

Update to WA Motor Vehicle Emissions using MOVES



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- ◆ Brief background of MOVES and how it fits into the Emissions Inventory
- ◆ Motor vehicle fleet updated with 2017 DOL data and as well as updated road type distribution and VMT.
- ◆ Trends

MOtor Vehicle Emissions Simulator

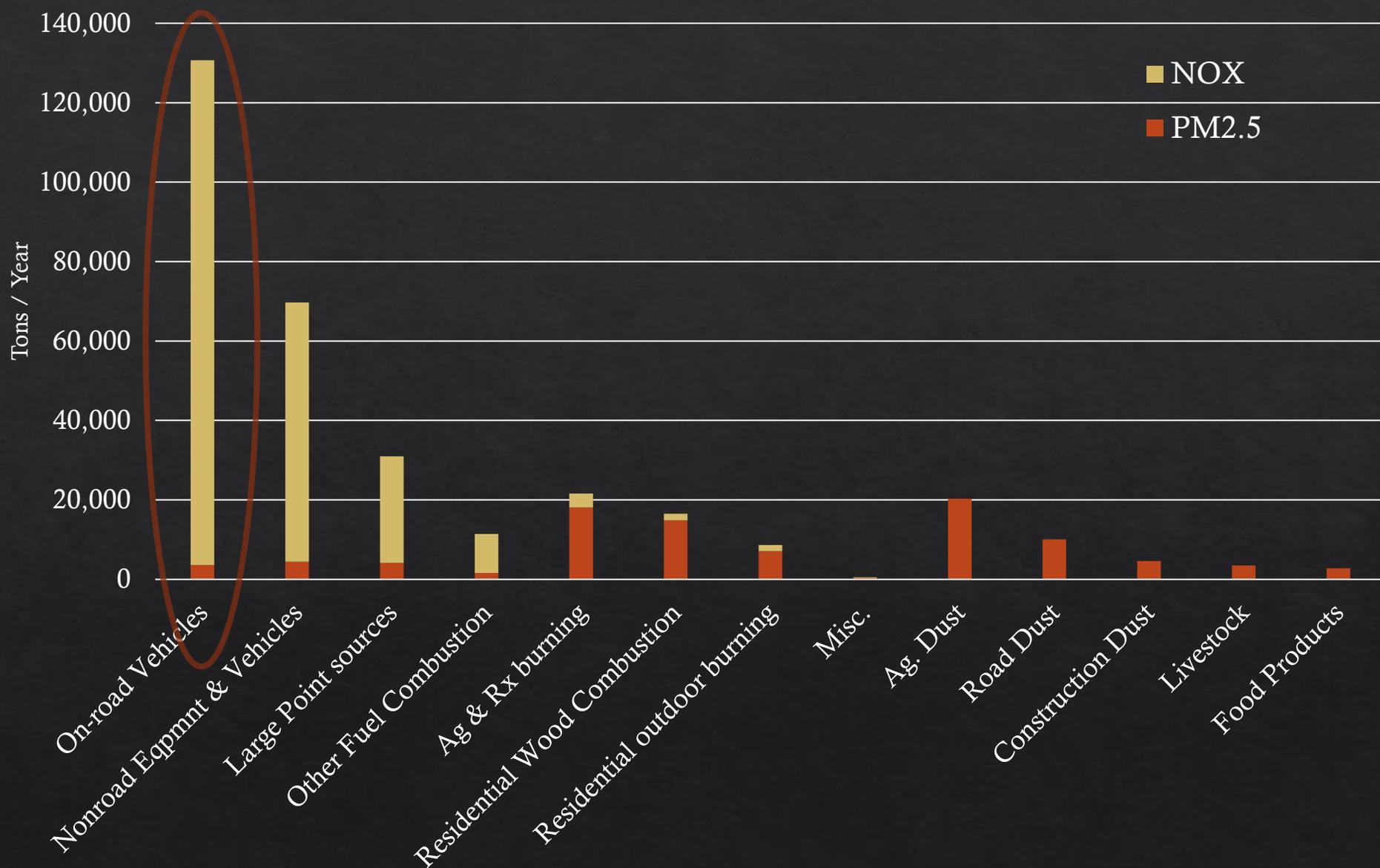
- ◆ It is an emission modeling system that estimates emissions from mobile sources for criteria air pollutants, greenhouse gases, and air toxics.
- ◆ Created by the EPA. First highway emissions model MOBILE1 created in 1978. Has gone through many updates. Latest version MOVES2014b.



Inventories developed using MOVES are used to meet the federal Clean Air Act's state implementation plan and transportation conformity requirements.

