A RECENT PROFILE OF MOTOR VEHICLE CHARACTERISTICS IN METROPOLITAN WASHINGTON

Analysis of 2020 Vehicle Registration Data

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Presentation Purpose – Why Now?

- Vehicle registration data, a.k.a. vehicle identification number (VIN) data, provide information about the composition of the current motor vehicle fleet in metropolitan Washington and are used to create key inputs for COG's mobile emissions model (MOVES)
- TPB staff periodically obtains vehicle registration data from departments of motor vehicles through the state air agencies and COG's Dept. of Environmental Programs (DEP) to ensure that MOVES inputs are current for the purposes of emissions forecasting
- Recently obtained 2020 vehicle registration data will be used for:
  - Upcoming air quality conformity analysis of the 2022 Update to the Visualize 2045 Long-Range Transportation Plan (ozone-season pollutants),
  - Greenhouse gas (GHG) analyses, and
  - Upcoming State Implementation Plan (SIP) activities related to the 2015 National Ambient Air Quality Standards (NAAQS) for ozone

Presentation Outline

- Background
  - Why are Vehicle Characteristics Important?
  - What are Vehicle Registration Data?
  - History of Vehicle Registration Data Analysis
  - Study Area
- Analysis of 2020 Data
  - National COVID-19 Pandemic Impacts
  - Regional Trends
- Key Findings
- Next Steps

Background

Why are Vehicle Characteristics Important?

- The **size, composition** and **age** of the vehicle fleet are important determinants of mobile source emissions calculations
- The current mobile emissions model (MOVES2014b) requires two key vehicle-related inputs to be specified by jurisdiction, obtained from vehicle registration data:
  - The number of vehicles by 13 vehicle classes; and
  - The age distribution by vehicle class

What are Vehicle Registration Data?

- A complete inventory of private, public, and commercial registered motor vehicles maintained by departments of motor vehicles (DMVs) at a specific point in time
- Data are obtained for specific jurisdictions that comprise the Ozone Nonattainment Area
- Registration data can be viewed as a list of Vehicle Identification Numbers (or “VINs”)

What are Vehicle Identification Numbers (VINs)?

- Can be viewed as the “fingerprint” of each vehicle
- A standardized 17-character code that indicates the characteristics of each vehicle including manufacturer, model year, engine type, weight, vehicle type, and fuel type
- VINs were standardized in 1981 by the National Highway Traffic Safety Administration (NHTSA)
- *VIN data analysis requires substantial staff effort:*
  - *data cleaning;*
  - *decoding; and*
  - *software and technical analysis.*

History of TPB Staff's Vehicle Registration Data Analysis

- Vehicle registration data have been collected and analyzed since 2008
- Previous registration data collections corresponded to:
  - July 1, 2008
  - July 1, 2011
  - July 1, 2014
  - December 31, 2016
- Current data presented today:
  - December 31, 2020 for Maryland and Virginia
  - July 1, 2020 for District of Columbia

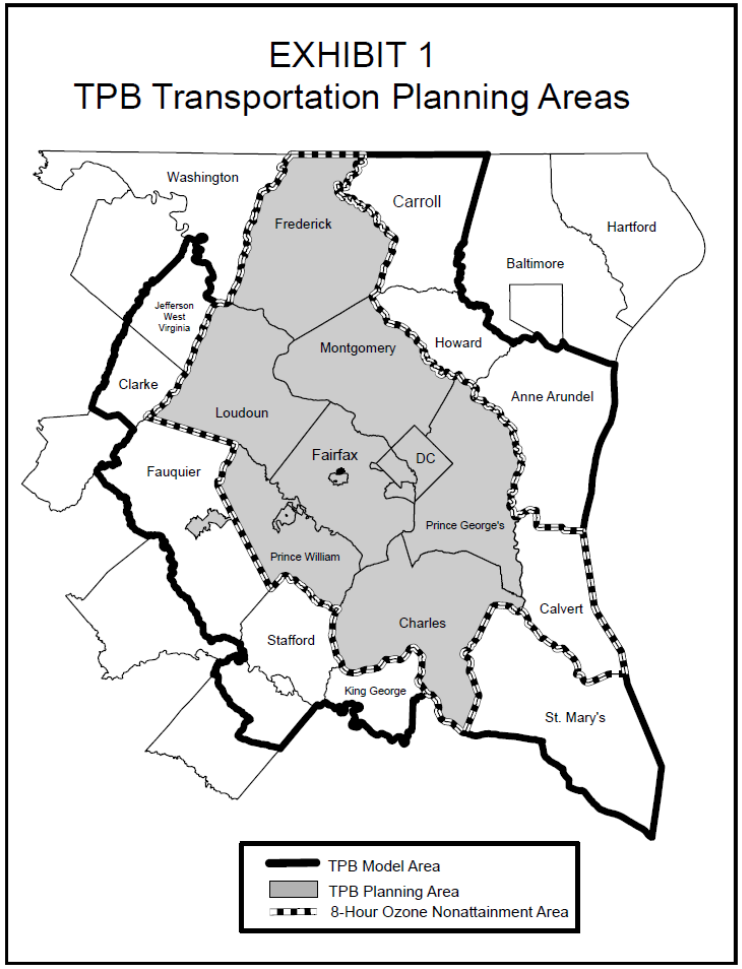
History of TPB Staff's Vehicle Registration Data Analysis (Cont.)

