CALIFORNIA
AIR RESOURCES BOARD

EMFAC2025 Final 4th Public Workshop: Update to California On-Road Mobile Source Emissions Inventory

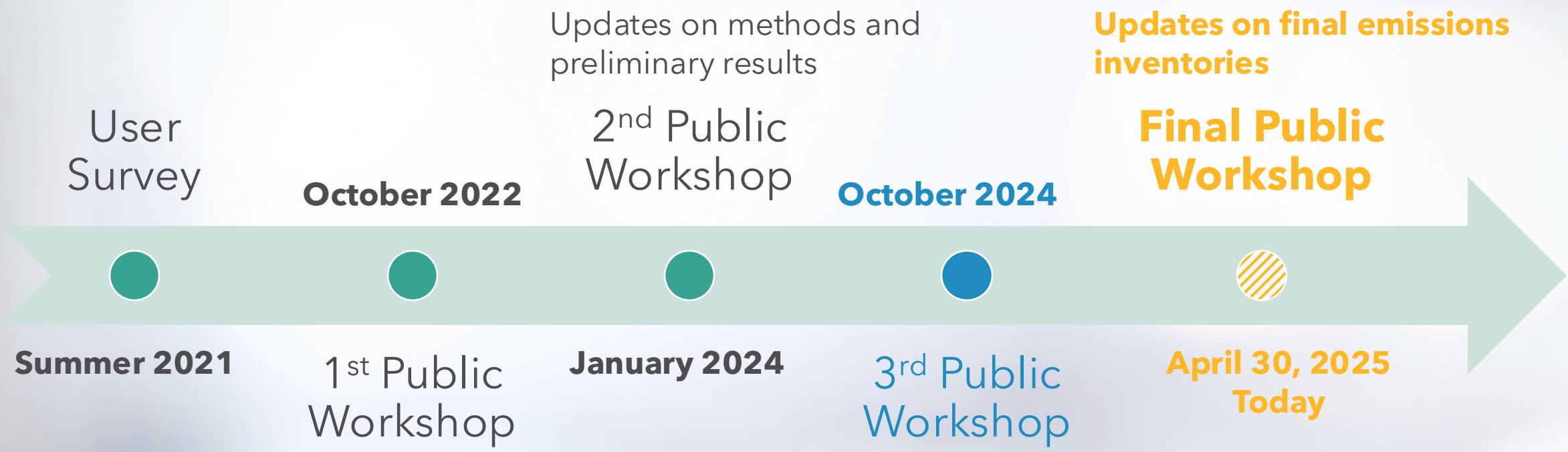
Mobile Source Analysis Branch
Air Quality Planning and Science Division

April 30, 2025

Workshop Instructions

- Telephone Call-In: (888) 363-4734
- Access Code: 350021
- Workshop is being recorded
- Slides and recording will be available on CARB's On-Road Conferences and Workshops web page

Public Process of EMFAC2025 Development



Three Draft Versions Tested by Stakeholders

Alpha Version	Beta Version	Release Candidate Version
• Released on 8/26/2024 • Focused on functionality • Included updates presented in 2nd workshop • EMFAC PC Application only	• Released on 11/18/2024 • Focused on functionality and emission results • Incorporated updates presented in 3rd workshop • EMFAC Web and PC Application were provided	• Released on 4/18/2025 • Near-final version • Scenario Analysis function or SG mode is fully functional • EMFAC Web and PC Application were provided

- Distributed to a group of testers from CARB, Caltrans, CEC, Air Districts, Metropolitan Planning Organizations, and consulting.
- Received and addressed bug reports and suggestions.
- Still receiving feedback on the Release Candidate version by May 2.

Today's Agenda

1. EMFAC Overview
2. Light-Duty Speed Correction Factors
3. Overall Updates: EMFAC2025 vs. EMFAC2021
4. Next Steps
5. Questions and Answers

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1. **EMFAC Overview**
2. Light-Duty Speed Correction Factors
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EMFAC Overview

Background of EMFAC

EMFAC

Scoping Plan

State Implementation Plans (SIP)

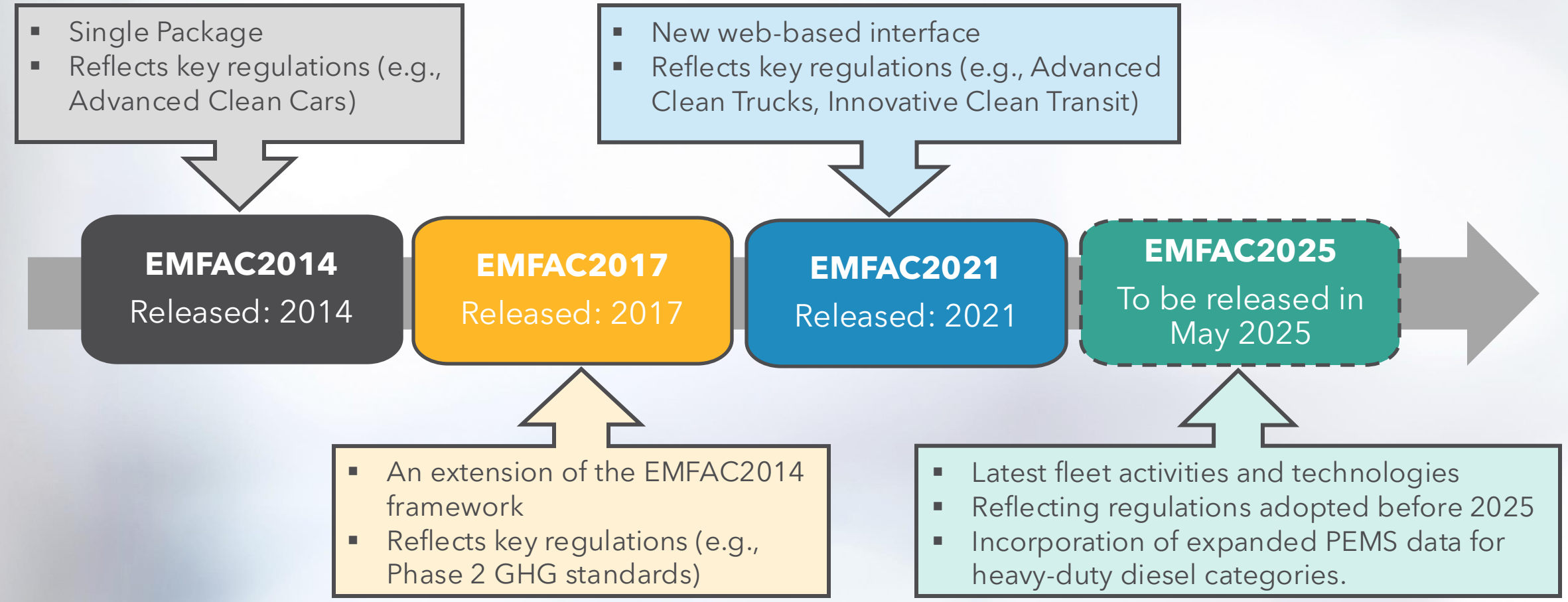
Transportation Conformity

Regulatory Development

Background of EMFAC (continued)

- California specific on-road vehicle emission inventory model approved by U.S. EPA for use in State Implementation Plans (SIP) and Transportation Conformity
- More than three decades of data collection and methodology refinement
- Incorporates extensive laboratory and on-road emissions testing, activity, and emerging “big” data sources
- CARB staff collaborates with other state agencies, Air Districts, Metropolitan Planning Organizations (MPO), community members, U.S. EPA and researchers

EMFAC Updates



Major Updates in EMFAC2025

Updated Emission Rates

Incorporated latest in-use testing data for light- and heavy-duty vehicles (chassis dynamometer and PEMS tests)

Including Classic Cars

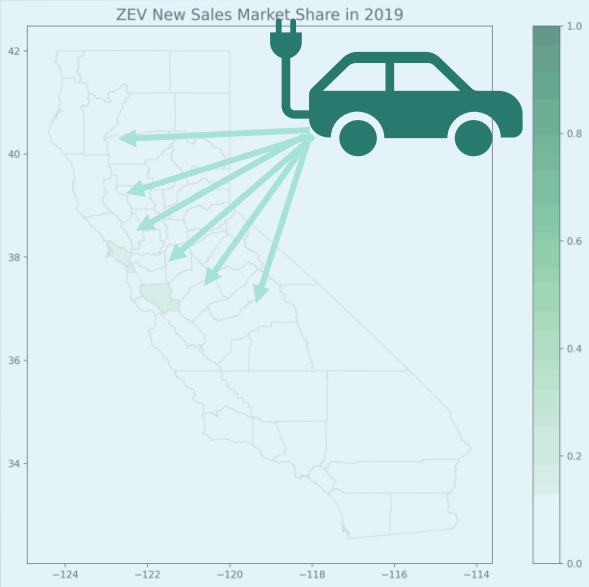
Emissions from vehicles aged 45 years and older are now included in the inventory

High Speed Driving

Now considering VMT and emissions at speeds >70 mph

Major Updates to Vehicle Population and Activity

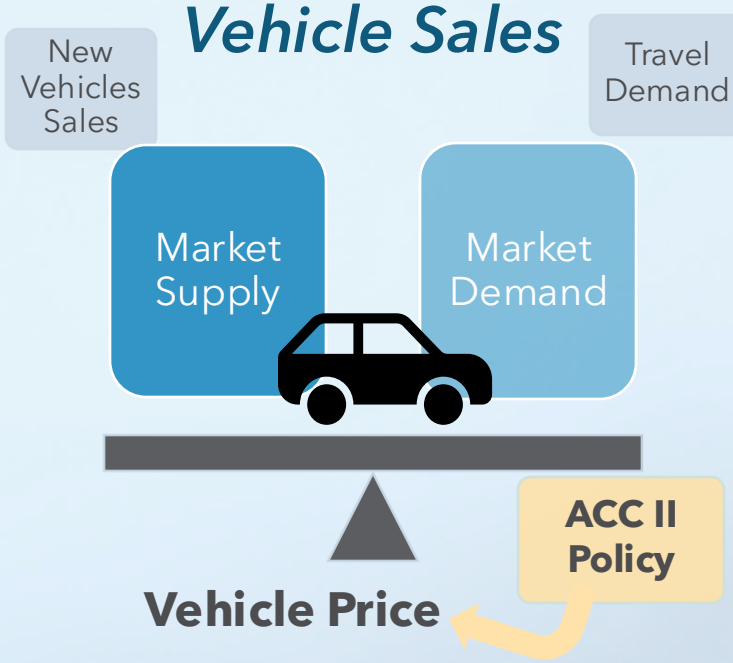
Zero Emission Vehicle Adoption



County level forecasting of ZEV adoption in California

Contract #22AQP010 with Lawrence Berkeley National Laboratory

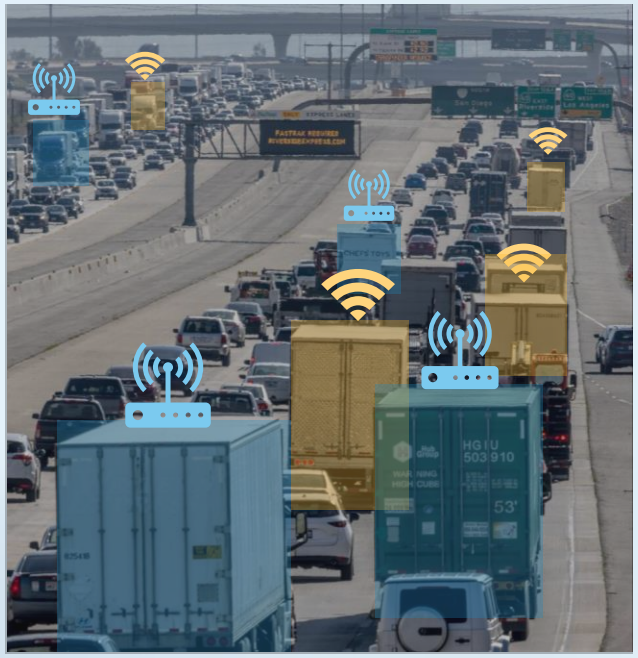
New Light-Duty Vehicle Sales



New equilibrium forecasting model considers economics, regulations, and VMT to project new car sales

Contract #21AQP018 with Prof. Mark Jacobsen at UCSD

Mapping Truck Activity



Incorporated telematics data from big data contracts to allocate heavy-duty truck activity (VMT) at sub-area level

New Regulatory Measures for Light-Duty Vehicles

Advanced Clean Cars II

Federal Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles

New Regulatory Measures for Heavy-Duty Vehicles

- Clean Truck Check (HD I/M) Program
- Federal Clean Trucks Plan
- Federal Heavy-Duty Phase 3 GHG Rule
- State and Local Government Fleet Requirements (Advanced Clean Fleets*)
- 100% heavy-duty zero-emissions sales in 2036 (Clean Trucks Partnership)

*** Excludes high-priority fleets and drayage**

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Light-Duty Speed Correction Factors

Background: Speed Correction Factors (SCFs)

EMFAC2021 and previous versions are based on Unified Correction Cycles (UCC)

- Not updated since EMFAC2000
- 12 separate Unified Correction Cycles (UCC) cycles with approximately 5 mph increments
- UCC15–UCC45 (average speed 15–45 mph) based on over 130 vehicles tested
- UCC5, UCC10, UCC55-65 (average speed 5, 10, 55–65 respectively) based on 10 vehicles tested

New Dynamometer Cycles

- Arterial Cycles (AC 1–4) and Freeway Cycles (FC 1–7)
- High-Speed Cycles (FC 8, 9, and 10) were based on Freeway Cycle 7
- Most data not yet reflected in EMFAC
  - Exception: CO_2 SCF updated in EMFAC2017

Arterial and Freeway Driving Cycles

Implemented in CARB Surveillance Test Plan 2S11C1 in 2012

- Four Arterial driving cycles
- Seven Freeway driving cycles
- Highest Freeway Cycle 7 (FC7) averaged 73 mph

Arterial Cycle (AC)	Average Speed [mph]
AC1	6.8
AC2	22.5
AC3	39.0
AC4	55.2

Freeway Cycle (FC)	Speed Range (Average) [mph]
FC1	10 to 20 (15.5)
FC2	20 to 30 (25.5)
FC3	30 to 40 (32.7)
FC4	40 to 50 (45.6)
FC5	50 to 60 (56.5)
FC6	60 to 70 (65.2)
FC7	70 to 80 (72.9)

CARB's Light-Duty Test Programs and Tested Vehicles

LD Vehicle Surveillance Program 19 (2S11C1) – Haagen-Smit Lab

- Collected dynamometer exhaust data from Arterial and Freeway Cycles
- 94 Gasoline vehicles (Pre-LEV, LEV I, LEV II, SULEV) tested within a range of tech groups

