



People for Energy and
Environmental Literacy

Electric Vehicle Greenhouse Gas (GHG) Emissions

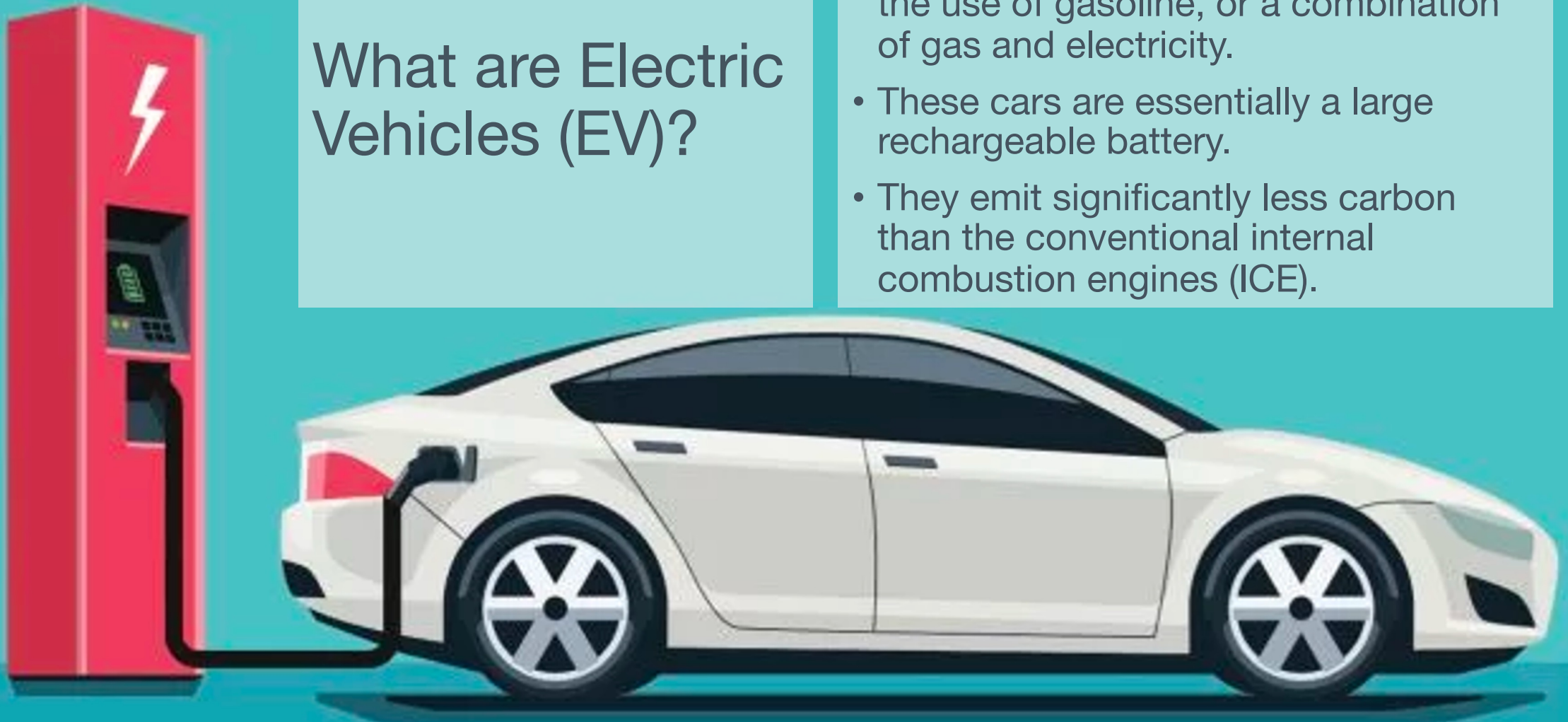
Which greenhouse gas emissions are associated with electric vehicles?

Recommended for grades 7 – 12

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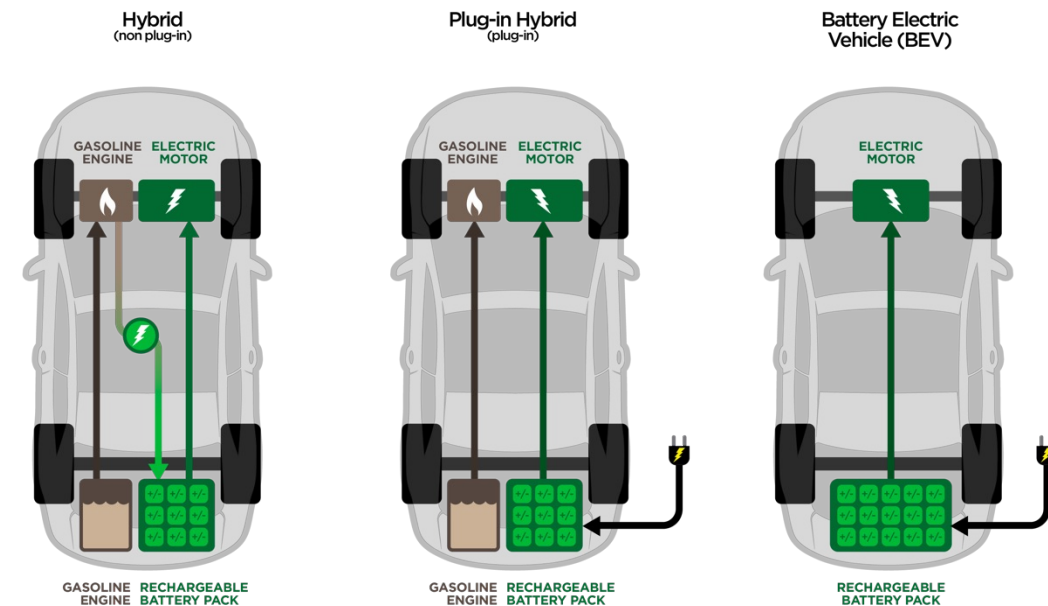
What are Electric Vehicles (EV)?

- An electric vehicle is a car that operates on an **electric motor** without the use of gasoline, or a combination of gas and electricity.
- These cars are essentially a large rechargeable battery.
- They emit significantly less carbon than the conventional internal combustion engines (ICE).