- Some of the state air agencies have adopted a year-end data collection cycle as opposed to a July 1 data collection cycle that had been implemented prior to 2016
- The analysis of December data may introduce some bias when comparing to prior July data
- July 2020 dataset was selected for the District of Columbia (rather than December 2020), because the District Department of Energy and Environment staff noted that the December 2020 dataset was a less representative dataset due to a backlog in processing of vehicle registrations in the District in the second part of 2020 as a result of the COVID-19 restrictions

Study Area

VIN data are collected for the **Ozone Nonattainment Area** (dashed line on map):

- District of Columbia
- Maryland:
  - Calvert County
  - Charles County
  - Frederick County
  - Montgomery County
  - Prince George's County
- Virginia:
  - Arlington County
  - City of Alexandria
  - Fairfax County and Cities
  - Loudoun County
  - Prince William County and Cities



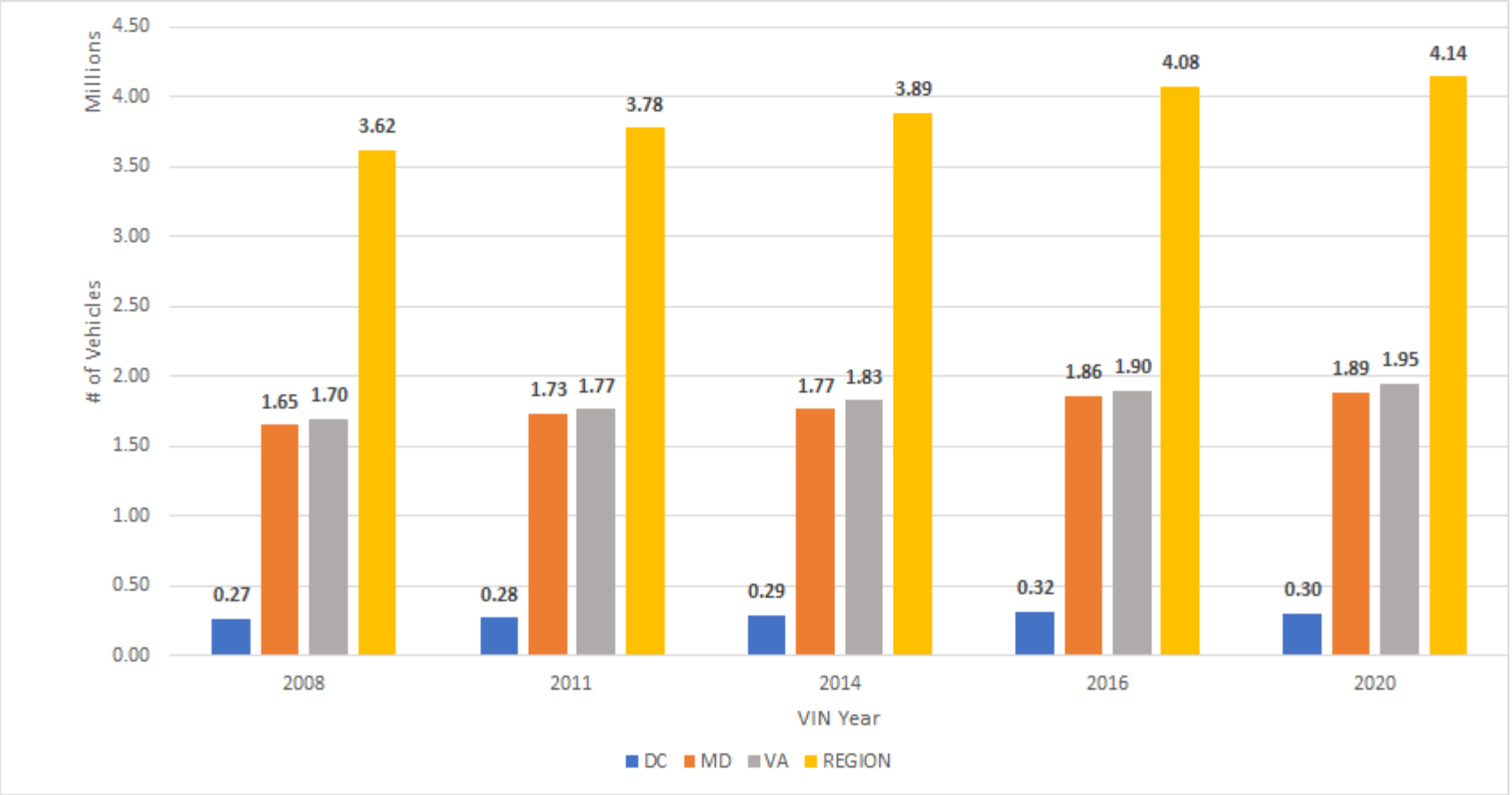
Analysis of 2020 Data

COVID-19 Pandemic Impacts (National)

- COVID-19 pandemic has impacted vehicle purchasing
- National sales estimated to be down by 15% in 2020 relative to 2019*
  - Economic uncertainty
  - Decrease in vehicle supply – temporary auto factory shutdowns
- However, for those who were able to purchase vehicles, the pre-pandemic trend of shifts away from the light duty vehicles to the light duty trucks (SUVs) has continued

* Eisenstein, Paul A. "For the auto industry, 2020 was a horrible year — but it ended better than expected." NBC News, January 5, 2021. https://www.nbcnews.com/business/autos/auto-industry-2020-was-horrible-year-it-ended-better-expected-n1252892

Vehicle Growth over Time by State



* Based on cleaned Total DMV Records

Historical Changes in Average Vehicle Age

- Following a slight decrease in vehicle age noted in the 2016 data, vehicle age increased for all vehicle types in 2020
- Average vehicle age for all vehicle types in 2020 is highest among all analysis years