LD Vehicle Surveillance Program 21 (2S22C01) – Riverside

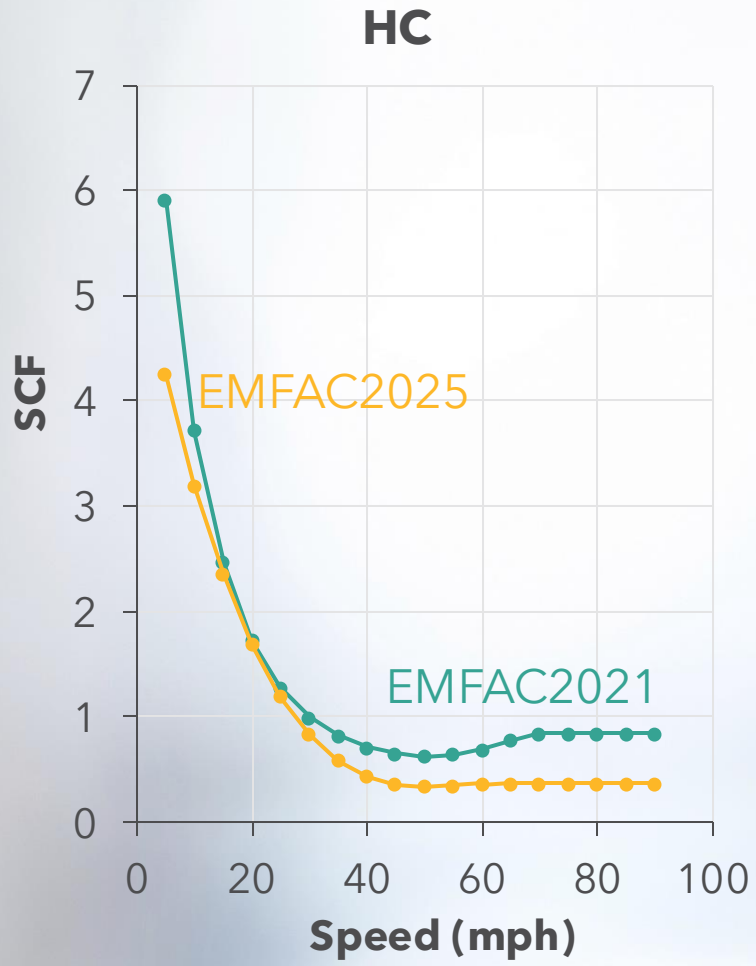
- Currently testing Arterial and Freeway Cycles
- 3 Gasoline vehicles (LEV II and LEV III) tested
  - 2 LEV II SULEV
  - 1 LEV III SULEV30 (grouped with LEV II SULEV)

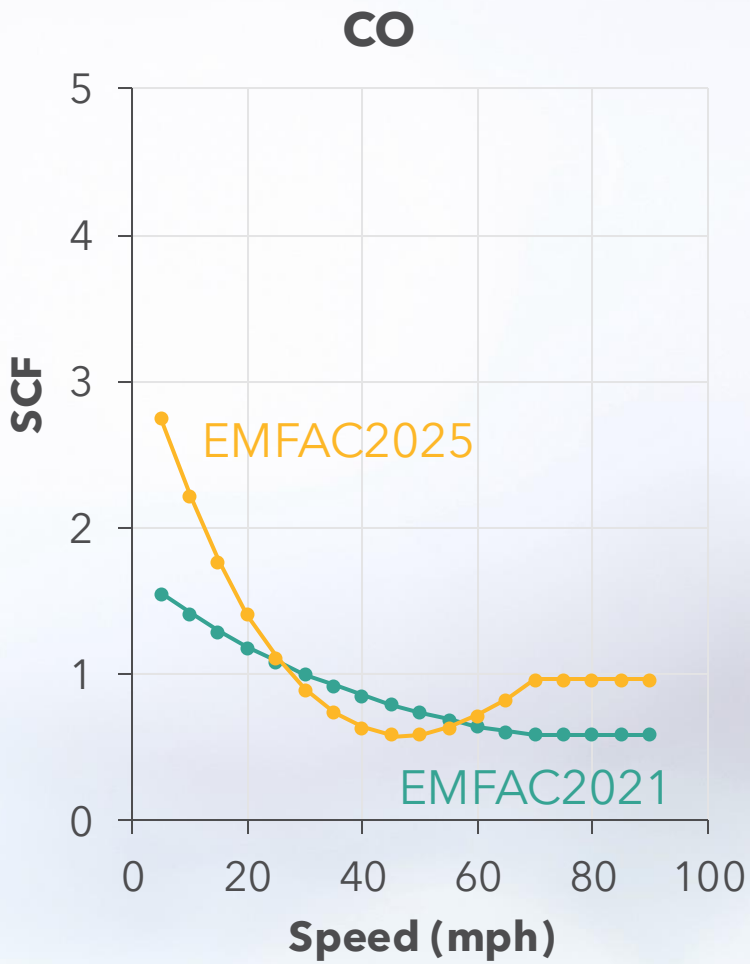
Light Duty Speed Correction Factor Analysis Groups

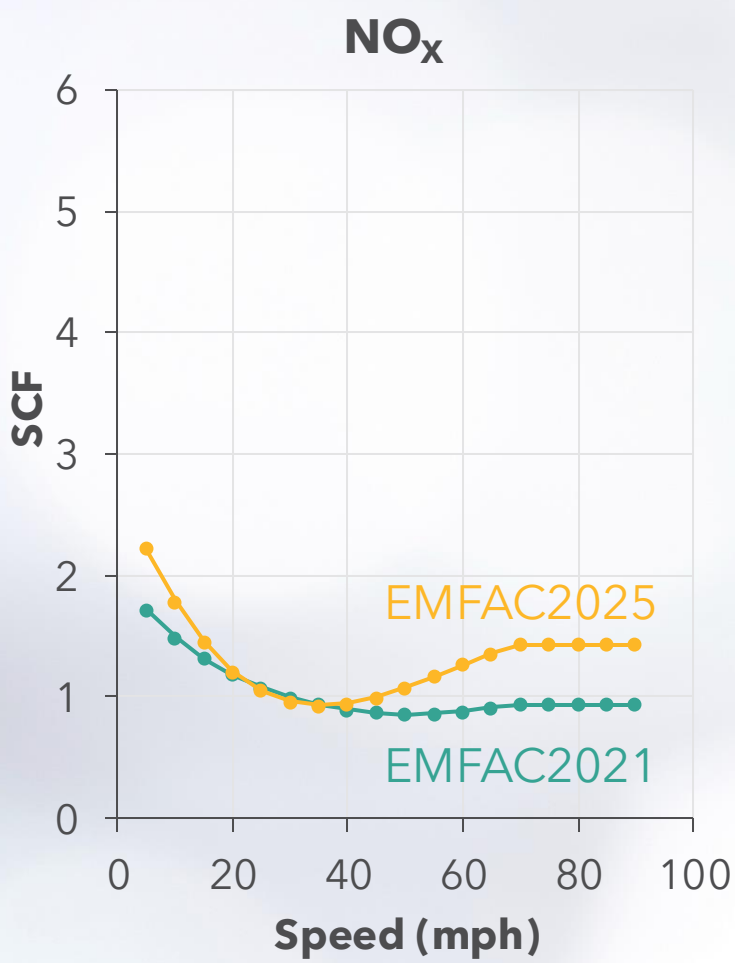
Pre-LEV	LEV I	LEV II/LEV III
• Tier0 • Tier1 • TLEV	• LEV • ULEV	• LEV II: LEV, ULEV • LEV III: SULEV30
17 vehicles	**42 vehicles**	**38 vehicles**

CARB

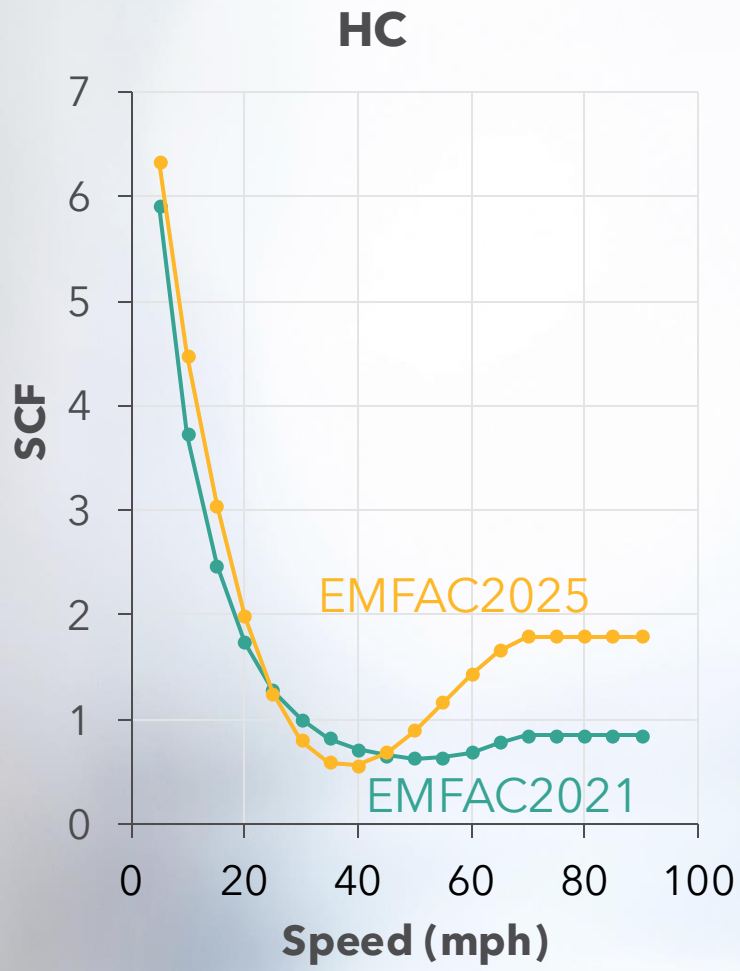
Pre-LEV Speed Correction Factors (17 vehicles)

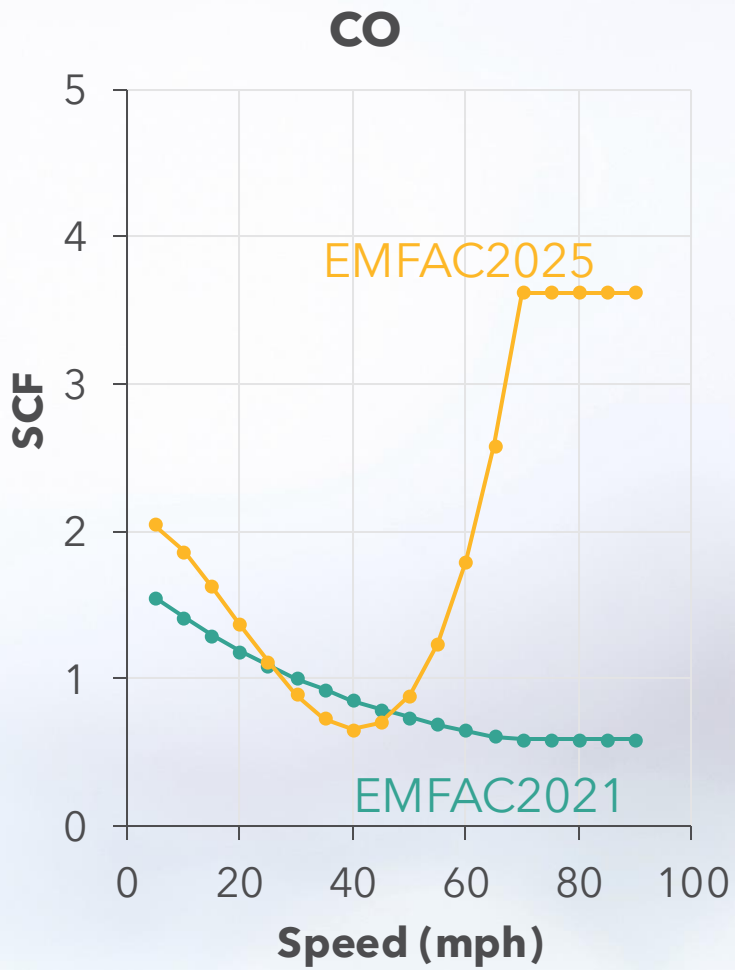


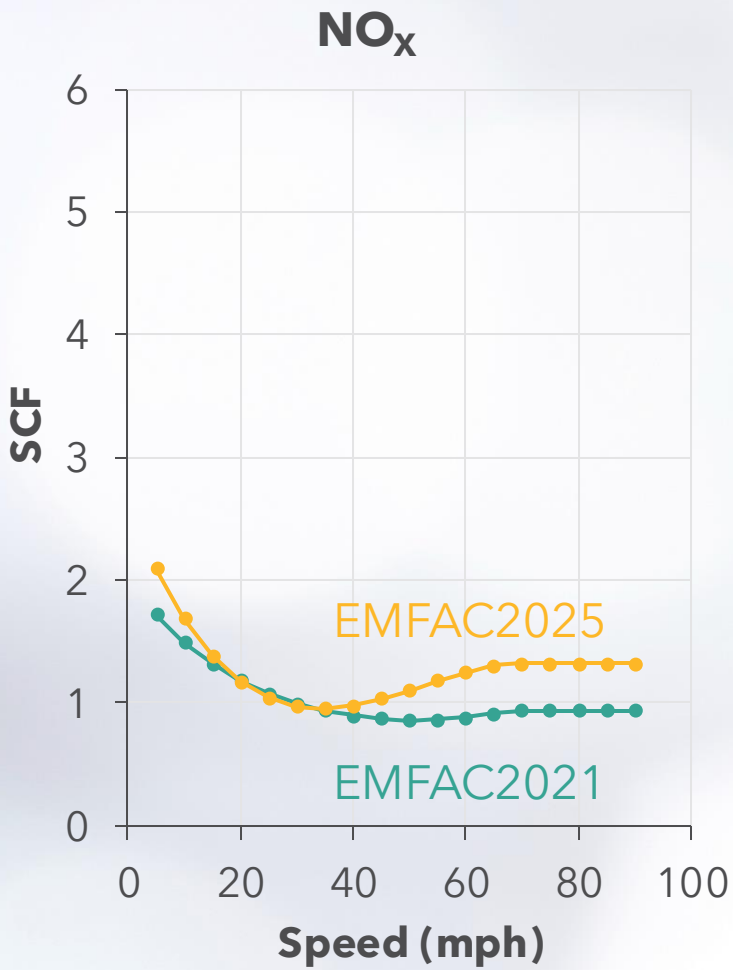




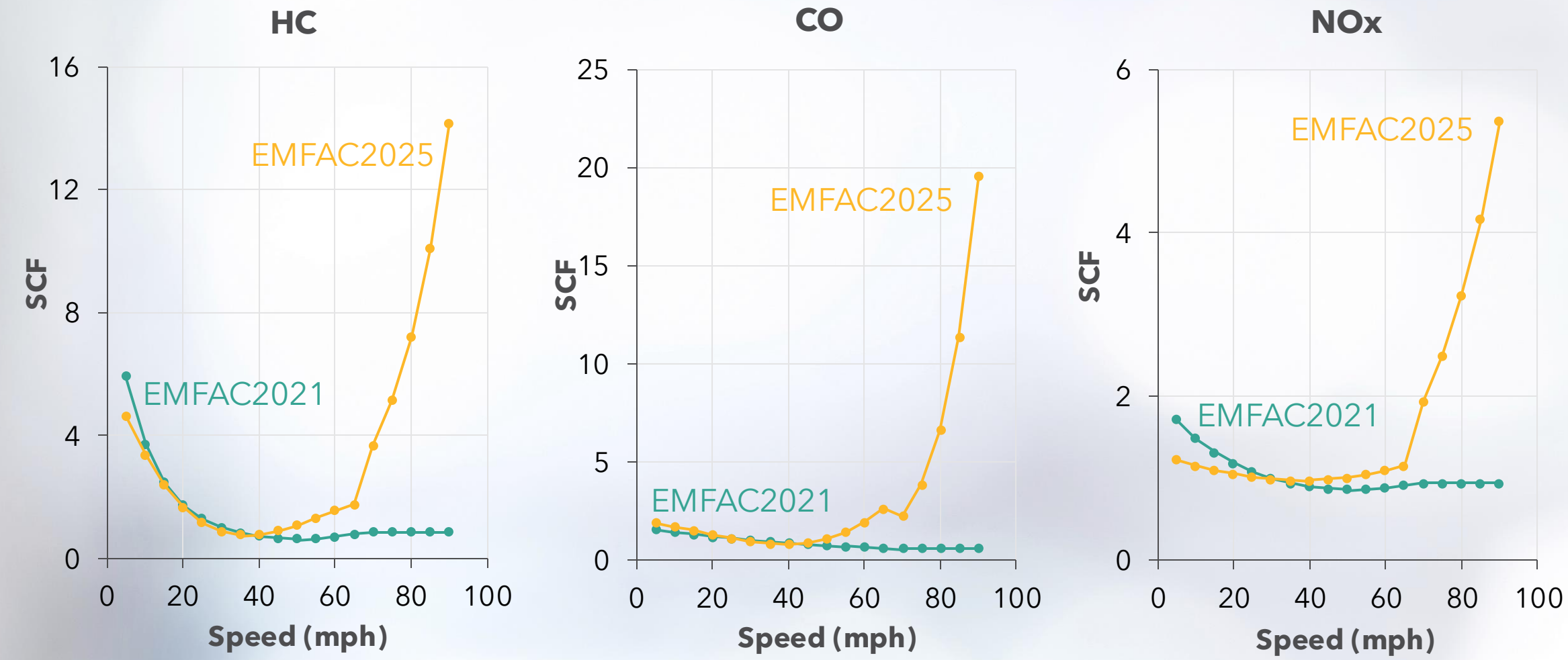
SCF: LEV I (42 Vehicles)