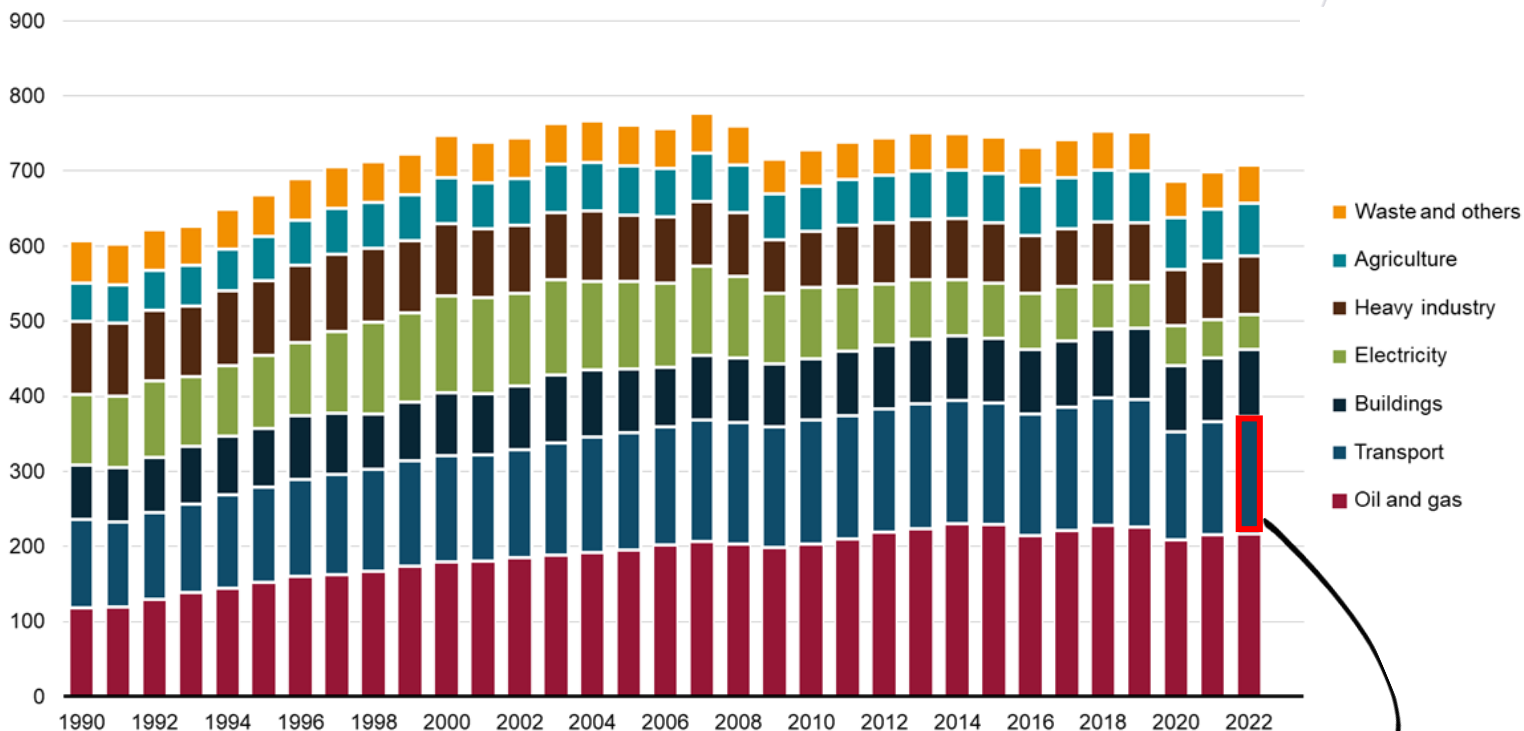
Types of electric vehicles

- **Hybrid:** Powered by gasoline and an electric motor. The battery is recharged while the vehicle is running on gas.
- **Plug-in hybrid Electric Vehicle (PHEV):** Similar to conventional hybrids, however, they can be plugged in to recharge the battery.
- **Battery Electric Vehicle (BEV):** Powered 100% by an electric motor and battery. All-electric cars do not burn gasoline, have gears or a transmission, or require oil for the parts. On average, all-electric cars can travel 200 – 250 km on a single charge.



Source: www.nspower.ca

Megatonnes of carbon dioxide equivalent



Transportation = 156 Megatonnes CO₂ eq = 22% of total emissions (2022)

Canadian Emissions by Sector

- The transportation sector is one of the largest GHG emitters in Canada.
 - The main GHG drivers in Canada are mining, upstream oil and gas production, and transport.
- Transportation is used every day – it is how the world operates.
- Transportation is used for trade, commercial business and leisure.
- In 2022, 156 Mt of CO₂ eq was emitted by the transport sector – that equates to 24% of Canada's total emissions.
- Between 2017 and 2022, transportation emission decreased by 2%.
- The transport sector had the second highest emission in Canada (after O&G)

What does “Green” mean to you?

- Brainstorm as a class what **green** means
- Consider the following questions:
 - Does the definition change depending on the group?
 - What is the Government’s (provincial and federal) definition?
 - How do different age groups define this term?
 - How do you *become* green?

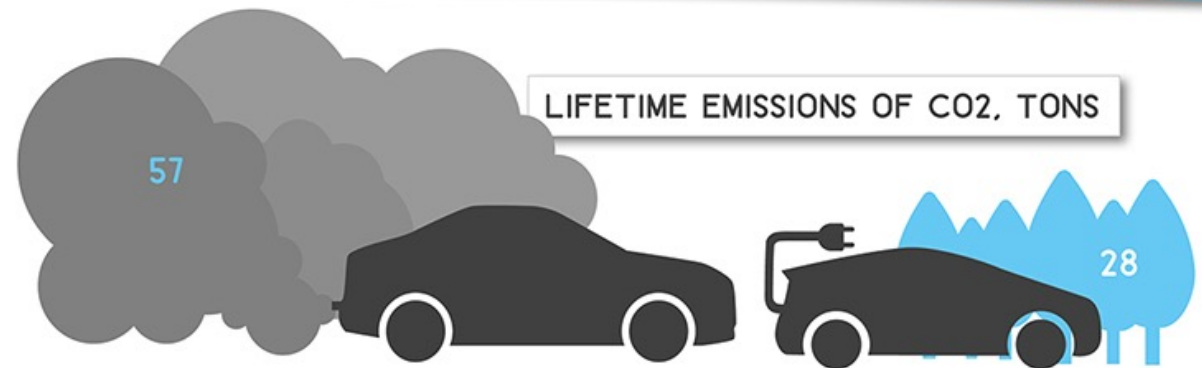
Green (v): make less harmful or more sensitive to the environment



Are EV's green?

