

# ICCT comments on EPA's proposed heavy-duty engine and vehicle standards

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ICCT Heavy-duty vehicles program

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# How did we get here?

**2001:** EPA adopts PM and NO<sub>x</sub> engine standards through model year 2010: 200 mg/bhp-hr

...

**Jan 2020:** EPA publishes *Advance Notice of Proposed Rulemaking (ANPR)*

**Aug 2021:** President Biden issues an executive order asking EPA to:

- consider new NO<sub>x</sub> emission standards starting in model year 2027
- consider revising Phase II GHG standards and the role of ZEVs in model years 2027–2029
- consider a Phase III GHG standard starting as soon as model year 2030

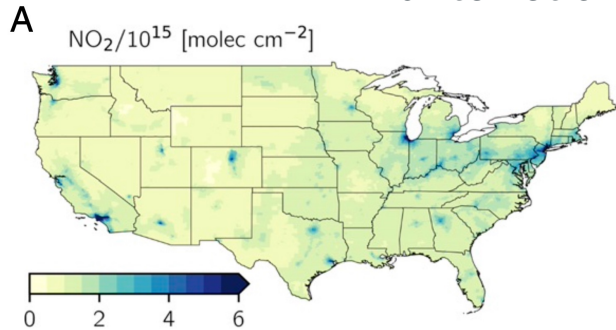
**Dec 2021:** California HDV Omnibus regulation finalized: 20 mg/bhp-hr

**Feb 2022:** EPA releases *Notice of Proposed Rulemaking (NPRM)* **\*\*actual proposal\*\***

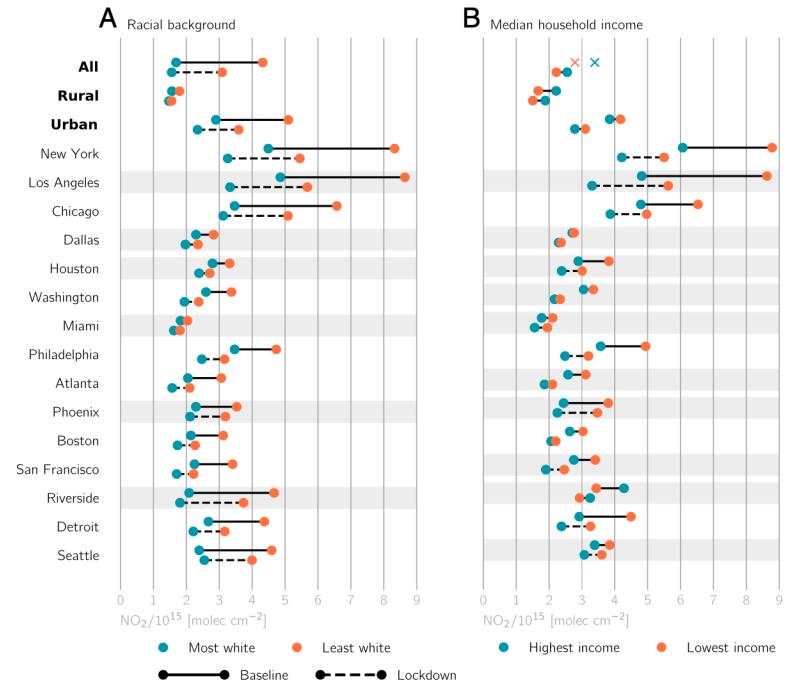
**May 2022:** public comment deadline

# COVID-19 has revealed the central role of HDVs in pollution exposure disparities

*“... targeting NO<sub>x</sub> emissions from heavy-duty diesel vehicles is likely the most effective strategy for reducing disparities nationwide.”*  
- Hunter et al. (2021)



## Disparities in NO<sub>2</sub> exposure pre- and post-COVID



# EPA's proposal, in a few bites

## NO<sub>x</sub>

*Option 1:* 90% reduction in NO<sub>x</sub> limits by 2031, with longer useful life and warranty periods

*Option 2:* 75% reduction in NO<sub>x</sub>, less stringent useful life and warranty