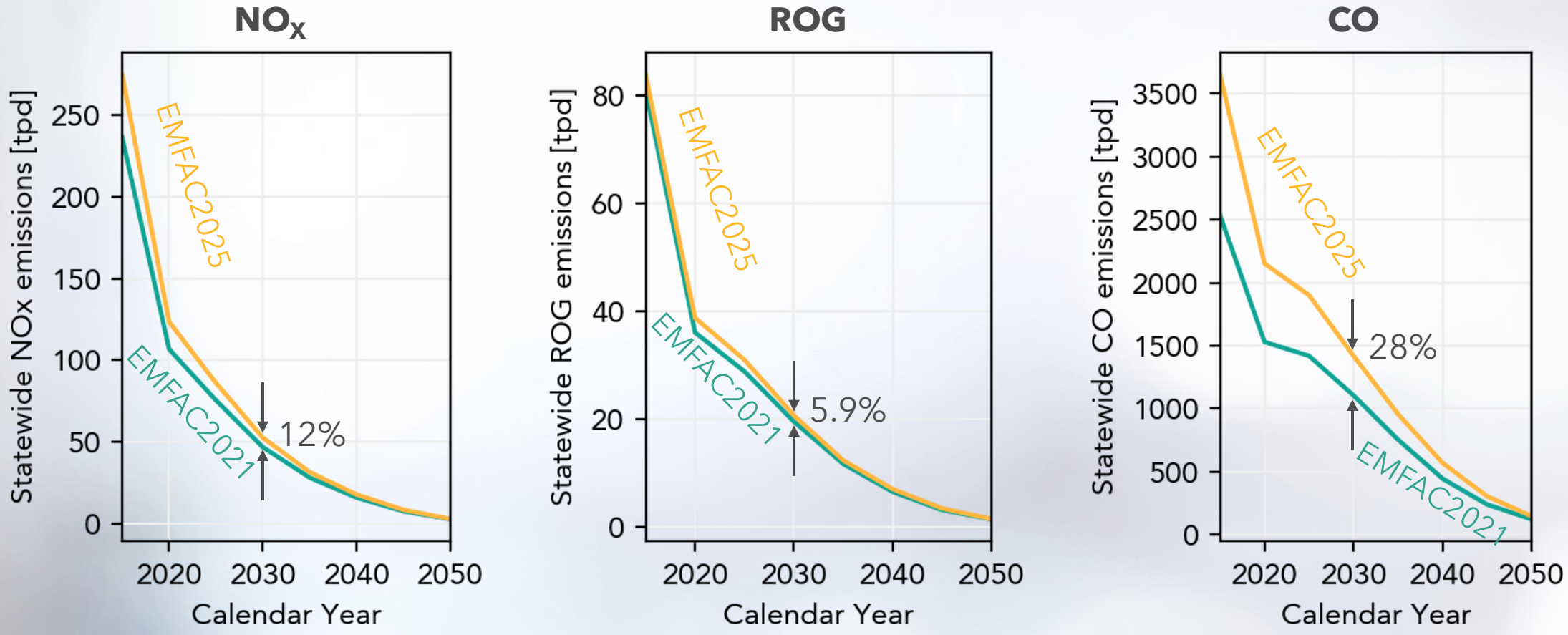




SCF: LEV II and LEV III (38 Vehicles)



Statewide LD Emissions Impact (SCF up to 62.5 mph)



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Overall Updates: EMFAC2025 vs. EMFAC2021

Overall Trends: Light-Duty Vehicle Updates (Gross Vehicle Weight Rating ≤ 8,500 lbs)

Update	Emissions Impact
Vehicle miles traveled forecasting	**Decrease in VMT led to a decrease in all pollutant emissions**
Advanced Clean Cars II	**Decrease in emissions for all pollutants and processes (except tire wear)**
Zero-emission (ZE) tire wear emission rate	**Increase in tire wear emissions for zero-emission vehicles**
Speed correction factors	**Increase in NOx, ROG, and CO**
High speed driving	**Increase in ROG, and NOx**
Age 45+ vehicles	**Increase in ROG and NOx**
Base emission rates	**Decrease in ROG and NOx**
Federal Multi-Pollutant Emissions Standards	**Decrease in CO_2**
Light-duty regional forecasting	**Neutral statewide (emissions impacts depend on region)**

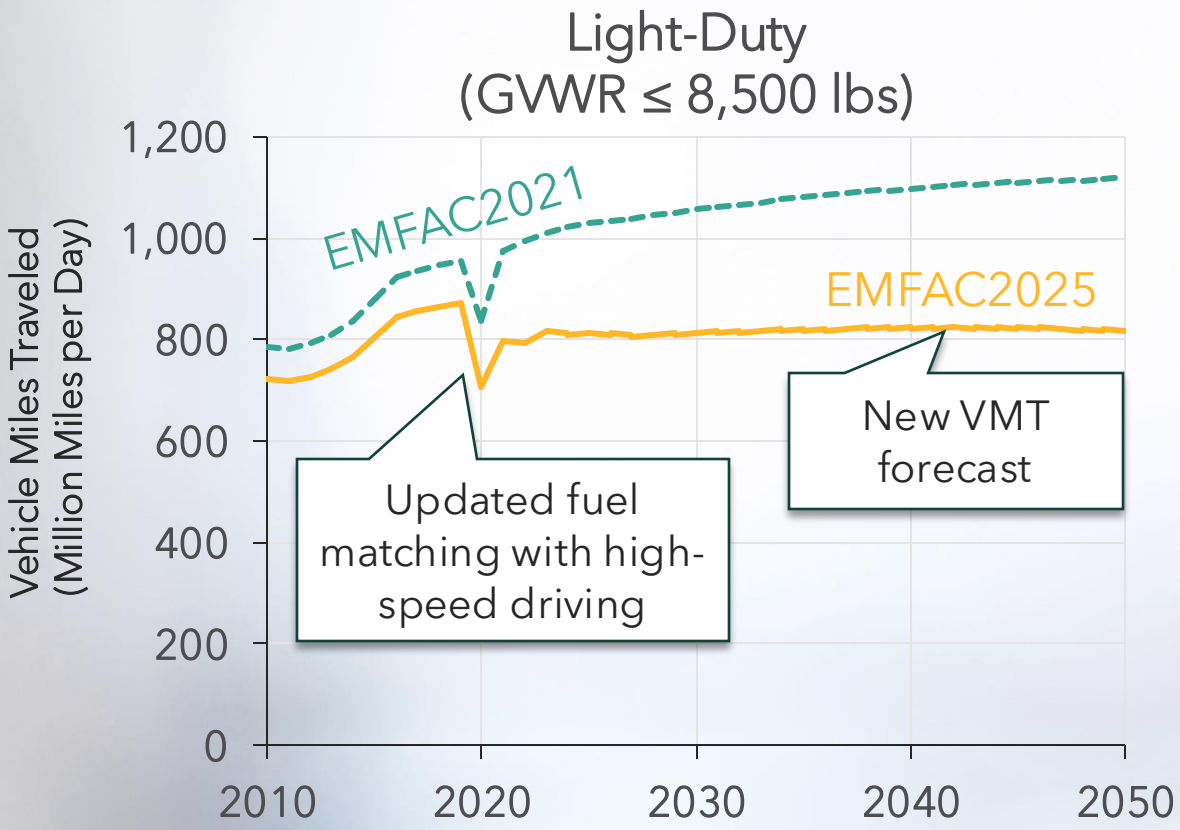
Overall Trends: Heavy-Duty Vehicle Updates (Gross Vehicle Weight Rating > 8,500 lbs)

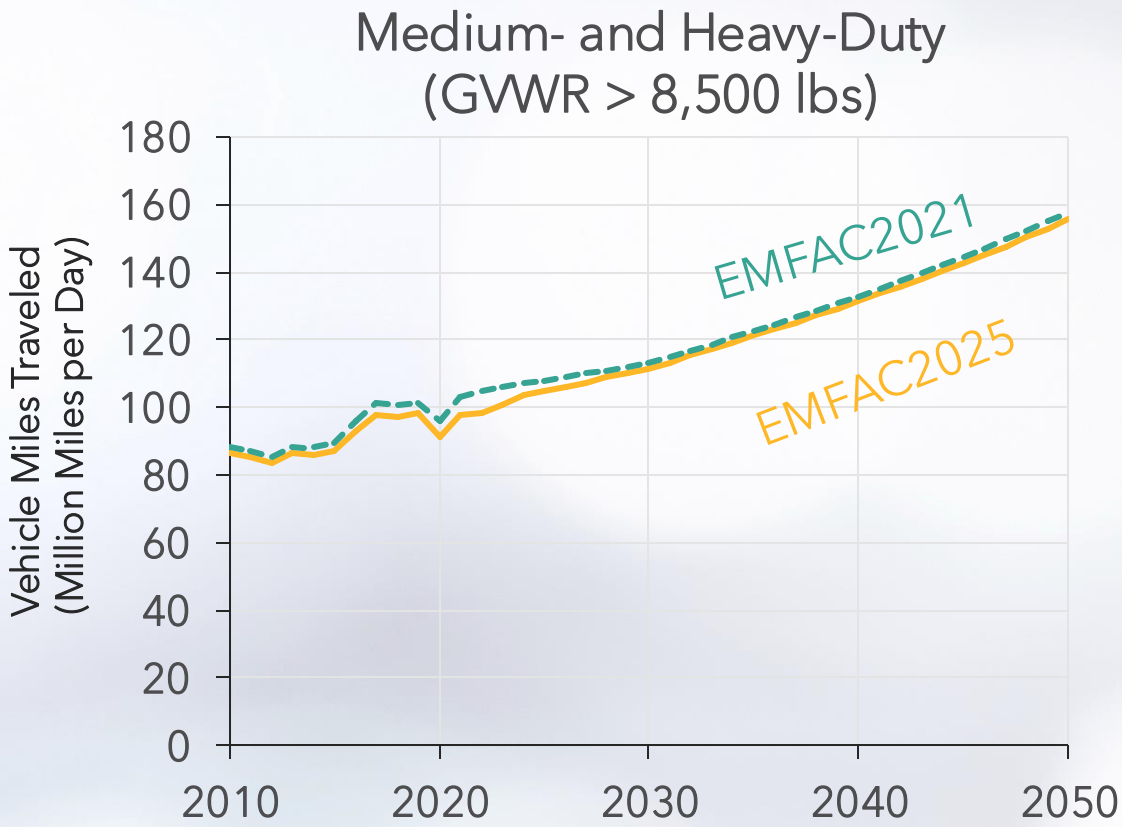
Update	Emissions Impact
Vehicle miles traveled forecasting	**Neutral**
• State and Local Government Fleet Requirements (ACF) • 100% heavy-duty ZE sales in 2036 • Heavy-Duty Phase 3 Greenhouse Gas Rule	**Decrease in emissions for all pollutants and processes (except tire wear)**
• Clean Truck Check • Clean Trucks Plan	**Decrease in NOx and exhaust PM**
Speed correction factors based on portable emission measurement systems (PEMS)	**Increase in NOx**
Activity reallocation based on telematics	**Neutral statewide (emissions impacts depend on region)**

Overall Updates: EMFAC2025 vs. EMFAC2021

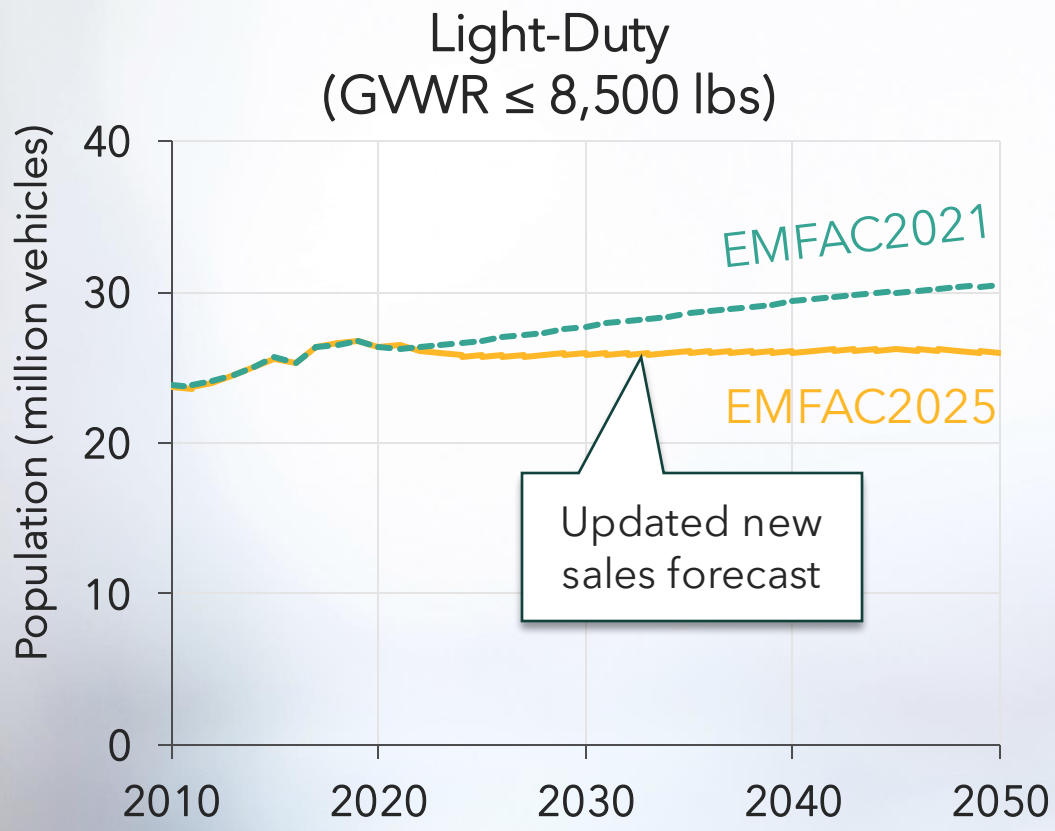
Vehicle Miles Traveled (VMT) and Population

