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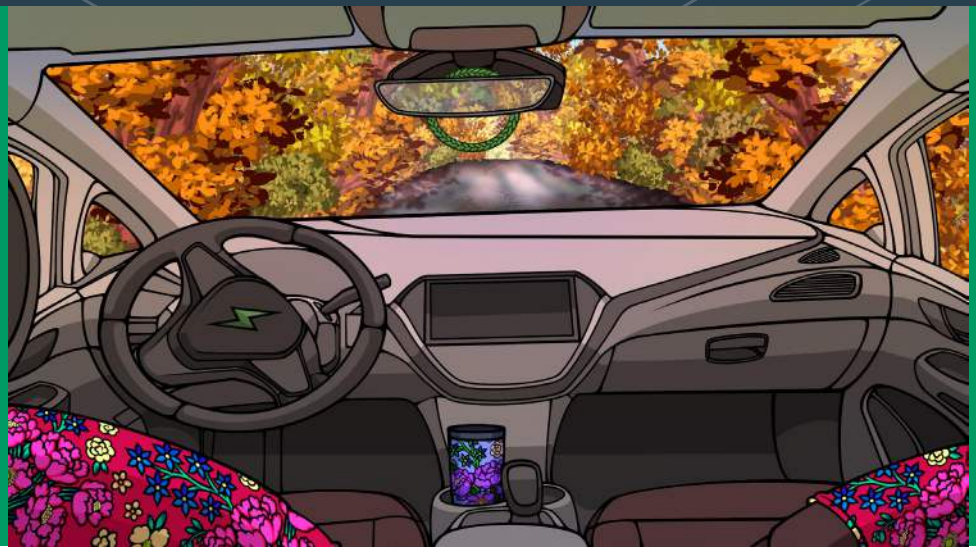
All About Electric Vehicle (EV) Range

For More ZEV Resources:
Visit the Reports & Publications page of the ICE website.



Range Factors

- **Cabin Conditioning:** Heat and air conditioning both use power from the battery.
- **Terrain:** Going uphill will use more power than flat roads. Going downhill can recharge the battery through regenerative breaking.
- **Temperature:** Hot and cold temperatures can both take the EV battery out of its optimal temperature range, affecting its power output.
- **Reduced Traction:** Dirt or gravel roads and wet or icy surfaces will also cause the motor to work harder.
- **Driving Style:** EVs can speed up very quickly - fun for drivers, but rapid acceleration causes faster battery drain.
- **Community vs Highway Driving:** High-speed highway cruising causes the battery to drain faster due to wind resistance.
- **Wind Resistance:** Headwinds or side winds will make the motor work harder.

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ZEVs Across the Land resources have been partially funded by NRCan's ZEVAI program.

Range

- Range is the anticipated distance an EV can travel when fully charged.

EV Range is Truly a Range

- EV range is calculated by manufacturers under ideal conditions. In some cases the **stated range will be shorter or longer** than the manufacturers stated range. It will vary depending on temperature conditions, speed, and more.

Trip Planning and Range

- Vehicle range can change based on all kinds of conditions. That's why it's important to understand the *lowest* potential range of the EV you're operating. You want to ensure the range of the vehicle can meet your needs before it needs to recharge.

Regenerative Breaking/One Pedal Driving

- **Regenerative breaking** refers to the energy recovered when EVs slow down with 'One Pedal Driving.'
- '**One Pedal Driving**' is when you let the EV slow down by lifting your foot off the accelerator.

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Electric Vehicle (EV) Durability and Other Considerations

