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EV 101 and Myths

Christopher Basilio
Research Coordinator
Research Partnerships & Innovation
Red River College

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Agenda

- RRC Introduction
- RRC Applied Research & Projects on Electric Vehicle
- Electric Vehicle Myths

RRC Introduction

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- Manitoba's largest institute of applied learning
- Over 200 full- & part-time academic programs
  - Personal Development to Trades to Degrees
- ~ 22,000 students
- Nine campuses across Manitoba
- Annual operating budget ~$193M
- Annual research operating support ~$4.5M
- #1 Western Canada 2017 – Research Infosource

Vehicle Technology Research/Projects

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2005:
Hybrid H2 Internal Combustion Engine (HHICE) transit bus cold-weather evaluation

2005 & **2008:**
Red River College Raycer solar car

2006: Hydrogen Fuel Cell transit bus demo.

2007 and **2010**:
Reduced Emission Diesel Engine Integration: MCI D4500 and J4500 bus prototypes

2008-**11**:
Plug-In Hybrid Vehicle Conversion/
cold-weather Testing and demonstration

2011:
Electric Vehicle Technology & Education Centre

2011-13:
Battery Electric Transit Bus Project

2012:
Vehicle Technology & Energy Centre (VTEC) - NSERC Innovation Enhancement Grant (5-year $2.3M)

2012-14:
BEV Mitsubishi iMiEV in Manitoba – Demo and Testing

2013:
PHEV Chevrolet Volt & BEV Nissan Leaf – Commercial EV Demo & Testing

2015:
RRC L3 Rapid Charger – Manitoba's 1st Level 3 Charger

2018:
Shell Eco-marathon (SpaRRCky-RRC battery-electric vehicle)

MotiveLab – Drive-in Climatic Chamber

Battery Electric Transit Bus Project

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Video Link: https://vimeo.com/93516597

Source: *RRC Zero Emissions Electric Transit Bus*

EV Myths Busted: EV Overview

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Electric Vehicle (EV):

"An **electric vehicle**, also called an **EV**, uses one or more ***electric motors*** or ***traction motors*** for propulsion. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft."

Source: *https://en.wikipedia.org/wiki/Electric_vehicle*

EV Types:

- Hybrid
- Plug-in Hybrid Electric Vehicle (PHEV)
- Battery Electric Vehicle (BEV)
- Fuel Cell Electric Vehicle

EV Myths Busted: EV Types

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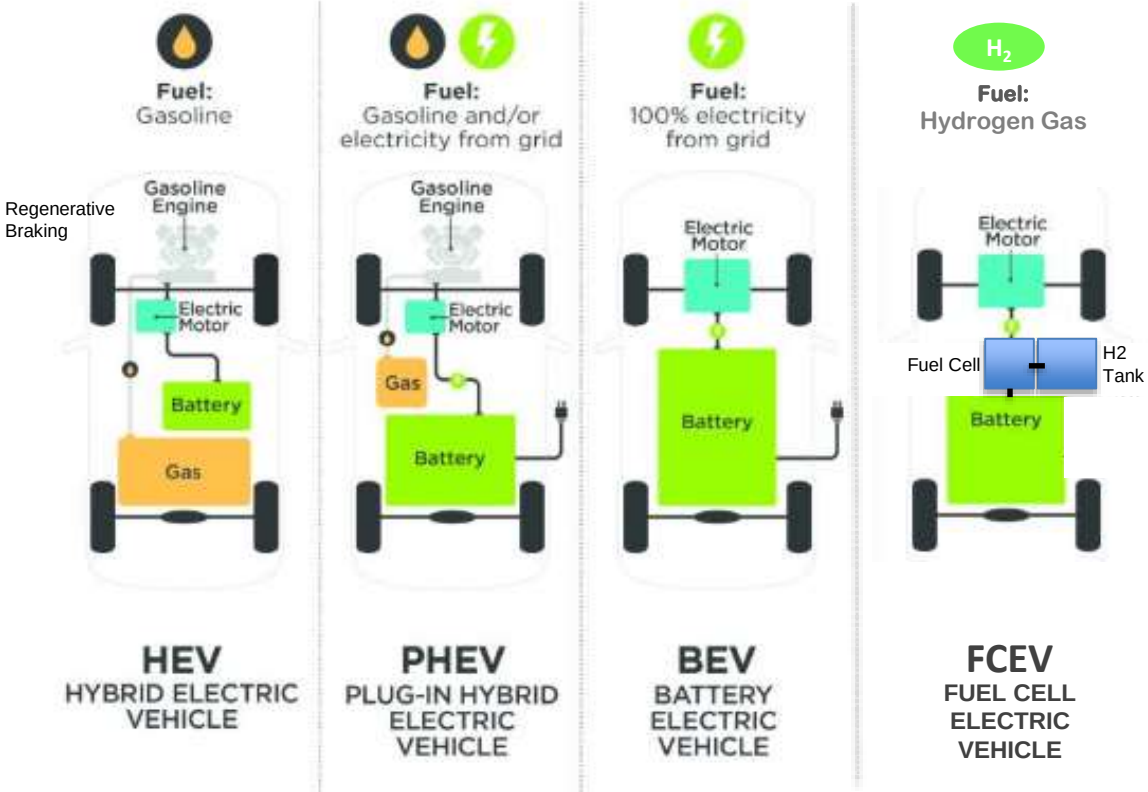
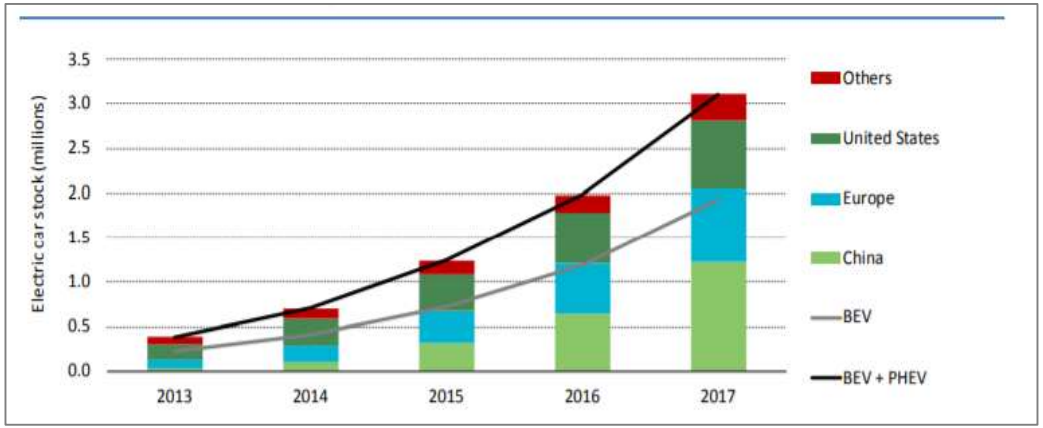
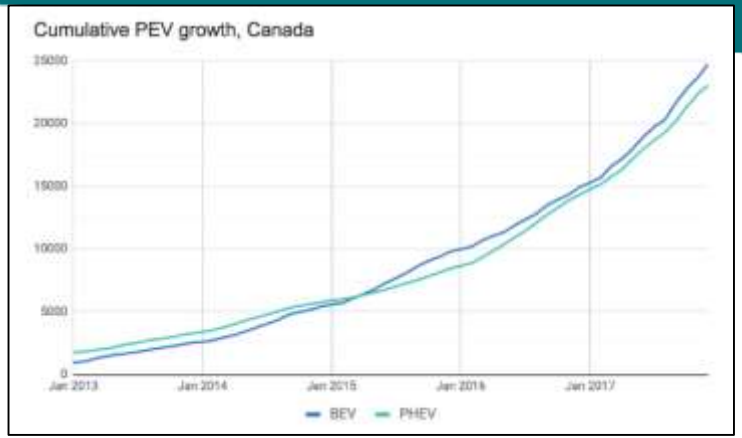