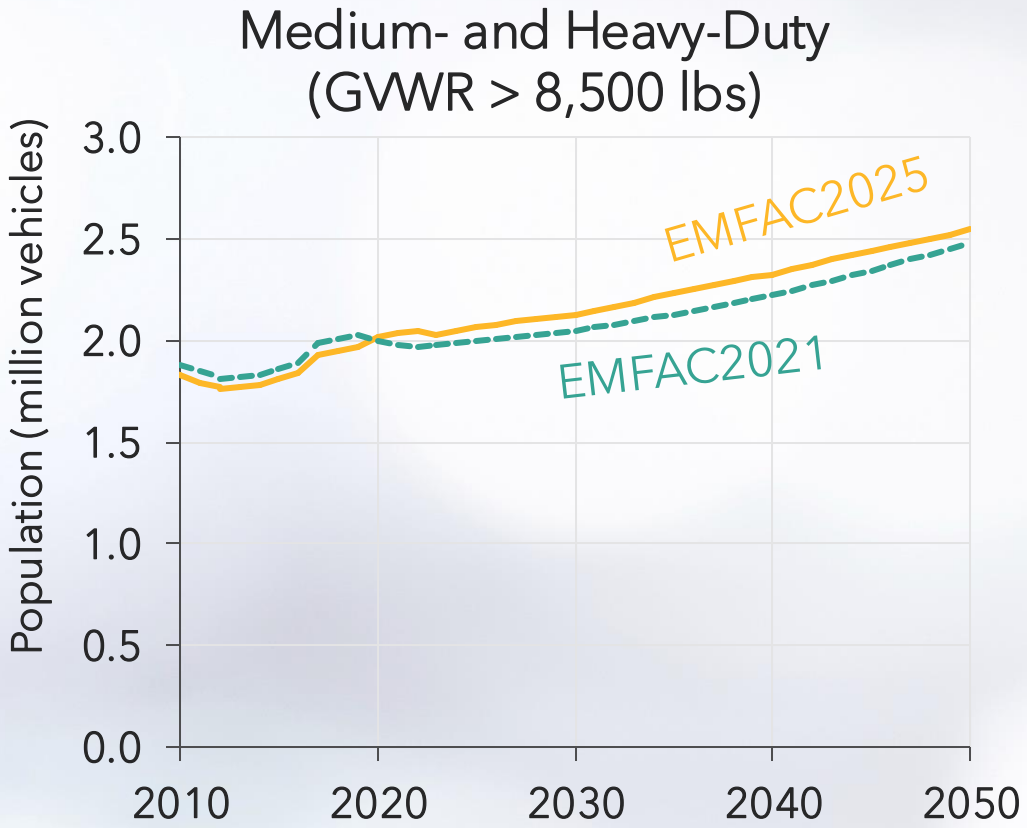
Vehicle Miles Traveled (VMT) – Statewide



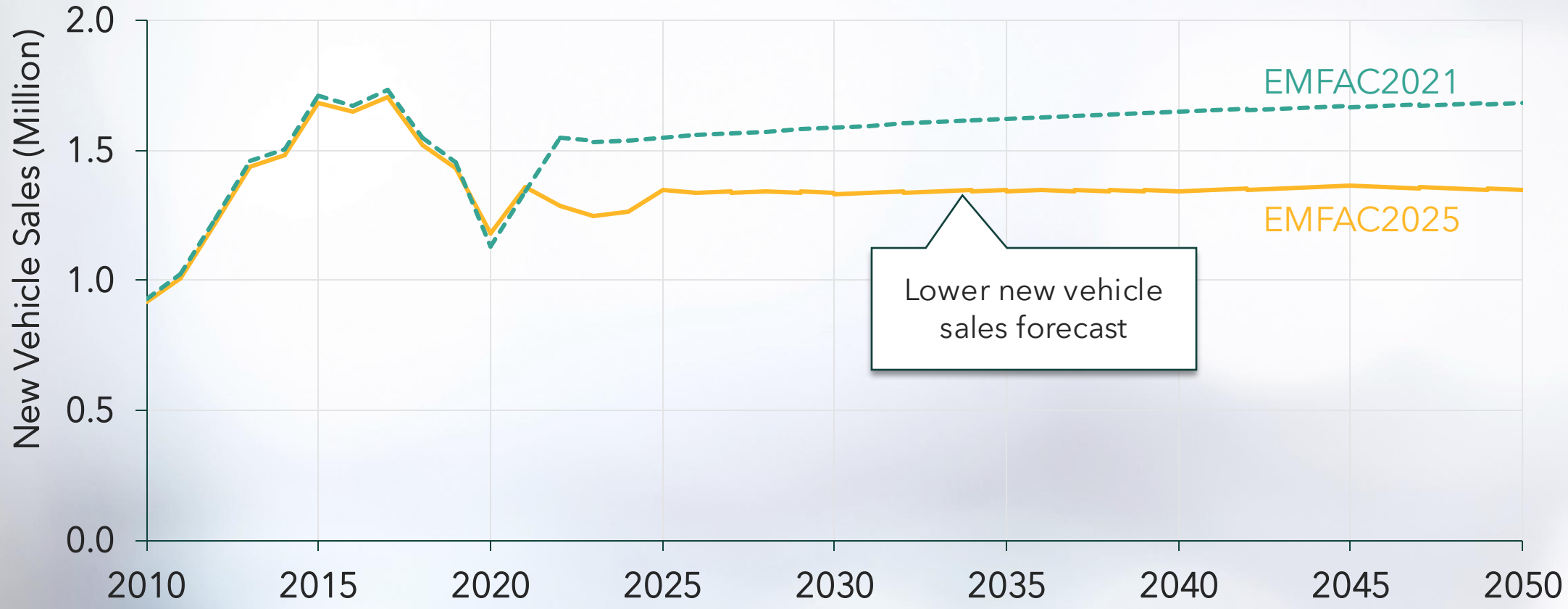


Vehicle Population – Statewide

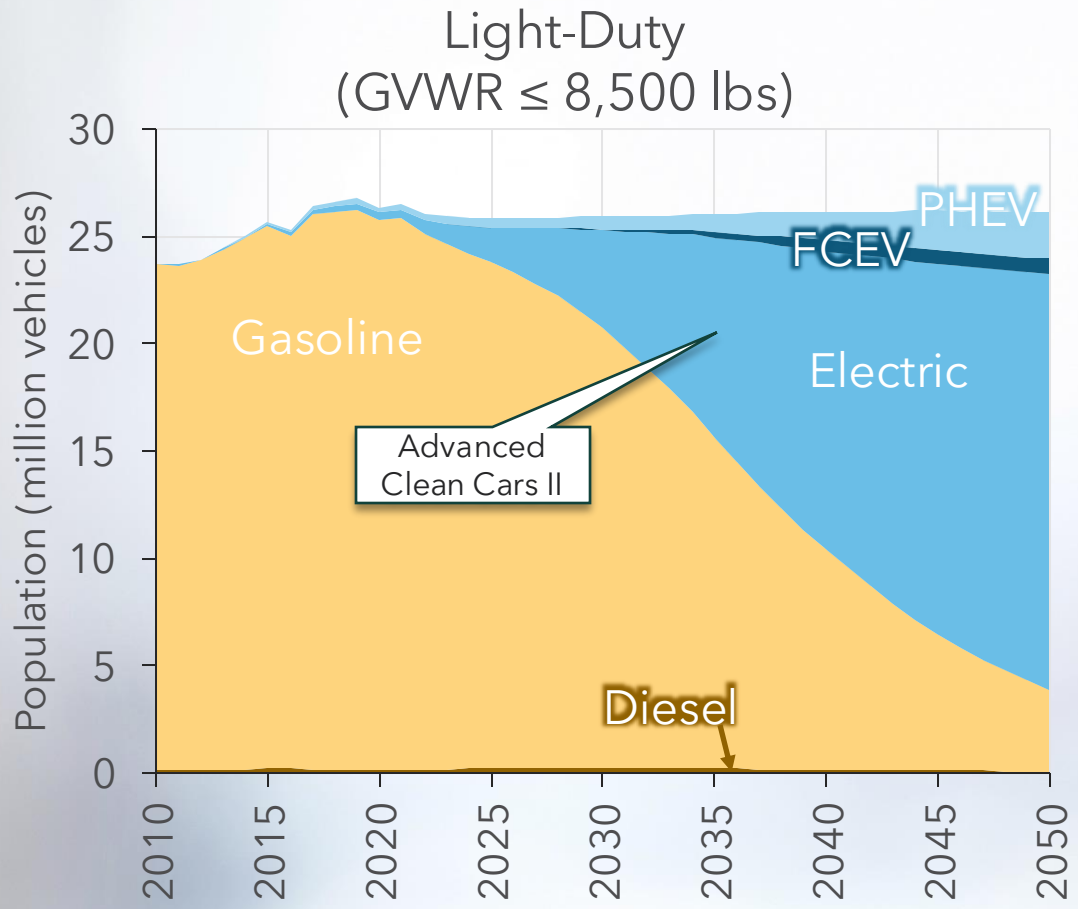


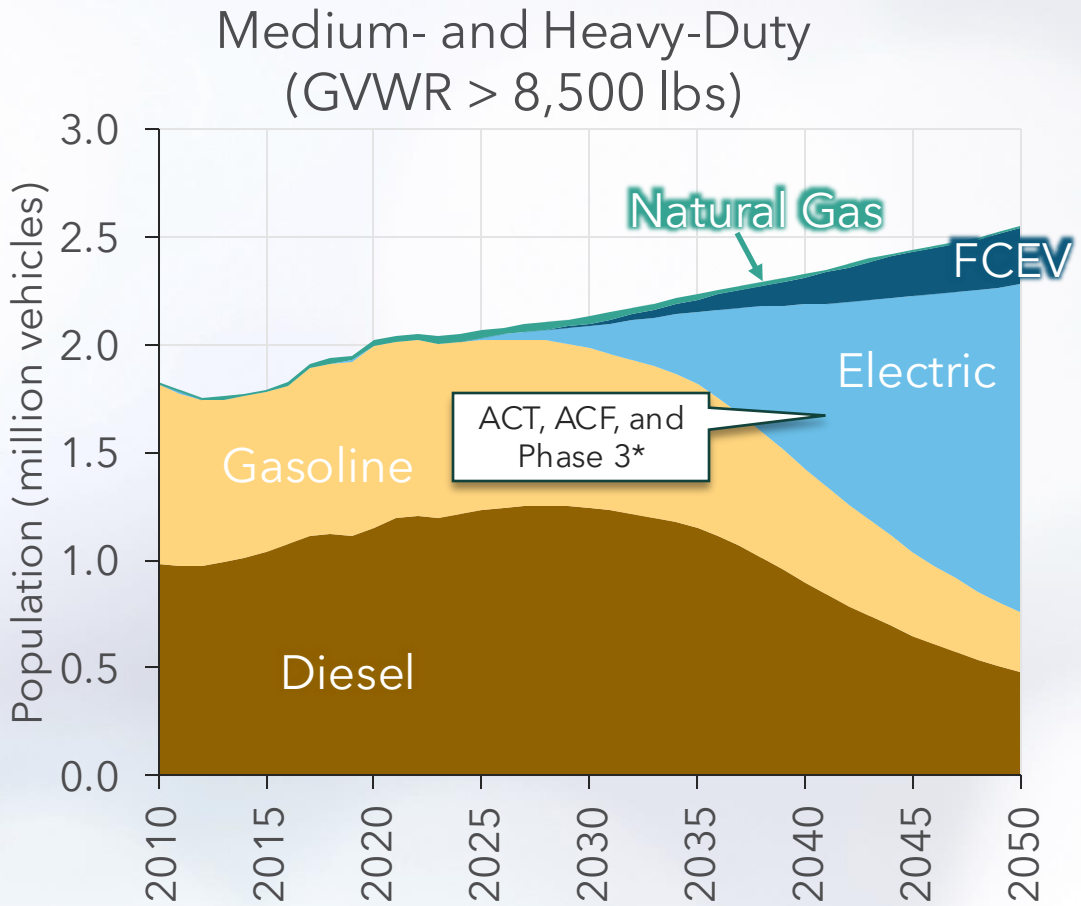


Light Duty New Vehicle Sales – Statewide



Fuel Mix – Statewide



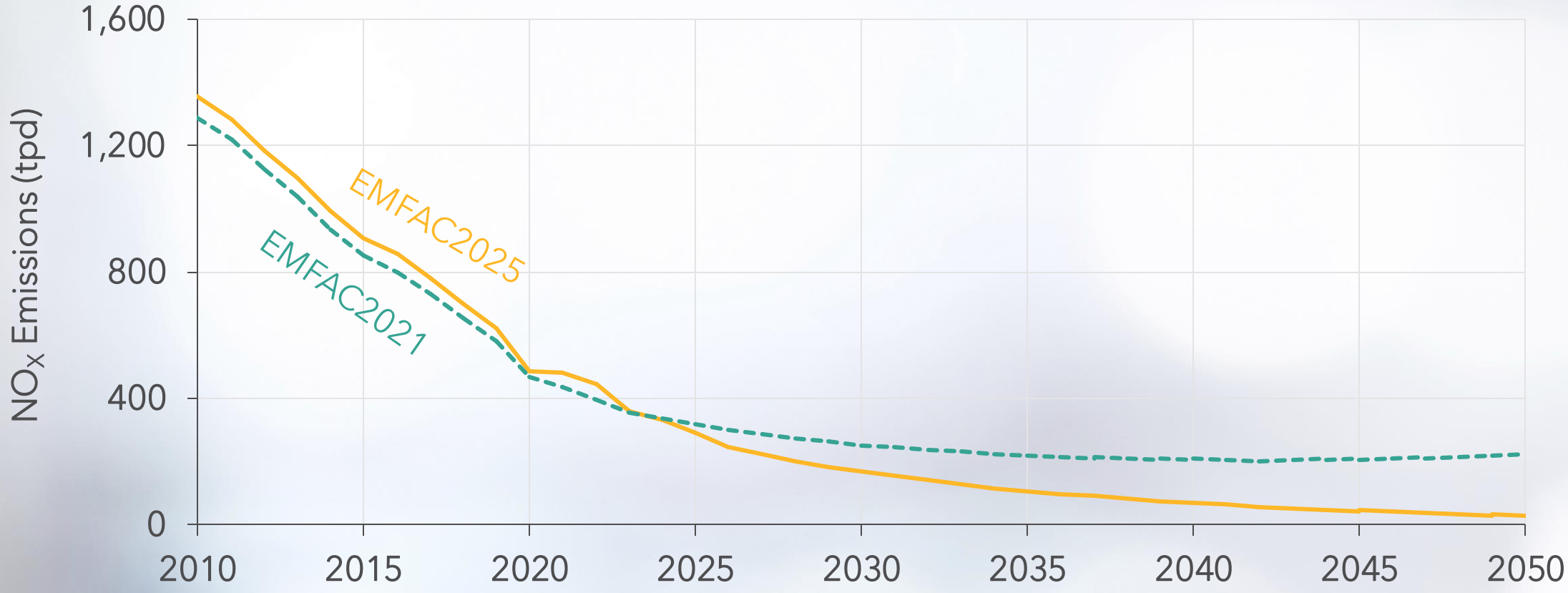


* Excludes drayage and high-priority fleet requirement.