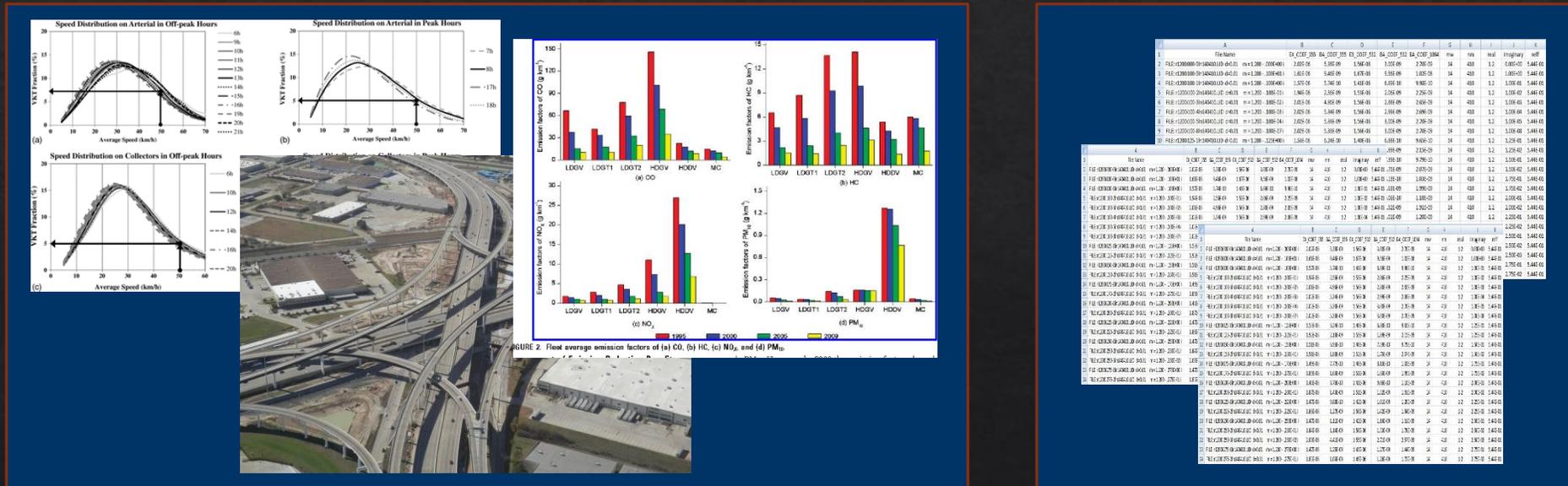
- ❑ Inventories required for attainment and maintenance SIPs.
- ❑ Emissions estimates created for air quality modeling for attainment demonstrations.
- ❑ Create emission inventory for submission to the National Emissions Inventory.

2014 Washington Emissions Inventory - Anthropogenic Sources



◆ During the modeling process, the user specifies vehicle types, time periods, geographical areas, pollutants, vehicle operating characteristics, and road types to be modeled.

◆ MOVES provides a system to manage databases used to calculate emissions.



Vehicular Emissions and AIRPACT

- ◆ SMOKE-MOVES input files are going to be using 2019 data.

But really...

- ◆ Most recent data in AIRPACT contains 2014 WA Department of Licensing vehicle registration (number, type of vehicles, age distribution).
- ◆ VMT was updated with 2016 WSDOT data then projected to 2019. Growth factors were calculated for 2019 by interpolating agency VMT estimates for reference counties.
- ◆ For all other counties, VMT is based on the assumption that VMT and population growth rates are equal. Growth rates were calculated between 2016 and 2019 and then applied to the 2016 VMT.

MOVES Emissions Processes

- ◇ Running Exhaust
- ◇ Start Exhaust
- ◇ Extended Idling
- ◇ Evaporative Processes
 - ◇ Permeation, vapor venting, leaks, refueling displacement, refueling spillage.
- ◇ Crankcase
- ◇ Tire wear
- ◇ Brake wear



- ◇ Generally, mobile emissions are estimated by multiplying emission factors (in grams per mile) with vehicle travel activity e.g. vehicle miles of travel (VMT) and number of vehicles. Emissions are generated for four seasons.

Ecology developed databases

- ◇ Fleet age and composition
- ◇ Vehicle counts
- ◇ Fuel characteristics
- ◇ Amount of miles traveled by vehicle and roadway type (VMT).
- ◇ WA emissions check program
- ◇ WA adoption of California vehicle engine standards

- ◆ MOVES includes detailed information about how emissions change with vehicle behavior.
- ◆ Estimates are based on the amount of time vehicles spend in different “operating modes”
 - ◆ “Operating mode” – what the vehicle is doing (e.g., accelerating , braking, cruising, idling)
 - ◆ Vehicles use different amounts of energy in different operating modes
 - ◆ MOVES defines 23 operating modes.

Capable of estimating emissions from 60 pollutants from 13 vehicle classes, 5 source types and 5 road types.