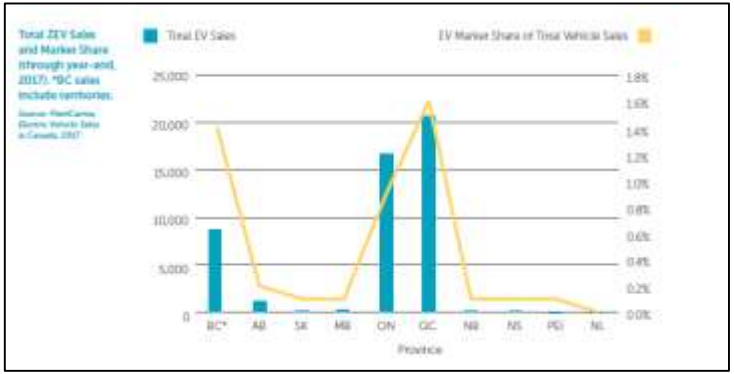
Source: *Electric Power Research Institute*

EV Myths Busted: EV Gowth



Source: IEA Global EV Outlook Report 2018





Source: *Fleetcarma Electric Vehicle Sales Canada-2017*

EV Myths Busted: EV Growth

Video Link: https://www.youtube.com/watch?v=cA5AcigRdEE

Source: *IEA Global EV Outlook Report 2018*

EV Myths Busted: EV in Canada (2017)

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MAKE	MODEL	ZEV TYPE	VEHICLE TYPE	MSRP (CAD)	ELECTRIC RANGE (KM)
Audi	A3 Sportback e-tron	PHEV	Hatchback	$40,900	26
BMW	330e	PHEV	Sedan	$52,100	22
BMW	740 Le xDrive	PHEV	Sedan	$107,900	22
BMW	X5 xDrive40e	PHEV	SUV	$74,000	28
BMW	i3	BEV	Hatchback	$47,300	183
BMW	i8	PHEV	Coupe	$150,000	28
Chevrolet	Volt	PHEV	Hatchback	$39,590	85
Chevrolet	Bolt	BEV	Hatchback	$42,895	383
Chrysler	Pacifica PHEV	PHEV	Minivan	$50,884	53
Ford	C-Max Energi	PHEV	Hatchback	$39,729	32
Ford	Focus Electric	BEV	Sedan/ Hatchback	$31,998	185
Ford	Fusion Energi	PHEV	Sedan	$36,399	34
Hyundai	Sonata PHEV	PHEV	Sedan	$43,999	43
Hyundai	Ioniq Electric	BEV	Hatchback	$35,649	170
Kia	Optima PHEV	PHEV	Sedan	$42,995	47
Kia	Soul EV	BEV	Hatchback	$35,395	149
Mercedes	GLE 550e	PHEV	SUV	$83,000	30
Mercedes	S 550e	PHEV	Sedan	$102,600	22
Nissan	Leaf	BEV	Hatchback	$37,398	172
Porsche	Cayenne S E-Hybrid	PHEV	SUV	$89,400	22
Porsche	Panamera S E-Hybrid	PHEV	Hatchback	$106,600	25
Smart	Fortwo ED	BEV	Hatchback	$28,800	160
Tesla	Model S	BEV	Sedan	$95,300	435
Tesla	Model X	BEV	SUV	$132,000	413
Volkswagen	e-Golf	BEV	Hatchback	$35,995	201
Volvo	XC90 T8 Twin Engine PHEV	PHEV	SUV	$73,400	22

Source: *FleetCarma Electric Vehicle Sales Canada-2017*

EV Myths Busted: EV Charging Station

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DESCRIPTOR	LEVEL 1	LEVEL 2	LEVEL 3
ZEVs Supported	All PHEVs and EVs	All PHEVs and EVs	BEVs (not all)
Typical Voltage	120	240	480
Current Type	AC	AC	DC
Requirements	Requires standard electrical outlet	Requires 240 volt electrical outlet (for portable chargers) or circuit (stationary chargers)	Charging facility in a fixed location
Charging Time Range	8–30 hours	4–10 hours	25–30 min (to 80% of full charge)
Hardware and Installation Cost	$0	$1,000–$5,000	$50,000–$100,000
Applications	Long term parking (home, work, etc.)	Long and short-term parking (home, office, retail storefronts, etc.)	Long-distance travel (highways)