*Both Options:*

- Endless ZEV crediting
- Inducement provisions that could lead to higher in-use emissions

## GHGs

- Tightens 2027 standards by 1.5% for school and transit buses, delivery vans, and short-haul tractors
- Maintains ZEV supercrediting until 2028 (4.5x for a BEV)
- Requests comment on setting a ZEV requirement

# ICCT's recommendations

## NO<sub>x</sub>

- Dismiss Option 2
- Strengthen Option 1, including:
  - 90% reduction in NO<sub>x</sub> limits by 2027
  - Strengthen SCR inducements, including lowering speed derates and removing overrides of disincentives
  - Do not allow ZEV crediting

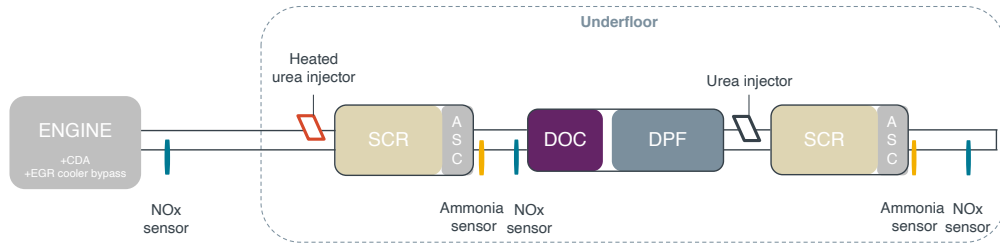
## GHGs

- Set minimum ZEV production requirements to achieve 20%, 30% and 40% ZEV sales in 2027, 2028 and 2029
- Preserve the original Phase II stringency for ICE vehicles
- Phase-out ZEV supercrediting towards GHGs in 2024 or as soon as feasible

NO<sub>x</sub>

# Updated NO<sub>x</sub> standards are technically feasible

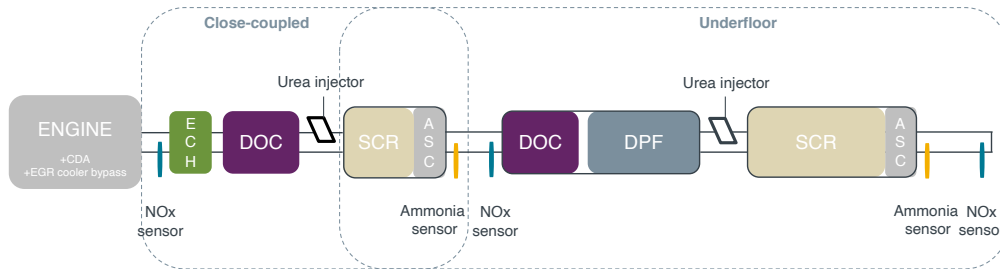
Various technology pathways can achieve 20 mg/hp-hr NO<sub>x</sub> emissions