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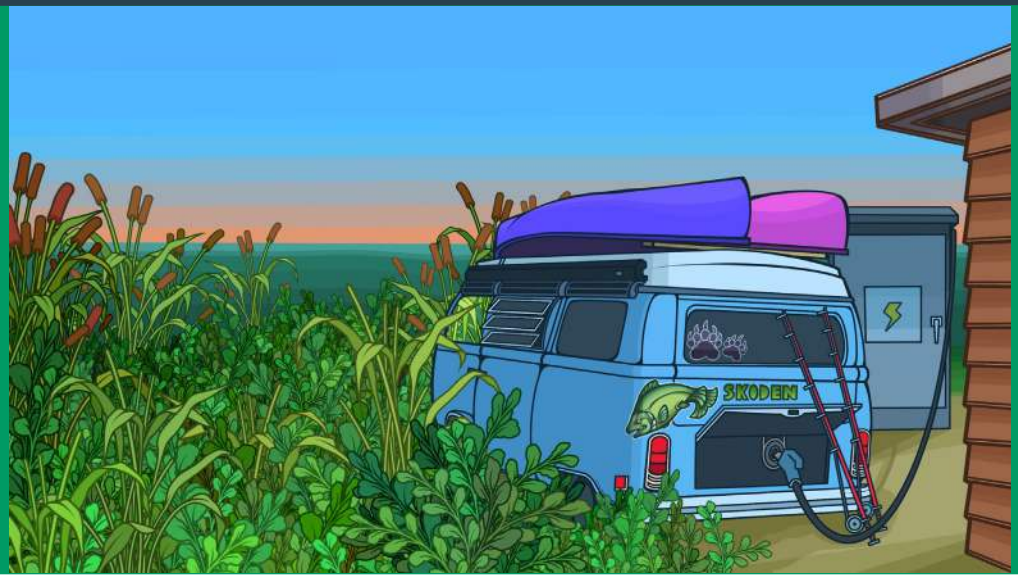

Durability

- All batteries lose some of their capacity over time. This is the effect of charging on the chemistry of the battery process, otherwise known as battery degradation. The **good news** is that battery degradation is not a serious issue when the battery is **properly managed**.

Factors Affecting Battery Life

- Time and usage cycles.
- Prolonged high battery temperature.
- Operating the vehicle at high and low states of charge.

Limit Use of High-kW Fast Charging

- The **biggest impact** on battery chemistry comes from using 150 + kW fast chargers. **Limit** using these as part of your overall charging strategy. Many EV owner manuals will recommend minimizing the use of fast charging.

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Sustainability

- Many groups are adopting electric fleets to help **meet sustainability targets**. EVs generate no tailpipe emissions or Green House Gases.
- EVs are also better than gas vehicles with **lower overall carbon emissions** when considering the **whole lifecycle** of the vehicle. This includes mining, manufacturing, energy grid emissions and end-of-use recycling.

Time Savings

- EV drivers can **save time** at auto shops due to **lower maintenance demands**.
- EV drivers also have access to **high-occupancy vehicle (HOV)** lanes, where they can save time by bypassing traffic

Waabshkigan Shane Monague

Beausoleil First Nations

"We're moving away from a dependence on fossil fuels, and towards a greener, more sustainable way of living. In Anishinaabe teachings specifically, that's one of our teachings, is to utilize what we have now. We don't have the technology that's completely extraction-free, emission-free. What we do have is the EVs we see here today."

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Electric Vehicle (EV) Maintenance

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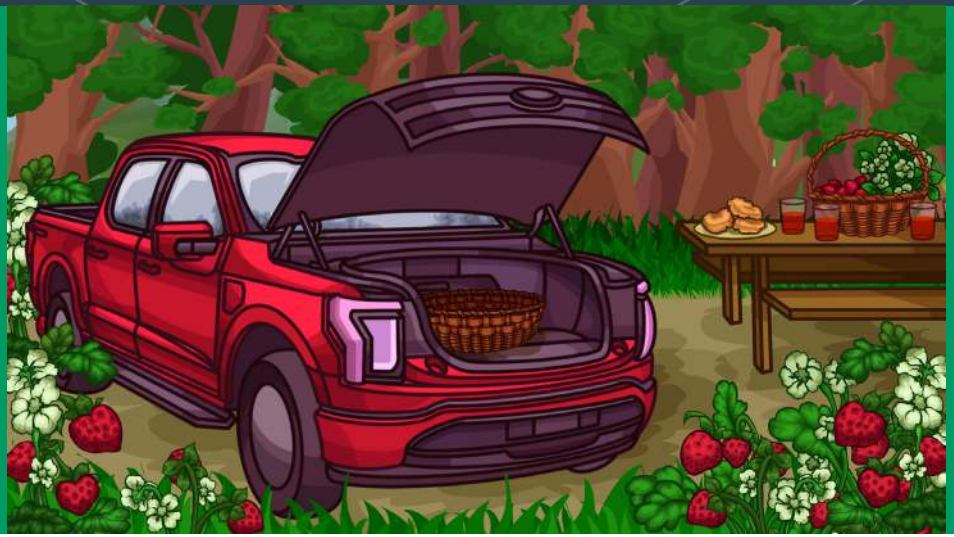