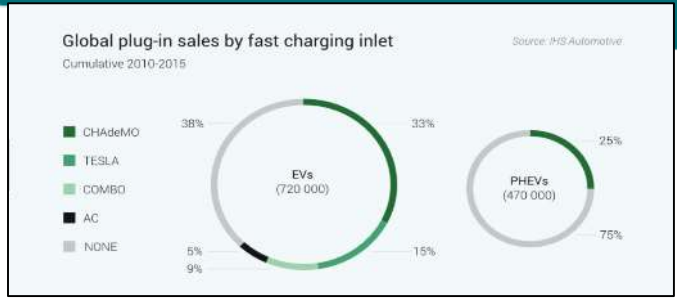
TYPE 1 PLUG

COMBINATION PLUGS

TESLA SC PLUG

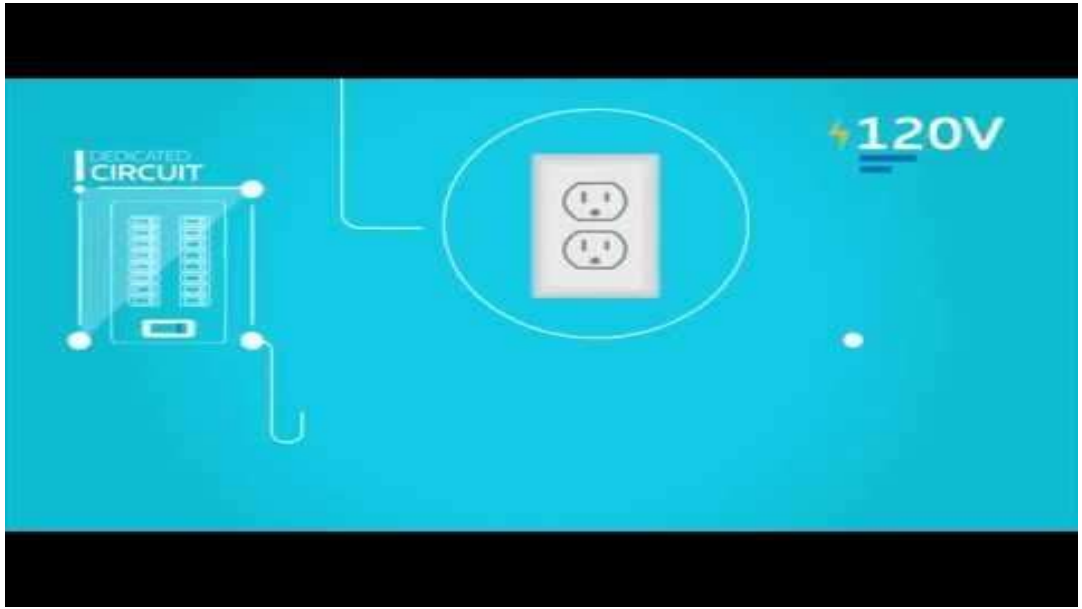
CHAdeMO PLUGS

***Source**: NRC/Delphi Group Accelerating the Deployment of Zero Emission Vehicles Report*



***Source**: IHS Automotive*

EV Charging in MB



Video Link: https://www.youtube.com/watch?v=uxeKQeh9QJk

Charging electric vehicles in Manitoba

Watch to learn about the options for charging an electric vehicle in Manitoba.

***Source**: Manitoba Hydro*

Electric Vehicle Charging Stations

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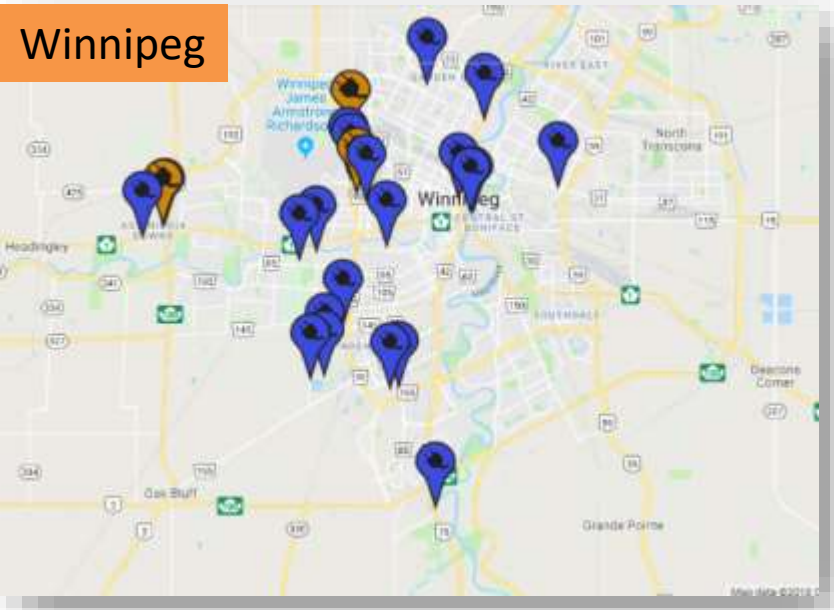
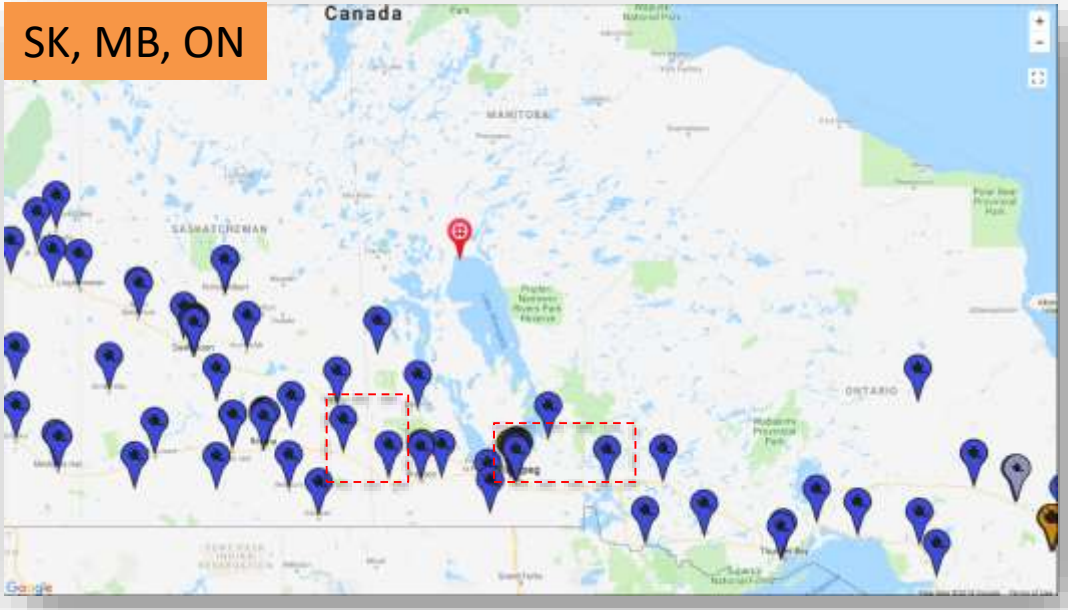
Winnipeg

