



PEEL

People for Energy and
Environmental Literacy

Electric Vehicle Greenhouse Gas (GHG) Emissions

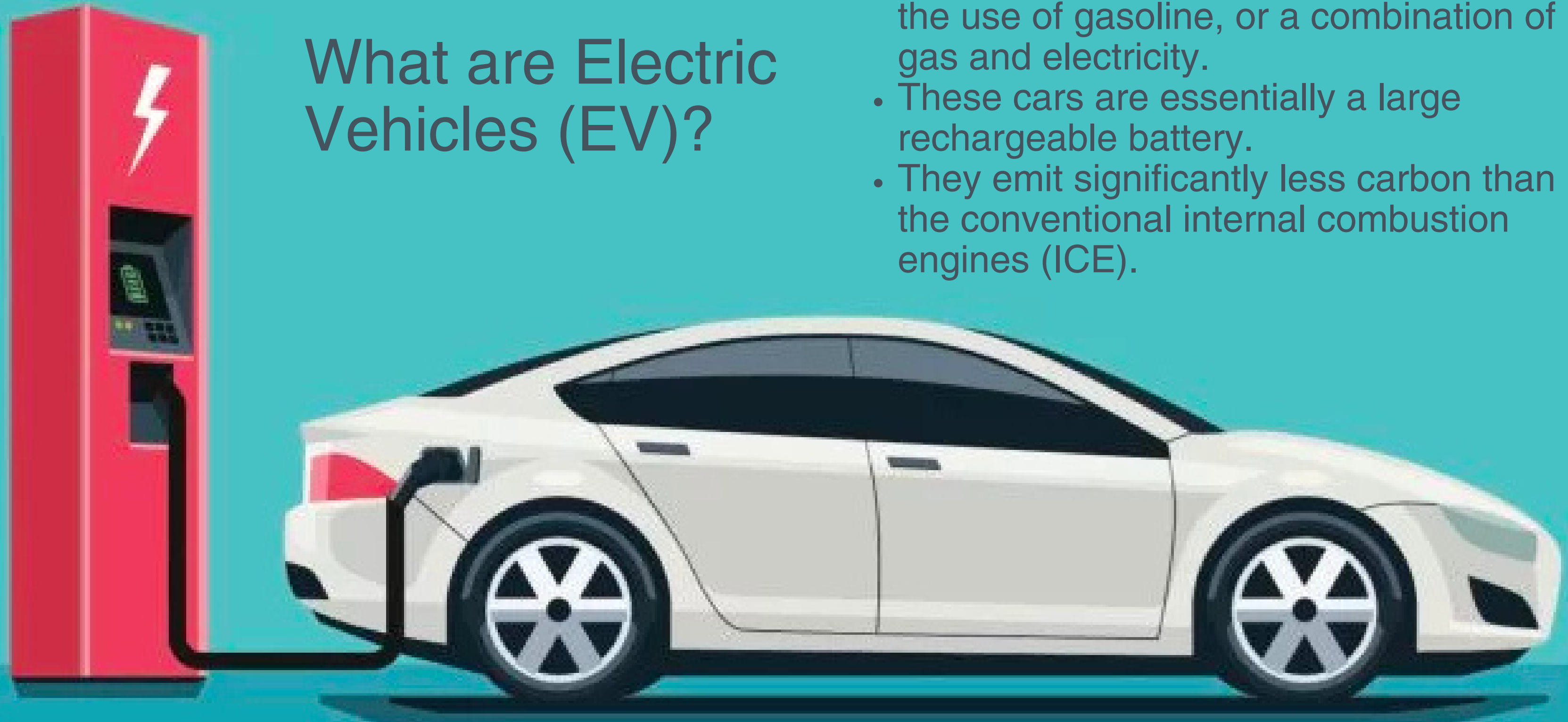
Which greenhouse gas emissions are associated with electric vehicles?

Recommended for grades 7 – 12

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What are Electric Vehicles (EV)?

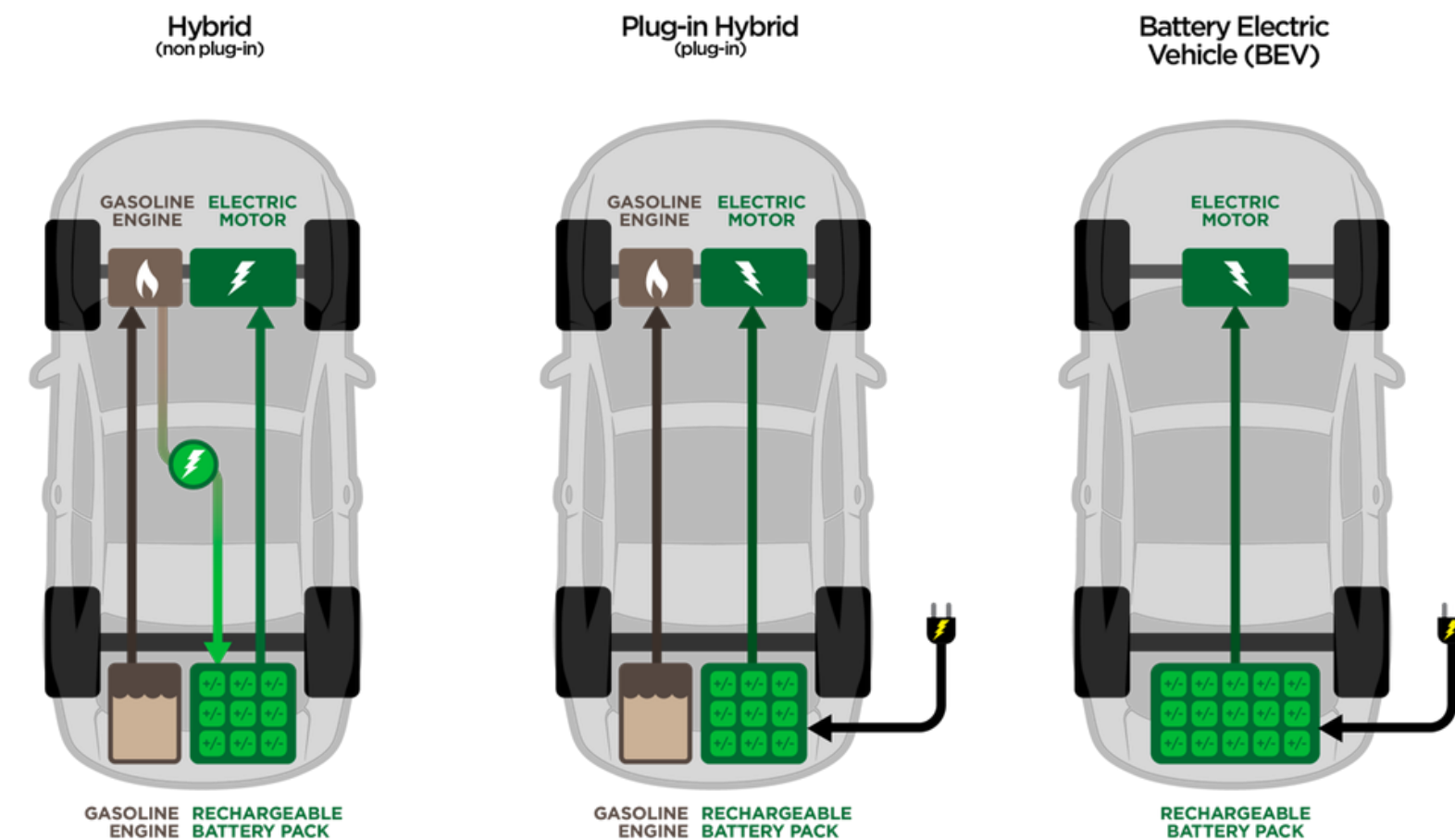
- An electric vehicle is a car that operates on an **electric motor** without the use of gasoline, or a combination of gas and electricity.
- These cars are essentially a large rechargeable battery.
- They emit significantly less carbon than the conventional internal combustion engines (ICE).