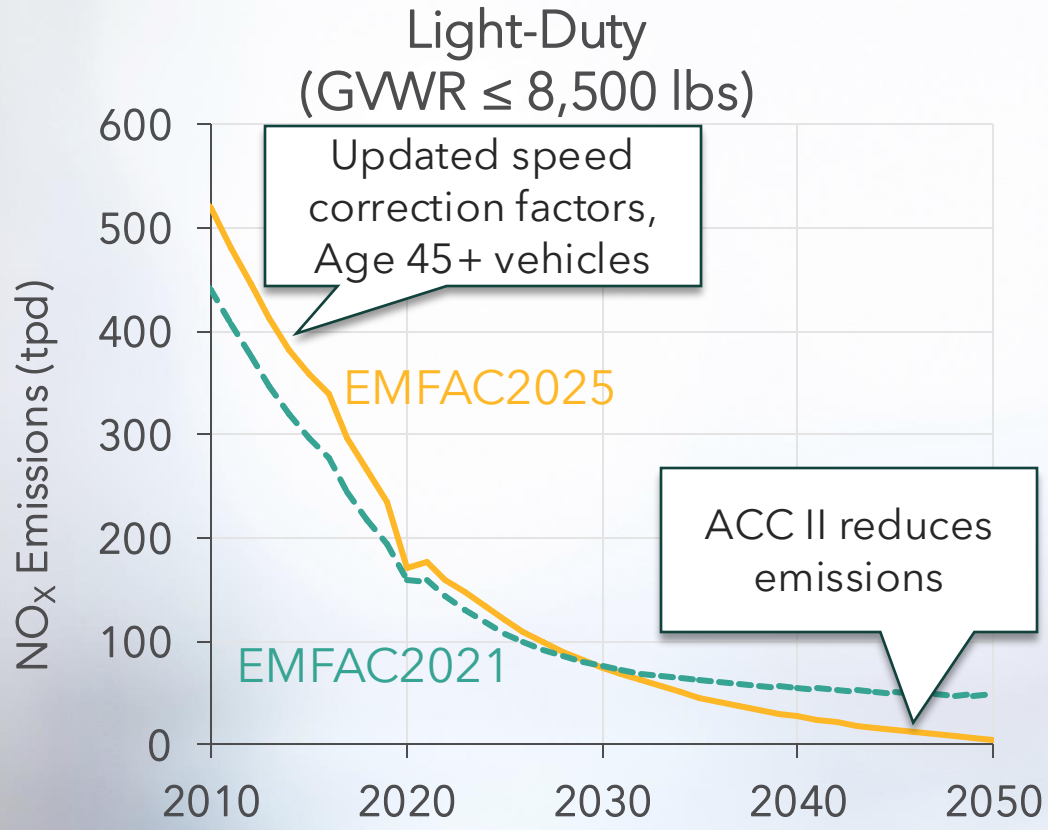
Overall Updates: EMFAC2025 vs. EMFAC2021

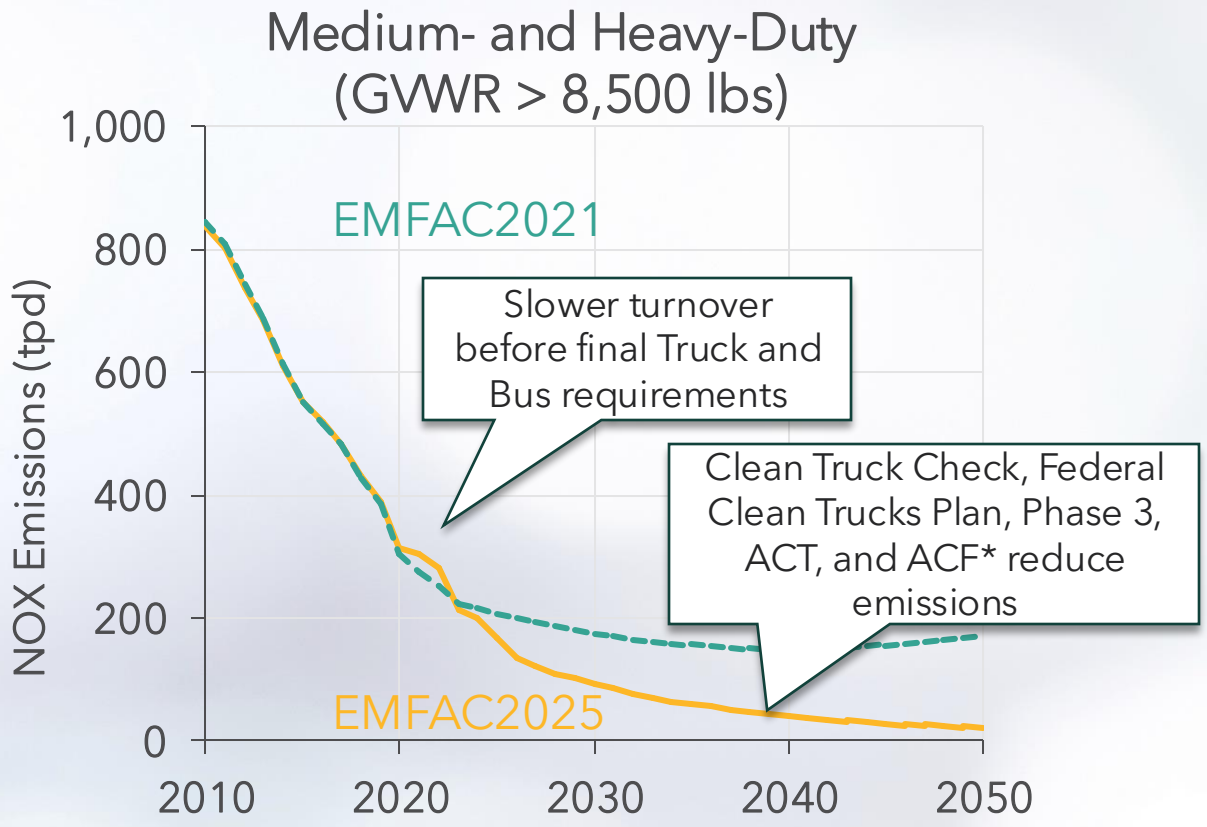
Emissions

NO_X Emissions – Statewide



NO_X Emissions – Statewide





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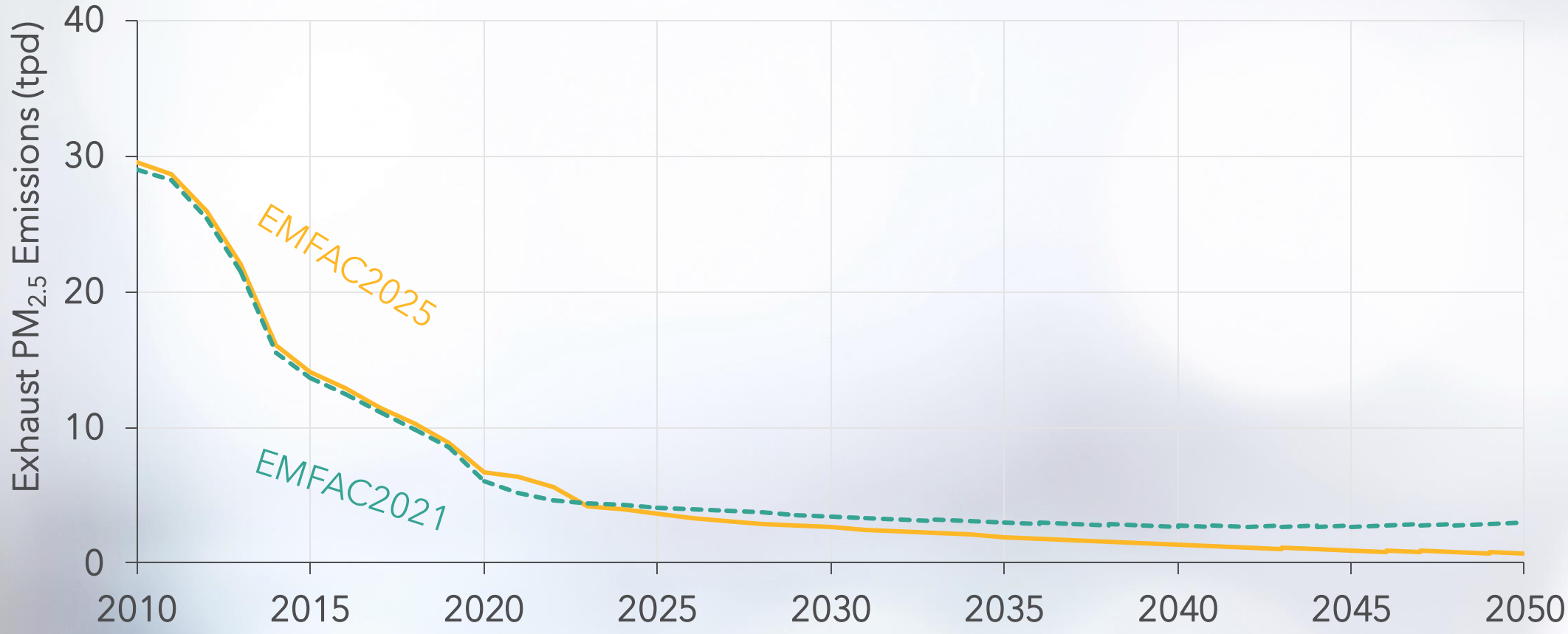
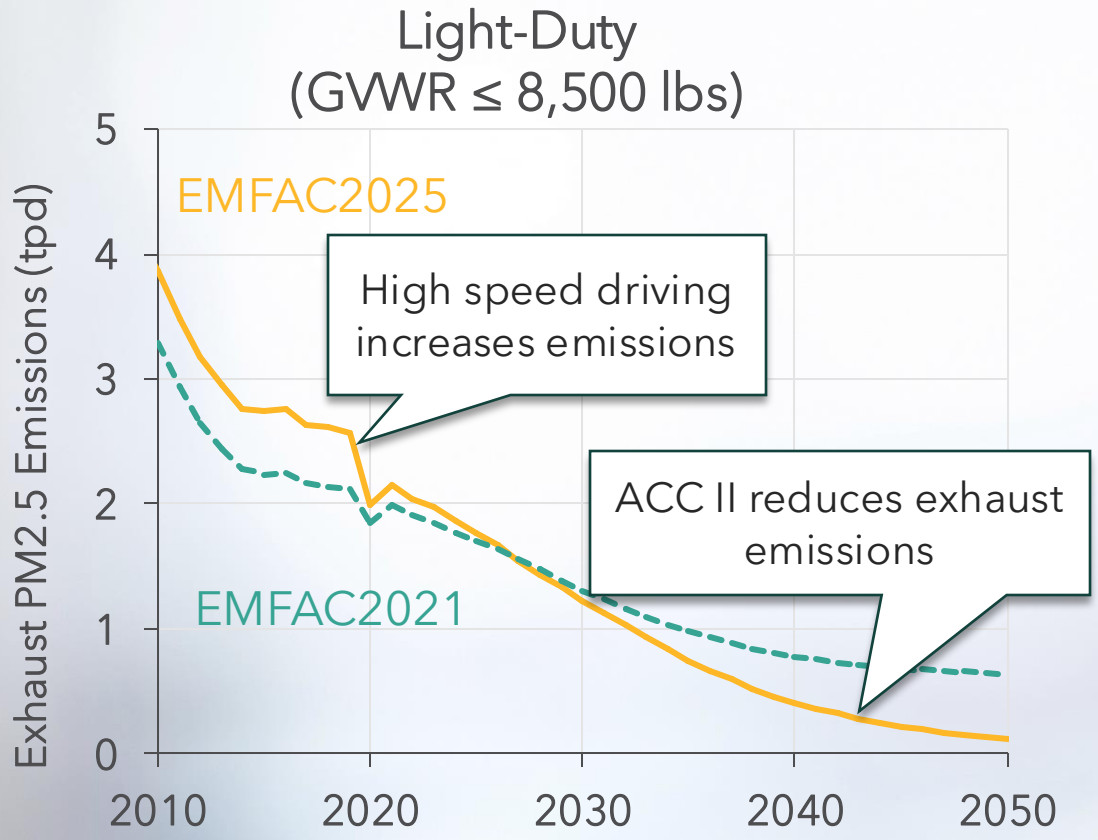
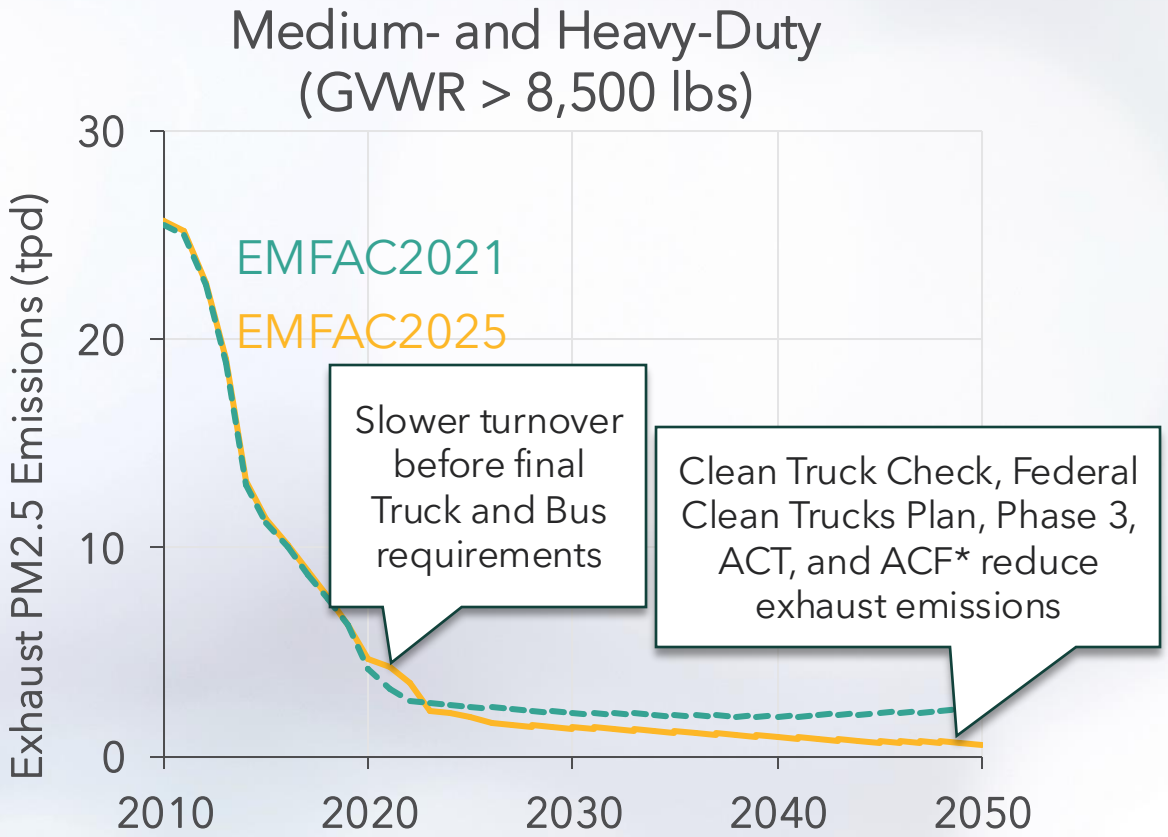
Exhaust $PM_{2.5}$ Emissions – Statewide