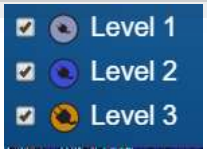


SK, MB, ON



***Source**: CAA website, http://www.caa.ca/evstations/*

Legend:



EV Incentives in Canada

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Province	Incentives Program	Amount
British Columbia	CEVforBC™ Vehicle Incentive Program	Rebate of up to $6,000
Ontario	Electric and Hydrogen Vehicle Incentive Program (EVHIP)	Incentives of up to $14,000
Quebec	Drive Green program	Rebate of up to $8,000

*MB, SK and AB (Without EV Government Incentives)

- **Mitsubishi Motors' Plug-Incentive: Mitsubishi Outlander (Private Sector Initiative)**
  - a $2,500 rebate for the provinces without an electric vehicle government incentive

Barriers to EV Adoption (Prairies Region)

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Barriers to EV Adoption

- The higher cost of EVs and lack of equivalent models (e.g., pickup trucks and SUVs)
- Lack of public charging infrastructure
- Lack of consumer awareness (economic and environmental benefits, total cost of ownership, infrastructure, safety)
- Technology barriers (battery performance and perceived cold weather performance)

Other barriers:

- *Lack of standardization of charging infrastructure*
- *Lack of provincial government interest/engagement*
- *Lack of EVs and service capabilities at dealerships*

***Source**: NRC/Delphi Group Accelerating the Deployment of Zero Emission Vehicles Report*

EV Myths BUSTED?

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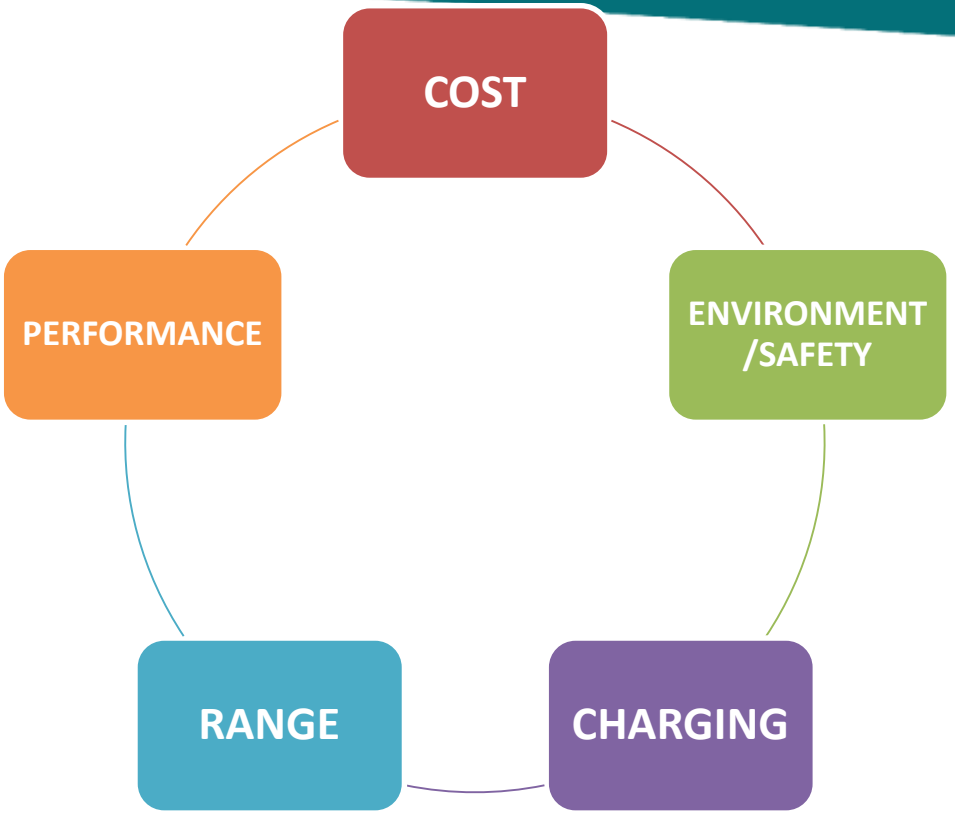

Cost of Running an EV

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Nissan LEAF 2017

Your annual fuel savings:

$1190

Chevrolet Bolt EV 2017

Your annual fuel savings:

$1236

Source: https://chargehub.com/en/calculator.html

Tesla Model X 2017

Your annual fuel savings:

$1174

EVs cost to much?