Source: www.greetechmedia.com

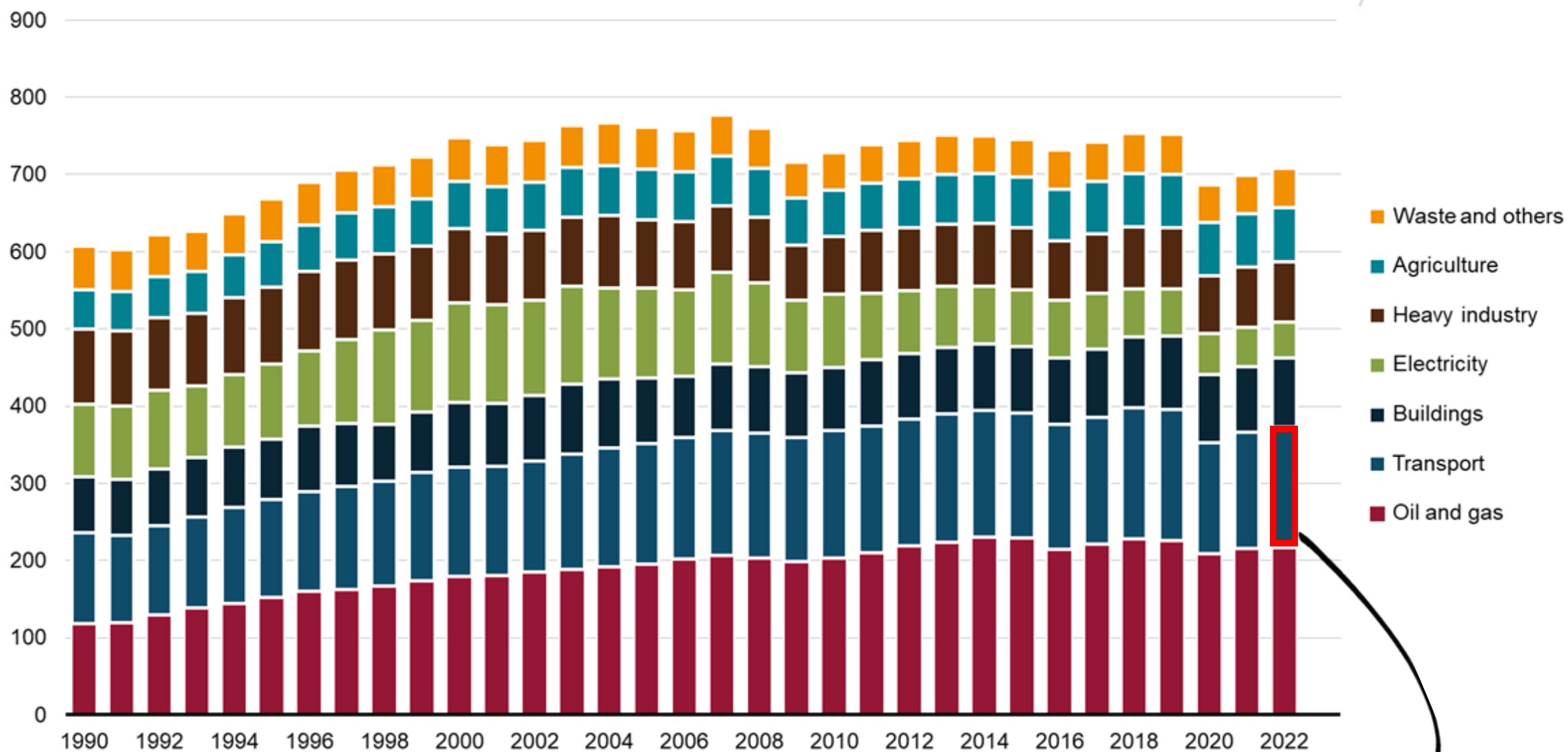
Types of electric vehicles

- **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)

www.canada.ca/environmental-indicators

- 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?

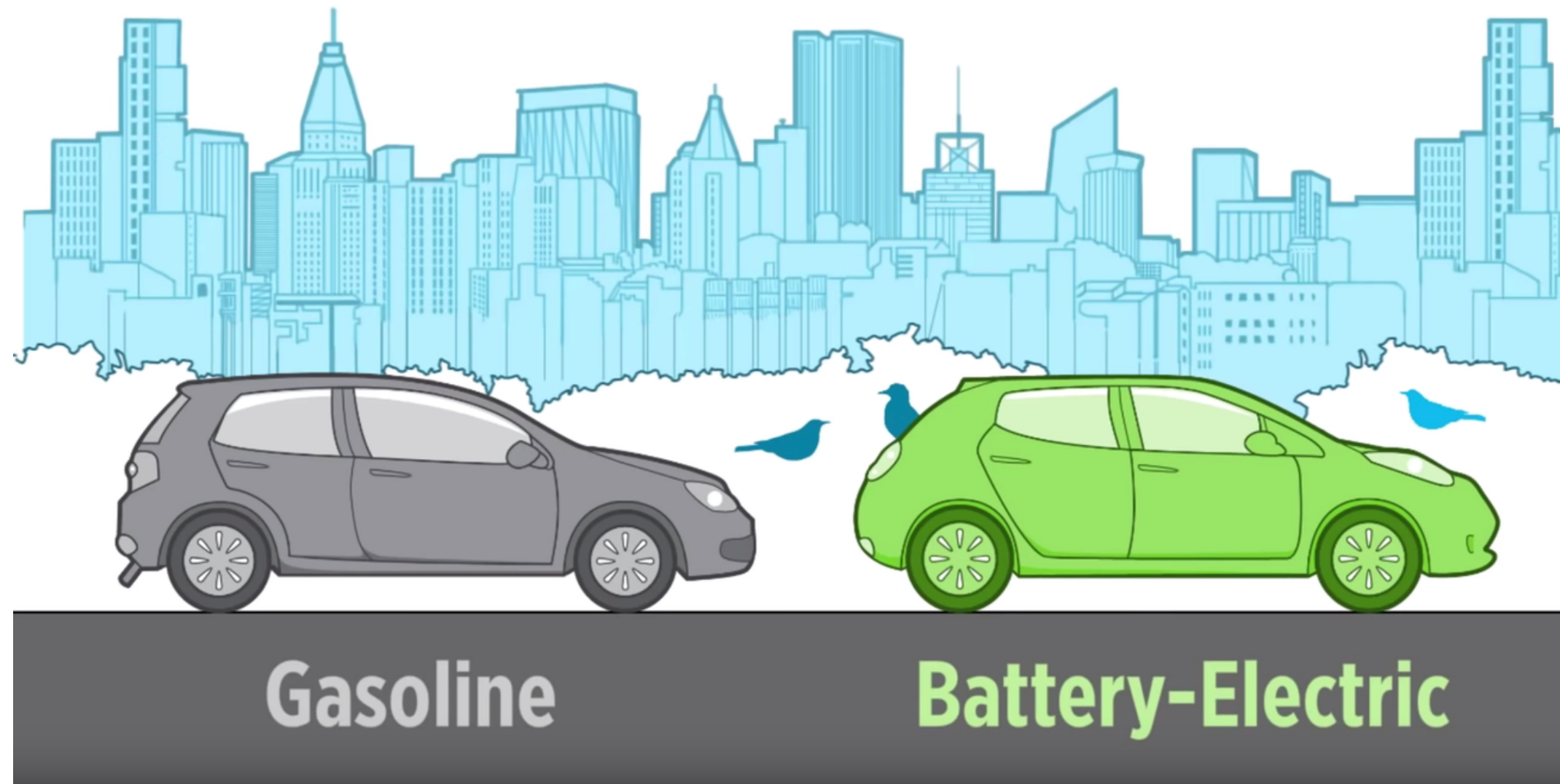
- We must look at the full picture to assess if an EV is green
- Cradle to grave: from sourcing of materials, to manufacturing through to decommissioning
- We must conduct a **life cycle analysis**