Average Age of the Regional Vehicle Fleet by VIN Year

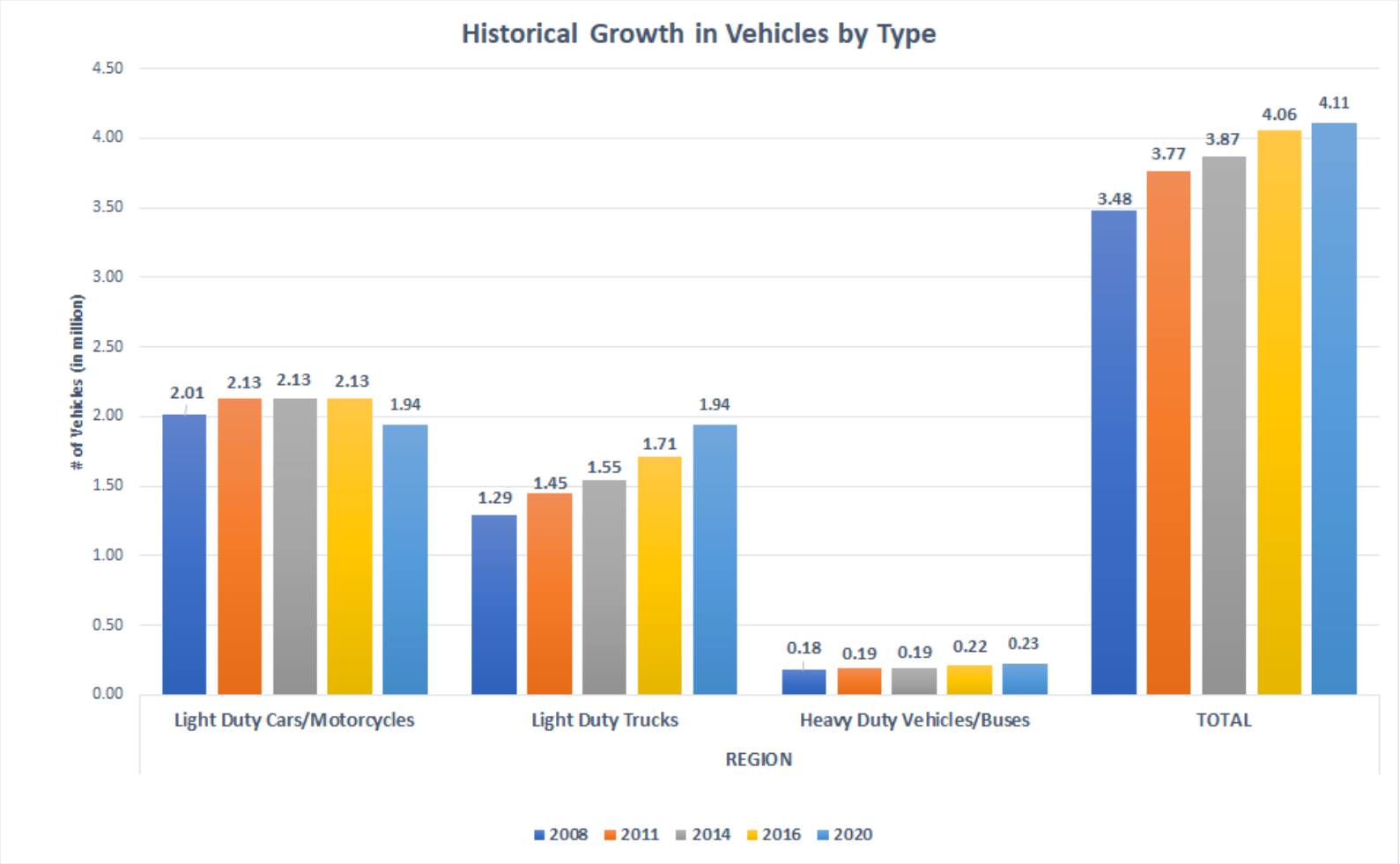
Year	Light Duty Vehicles* (LDV)	Light Duty Trucks (LDT)	Heavy Duty Vehicles (HDV)	All Vehicle Types
2008	8.51	7.53	9.21	8.18
2011	9.25	8.55	10.56	9.05
2014	9.62	9.09	11.30	9.49
2016	9.32	8.68	11.29	9.16
2020	10.05	8.74	11.51	9.51