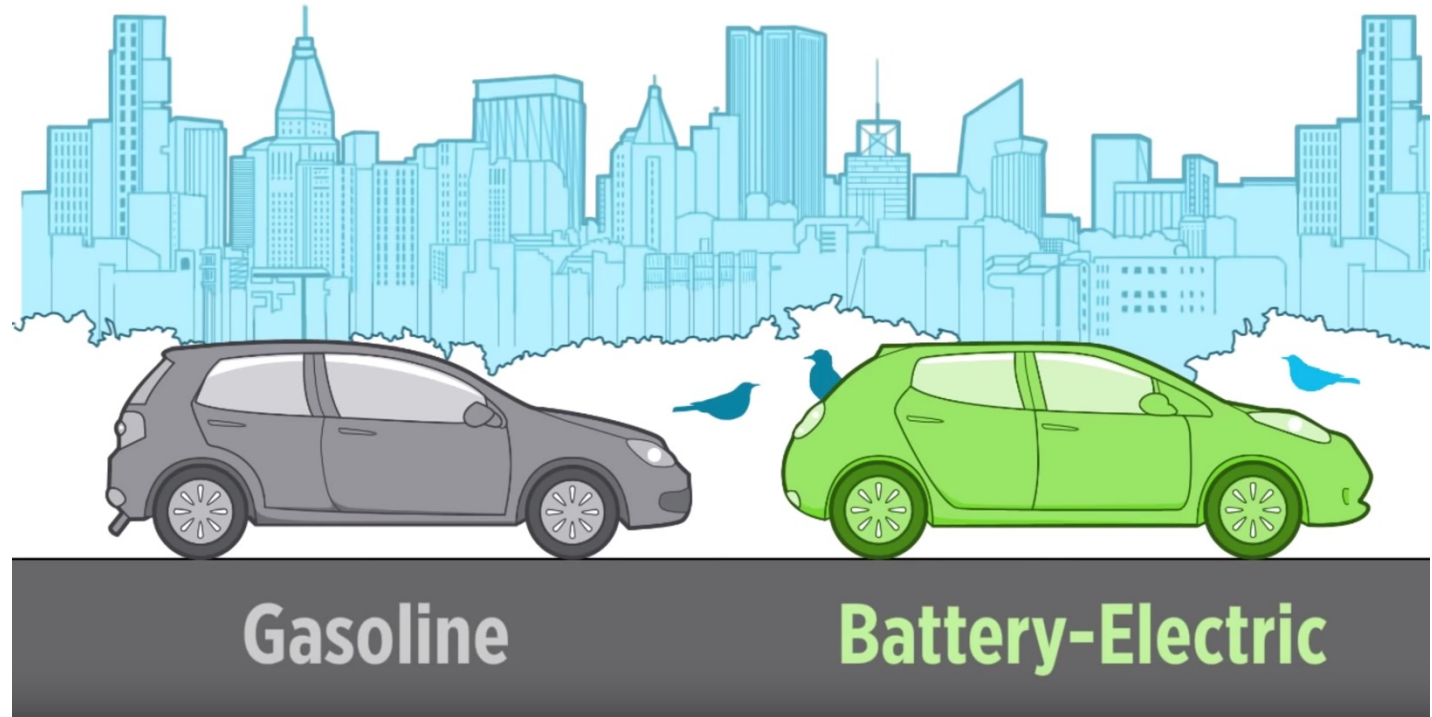
- We must look at the full picture to assess if an EV is green
- Cradle to grave: from sourcing of materials, to manufacturing through to decommissioning
- We must conduct a **life cycle analysis**

ELECTRIC CARS ARE CLEANER FROM CRADLE TO GRAVE



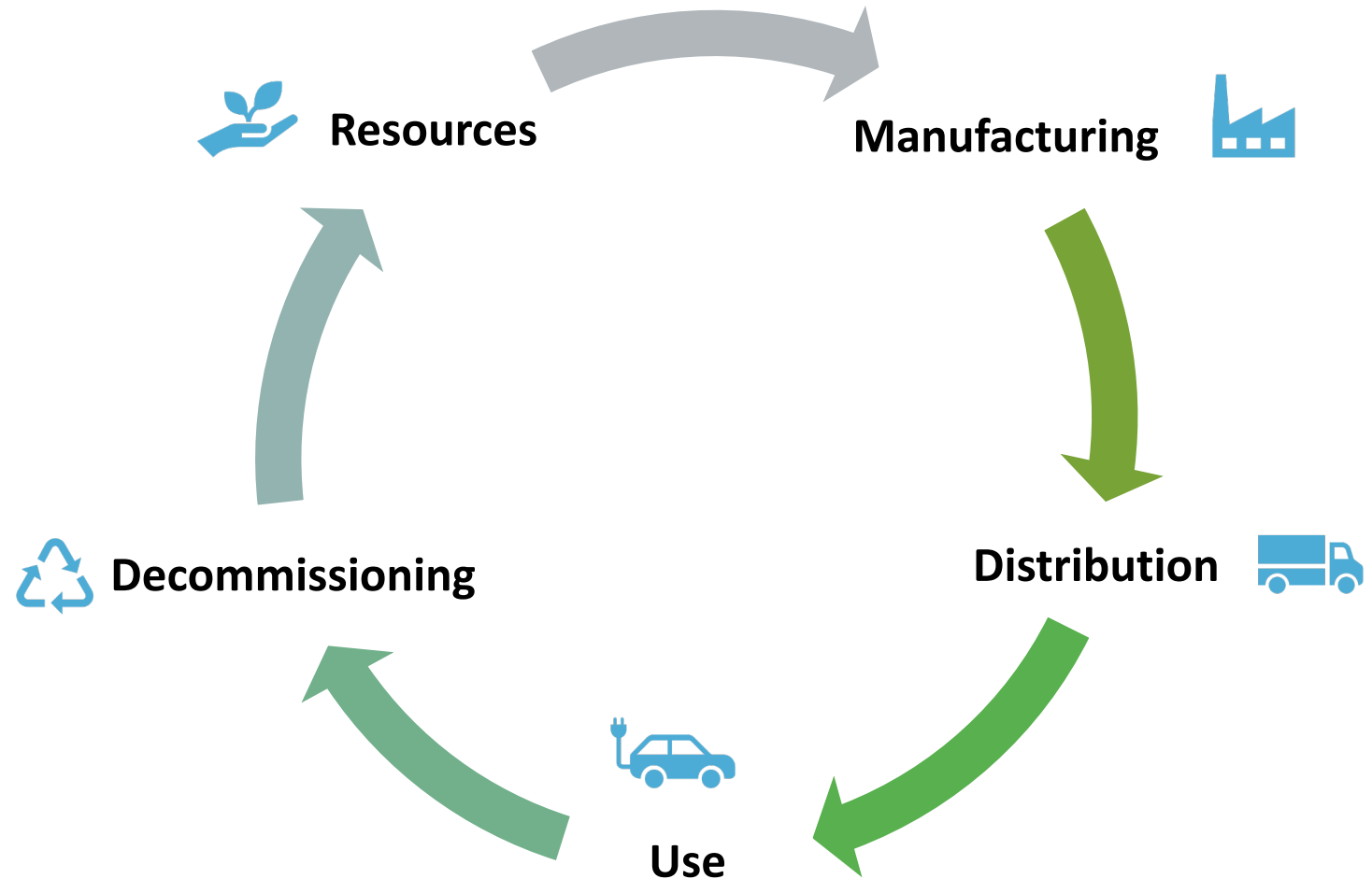
Video on Car Emissions

- Electric Cars & Global Warming Emissions
 - Union of Concerned Scientists
 - 2 minutes, 18 seconds
 - <https://www.youtube.com/watch?v=K9m9WDxmSN8>