Source Type ID	Source Types	HPMS Class ID	HPMS Vehicle Class
11	Motorcycle	10	Motorcycles
21	Passenger Car	25	Light Duty Vehicles – Short and Long Wheelbase
31	Passenger Truck		
32	Light Commercial Truck		
41	Intercity Bus	40	Buses
42	Transit Bus		
43	School Bus		
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck		
53	Single Unit Long-haul Truck		
54	Motor Home		
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck		

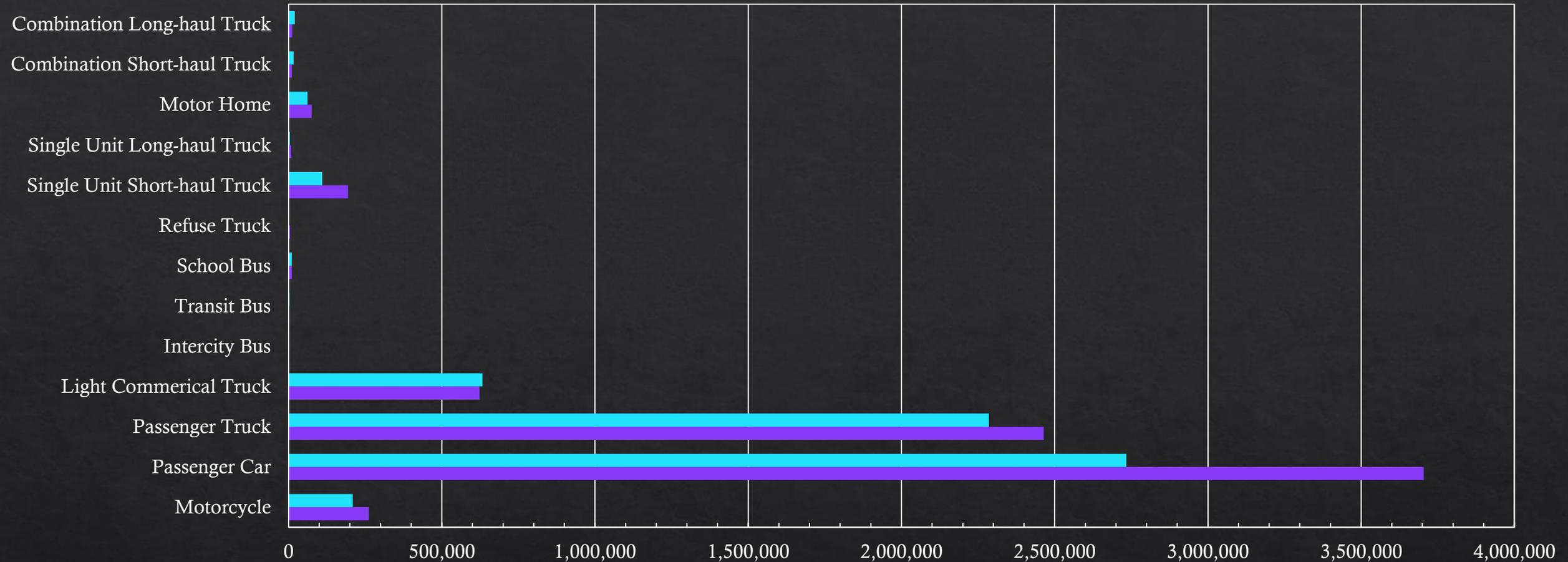
- ◇ for a given place and time, there are a certain number of vehicles engaged in a certain activity (including parked) generating emissions. Calculating total emissions requires for each emission process:
 - 1) total activity
 - 2) distributing total activity across the vehicle fleet and operating modes
 - 3) calculating emission rates for each vehicle class, road type and operating mode
 - 4) and aggregating emissions across the modes.

WA DOL provides vehicle population data from which information is extracted to develop databases to upload into MOVES.

MOVES inputs that are derived include:

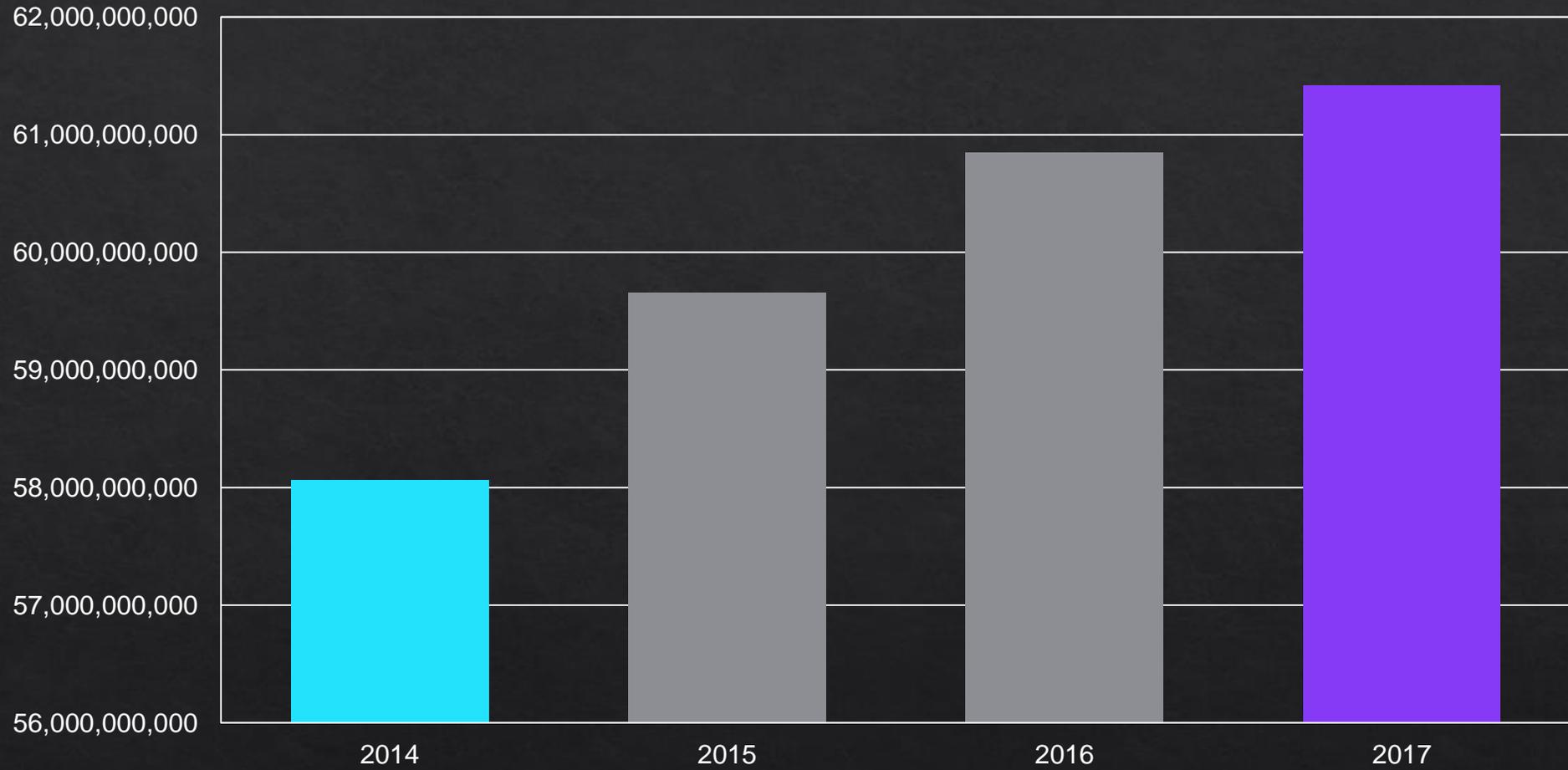
vehicle age distribution and vehicle counts