ELECTRIC CARS ARE CLEANER FROM CRADLE TO GRAVE



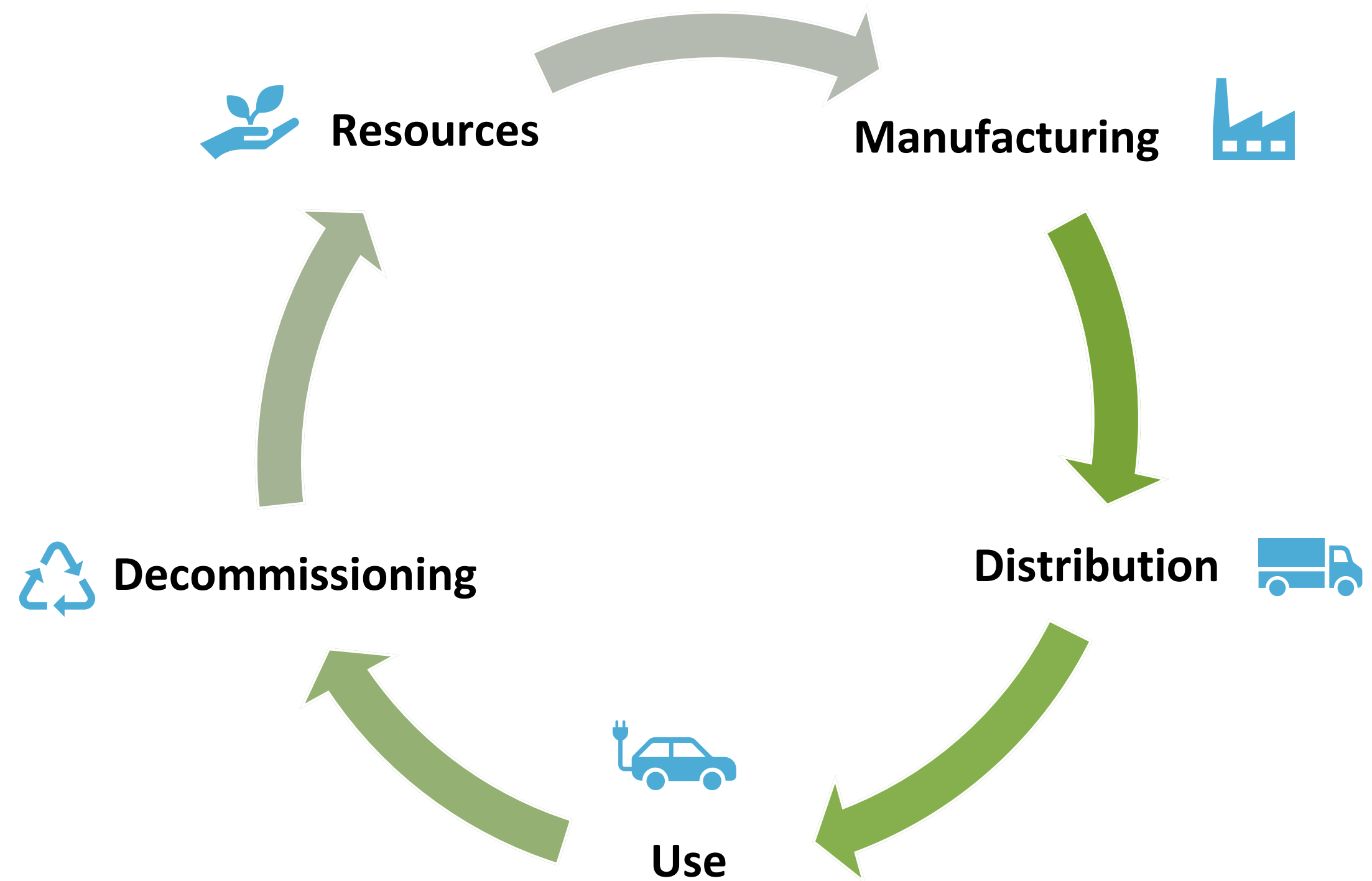
Video on Car Emissions

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

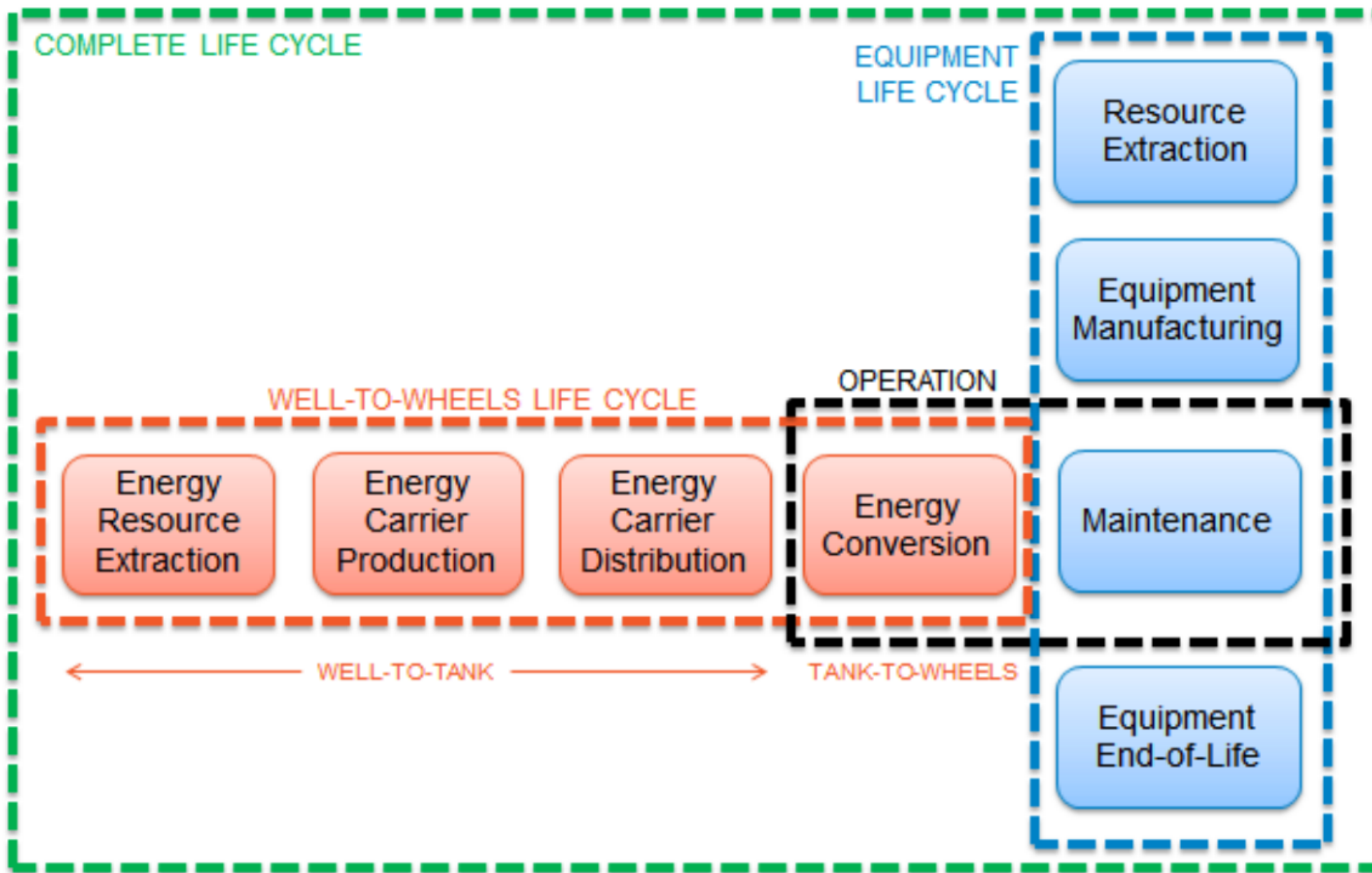


Life Cycle Analysis

- 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.