Exhaust $PM_{2.5}$ Emissions – Statewide





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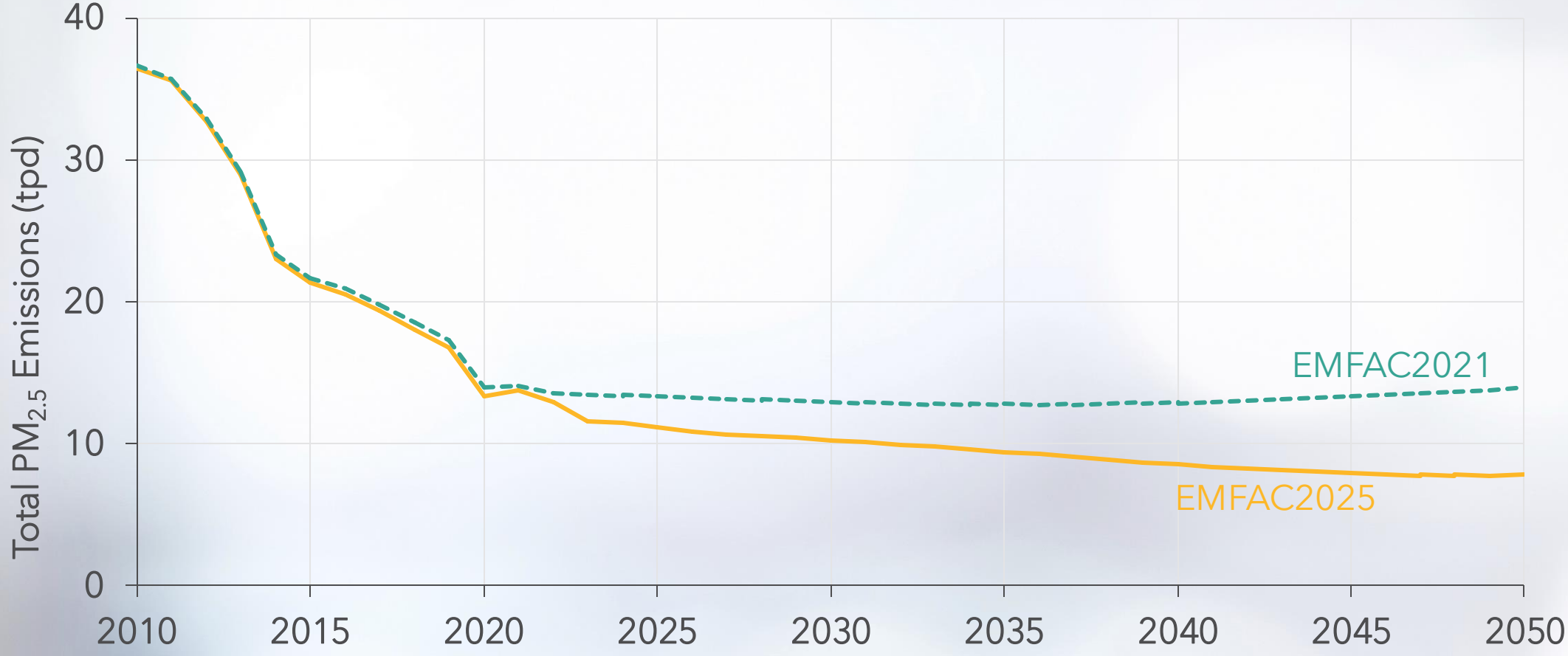
Total $PM_{2.5}$ Emissions – Statewide
Exhaust + Non-Exhaust



Total $PM_{2.5}$ Emissions – Statewide
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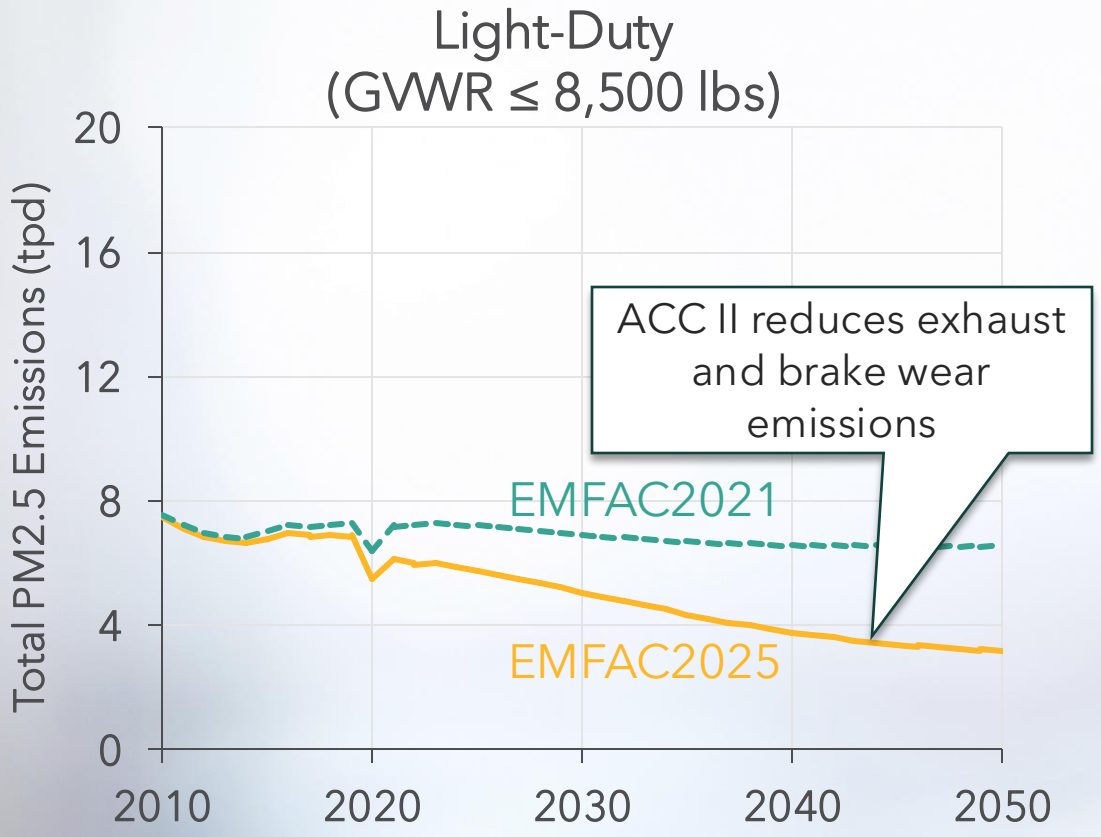

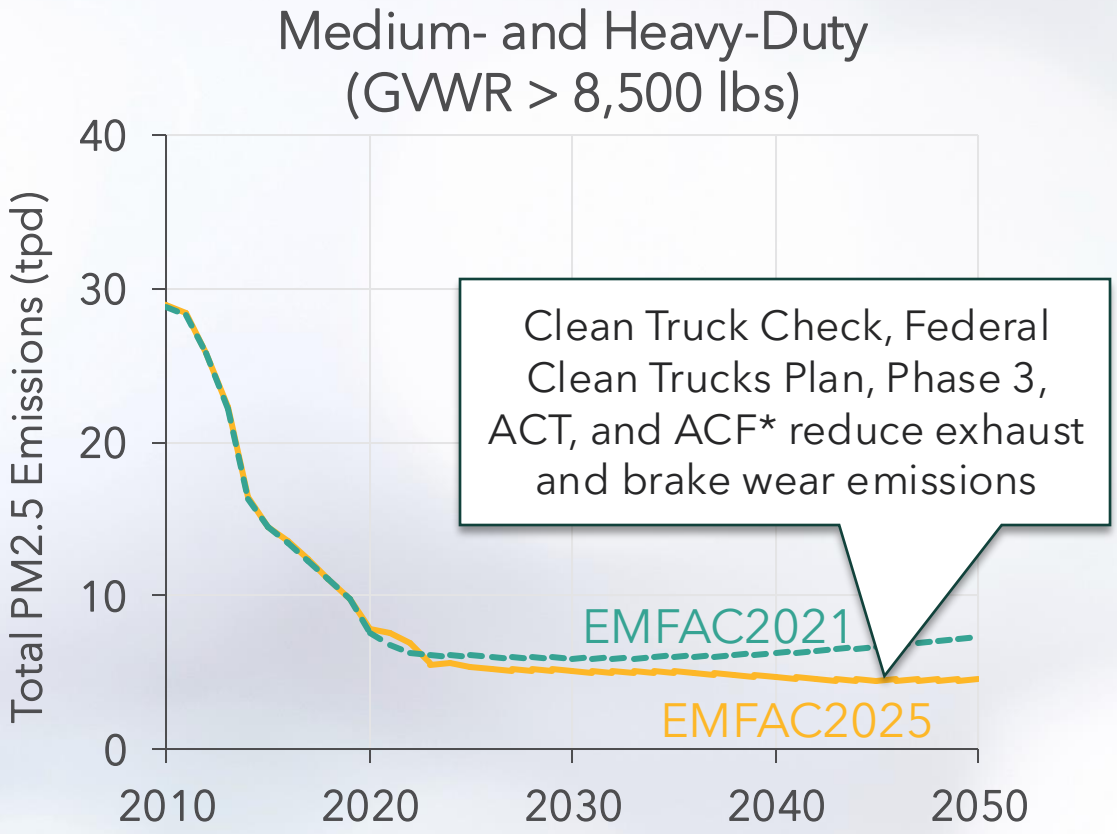

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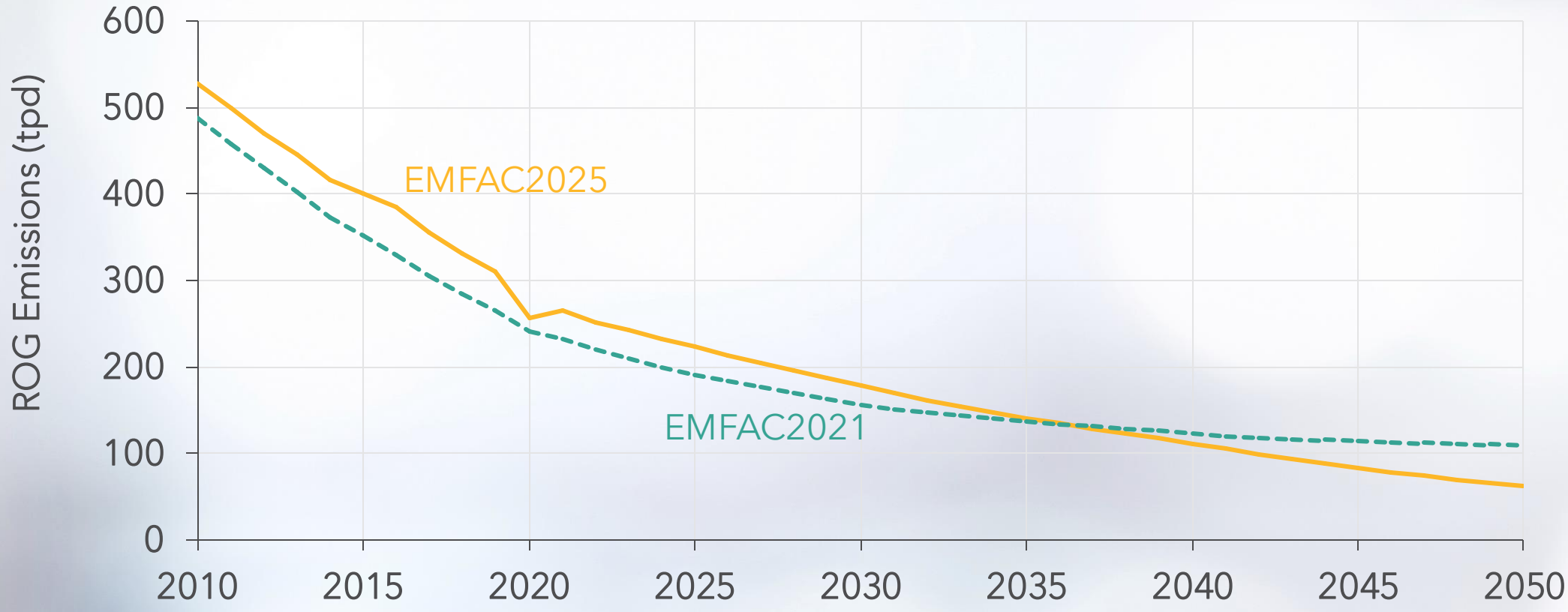
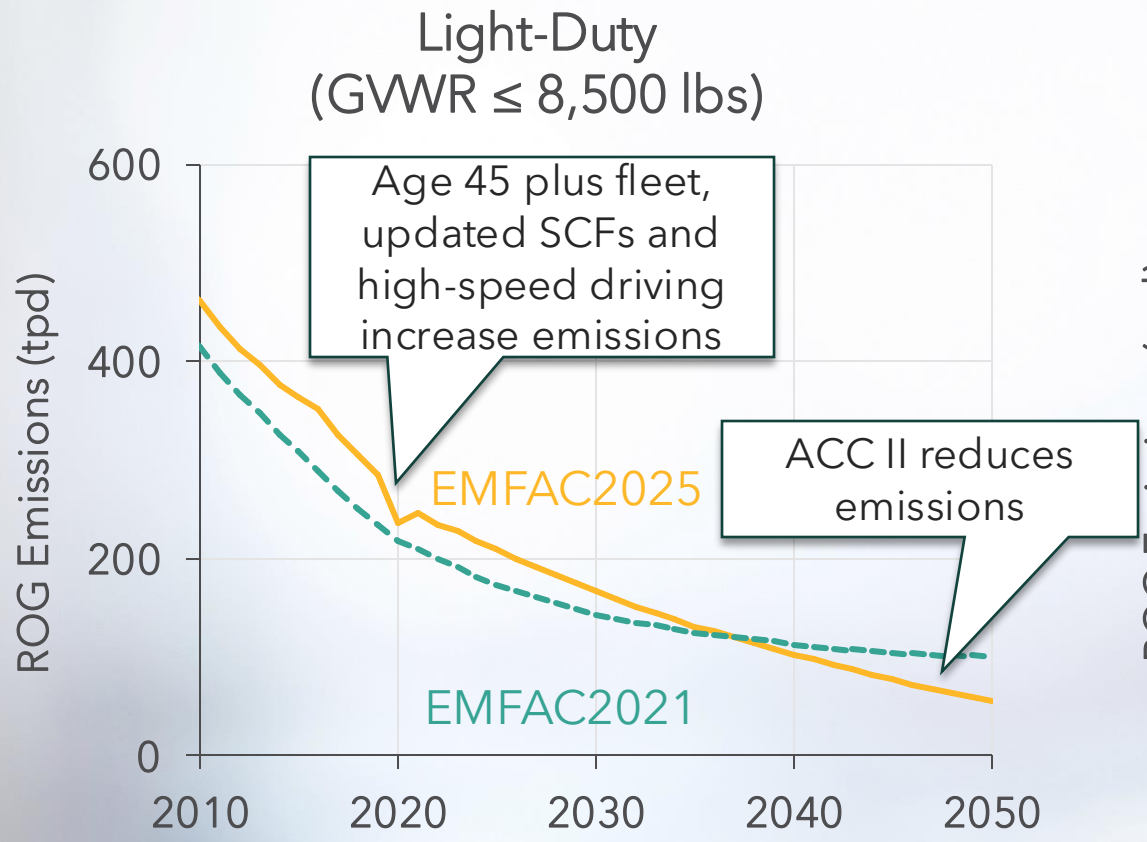
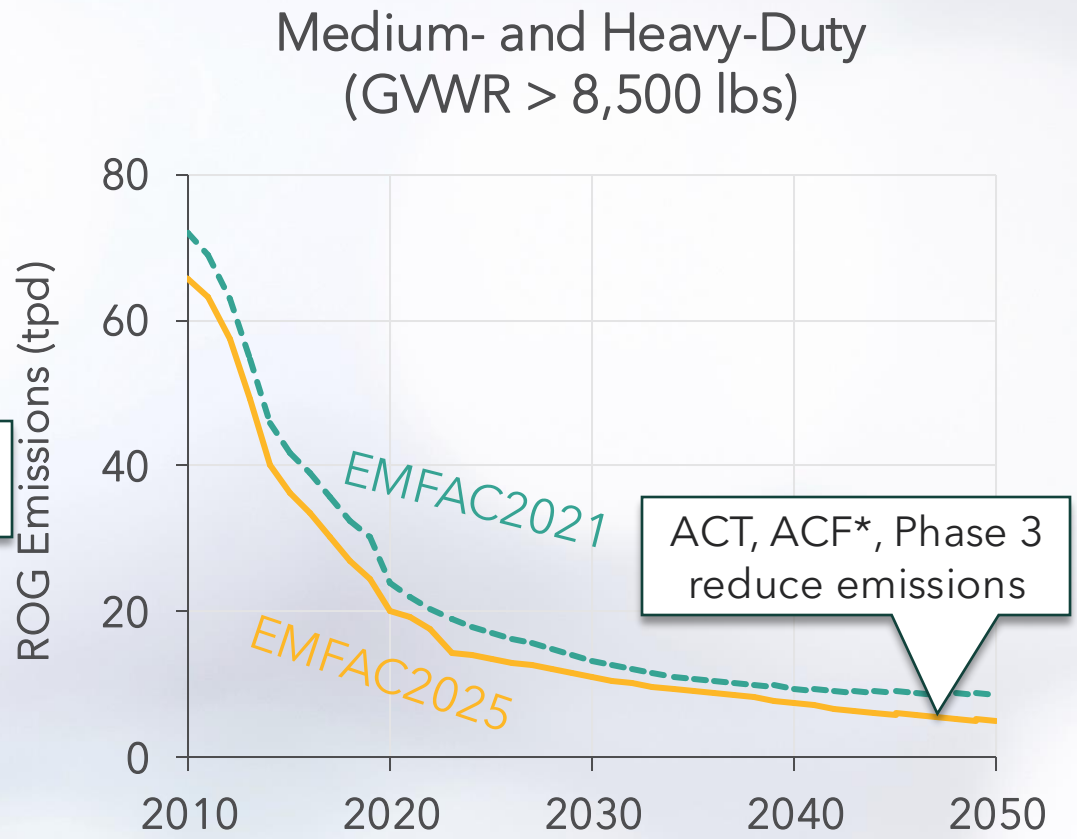
ROG Emissions – Statewide