Assumption: 20000 km/year
Gas consumption: 7.5 L/100 km
Gas Price: C$/Liter = $0.99
Electricity Rate: ¢/kW-h= 7.93
Electric consumption: 18.6 kWh/100 km

Vehicle Type	Annual Fuel Cost	Difference	Monthly Fuel Cost
Electric Vehicle	$294	$1190	$24.5
Gas Vehicle	$1484		$123.67

Cost of Running an EV

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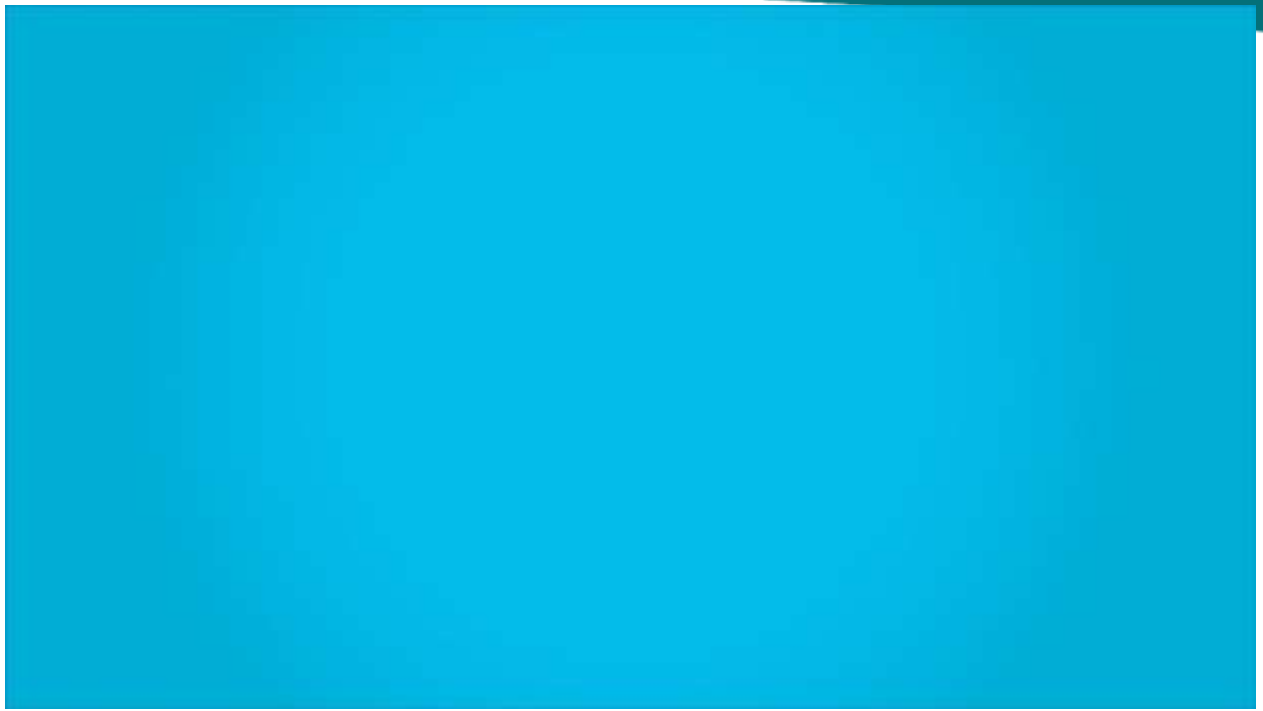
EVs cost to much?



The cost of running an electric vehicle

Video Link: https://www.hydro.mb.ca/your_home/power_smart/electric_vehicles.shtml

***Source**: Manitoba Hydro*

Total Cost of Ownership EV

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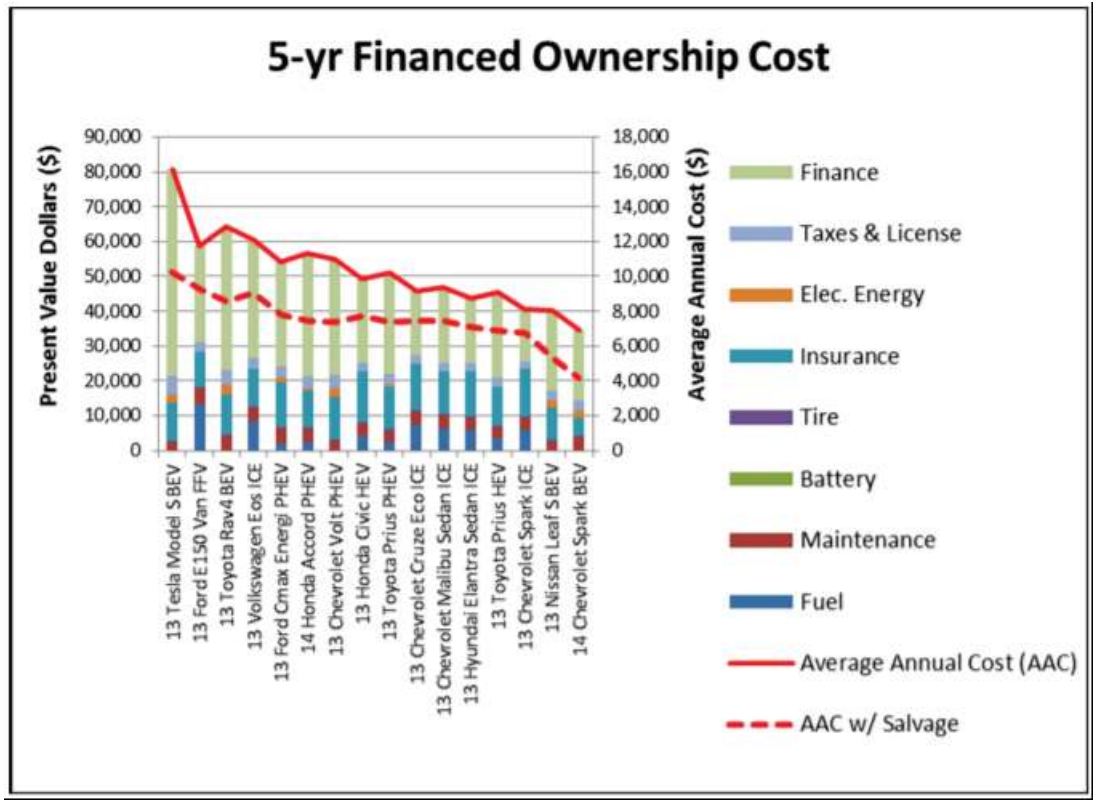
EVs cost to much?