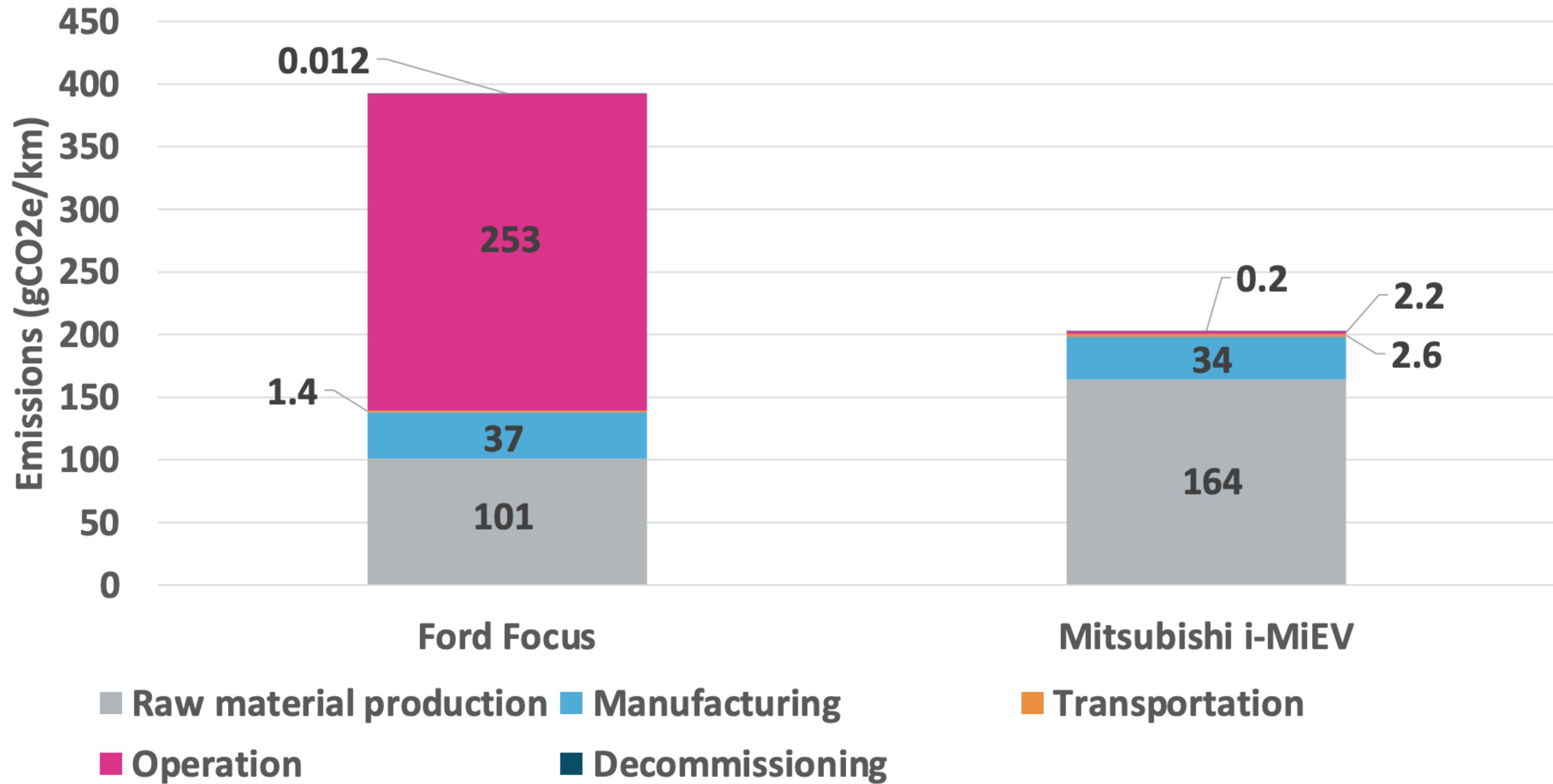
University of British Columbia, Life Cycle Analysis, 2018