Demonstrated by SwRI

- Up to 800k miles
- 2% FTP compliance margin

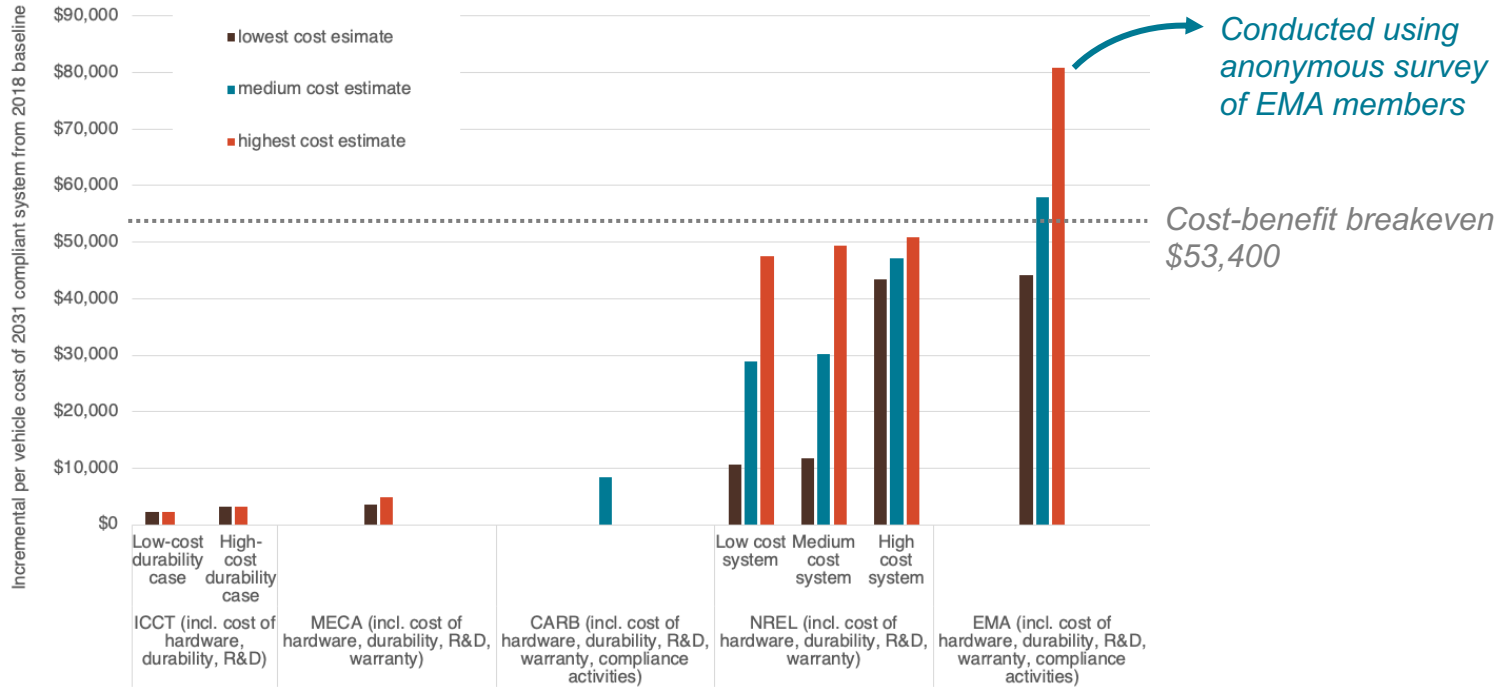
Source: SwRI 2022. SAE presentation



Ongoing project in Europe at the vehicle level in real world use

Source: AECC 2021. <https://www.aecc.eu/wp-content/uploads/2021/10/211005-AECC-presentation-Aachen-1.pdf>

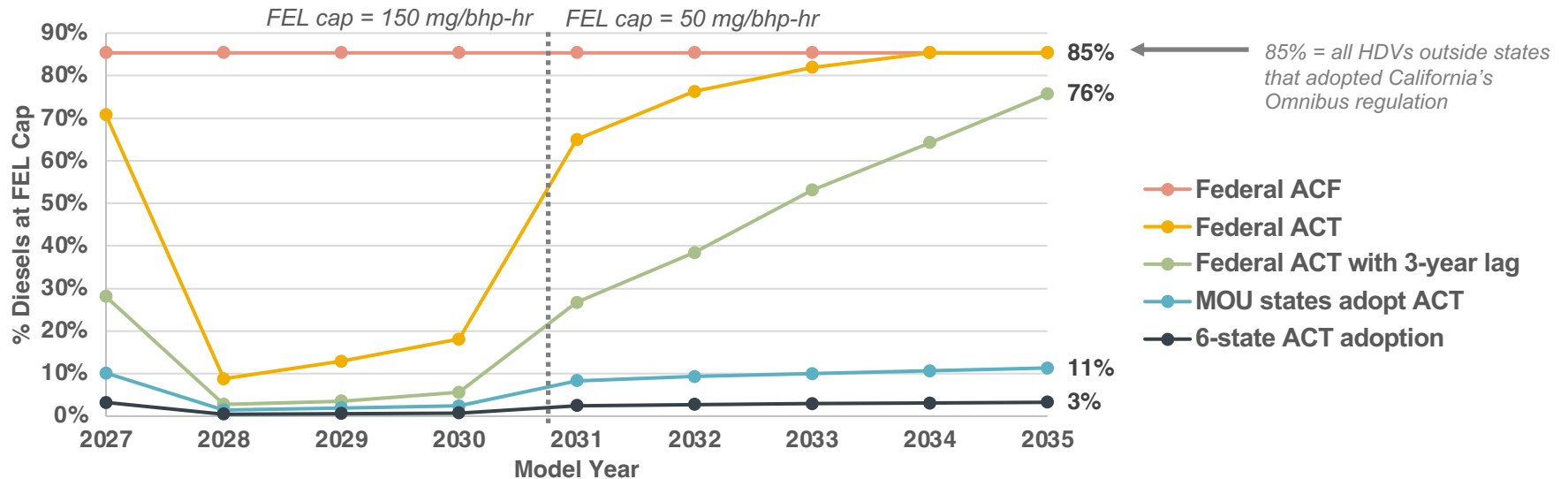
# Updated NO<sub>x</sub> standards are economically feasible