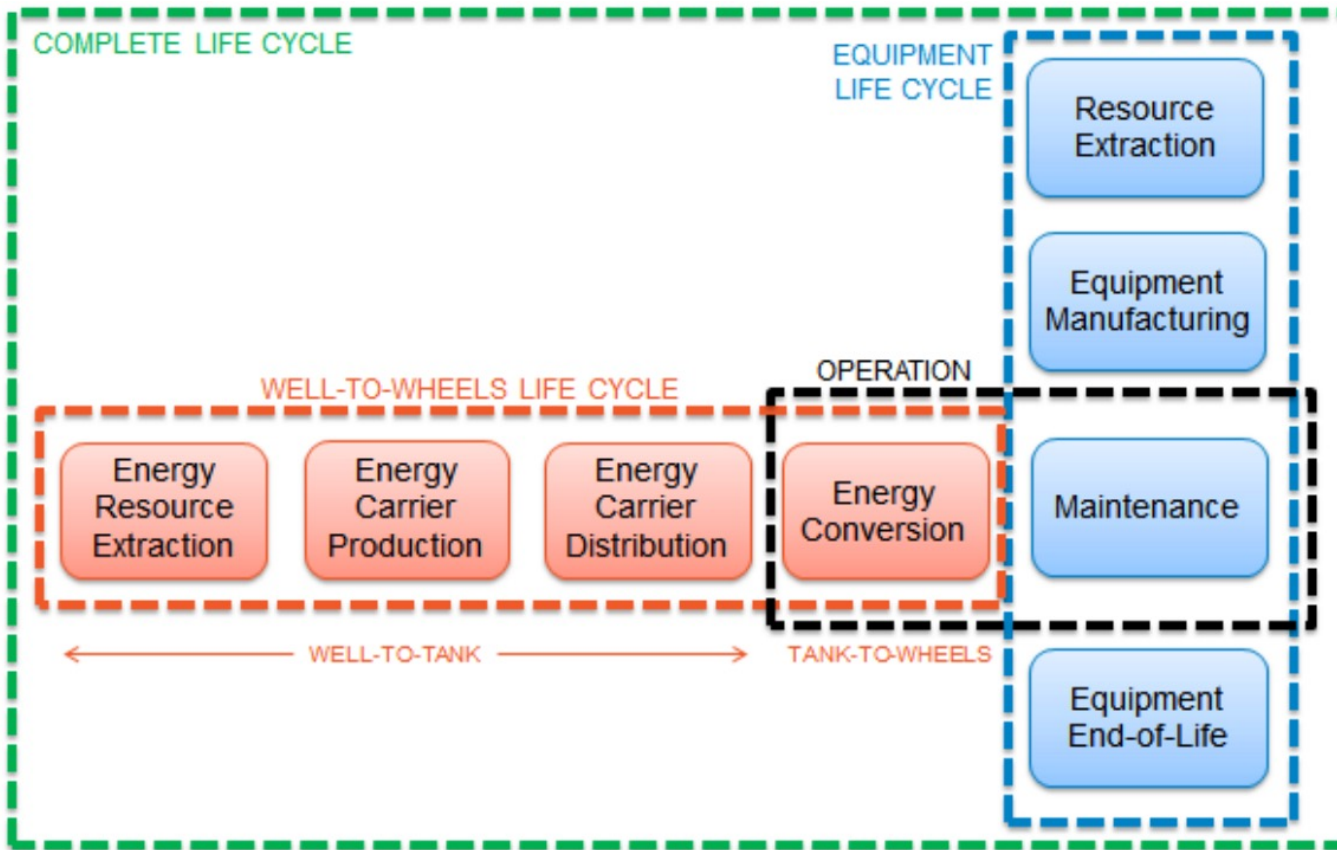


Life Cycle Analysis

- A life cycle analysis looks at each stage of a product to determine a metric (i.e., GHG emissions)
- Manufacturing, operation, decommissioning, etc. are assessed.



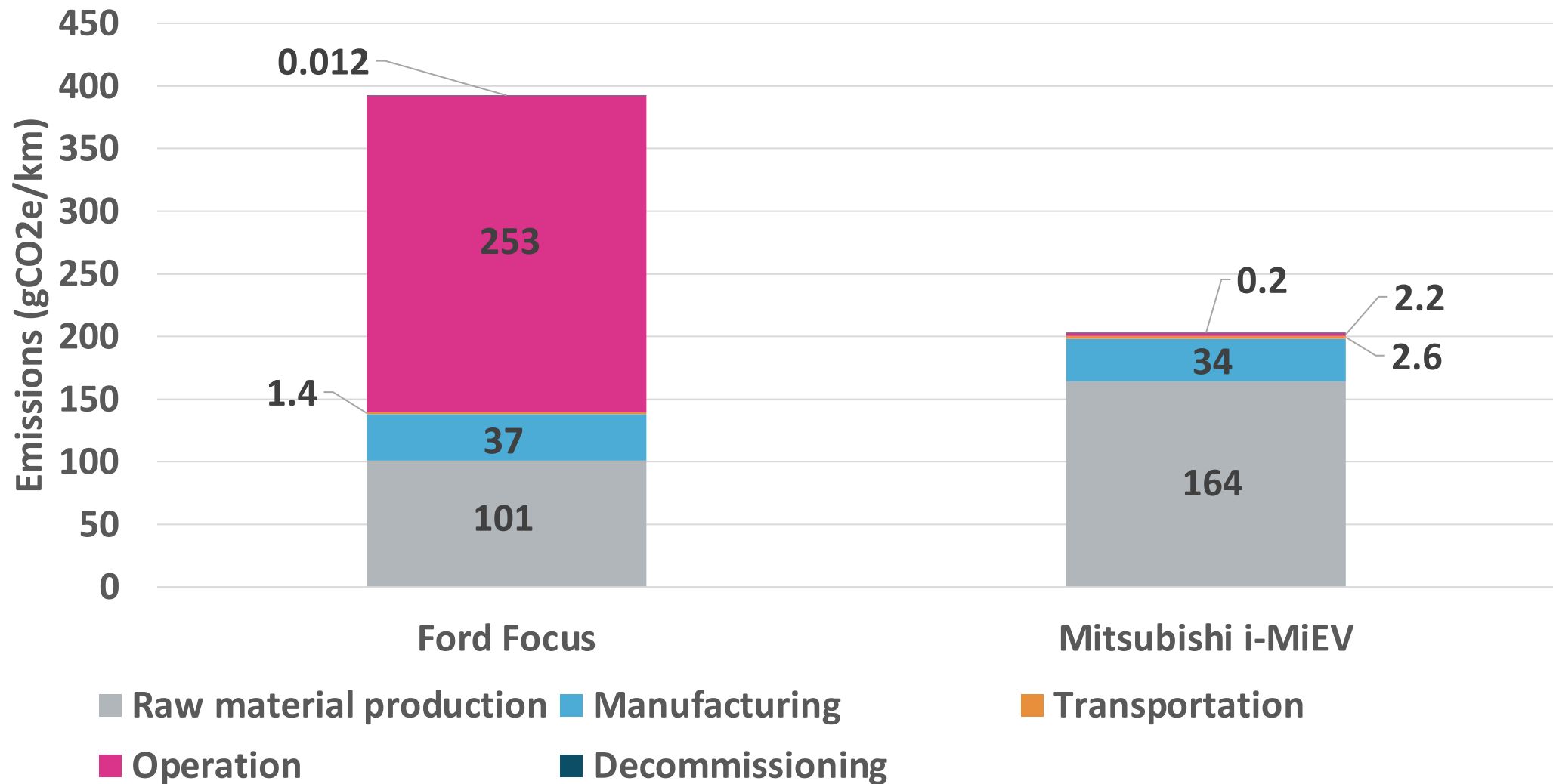
University of British Columbia, Life Cycle Analysis, 2018