- 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

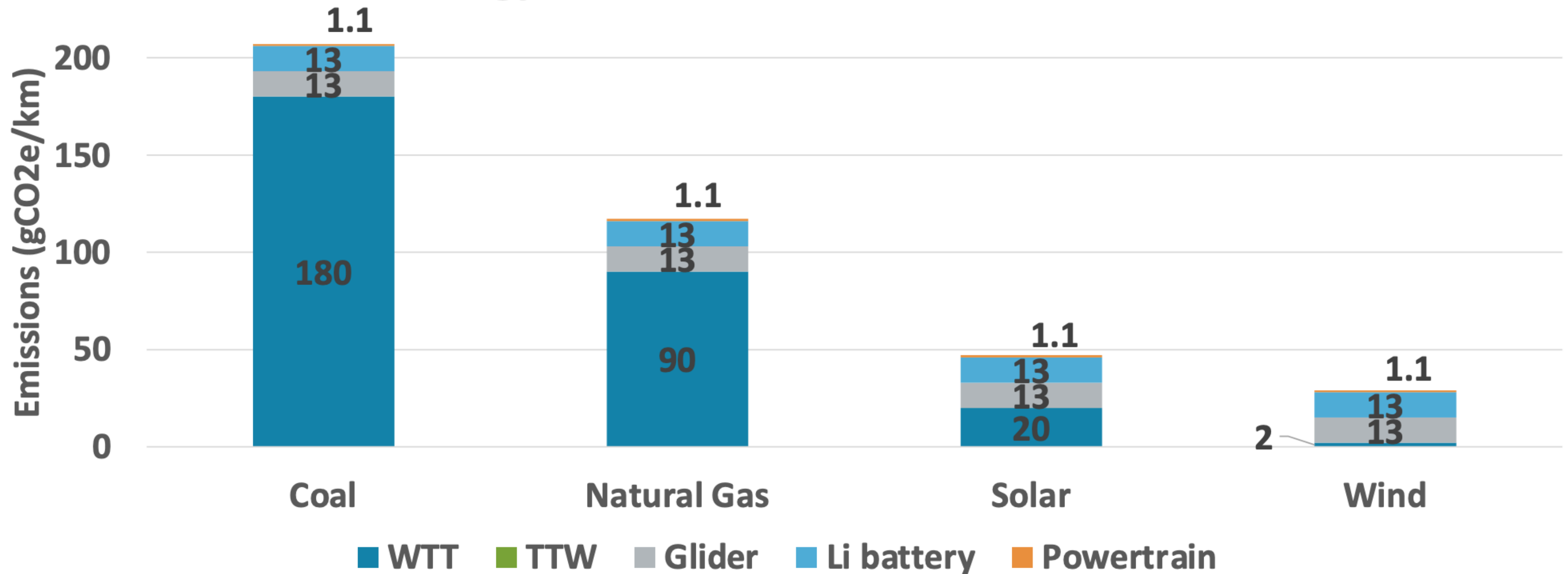


UBC Life Cycle Analysis - Results



Transport & Environment Life Cycle Analysis

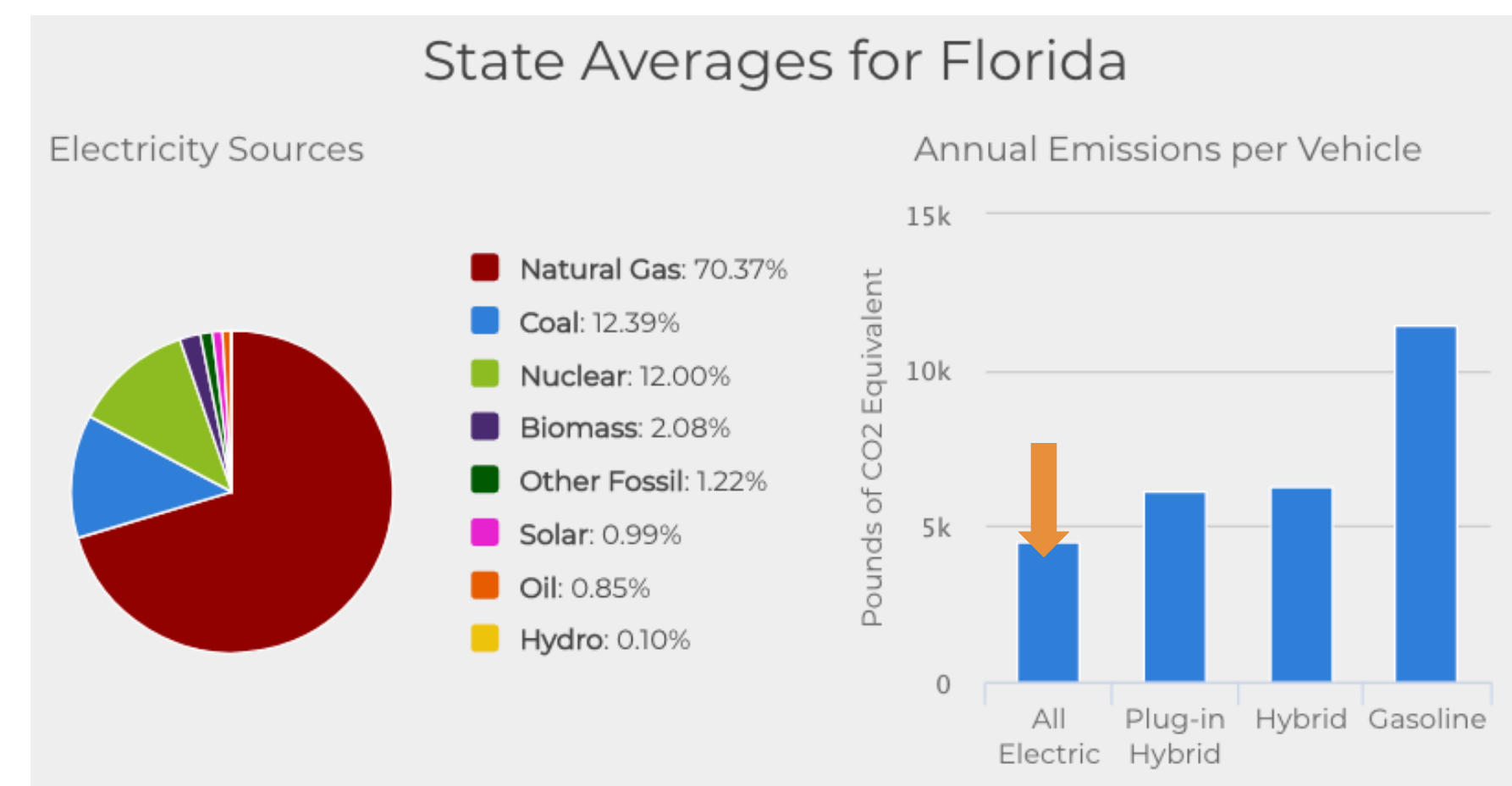
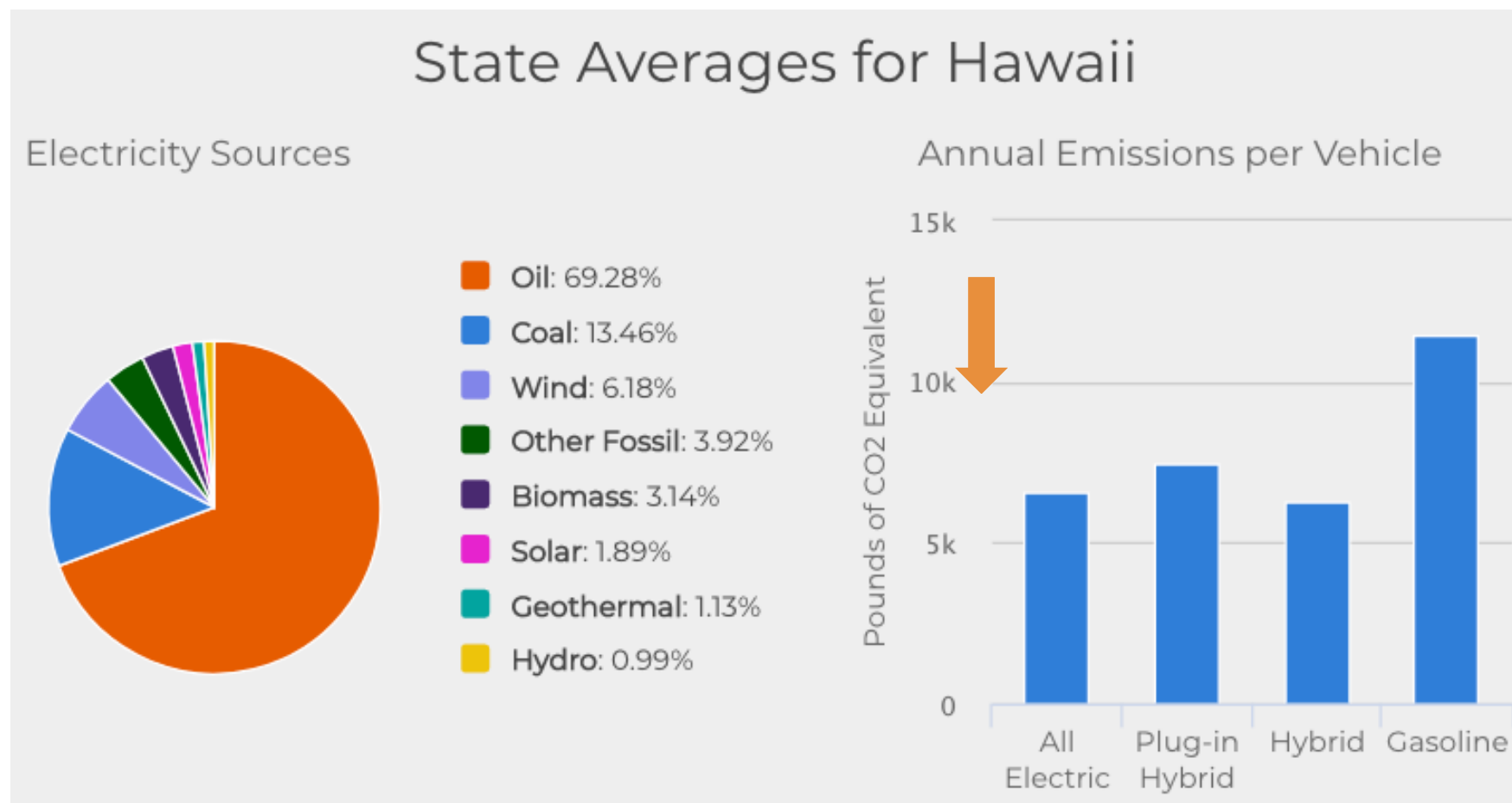
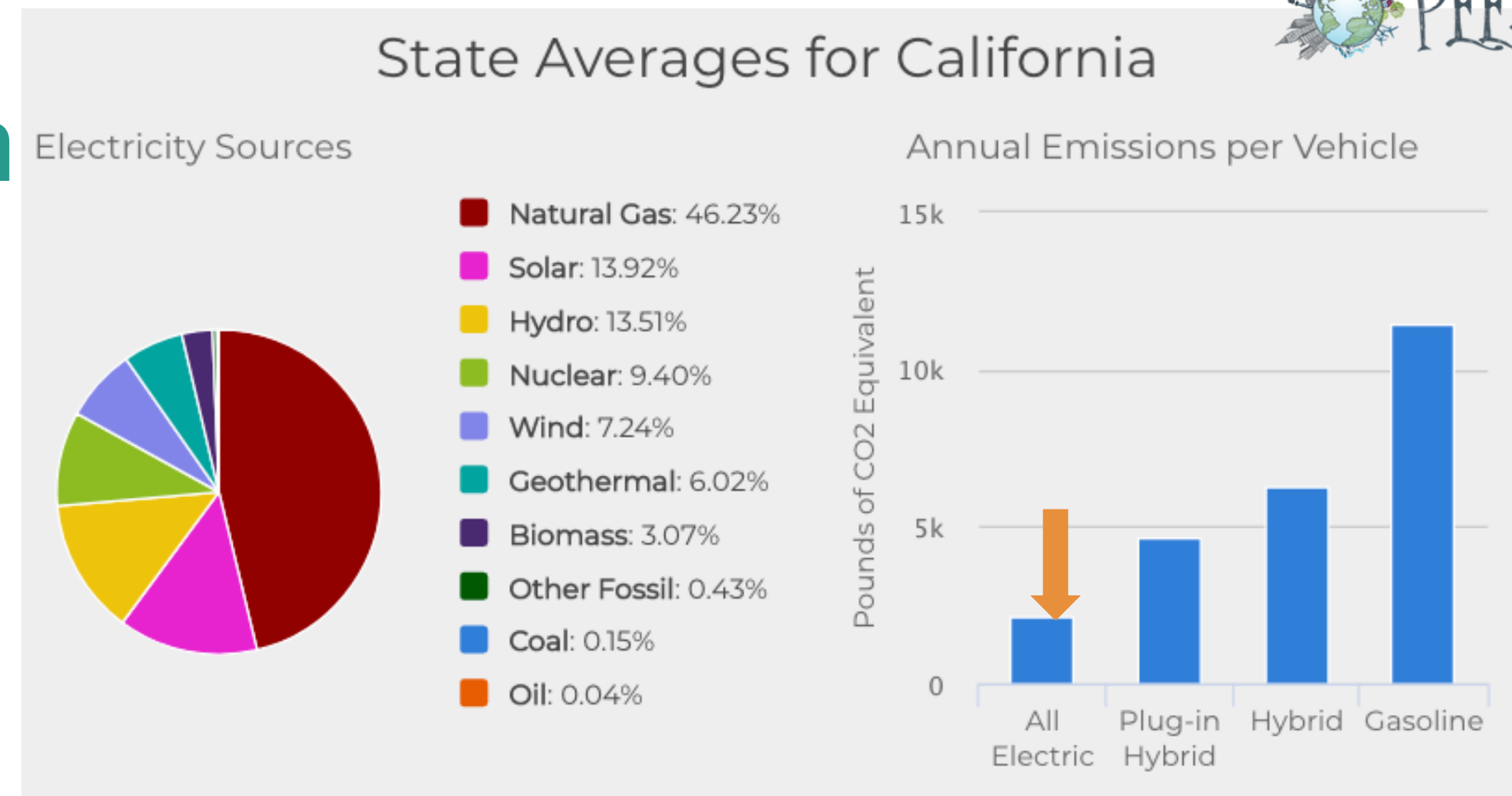
Energy Source Wheel-to-Tank Emissions