ROG Emissions – Statewide





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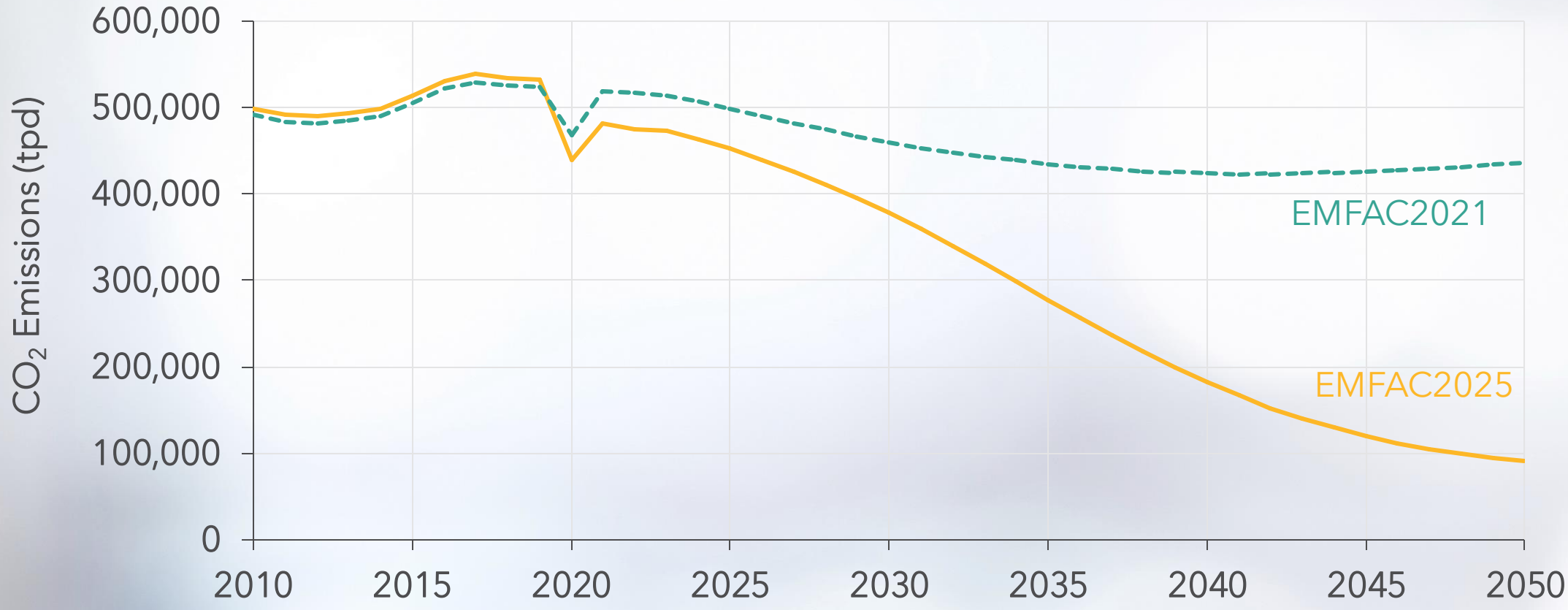
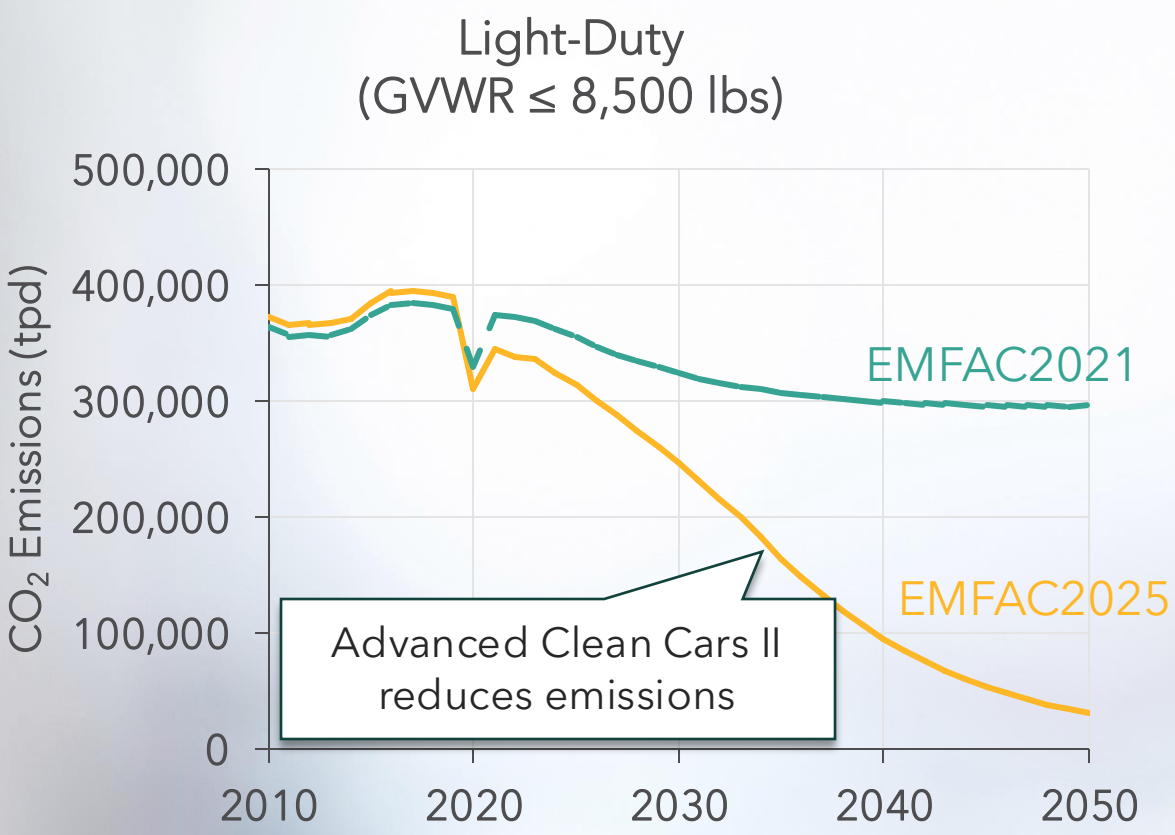
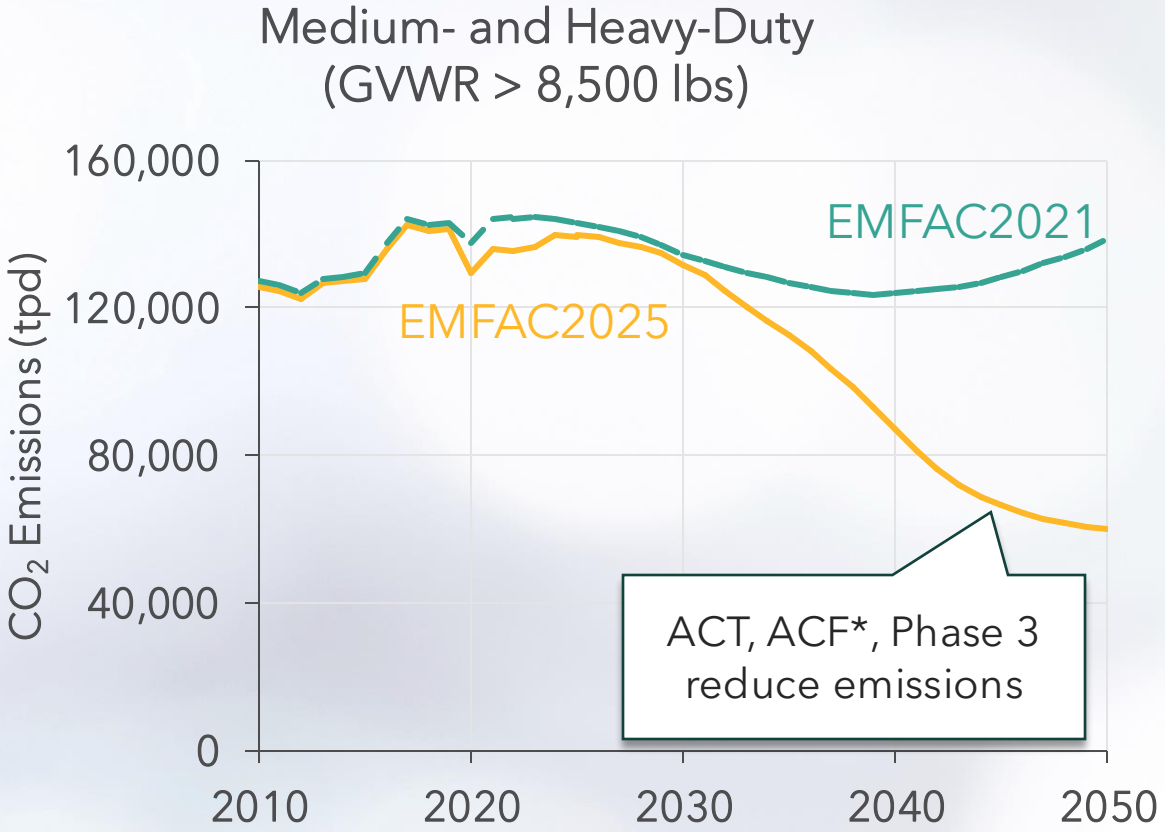
CO_2 Emissions – Statewide