2014 and 2017 Vehicle Counts

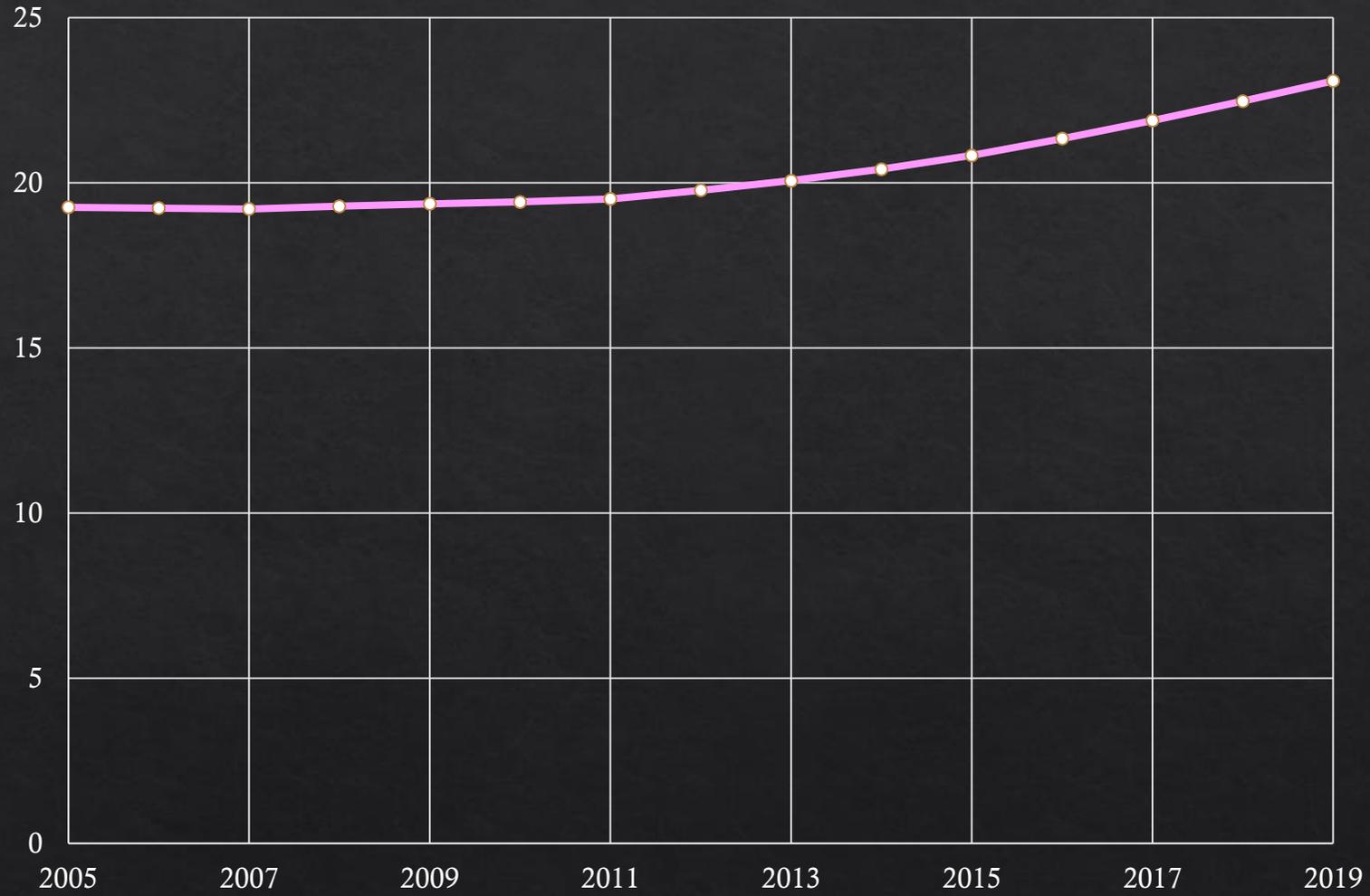


	Motorcycle	Passenger Car	Passenger Truck	Light Commerical Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck
■ 2014	209,689	2,733,761	2,285,121	632,823	1191	2,937	10,308	1,754	109,308	4255	61,491	16,411	20,113
■ 2017	262,053	3,704,178	2,464,069	623,040	422	1,571	10,546	4,501	193,884	8,219	75,314	10,545	11,925