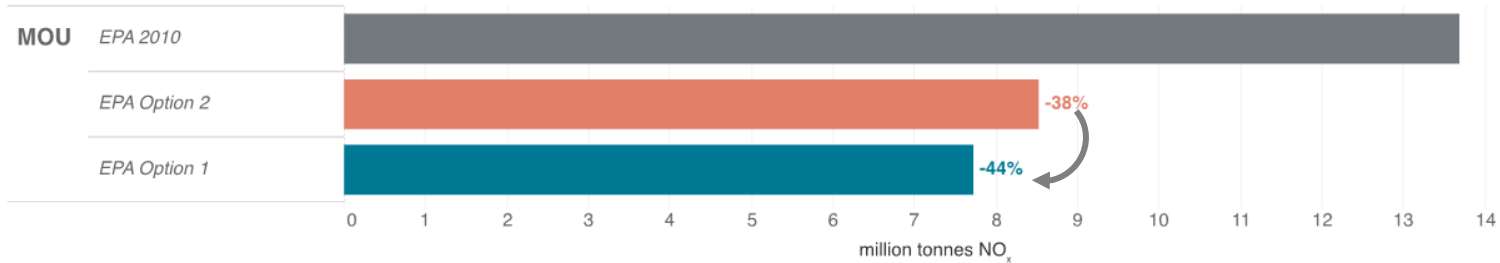
# ZEV crediting would allow OEMs to produce higher emitting diesel engines

Share of diesel engines that can be certified at the **FEL** cap by model year and scenario under **Option 1**



# Stricter NO<sub>x</sub> regulations reduce HDV NO<sub>x</sub> emissions

Cumulative tailpipe NO<sub>x</sub> emissions by scenario, 2027–2050



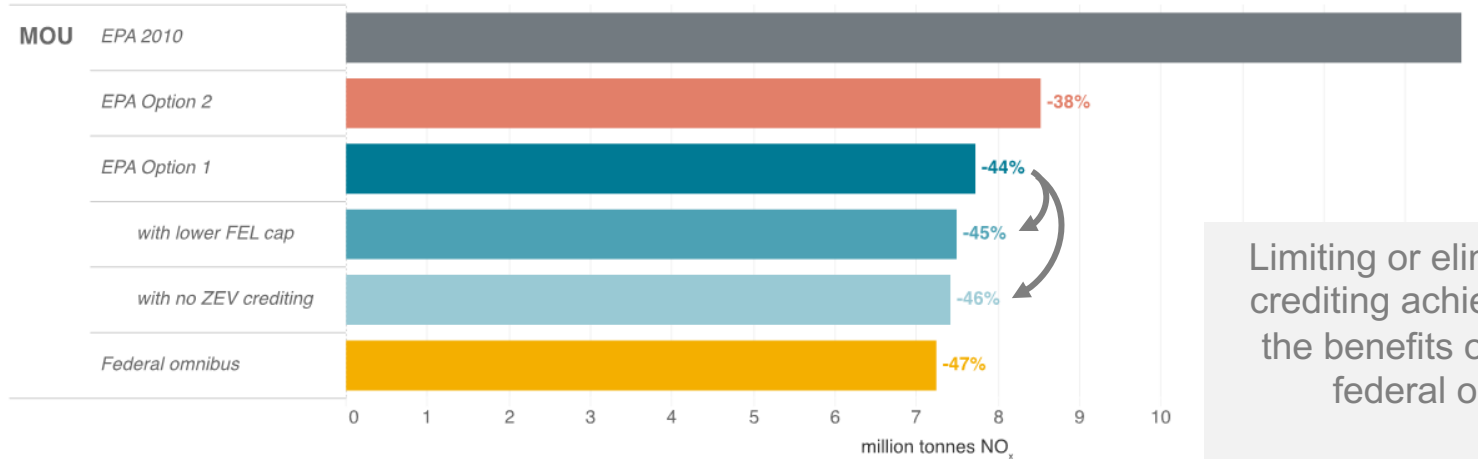
Choosing Option 1 over Option 2 avoids nearly **1 million tonnes** of NO<sub>x</sub> emissions between 2027 and 2050