- Compared the Ford Focus (ICE) and the Mitsubishi i-MiEV (EV)
- Both had 150,000 km
- Emissions due to raw material production, vehicle manufacture, transportation, operation and decommissioning were considered
- Results: EV emissions are lower within the car's life
 - Ford focus emissions: 392.4 g CO₂eq/km
 - Mitsubishi i-MiEV: 203.0 g CO₂eq/km

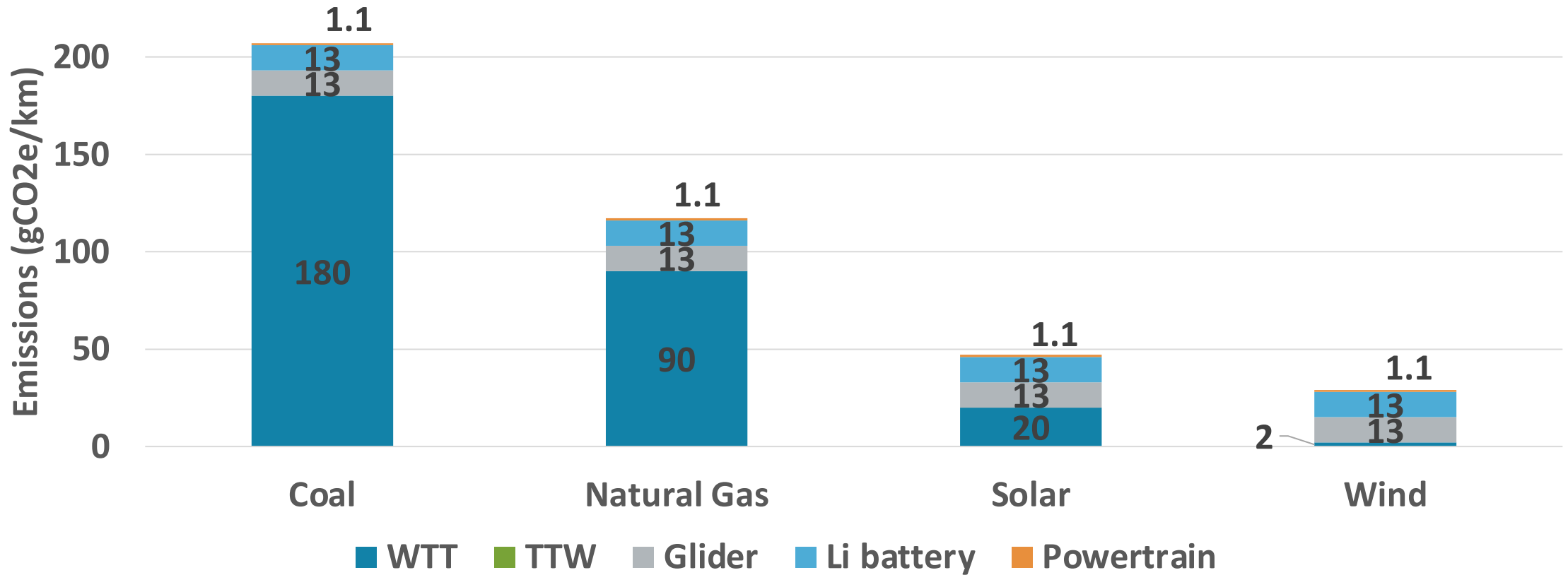


UBC Life Cycle Analysis - Results



Transport & Environment Life Cycle Analysis

Energy Source Wheel-to-Tank Emissions



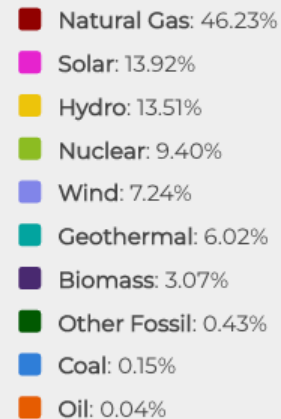
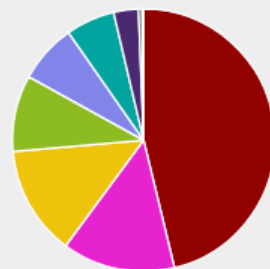
WTT: Well-to-Tank
TTW: Tank-to-Wheel

Electricity Source Impacts on Emissions - USA

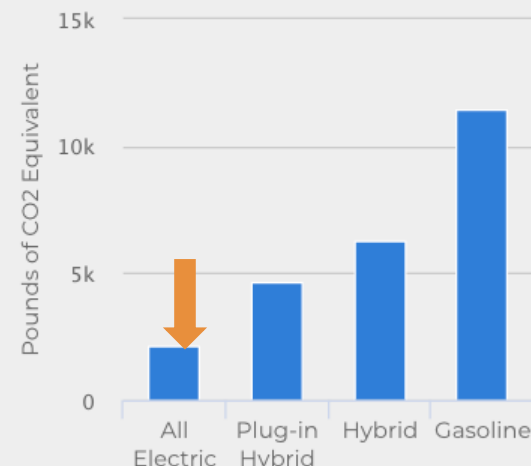
- The emissions of an EV is partially dependent on the electricity source
- Emissions vary based on if electricity comes from renewable energy or from coal
- For the three states shown below, all electric is still lower emissions than gasoline powered vehicles for annual emissions.