Ownership Years	Average Annual Cost ($)		
	LEAF	Elantra	Volt
5	5,360	7,076	7,388
10	4,683	6,040	6,286
15	4,369	5,444	5,691

Source: *Electric Vehicle Transportation center - Electric Vehicle Life Cycle Cost Analysis*

Total Cost of Ownership EV

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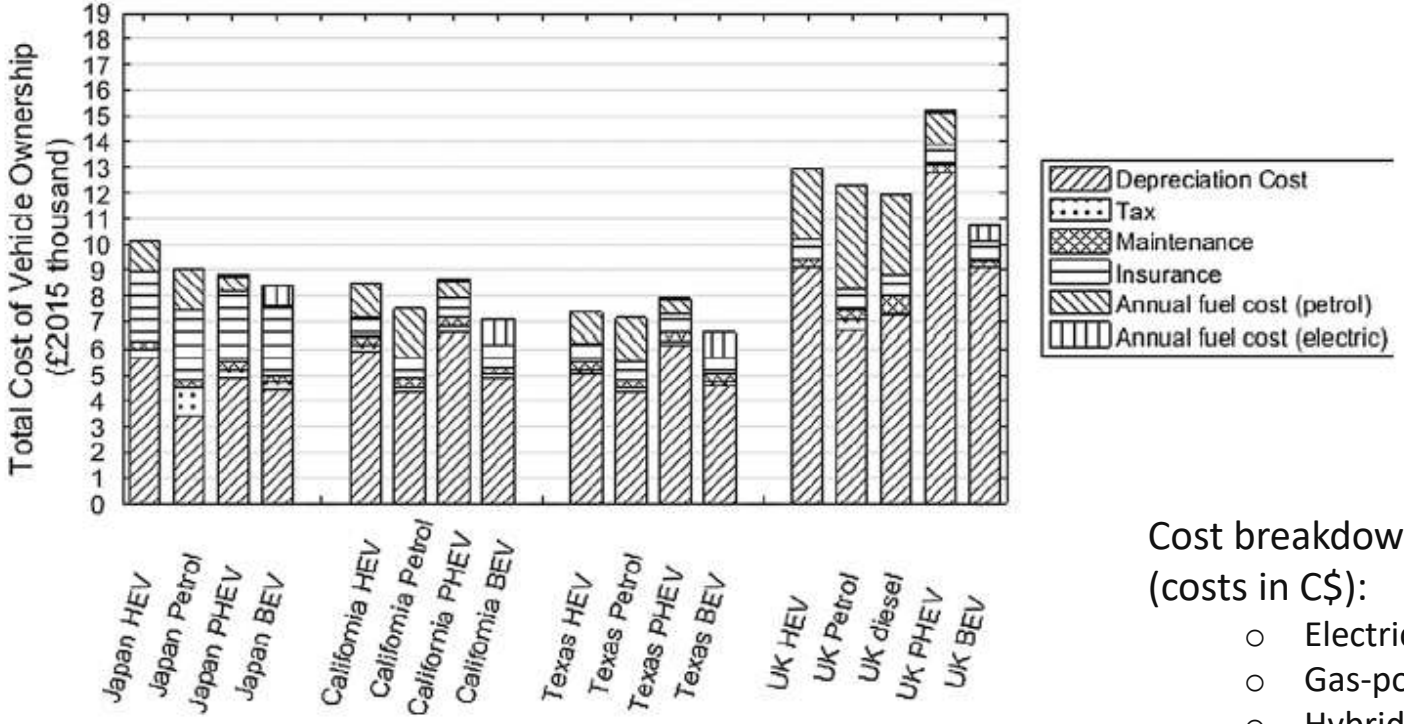
EVs cost to much?

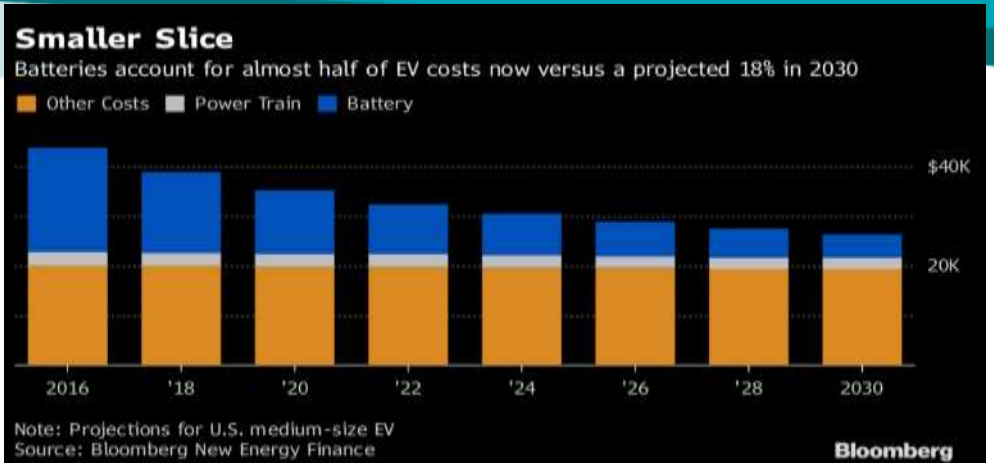


Source: *Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan - Kate Palmer, James E. Tate, Zia Wadud, John Nellthorp*