Statewide Annual Vehicle Miles Traveled



WA light and medium duty gasoline vehicle MPG



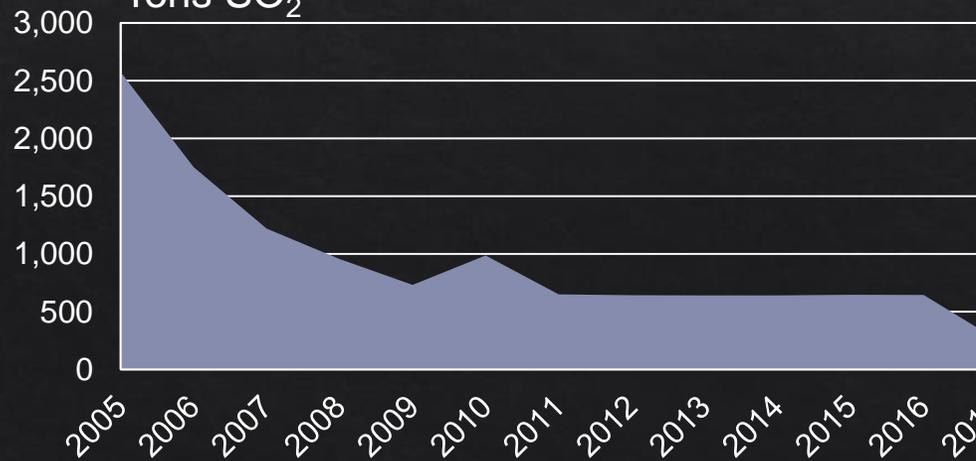
Tons PM_{2.5}



Tons NO_x

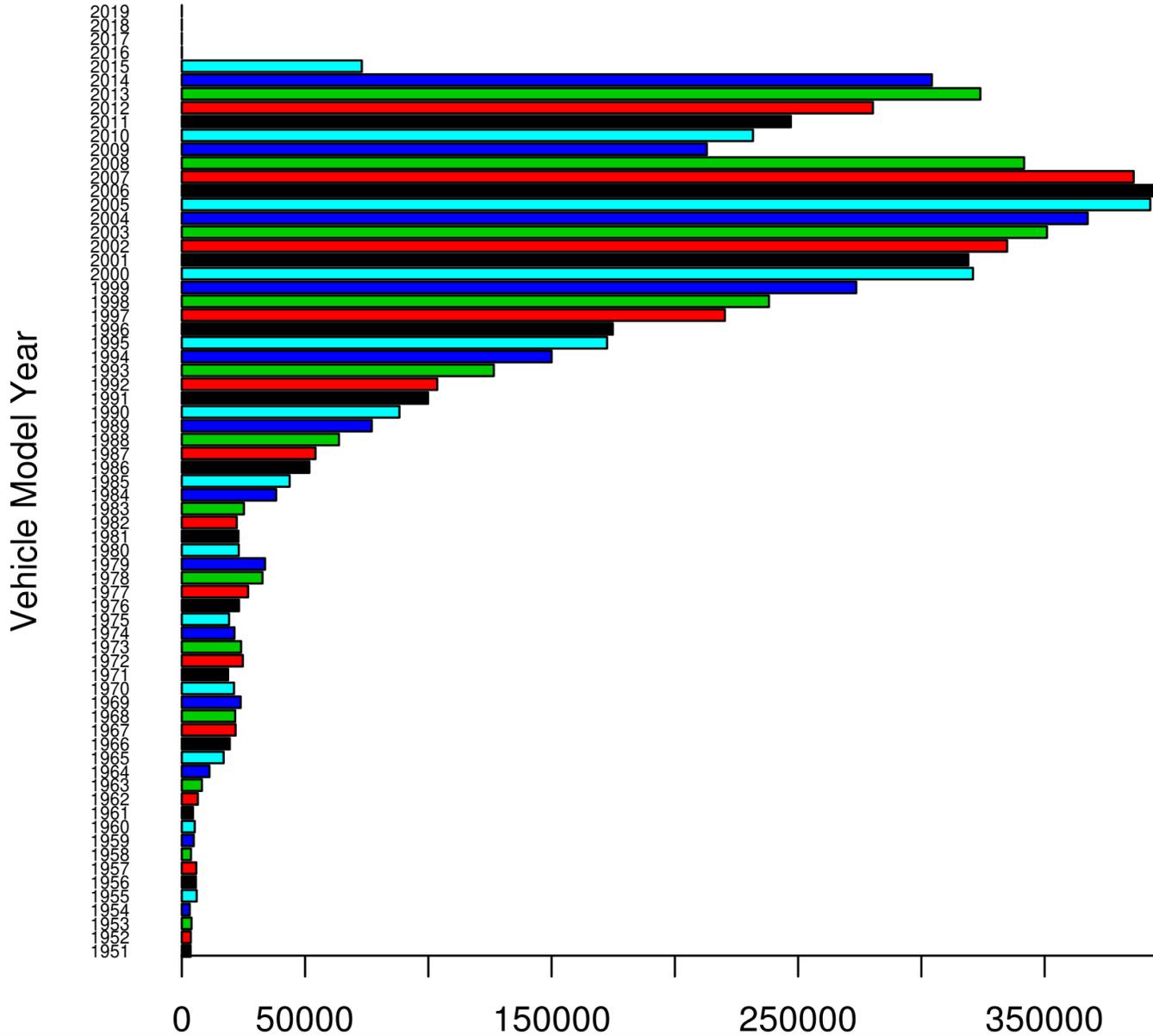


Tons SO₂

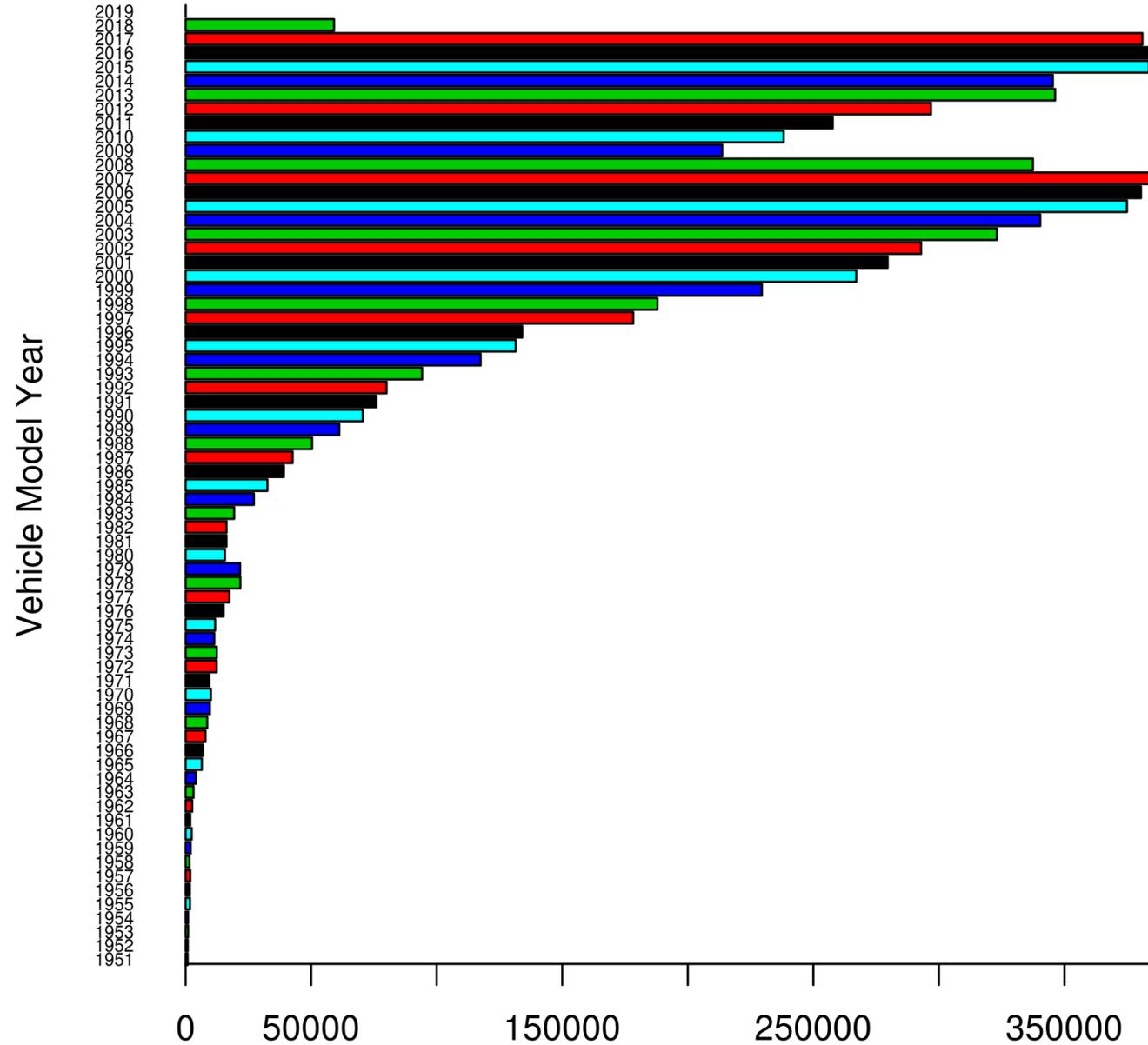