Historical Retail Gas Prices by Year

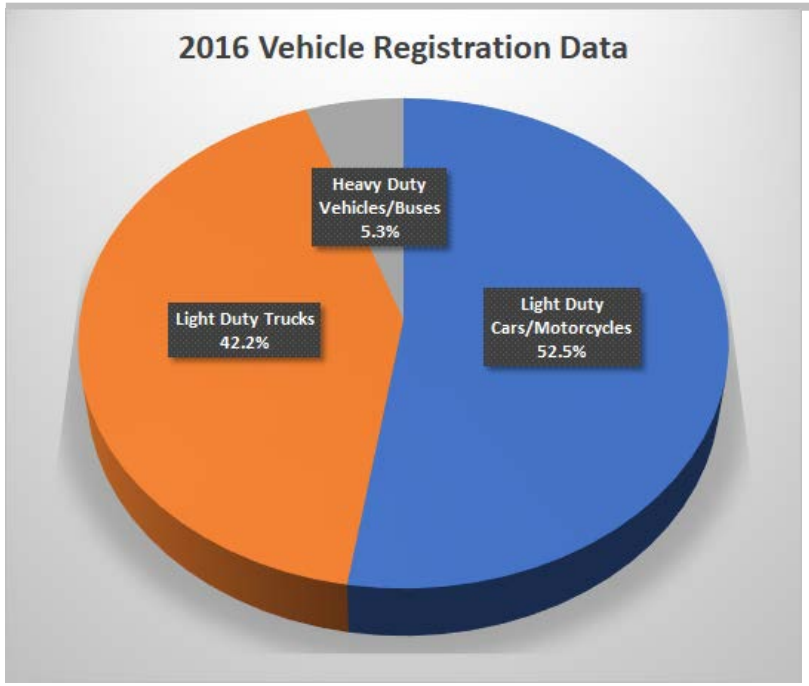
Source: https://www.gasbuddy.com/charts

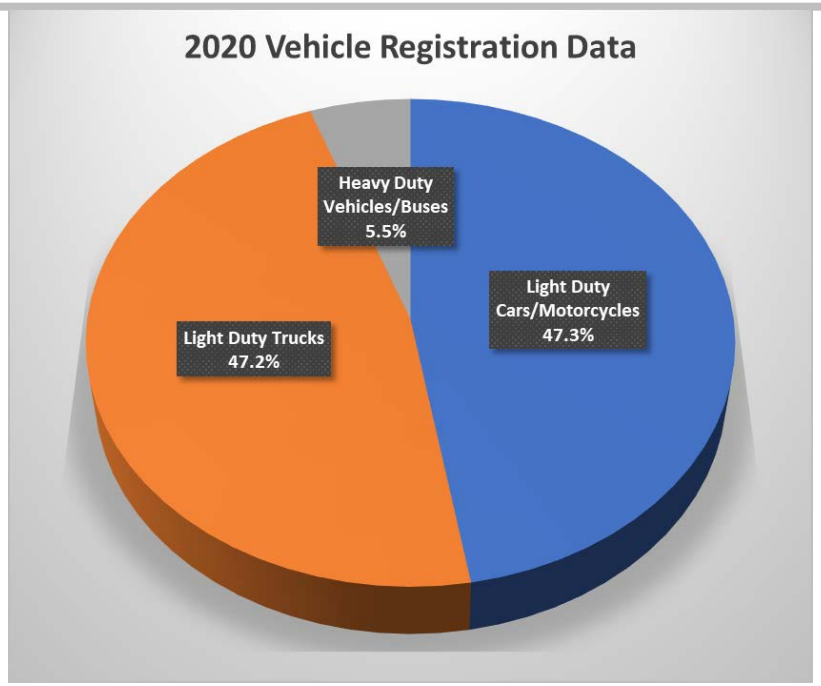
- Could be a factor in vehicle purchase decisions
- Washington, D.C. data show higher retail gas price than the national average
- Decrease of average gas prices during the height of the stay-at-home orders designed to stop the spread of COVID-19 appears on the chart