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

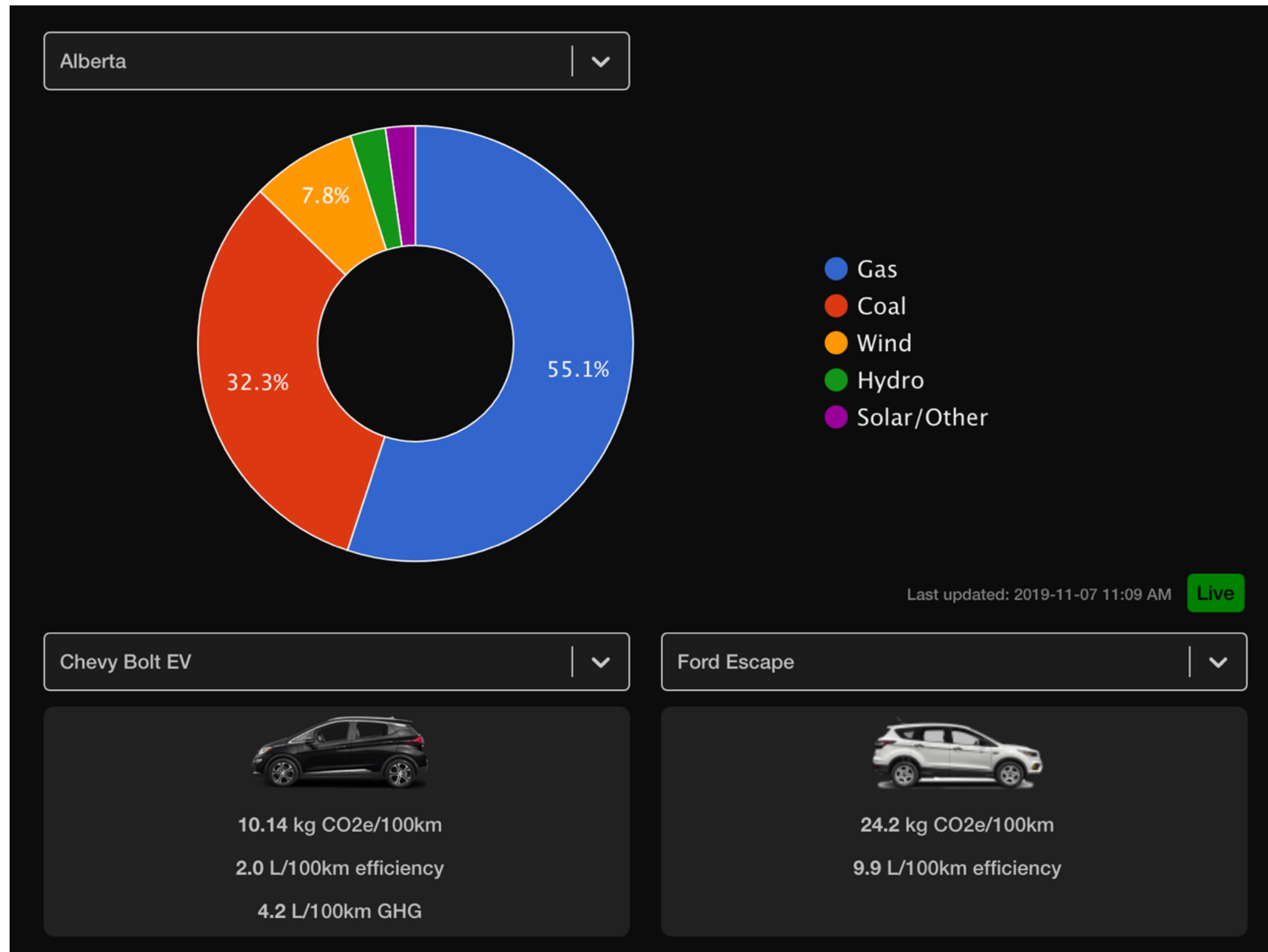
Electricity Source Impacts on Emissions - USA

- 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.