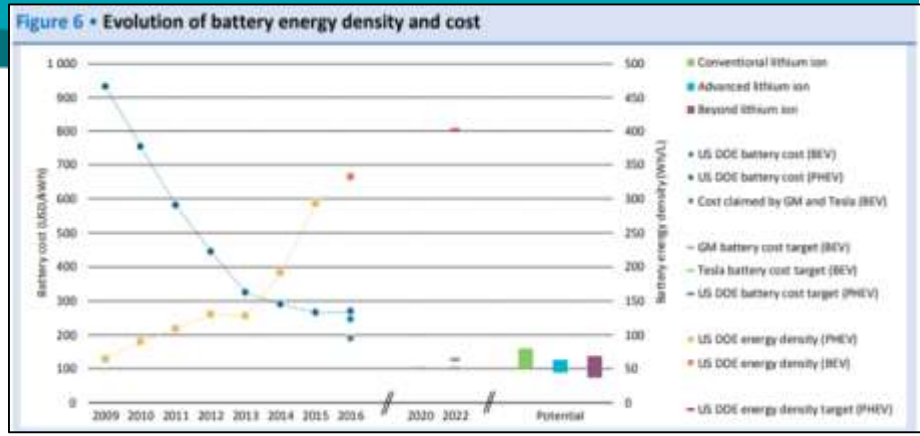
Cost breakdown for California (costs in C$):

- Electric: $9002
- Gas-powered: $9,545
- Hybrid: $10,792
- Plug-in Hybrid: $10,992

Battery Cost/Density



Source: Bloomberg New Energy Finance



Source: *Howell (2017), EV Obsession (2015) and Cobb (2015a)*

EVs battery are expensive?

EVs battery are not covered by warranty?

EV Brand	Warranty
Nissan Leaf	8 years/100,000 miles against defects and 5 years/60,000 miles against capacity loss
BMW i3	8 years /100,000 miles, to 60 percent capacity
Kia Soul EV	10 years/100,000 miles, to 70 percent capacity
Mercedes B250e	8 years or 100,000 miles to 70 percent capacity
Volkswagen e-Golf	8 years or 100,000 miles to 70 percent capacity

Battery Capacity Degradation

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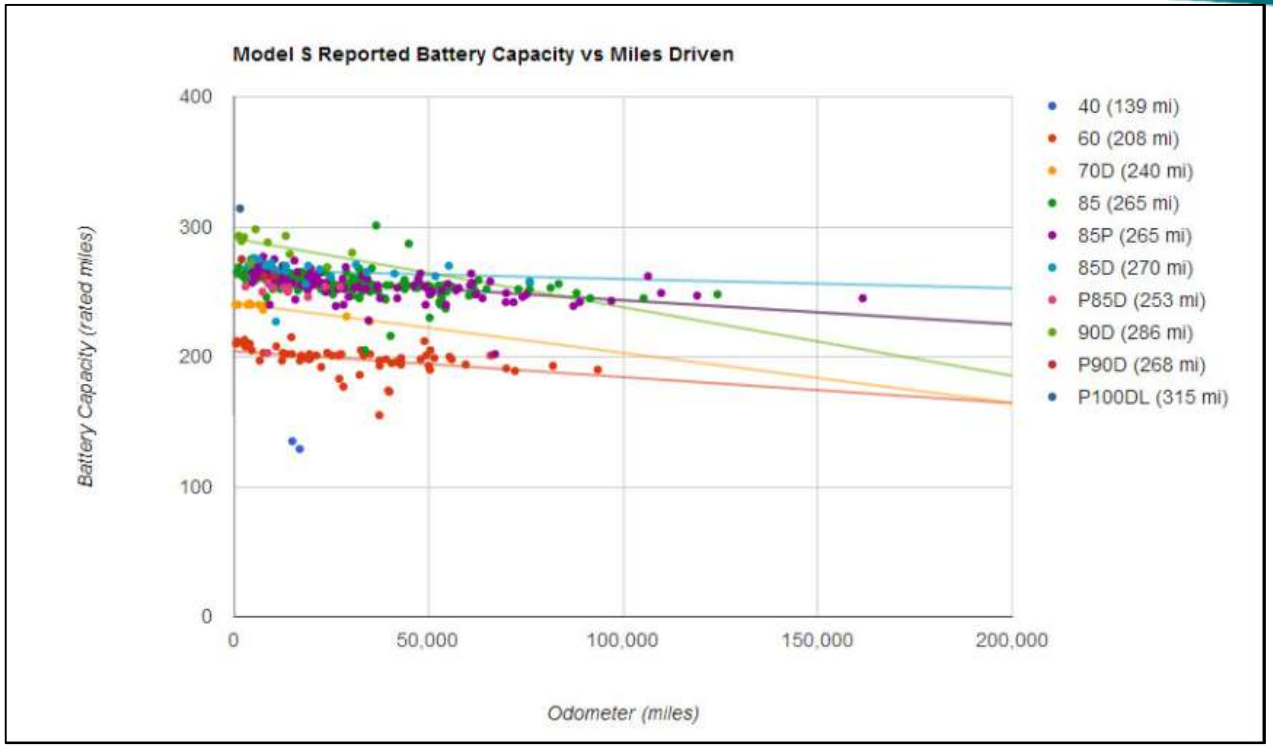
EVs loss battery capacity overtime?



Source: *PlugIn America survey*

Cold Weather Effect on EV

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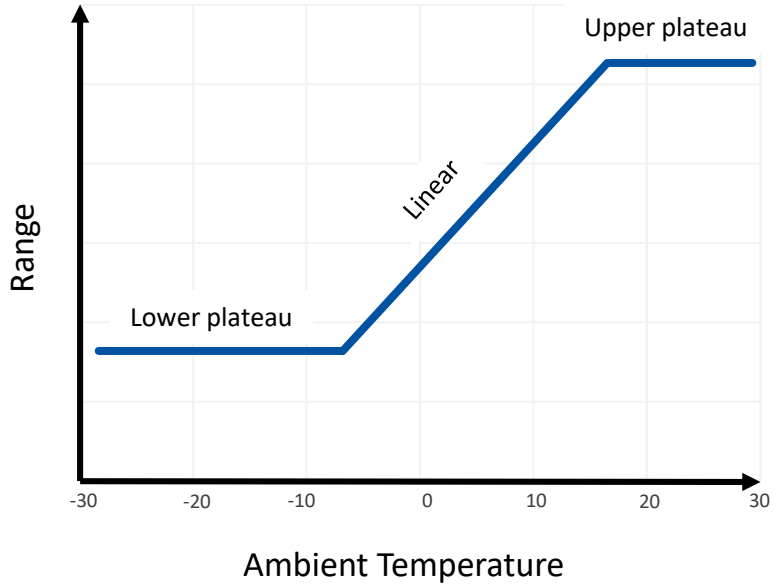
Canada is too cold for EV?