Historical Growth in Vehicles by Type



Changes in Regional Vehicle Composition: 2016 vs. 2020 Vehicle Registration Data

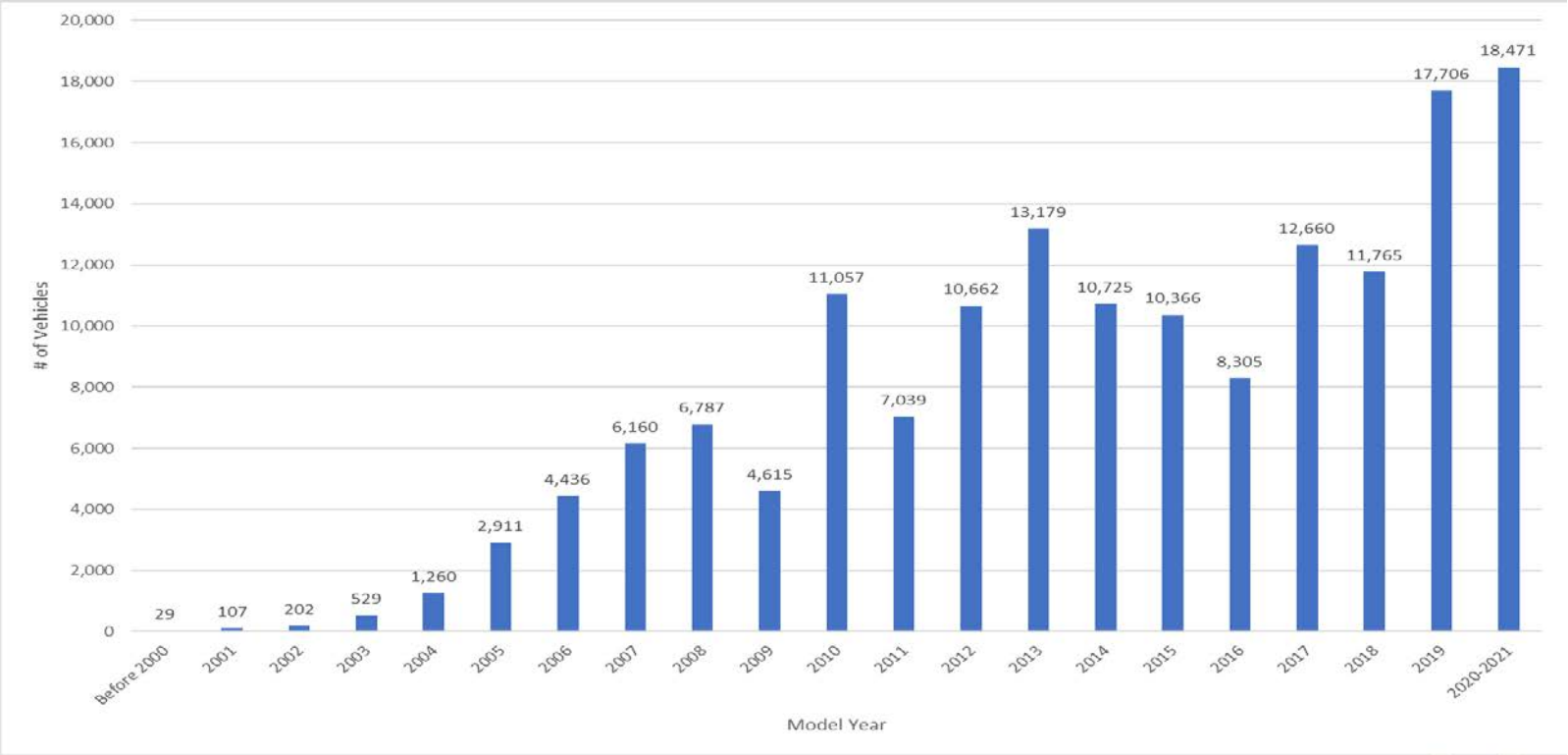




Between 2016 and 2020:

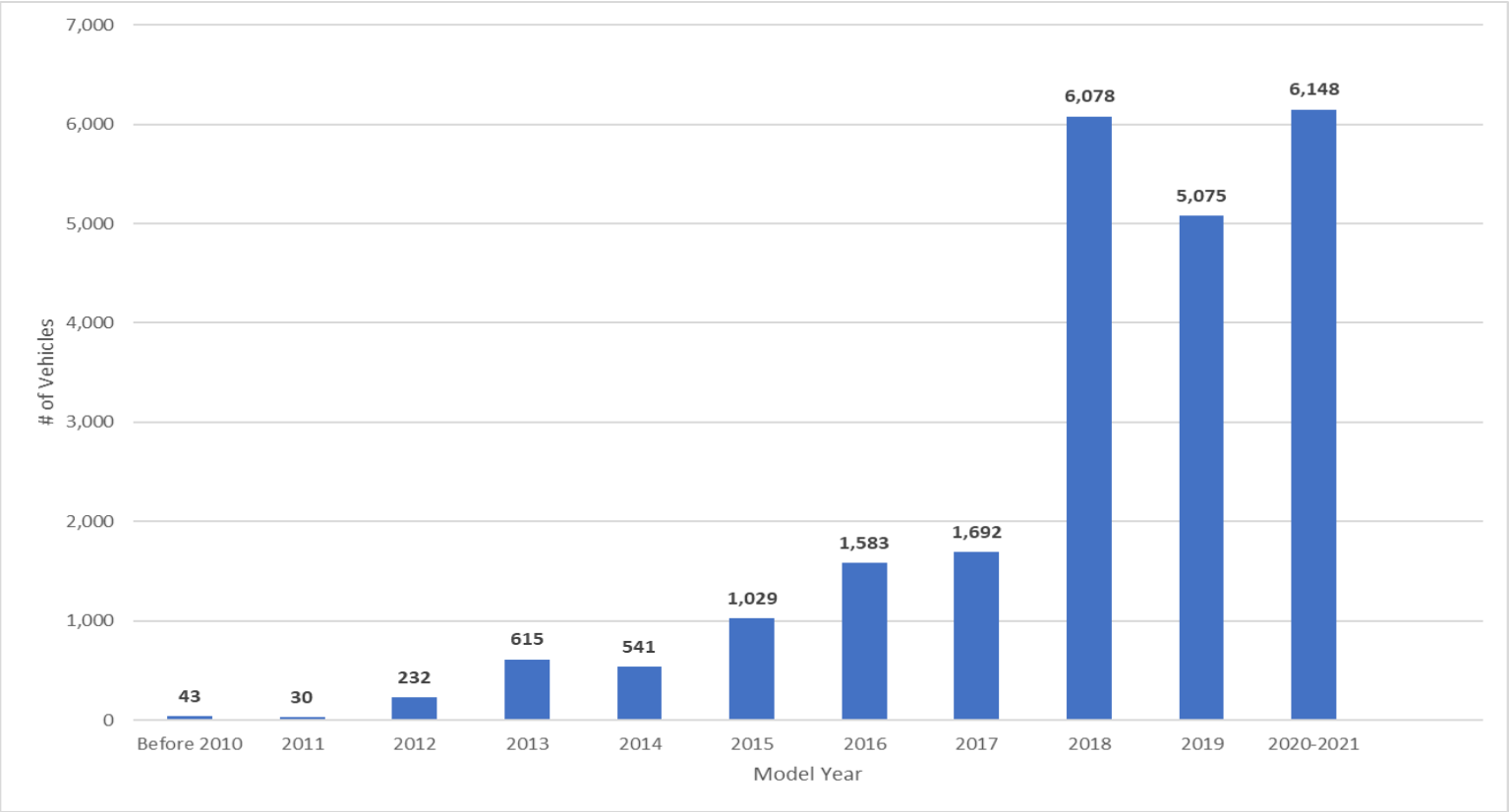
- Share of light duty trucks (including SUVs) increased by 5.0%
- Share of heavy duty vehicles increased by 0.2%
- Share of light duty cars decreased by 5.2%