State Averages for California

Electricity Sources

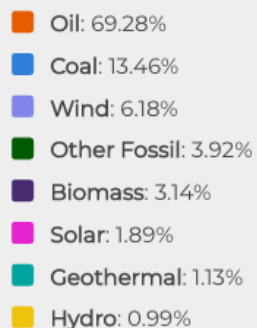
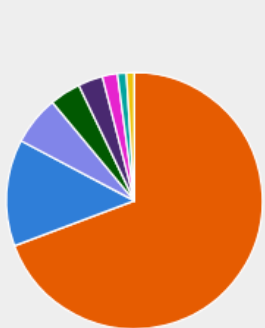


Annual Emissions per Vehicle

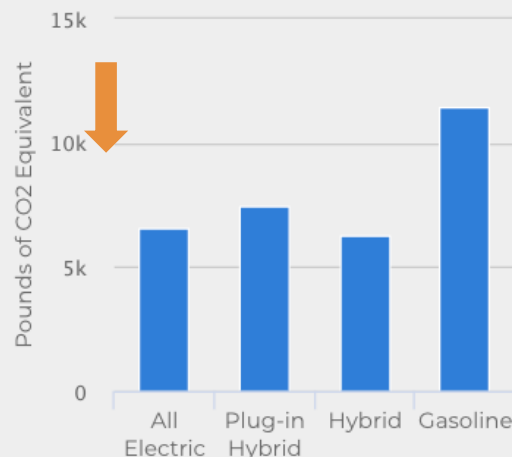


State Averages for Hawaii

Electricity Sources

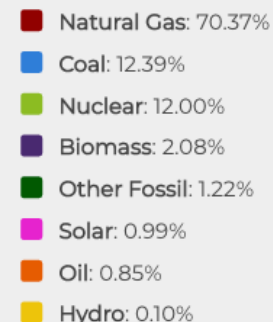
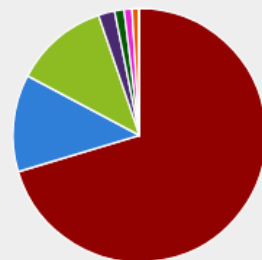