Winnipeg climate data

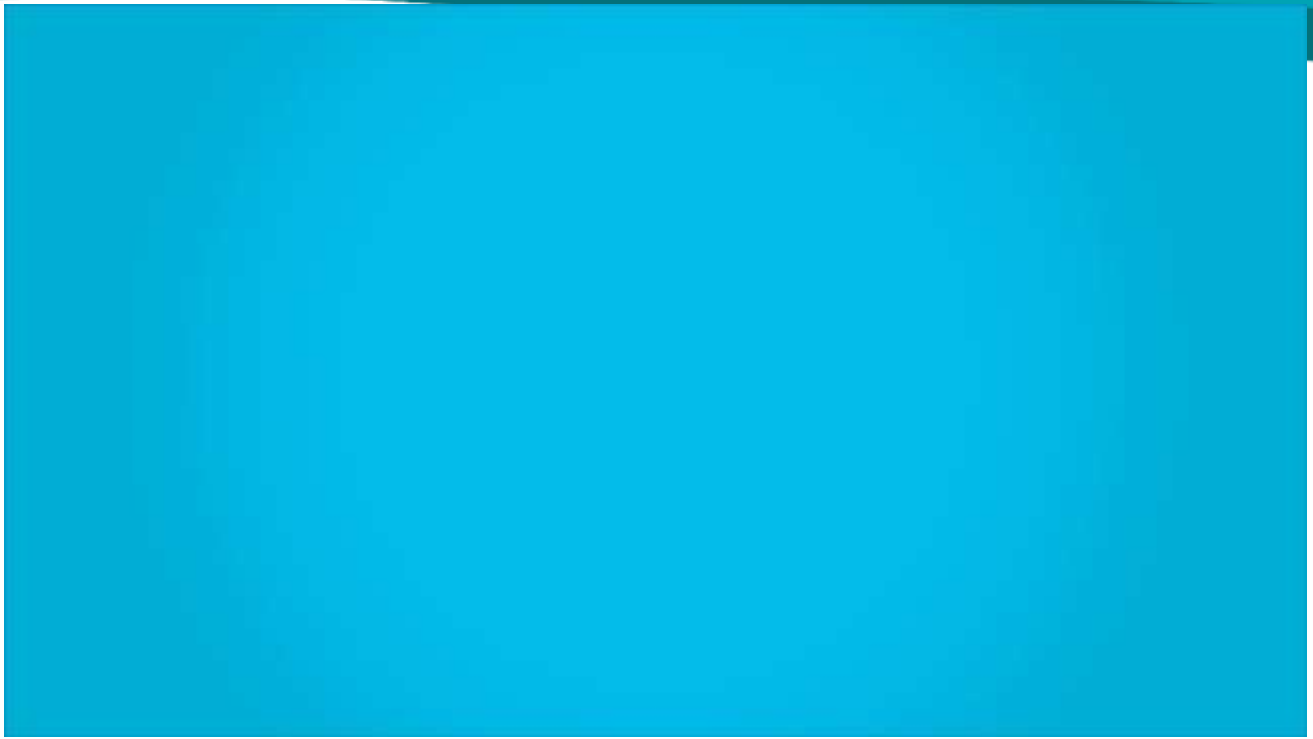
Avg Lo (°C)	Month	Avg Hi (°C)
-21.4	Jan	-11.3
-18.3	Feb	-8.1
-10.7	Mar	-0.8
-2.0	Apr	10.9
4.5	May	18.6
10.7	Jun	23.2
13.5	Jul	25.9
12.1	Aug	25.4
6.4	Sep	19.0
-0.5	Oct	10.5
-9.2	Nov	-0.5
-17.8	Dec	-8.5



Nissan Leaf

Source: *RRC BEV Nissan Leaf – Commercial EV Demo & Testing*

Electric Vehicles in Manitoba Winters



Electric vehicles in Manitoba winters

Does an electric vehicle work in a Manitoba winter? What's the best way to conserve charge? In this video, we answer these questions and more about electric vehicles in our harsh winters.

Video Link: https://www.hydro.mb.ca/your_home/power_smart/electric_vehicles.shtml

***Source**: Manitoba Hydro*

Electric Vehicles in Manitoba Winters

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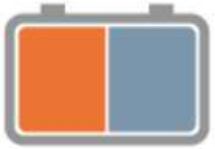
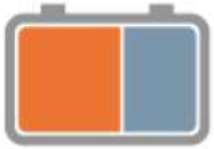
Its takes to long to charge an EV?

PHEVs	BEVs
Plug-in Hybrid Electric Vehicles	Battery Electric Vehicles
	
2.5 to 5 hours (total) Average session length	3 to 6 hours (total) Average session length
1 to 2.5 hours Average charging time	1.5 to 3.5 hours Average charging time
1.5 to 2.5 hours Average idle time	1.5 to 2.5 hours Average idle time

Source: *https://www.chargepoint.com/*

EV Safety

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EV is not safe?

- EVs undergo the same rigorous safety testing and meet the same safety standards required for conventional vehicles
- EV-specific standards for limiting chemical spillage from batteries, securing batteries during a crash, and isolating the chassis from the high-voltage system to prevent electric shock.
- In addition, EVs tend to have a lower center of gravity than conventional vehicles, making them less likely to roll over and often improving ride quality.

Source: *Office of Energy Efficiency and Renewable Energy Website*

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