How do emissions decrease when vehicle counts and vehicle miles traveled have increased?

2014 WA Registered Vehicle Model Year Distribution



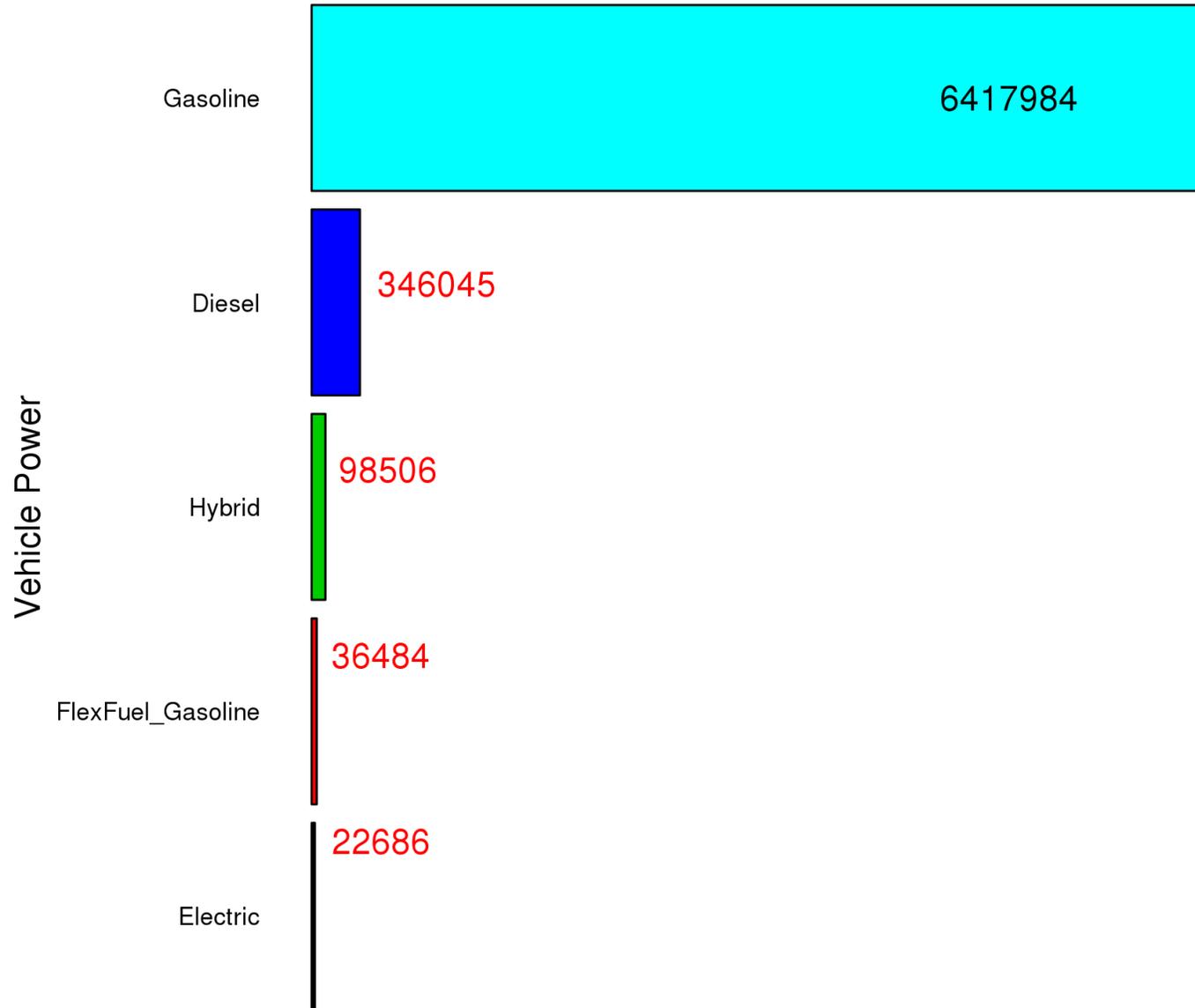
2017 WA Registered Vehicle Model Year Distribution