Annual Emissions per Vehicle

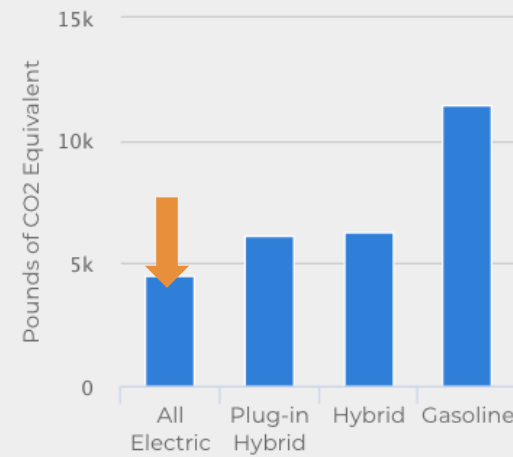


State Averages for Florida

Electricity Sources

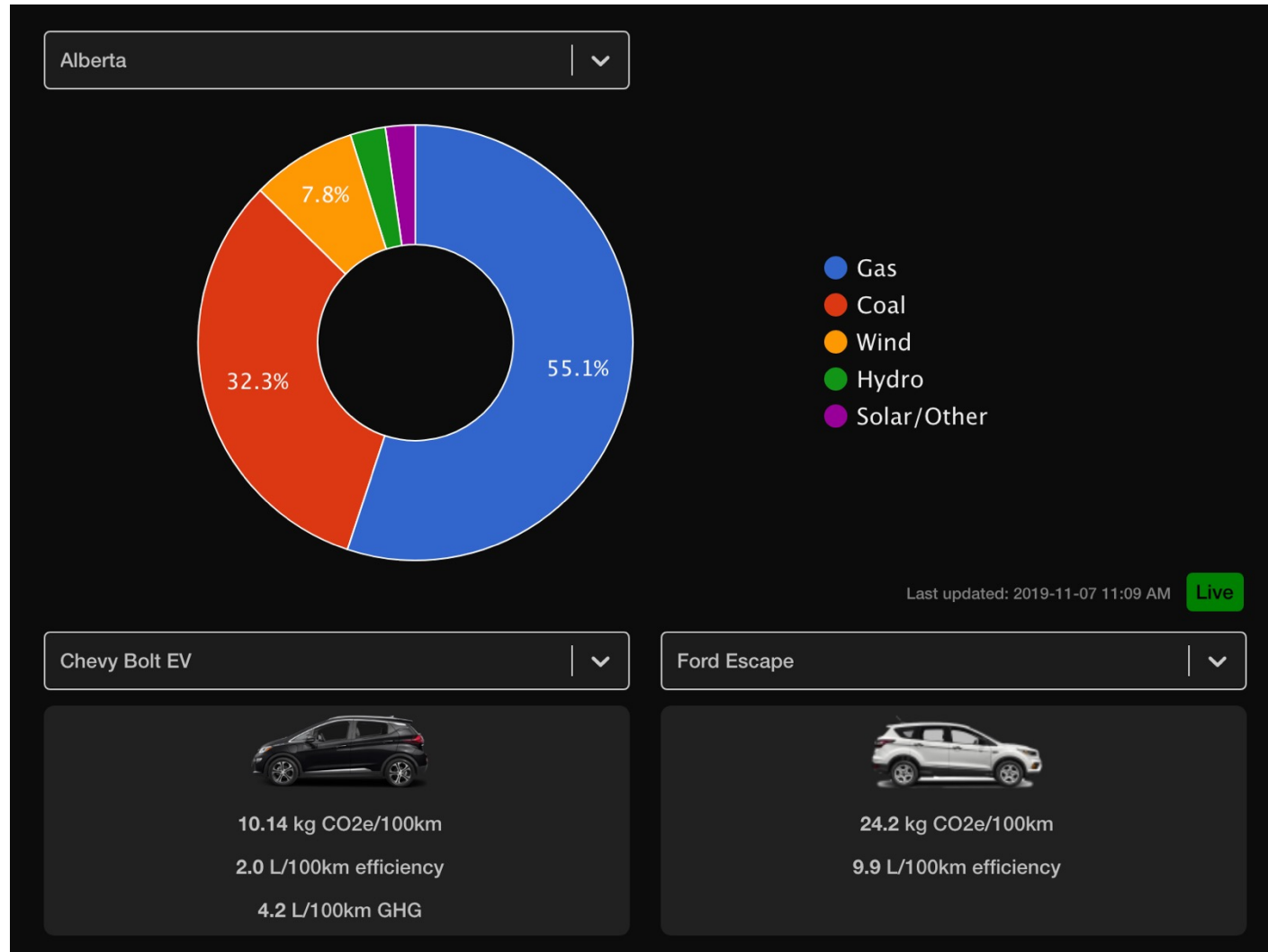


Annual Emissions per Vehicle

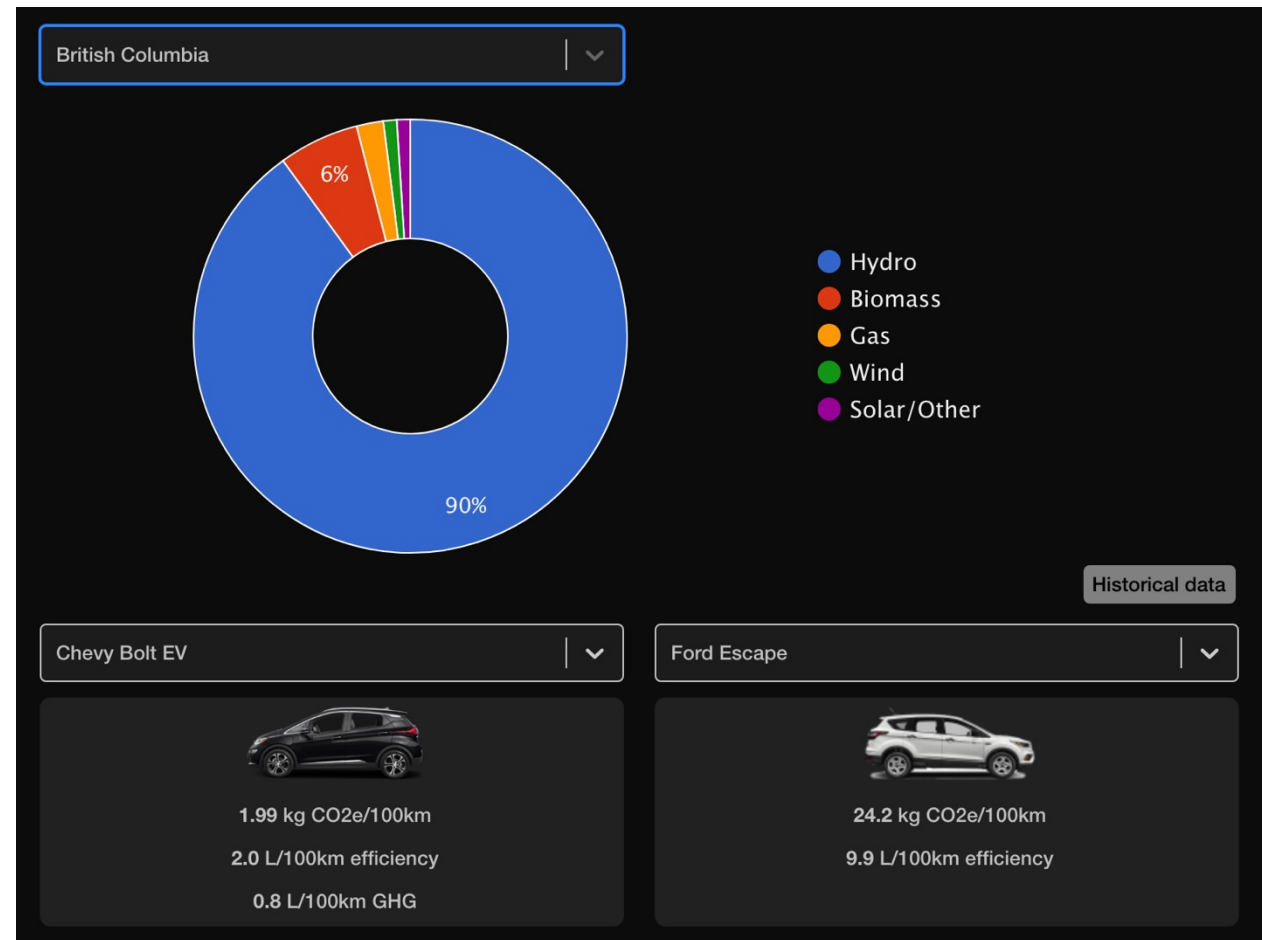
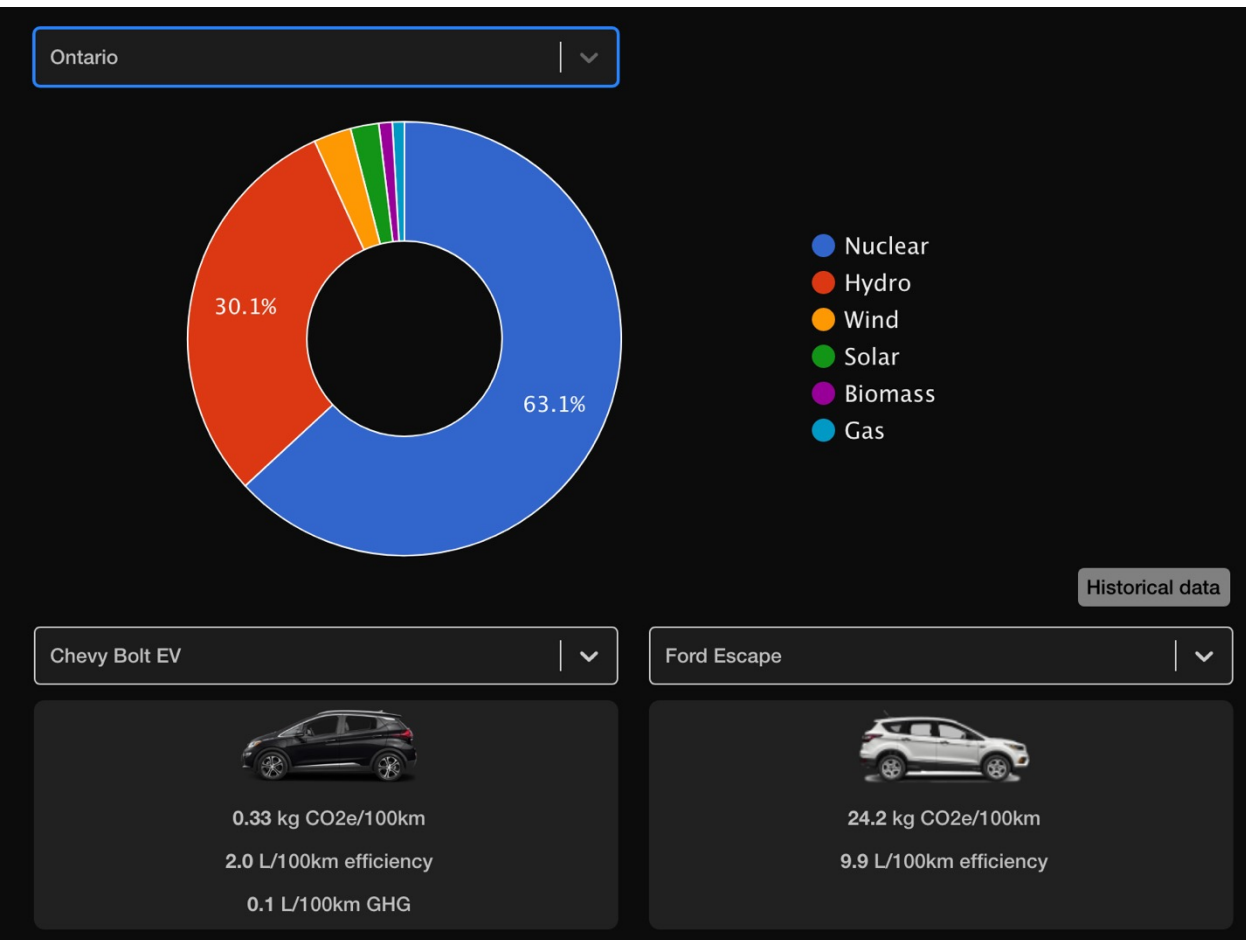