Gas-powered Vehicles Need

- **Regular** oil changes.
- Attention to belts, coolant, and **exhaust systems.**
- Attention to the electrical system including **spark plugs, coils and the alternator.**
- Regular replacement of brake pads and rotors (**on a gas-powered vehicle, these get much more use**).

For Electric Vehicles

- The most common fluid top-up is **windshield washer fluid**!
- **Annual lubrication** at the cost of roughly $100 per vehicle to prevent brake corrosion.
- Slightly higher tire wear with standard tires.
- Some EVs may also need replacement of the battery coolant fluid. This can cost hundreds of dollars **every few years.**

Why EVs Need Less Maintenance

- EVs have fewer moving parts than gas vehicles. They don't need as much regular maintenance and repair.
- The average electric motor has about **20** moving parts. An internal combustion (gas) engine has more than **2,000**. This is a big reason why EV maintenance is less demanding.

Warranty Wait-times

- Rarely, when an EV does have an issue needing warranty repair, the wait times can be longer. This can be due to parts availability and the complexity of diagnosing the vehicle issue.

EV Tires

- **New EV-specific tires are coming onto the market!**

Employment Potential

- The EV sector is **growing**!
- **Training and investment** in equipment for local mechanics will support EV adopters and **confidence in EV adoption** in rural and remote communities.

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Electric Vehicle (EV) Charging 101

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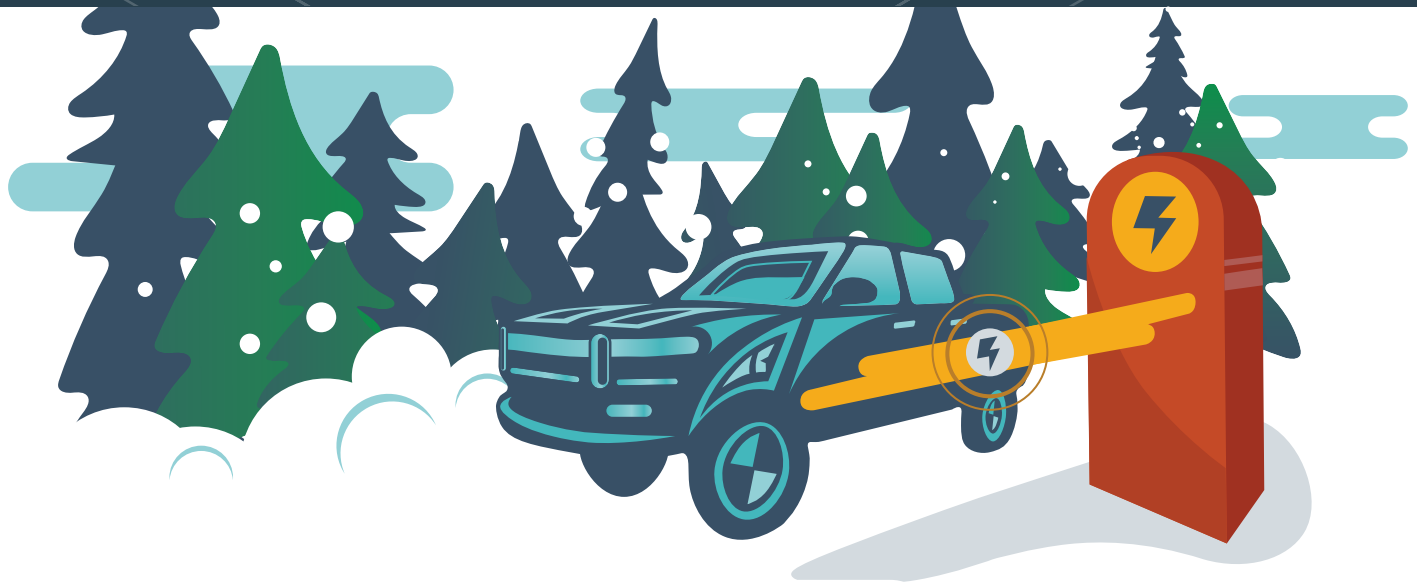