Not considered:

- Inducements
- In-use testing
- New test cycles

# Stricter NO<sub>x</sub> regulations reduce HDV NO<sub>x</sub> emissions

Cumulative tailpipe NO<sub>x</sub> emissions by scenario, 2027–2050



Limiting or eliminating ZEV crediting achieves some of the benefits of adopting a federal omnibus.

These benefits **increase** with accelerated ZEV deployment.

# Key recommendations on **NO<sub>x</sub>** standards

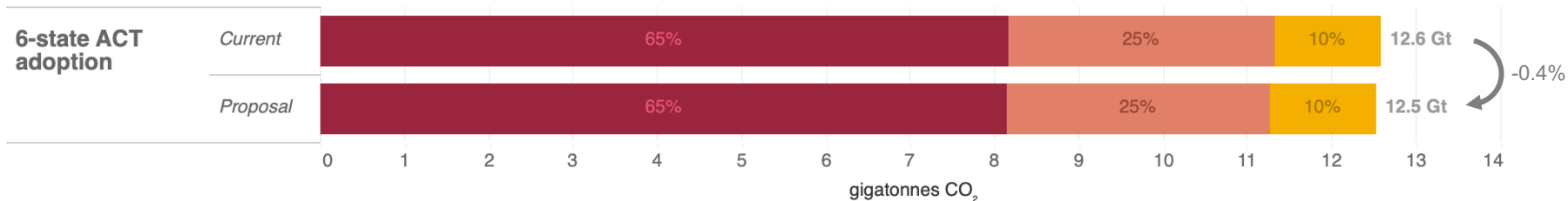
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1. We encourage EPA to **finalize NO<sub>x</sub> engine standards this year**
2. We recommend EPA **adopt a strengthened Option 1** to fully align with a 90% NO<sub>x</sub> reduction in model year 2027
3. We recommend EPA **eliminate ZEV crediting towards NO<sub>x</sub> engine standard compliance**
4. We recommend EPA **strengthen proposed SCR inducement provisions**