1 pound = 453 grams

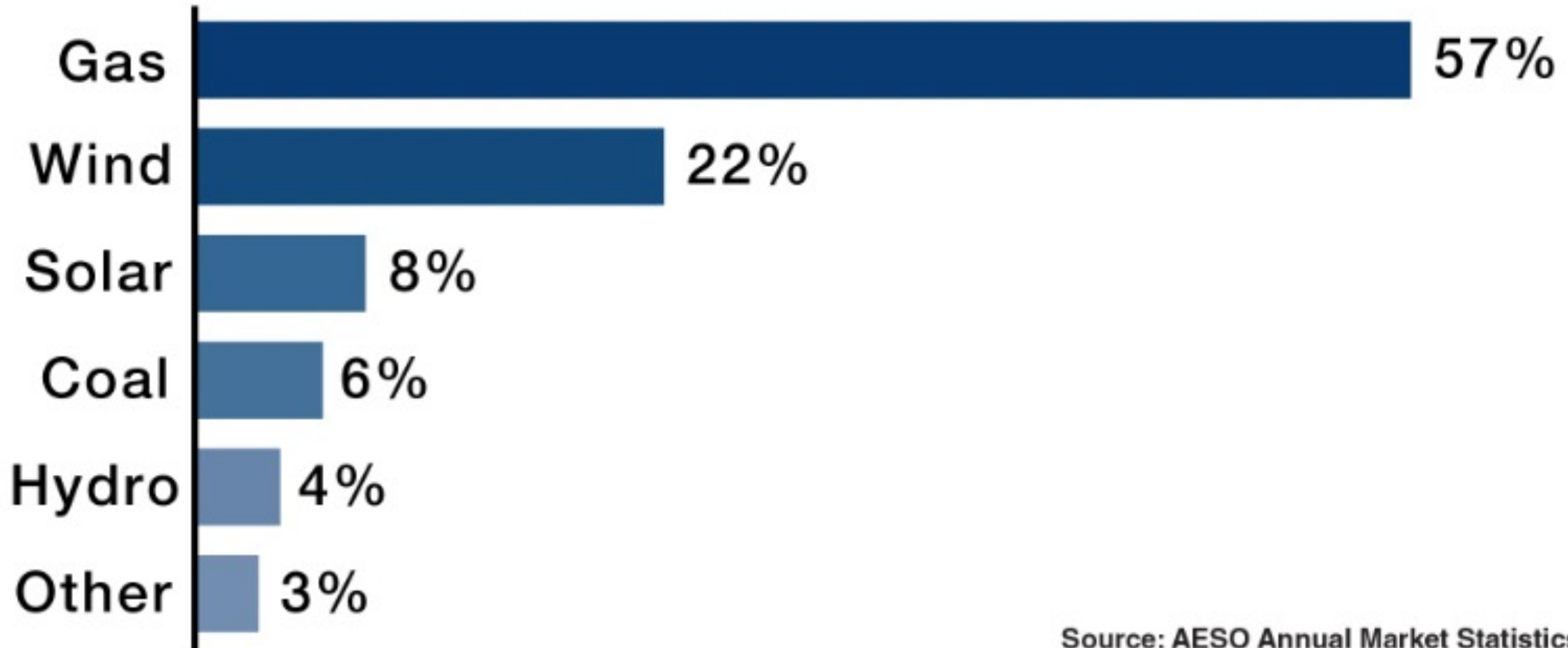
Electricity Source Impacts on Emissions - Alberta



Electricity Source Impacts on Emissions – Ontario, BC



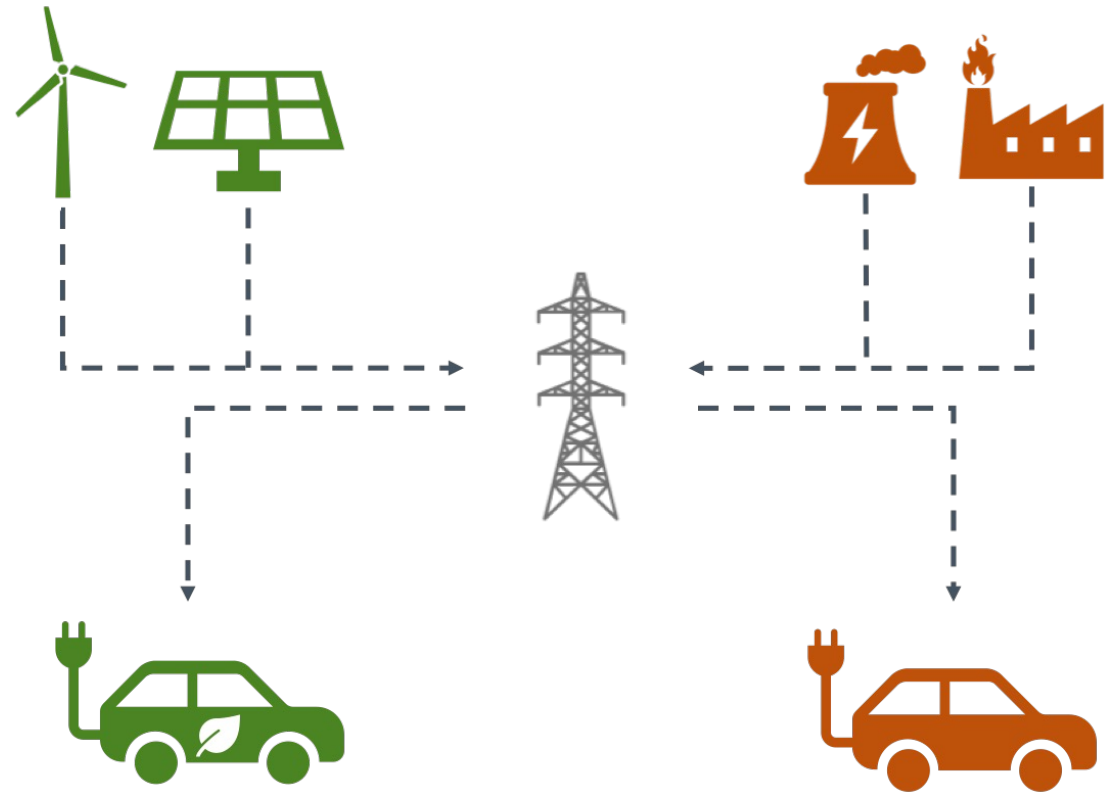
Sources of Electricity in Alberta - 2023



Source: AESO Annual Market Statistics Datafile

'Green' Electricity Suppliers

- Some Alberta Energy Suppliers offer green incentives to their customers. Suppliers include:
 - ATCO Energy
 - 25-100% of your electricity can be sourced from renewable energy
 - Just Energy
 - You can have access to renewable energy and renewable energy credits
 - ENMAX
 - Businesses have the option to add renewable energy certificates (RECs) to their energy plans and reduce their overall carbon footprint
 - Hudson Energy
 - Energy options can supplement traditional sources of energy
- YOU! You can install solar PV on your roof and charge your own EV.





Thank you!

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