Level 1 (L1)

- One of the terms you'll hear most often about EV charging is 'levels.'
- An EV can charge at different power levels, which will affect how quickly the charging station can recharge it.
- Level 1 is a term used for charging with a regular household plug.

Level 2 (L2)

- L2 means charging with 240 volts of AC power from outlets used by home appliances (like a stove or clothes dryer) or with a Level 2 charging station.
- L2 chargers can be installed in homes, band offices, community centers, hotels, etc.

Level 3 (L3 or DCFC)

- Fast Charging is most often associated with the high-powered chargers found at gas stations. L3s are in the 20 kW to 350 kW range.
- The large L3 charger does the work of converting AC power to DC power faster than your on-board charger can. That's why L3's are so fast.

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Charging Curves

- Charging is not a straight line: the first 50% will charge up quickly, while the last 20% is typically much slower, to protect the battery.
- DC fast charging slows down a lot once the battery hits 80%, which helps protect the battery from damage due to overcharging.

Manufacturer Recommendation

- Vehicle manufacturers recommend minimizing the use of Fast Charging (L3/DCFC) as it can affect battery performance and lifespan.

Smart Charging

- Smart charging refers to software that connects the EV's on-board computer to the charging station's computer to enable functionality such as remote charging (when an EV is plugged in) and scheduled charging.

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Managing Electric Vehicle (EV) Range

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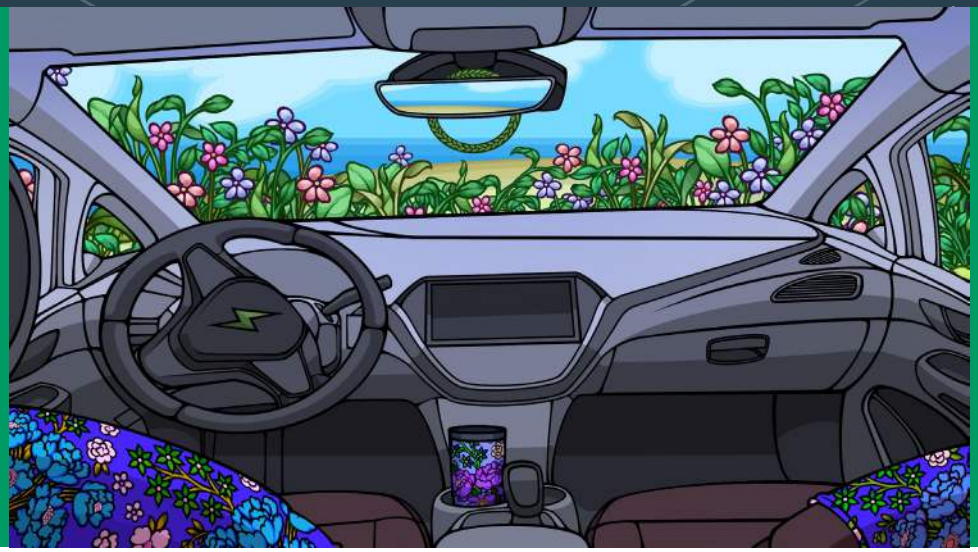

How to Maximize an EV's Range

- **Go easy on the accelerator.** EV efficiency is lowest at highway speeds. Cruising over 110 km/h will reduce range. Accelerating too quickly will also reduce range, so drive smoothly.
- **Adopt one-pedal driving.** 'One-pedal driving' is when you let the EV slow down or stop by lifting your foot off the accelerator. The kinetic energy is recovered and stored again as electrical energy in the battery.
- **Warm or cool the cabin before leaving.** Using the heat or air conditioner needs battery power. It's best to heat or cool the cabin while the vehicle is still plugged into its charger to conserve the battery. That way, all the battery power can be used for range.
- **Consider your EV's optimal carrying capacity.** Carrying or towing extra weight such as trailers, will reduce range.
- **Wind resistance can also lower EV range.** Roof racks, ladders, and other accessories can add wind resistance.