# GHGs

# Accelerating ZEV uptake prior to 2030 is crucial to put the sector on a pathway compatible with 2°C

Cumulative well-to-wheel CO<sub>2</sub> emissions by scenario, 2027–2050

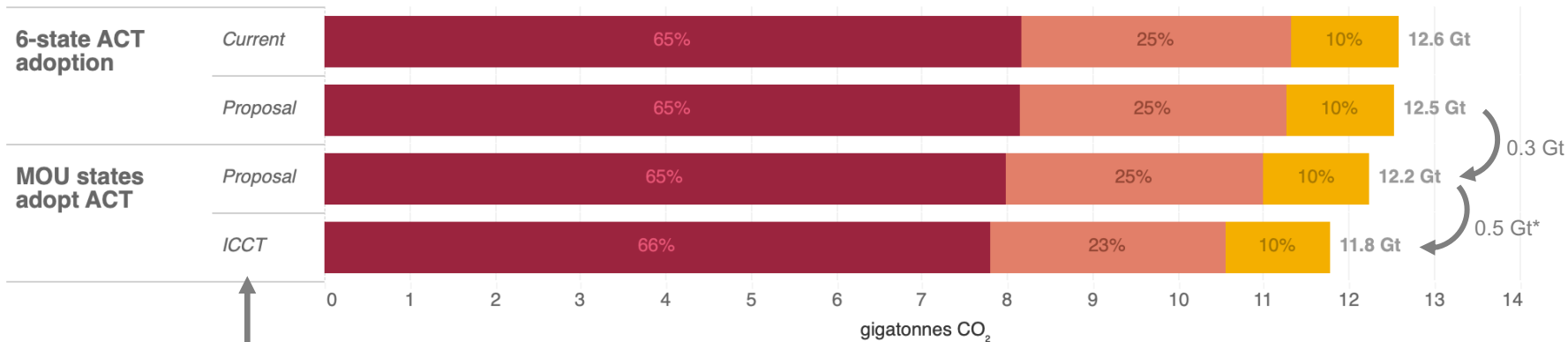


EPA's proposed revisions to the GHG standard will reduce cumulative class 4-8 vehicle CO<sub>2</sub> emissions by **only 0.4%** from 2027–2050.

■ Tractor trucks ■ Rigid trucks ■ Buses

# Accelerating ZEV uptake prior to 2030 is crucial to put the sector on a pathway compatible with 2°C

Cumulative well-to-wheel CO<sub>2</sub> emissions by scenario, 2027–2050



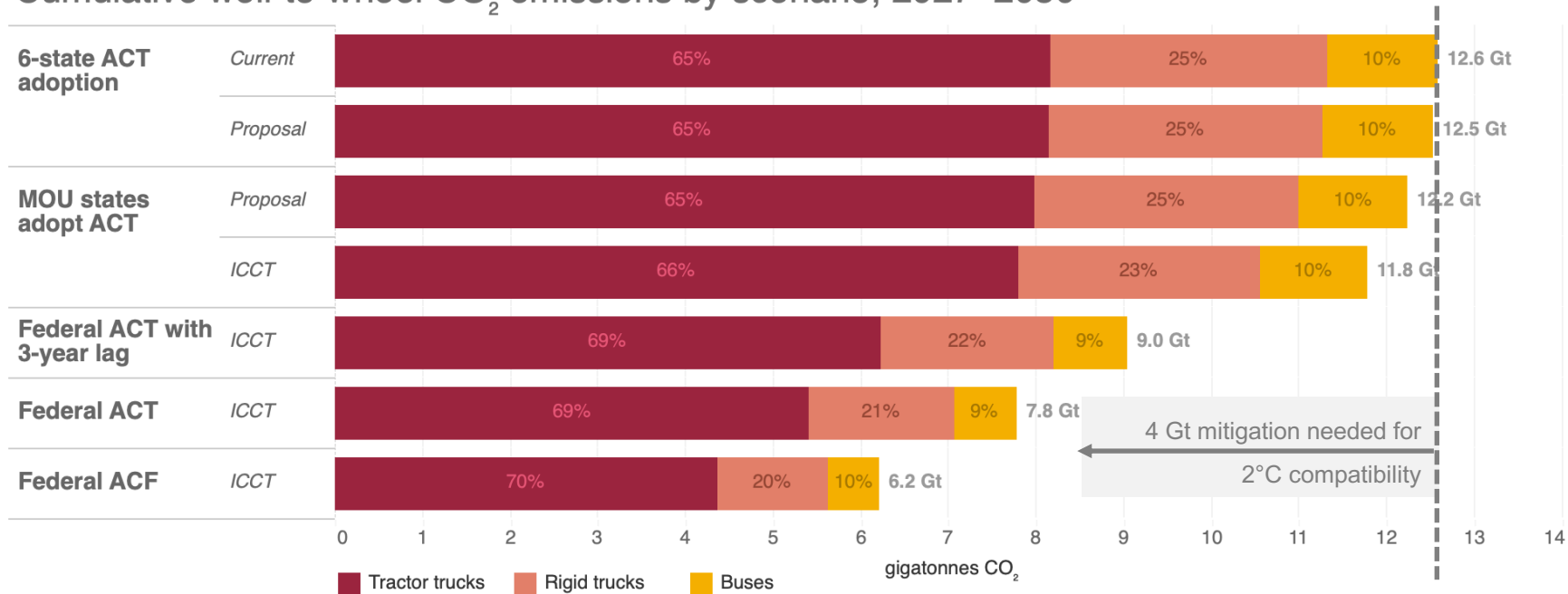
Incorporating ICCT's recommendations to preserve ICE stringency could **more than double** the benefits of expected actions by MOU states.

