efficiency upgrades in provinces or territories that do not yet have them.
- Offer more generous heat pump purchase incentives for low-income households, modelled off of existing PEI and Nova Scotia programs, as well as for those who need cold-climate heat pumps.
- Establish energy efficiency standards for rental units to lower energy costs for renters.[22]
- Prohibit the use of natural gas for space and water heating in new construction by 2030, joining jurisdictions like the U.K., Norway, New York State, and a number of Canadian and U.S. cities.

Enhance accessibility

Governments must also take the following steps to ensure all Canadians can benefit from the cost savings clean energy technologies provide, regardless of income or housing situation:

- Fund EV-ready retrofits in multi-family buildings.
- Advance right-to-charge legislation for condo owners who are willing to pay to install a charger.
- Support community EV charging hubs.
- Prioritize energy efficiency retrofits for low-income homeowners and tenants.
- Create targeted programs for Northern communities.
- Make accessing incentive, loan, and rebate programs easier.
- Finalize the federal government's forthcoming zero-emission vehicle sales regulation to make it easier to find an EV to purchase.

Empower customers

One of the key roles that provincial and municipal governments will play is removing barriers and supporting homeowners who want more control over their electricity use and production:

- Approve time-of-use pricing (like Ontario has) to incentivize the adoption of clean technologies like EVs, giving consumers more control over the price they pay for electricity depending on when they use it.
- Remove regulatory barriers to rooftop solar for households that want to generate their own electricity.
- Encourage smart grid technologies, such as home energy management and vehicle-to-grid systems, to help lower energy bills.

Methodology

The total cost of ownership for the vehicles shown in this report was calculated using the Fleet Procurement Analysis Tool by Atlas Public Policy.[94] The vehicles were selected based on their popularity on the Canadian market. The vehicle performance data was taken from Natural Resources Canada.[95] The analysis is based on the following data and assumptions:

- Average retail prices for regular gasoline in 2022 as provided by Natural Resources Canada (Canadian average: $1.73/L).[96]
- Average prices for residential electricity in 2022 from Hydro-Québec with Canadian average (14.4¢/kWh) calculated as population-based weighted average.[97]
- Annual vehicle mileage of 20,000 kilometres as per information from Natural Resources Canada.[98]
- Combined fuel/electricity consumption ratings that reflect 55% city and 45% highway driving.
- Expected vehicle ownership of 10 years.
- Canadian average EV purchase incentives based on EV sales-weighted provincial rebates plus federal incentive.
- A carbon price of $65 per tonne in 2023 that rises in line with the schedule announced in the federal government's climate plan of December 2020.[99]
- 88% home charging of EVs based on the midpoint of a range provided in a report from the U.S. National Renewable Energy Laboratory.[99,100]
- Public charging price ($0.352/kWh) based on a review of per-minute rates in B.C., Ontario, and Quebec to charge a 75 kWh battery (the sales-weighted average battery size in the U.S. in 2021) at an average charging speed of 70 kW (the average rated fast charging speed in Quebec and Ontario) and assumed losses in charging and grid delivery of 36%.[101–103]

Note that the affordability of EVs increases even further with additional rebates, higher gasoline prices, lower electricity rates, longer vehicle ownership, and higher annual mileage.

Changes from our previous analysis *(The True Cost)*:

- Updated prices for gasoline, electricity, and the carbon price.
- Vehicles updated to the most recent model years available from Natural Resources Canada and adjusted trims to ensure best comparability between EV and gas vehicles.[95]
- Vehicle rebates updated to reflect current incentives.
- Expected vehicle ownership increased from 8 to 10 years.
- Equal depreciation rates assumed across powertrains to align with real world observations of resale value to account for a lack of data on EV depreciation as the technology rapidly evolves.
- Vehicle purchase prices now include federal and provincial sales tax.
- Estimated inflation rate updated, based on the 2023-2033 average of the Consumer Price Index from the Canada Energy Regulator.

The household comparison is based on the following data and assumptions:

- Baseline electricity bill based on Statistics Canada's 2019 Survey on Household Spending and calculated average for Ontario households living in single-detached homes and condos.[12]
- Vehicle cost based on Ontario-specific results from the total cost of ownership analysis as indicated above. In order to better reflect cash flow for households, monthly bills do not account for vehicles' resale values.
- Heating and cooling cost kindly provided by the Canadian Climate Institute, as modelled by Dunsky Energy + Climate Advisors, for a post-1980 single detached home (1,770 sq ft) and post-1980 condo building with 20 units of 1,040 sq ft each in Toronto.[5] For additional data and housing types, see the institute's separate report. Financing costs were not included, in order to be consistent with the other categories of the household comparison. For the clean energy family in the household bill comparison, natural gas service costs were deducted, as this household is fully electrified and would not require a natural gas connection.
- Natural gas prices for cooking and water heating based on effective 2022 rates for the Enbridge Gas Distribution rate zone as provided by the Ontario Energy Board, with carbon price and sales tax added.[104]
- Electricity prices for cooking and water heating based on the average of mid-peak and on-peak time-of-use rates between November 2021 and November 2022 as provided by the Ontario Energy Board, excluding the January 2022 temporary three-week price freeze.[105]
- Energy use data for different types of cooking stoves based on analysis by Frontier Energy.[106] Water heating energy use based on 225L of warm water per day for the single-detached homes and 150L for the condos. Assumed standing losses of 15% across all systems and efficiency of 90% for the natural gas water heater and 375% for the heat pump water heater. Equipment cost of cooking stoves and water heating equipment based on a review of models using different technologies available at a large retailer operating in Canada.
- Energy and equipment costs include federal and provincial sales tax.
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