CO_2 Emissions – Statewide





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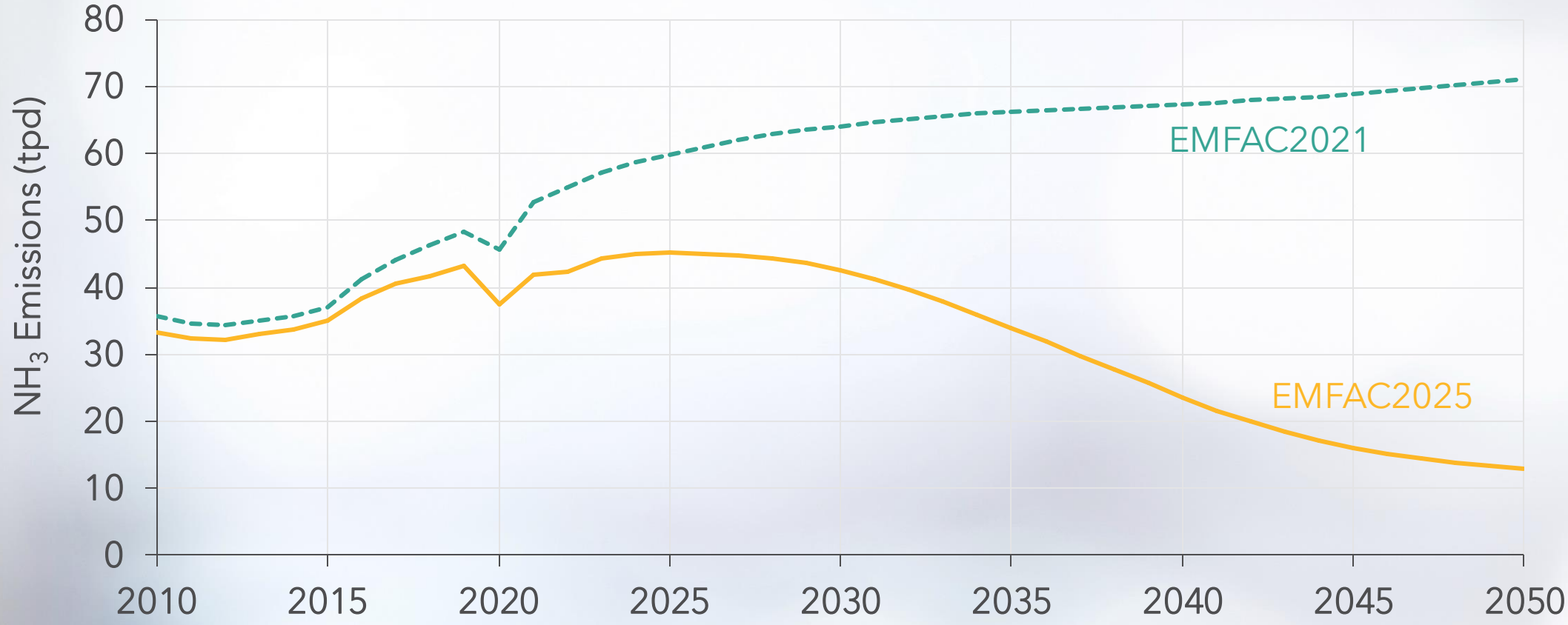
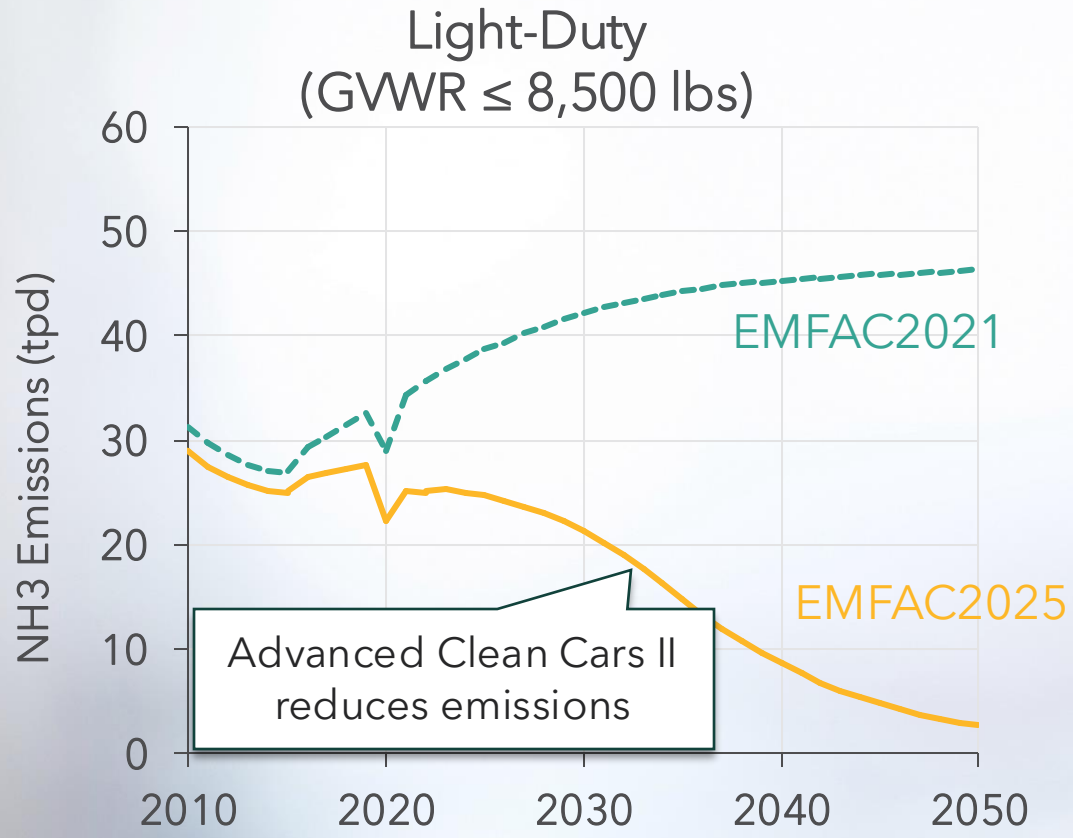
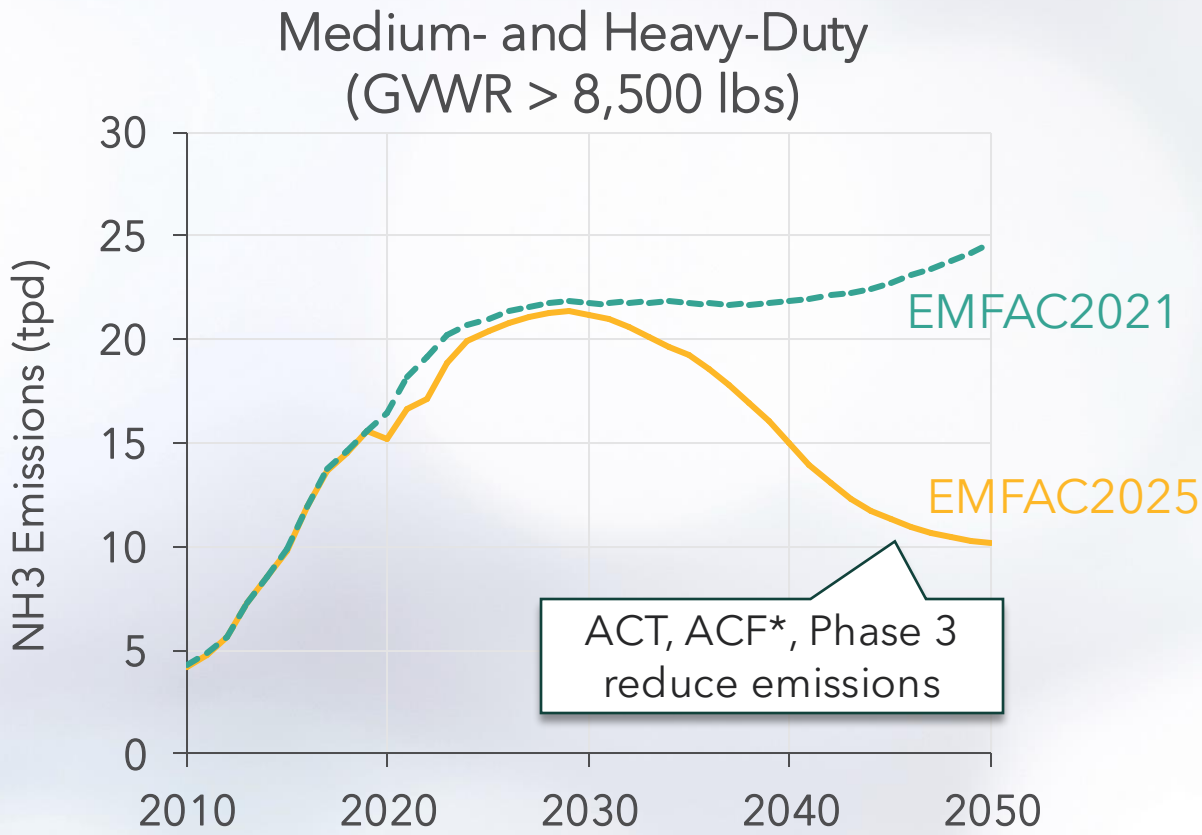
Statewide NH_3 Emissions



Statewide NH_3 Emissions





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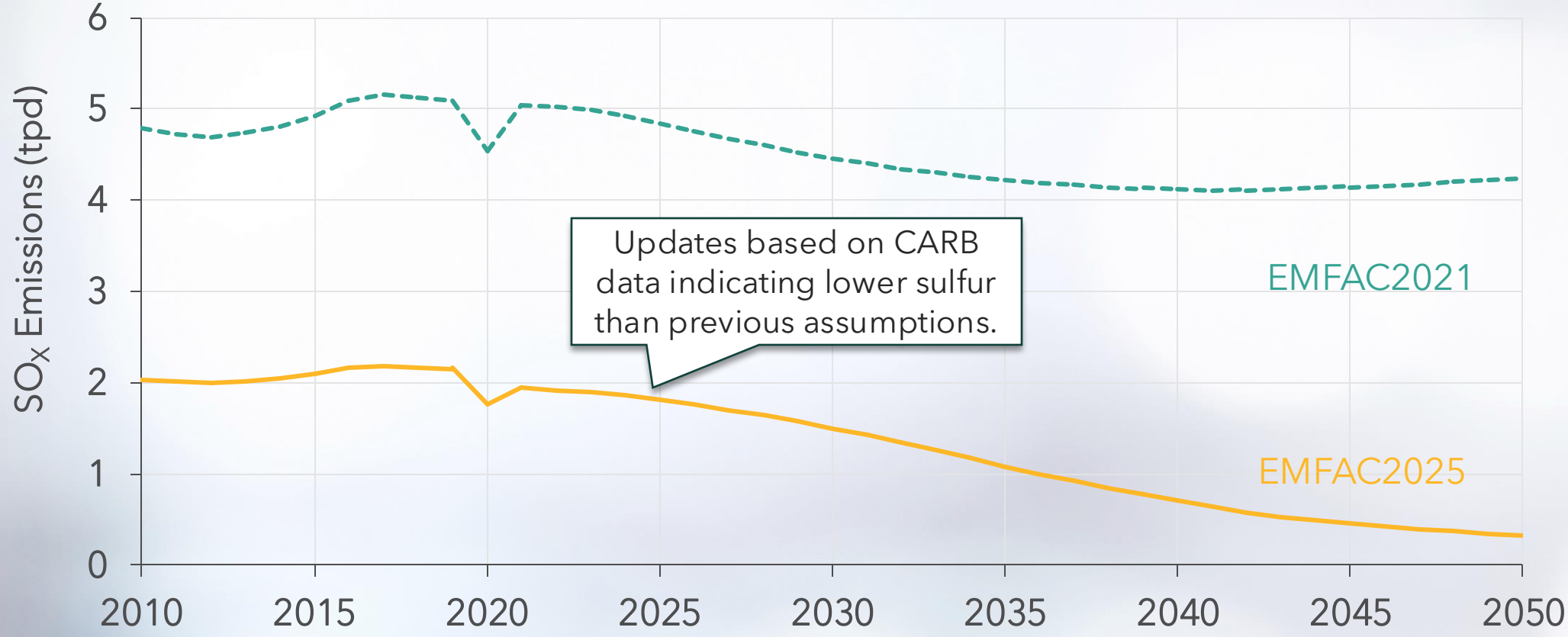
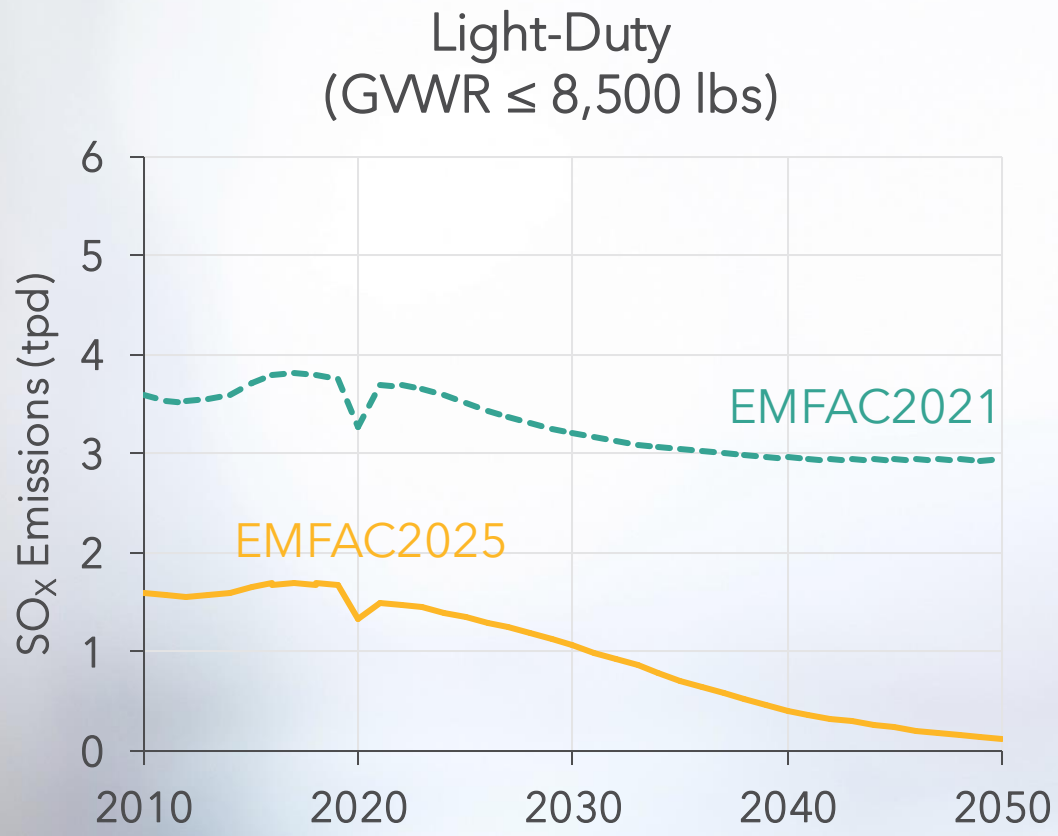
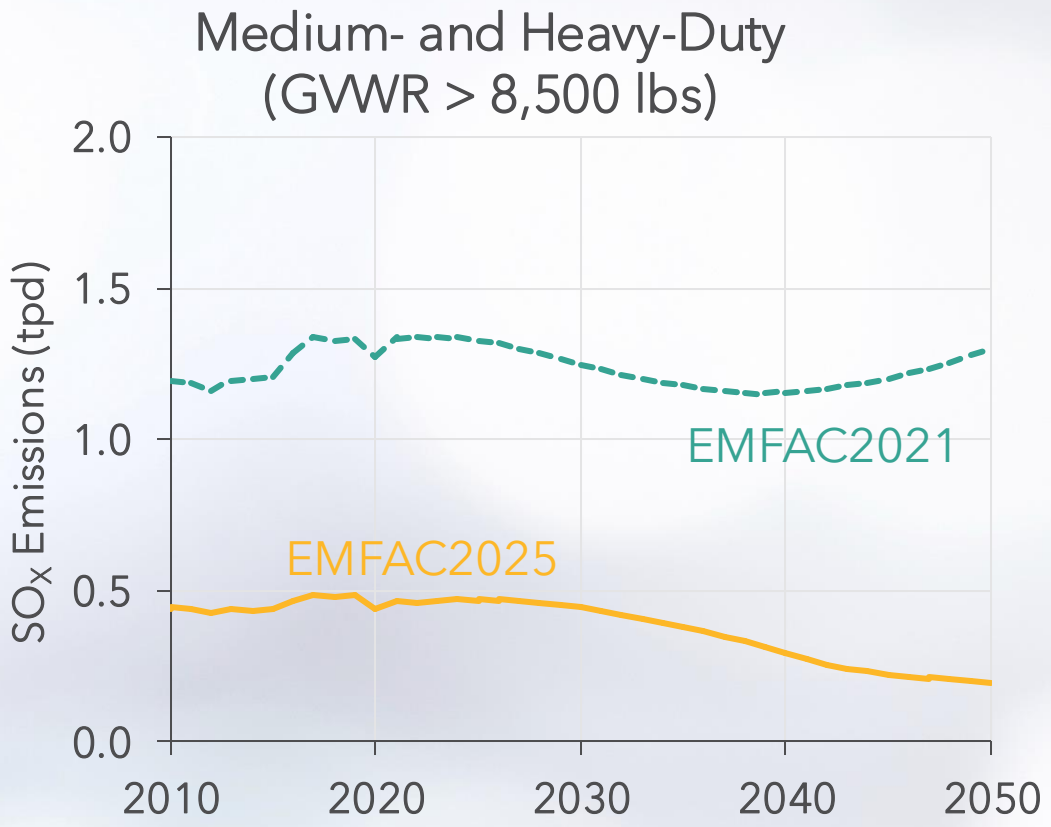
SO_X Emissions – Statewide



SO_X Emissions – Statewide





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EMFAC2025 Next Steps

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5. **Questions and Answers**

Questions and Answers

- Please raise your hand if you would like to ask a question
  - Include slide numbers, if possible
  - In Zoom: Use “Raise Hand” feature
  - On phone:
    - #2 to “Raise Hand”
    - *6 to Unmute/Mute
- Additional questions may be submitted after today to emfac@arb.ca.gov.