Tractor trucks Rigid trucks Buses

\*difference due to rounding

# Accelerating ZEV uptake prior to 2030 is crucial to put the sector on a pathway compatible with 2°C

Cumulative well-to-wheel CO<sub>2</sub> emissions by scenario, 2027–2050



A 3-year lag in ACT stringency **reduces CO<sub>2</sub> benefits by 1.2 Gt** and is not compatible with 2°C. More is needed for compatibility with limiting warming to 1.5°C.



# Under EPA's proposal, model year 2027 ICE vehicles could emit more than in model year 2017

Efficiency improvements required for ICE vehicles by ZEV pathway and GHG standard.

ZEV pathway	GHG standard	Rigid trucks and buses	Tractor trucks	Overall
No ZEV deployment	Current	14%	22%	15%
6-state ACT adoption	Current	3%	0%	2%
	Proposal	4%	1%	3%
MOU states adopt ACT	Proposal	-1%	-19%	-3%
	Proposal, no ZEV supercredits	11%	14%	11%
	ICCT	14%	22%	15%
Any ZEV pathway	ICCT	14%	22%	15%

} if OEMs backslide on ICE efficiency

**Current:** EPA maintains the original Phase II GHG standards.

**Proposal:** EPA tightens the Phase II GHG standards by 1.5% for certain segments, as proposed in the NPRM.

**ICCT:** EPA removes ZEV crediting and requires all ICE to meet the original Phase II GHG standards.

# Key recommendations on **GHG** standards

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1. We encourage EPA to **finalize GHG standards this year**
2. We recommend EPA **set minimum ZEV production requirements** of 20%, 30%, and 40% in 2027, 2028 and 2029
3. We recommend EPA **preserve the original Phase II stringency for ICE vehicles**
4. We recommend EPA **phase-out ZEV supercrediting towards GHGs** in 2024 or as soon as feasible

Questions?

**icct**

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# Additional slides

# EPA Option 1 vs. California Omnibus

## NO<sub>x</sub> Limits:

2027: Option 1 **weaker** than Omnibus for most vehicle categories and the same for heavy-heavy duty diesel.

2031: Option 1 **same** as Omnibus for all vehicle categories.

## Useful life:

**Same** as Omnibus for all categories.

Intermediate useful life for heavy-heavy-duty diesel starts in 2031 instead of 2027 (**weaker** than Omnibus) .

## ZEV Crediting:

Option 1 **weaker** than Omnibus on diesel engines because it allows ZEV crediting with no sunset date.