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EV Battery Considerations

- Respect the top and bottom battery buffer of between **20%-80%.**
- **An EV battery should never be at 0%.** Therefore, you're never accessing a vehicle's total range rating.

EV Battery Lifespan

- As EV batteries age, they lose a very small amount of range each year, about **2%**.

Travel Planning

- There are **many EV charging apps** available to help you plan your next EV trip.
- PlugShare, ChargeHub, and ChargePoint, are **just a few examples** of EV charging apps.
- When travelling, it's a great idea to **review your route** and make sure you'll have enough battery power to get you to the next charging point.

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Operating Electric Vehicles (EVs) in Winter

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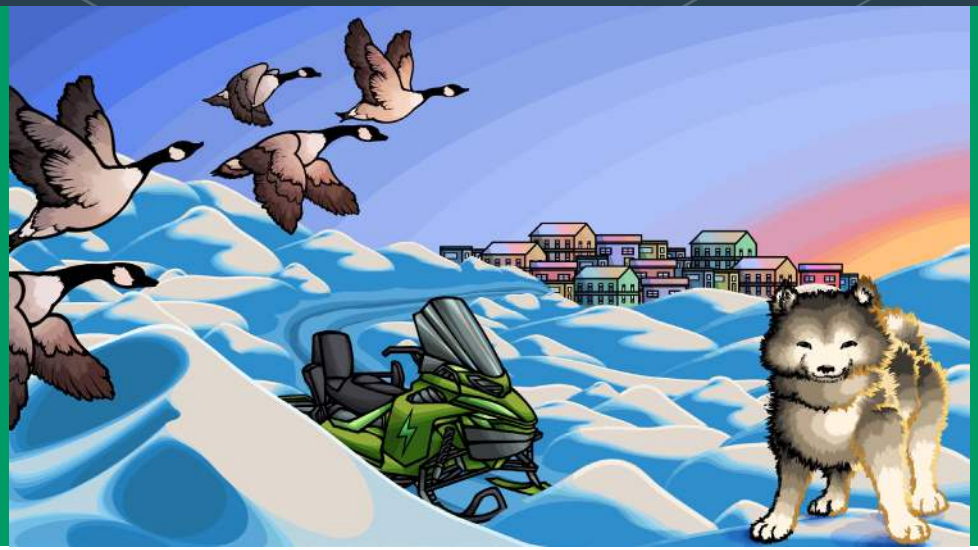

How Do Electric Vehicles Perform in Winter Conditions?

- EVs start **more reliably in winter** than gas or diesel vehicles.
- EVs lose some range in the cold when it drops below -5°C. Many will lose close to 45% at -20°C.
- When traction is reduced due to icy conditions range might also be reduced.

Why Do EVs Lose Range in Winter?

- It takes as much power to **heat the air in the cabin** as it does to run the powertrain of an electric vehicle and to operate the wheels.
- **Winter modes** reduce the regenerative braking in ice and snow. Under slippery road conditions, it's safer to use controlled braking.

Batteries and Temperature

- Batteries are most efficient when the temperature is **between 15°C and 25°C.**
- Most EVs have a battery thermal management system and as the battery warms up, **the EV will recover range.**

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Expert Tips to Maintain Winter Range

- Since winter range is most affected by the need to keep the driver warm, use these best practices to reduce the drain on auxiliary battery power in cold weather.

Preheat the Cabin

- Warm up the vehicle while you're still plugged in to power. You're also heating the powertrain, including the battery.

Use the Vehicle's Heated Seats and Steering Wheel

- Heating the cabin air requires 5000 W.
- Heating the seat requires 40 W.
- Heating the steering wheel requires 15 W.
- Use the seat heater and heat the wheel first. **You'll be using 55 W instead of 5000 W!**

Plug in When You Can

- Condition the cabin and battery again if you're stopping at a store, restaurant, or your band office, with EV charging.

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