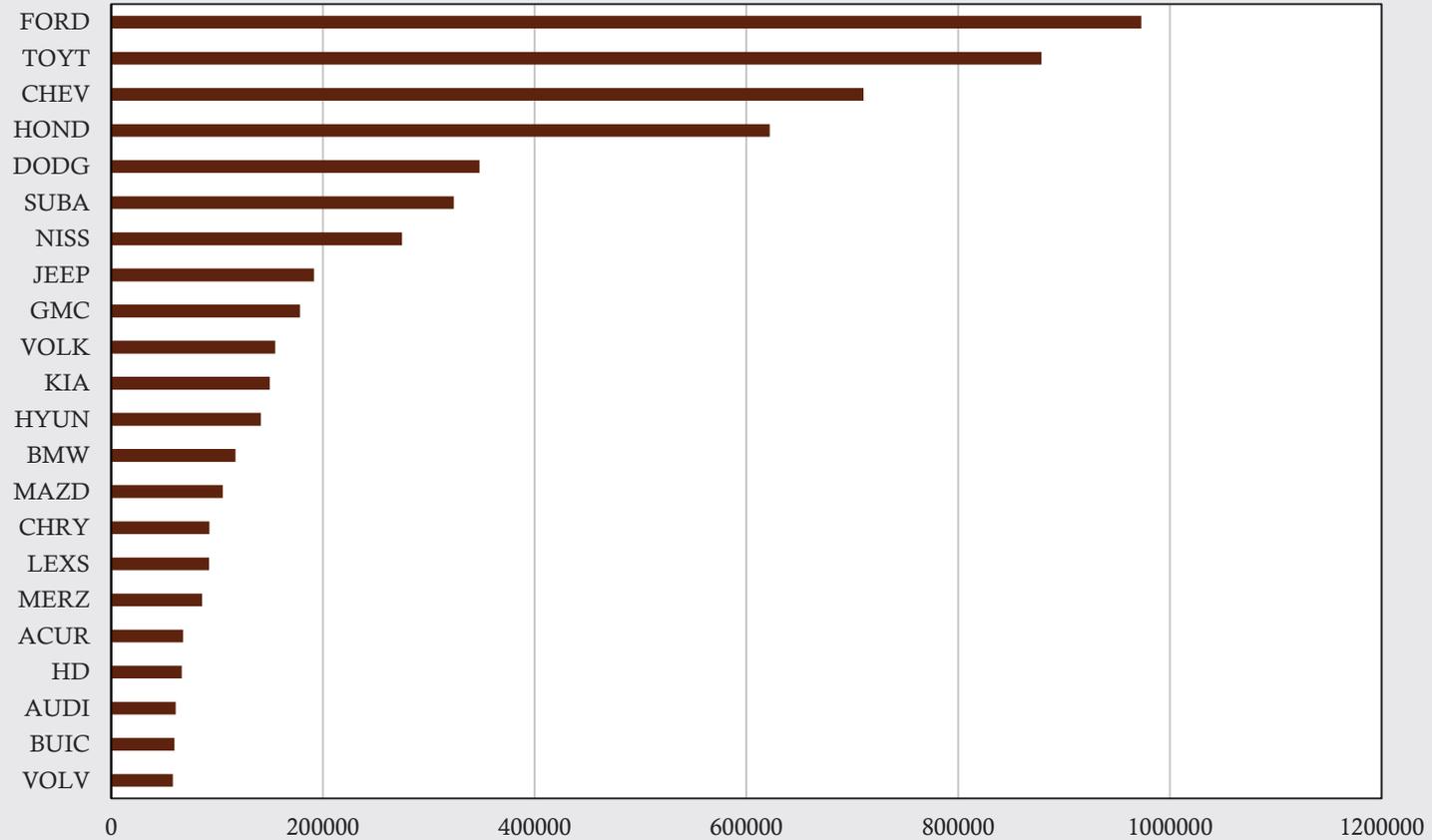
Summary

- ◇ Vehicle population and vehicle miles traveled have increased.
 - ◇ Passenger cars increased by 970,417 vehicles.
 - ◇ Passenger trucks increased by 178,948
- ◇ Vehicle emissions are decreasing at ~10% per year.
- ◇ Decrease in emissions attributed to change in vehicle fleet to newer vehicles.

2017 WA Registered Vehicle Power Distribution



2017 Vehicle Make Counts



Questions?