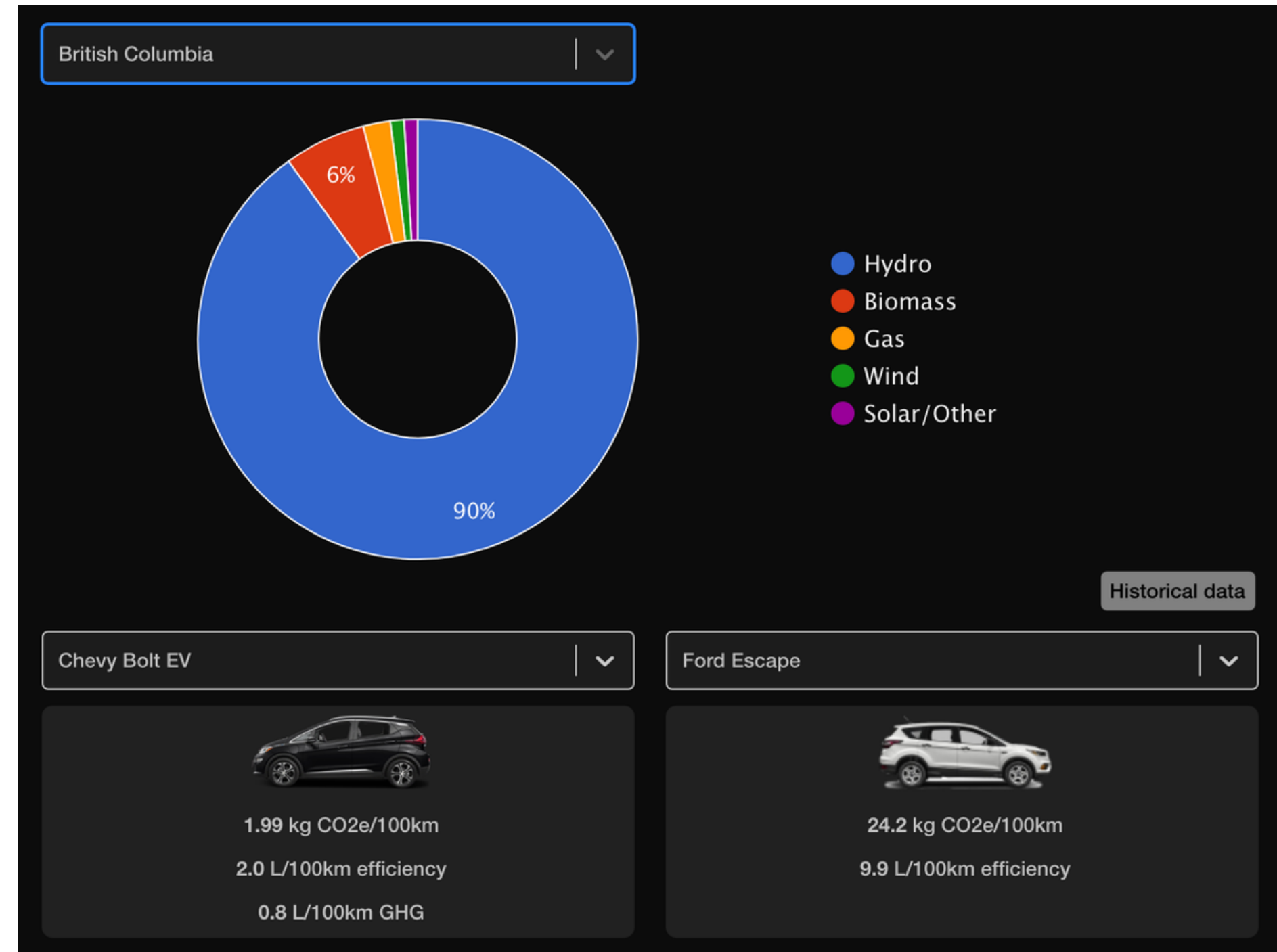
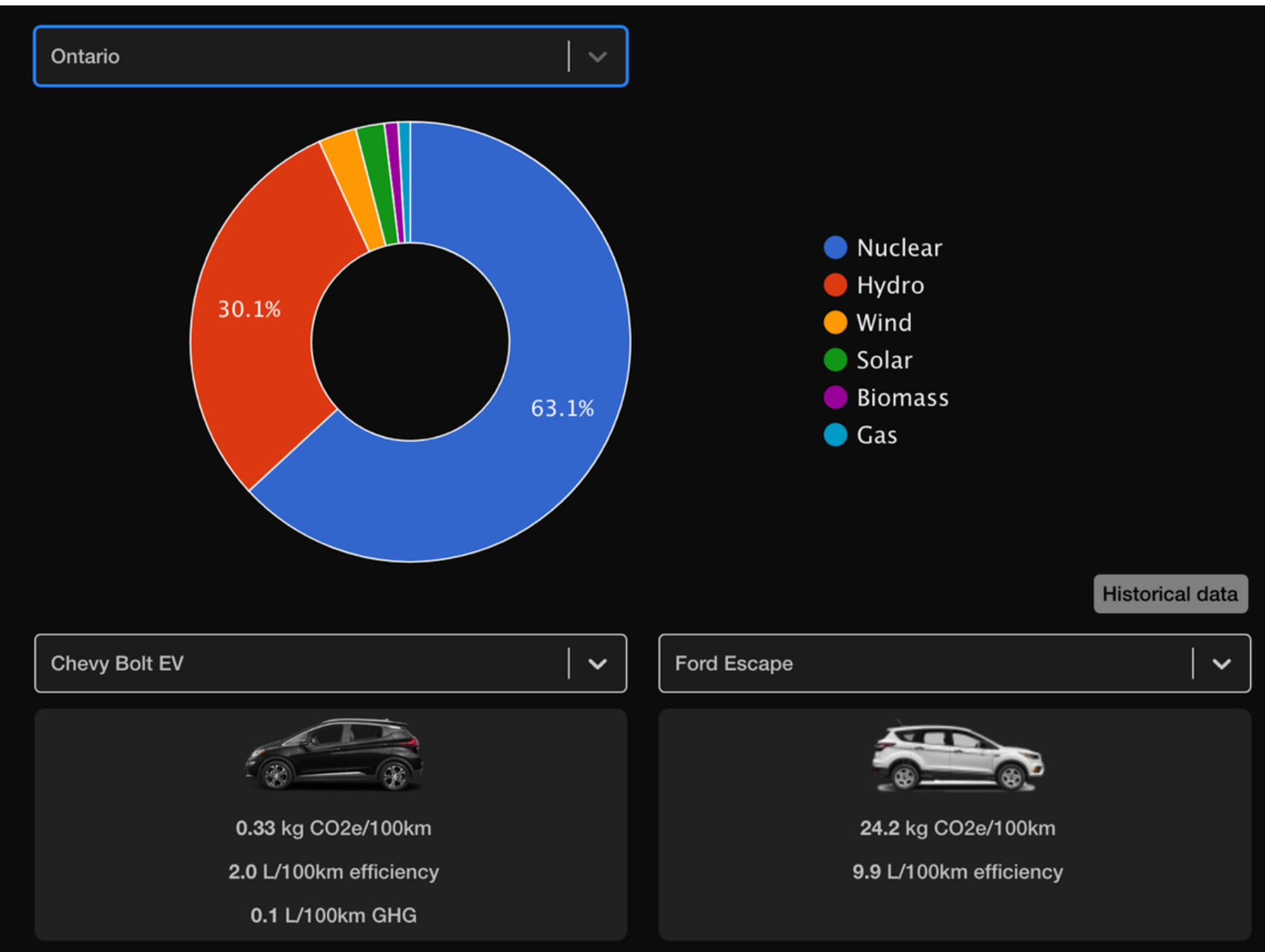