Current Distribution of Hybrid Vehicles by Model Year



- Hybrid vehicles include hybrid electric and plug-in hybrid vehicles
- Regional total = 159k hybrid vehicles, 8.2% out of LDVs total, 3.9% out of all vehicles
- Number of registered hybrid vehicles in the fleet increased by 32.0% between 2016 and 2020 data

Current Distribution of Battery Electric Vehicles (BEVs) by Model Year



- Regional total = 23k electric vehicles (BEVs), or 1.2% out of LDVs, 0.6% out of all vehicles
- Number of registered BEVs in the fleet increased by 452.9% between 2016 and 2020 data

Key Findings

- COVID-19 pandemic has impacted vehicle purchases both nationally and regionally
- In recent years, growth in the number of total vehicles has slowed down, with total number of registered vehicles increasing from 4.08M in 2016 to 4.14M in 2020
- The vehicle composition is changing between 2016 and 2020:
  - ✓ The share of LD trucks (SUVs) increased by 5.0%
  - ✓ The share of LD cars decreased by 5.2%
  - ✓ The share of HDV/buses increased by 0.2%

Key Findings (Cont.)

- Average age of the vehicle fleet has increased from 9.16 years in 2016 to 9.51 in 2020
- Hybrid vehicles account for 3.9% of the vehicle fleet
- Electric vehicles account for 0.6% of the vehicle fleet, but the size of EV fleet has increased at a fast rate over time
- While the growth in electric and hybrid vehicles is encouraging, an older vehicle fleet and a shift toward light duty trucks and away from light duty cars could lead to negative impacts on emissions (in 2020, for the first time in our region, number of LD cars ≈ number of LD trucks)

Next Steps

- Assemble vehicle population, vehicle composition and vehicle age distribution inputs to the MOVES model based on the 2020 dataset
- Apply in:
  - Air quality conformity analysis of the constrained element of the 2022 Update to Visualize 2045
  - GHG Analysis of the 2022 Update to Visualize 2045
  - 2015 National Ambient Air Quality Standards Ozone SIP

Appreciation

- The state air agencies and DEP staff for granting access to the 2020 vehicle registration data
- Daniel Son for data cleaning, VIN decoding and conducting detailed analysis of the data

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