1 pound = 453 grams

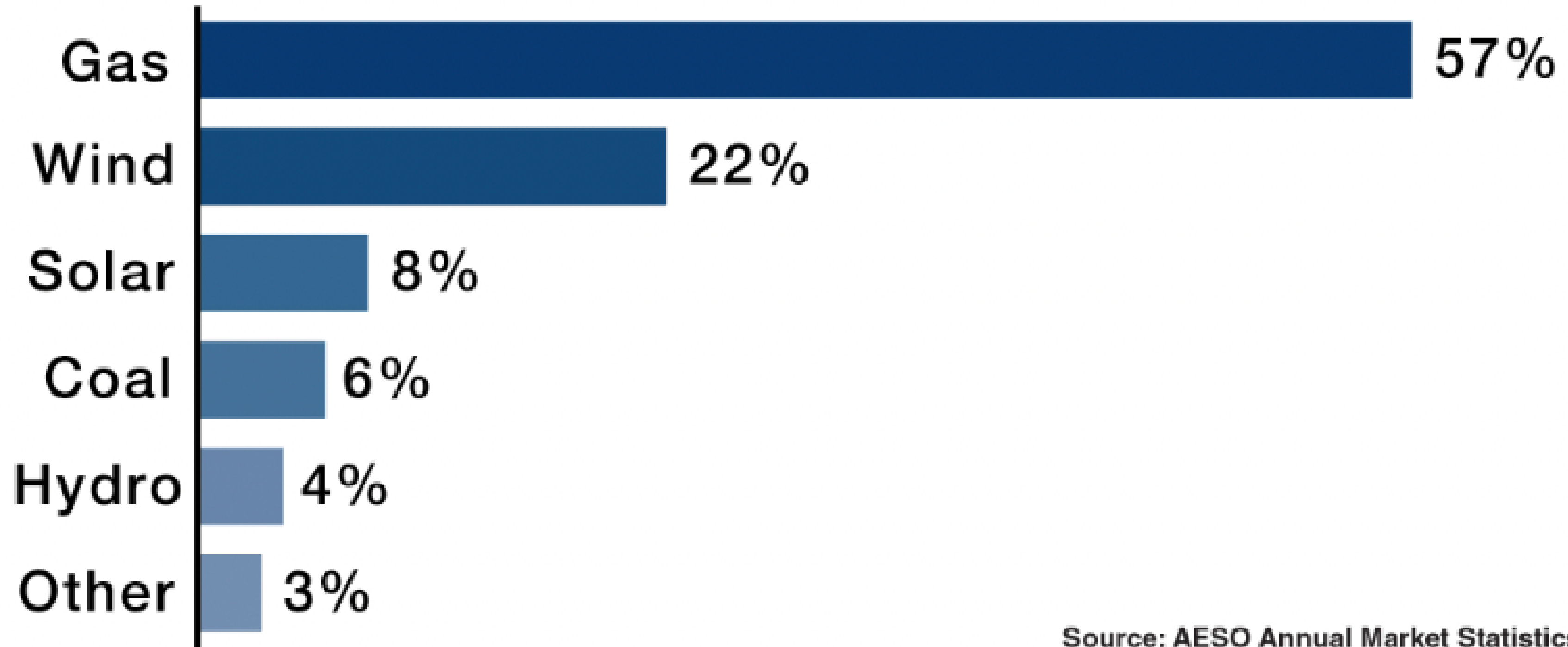
Electricity Source Impacts on Emissions - Alberta



Electricity Source Impacts on Emissions – Ontario, BC



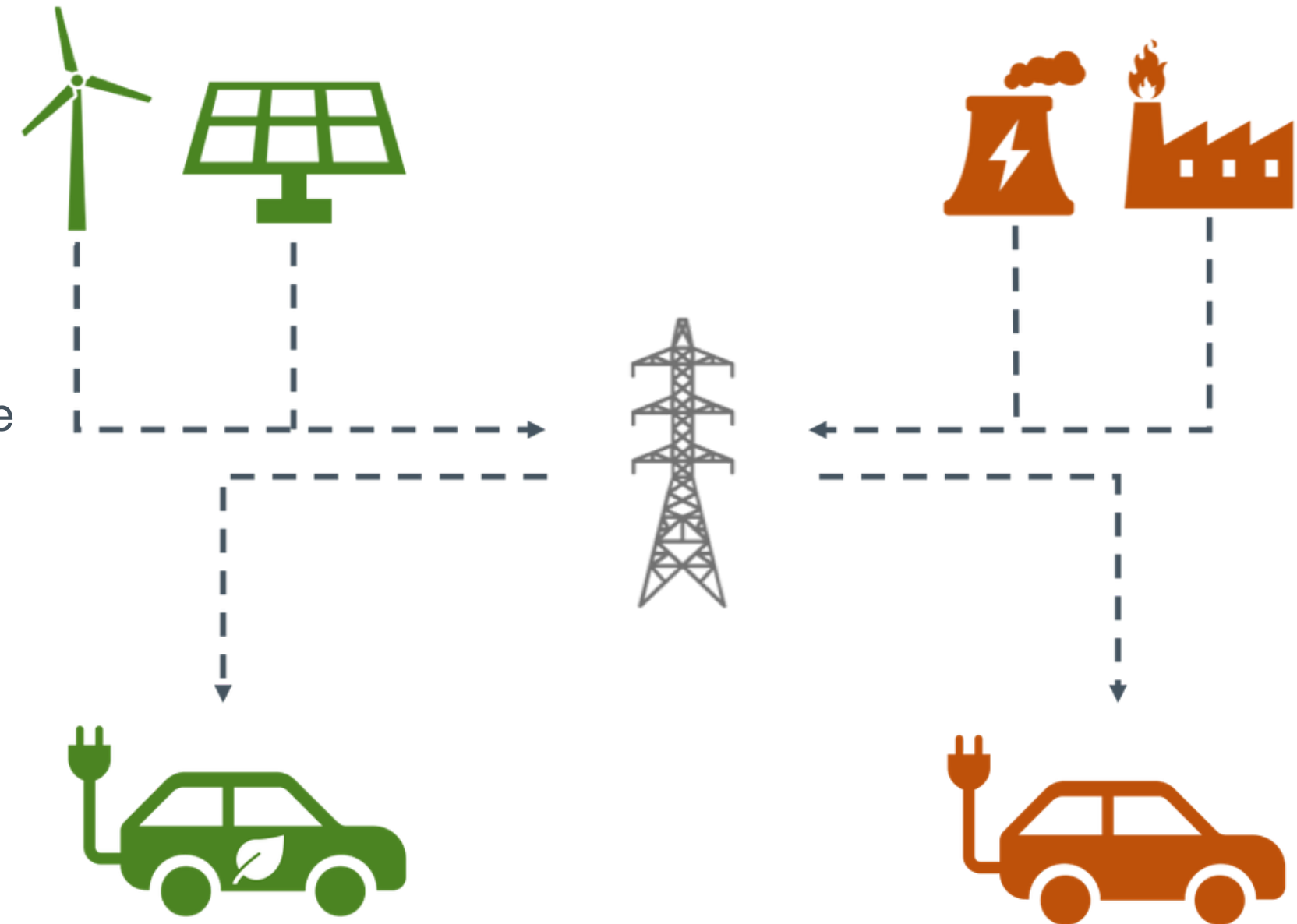
Sources of Electricity in Alberta - 2023



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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