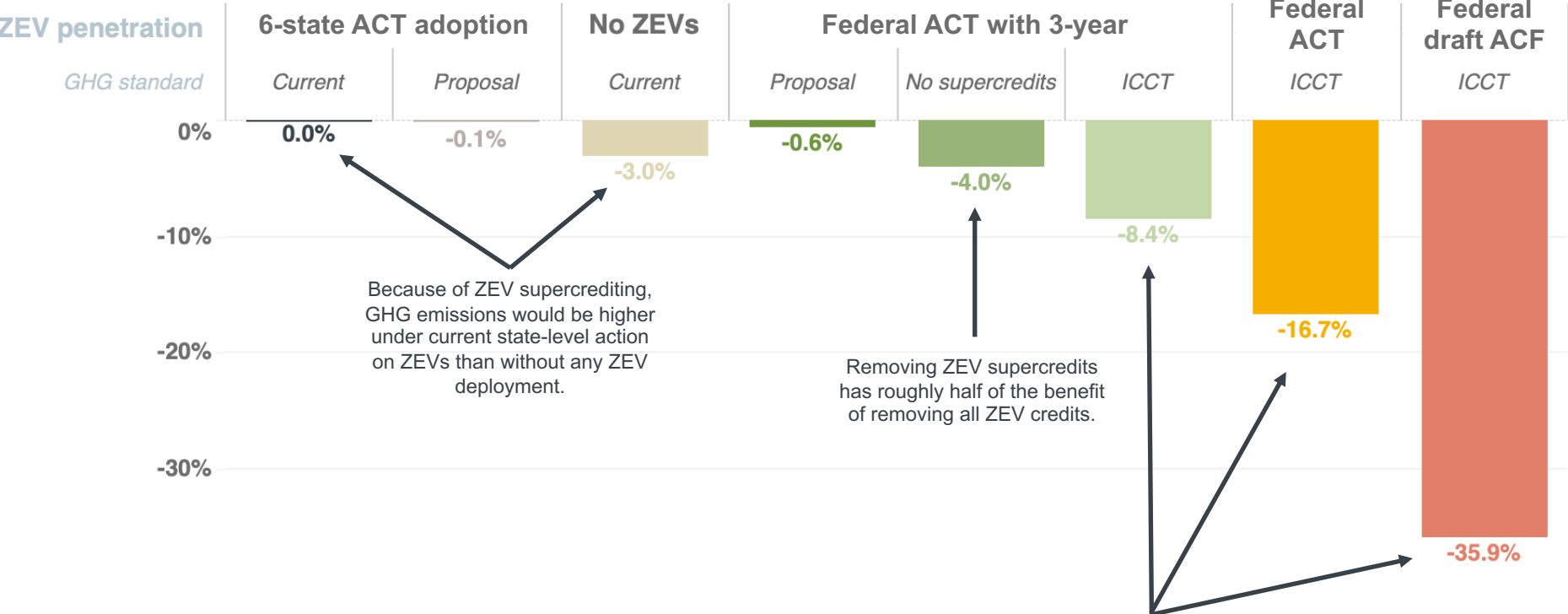
## Inducements:\*

Option 1 **weaker** on inducement provisions than Omnibus.

## In-Use Testing:\*

Option 1 keeps Not-to-Exceed test procedure, which is **weaker** than Omnibus 3-Bin Moving Average Window.

# Lifetime greenhouse gas emissions of model year 2027 vehicles by scenario relative to current Phase II GHG standards



**MOU:** (Multi-state) memorandum of understanding  
**ACT:** Advanced Clean Trucks Rule  
**ACF:** Advanced Clean Fleets Rule (9/9/2021 draft)

# Summary of literature on ZEV market details

	Segment	Share of HDV sales	Year of TCO parity between ZEVs and ICEVs	Upfront cost ratio of ZEVs to ICEVs in 2027	Market readiness
Fast	<b>Transit buses</b> primarily class 8	1.3%	Before 2025	1-1.1	Mature market, depot charging
	<b>Refuse trucks</b> primarily class 8	0.7%	Before 2025	1.1-1.15	Small-scale commercialization, depot charging
	<b>Short-haul rigid trucks</b> class 4-7 (e.g., delivery, utility)	40.1%	2022 (Class 4) -2027 (Class 7)	0.9-1.5	Small-scale commercialization, depot charging
Medium	<b>Short-haul rigid trucks</b> class 8 (e.g., delivery, utility)	15.7%	2028	1.45-6	Approaching commercialization, depot charging
	<b>Short-haul tractors</b> primarily class 8 (e.g., drayage, beverage)	8.6%	2025-2033	1.3-1.8	Approaching commercialization, depot charging
	<b>School buses</b> primarily class 6-7	4.9%	2026	1.25	Mature market, depot charging, some limitations in rural areas
	<b>Other buses</b> (e.g. shuttle buses, regional transit)	3.3%	2027-2030	1-1.2	Mixed charging requirements
Slow	<b>Long-haul rigid trucks</b> class 4-8	2.5%	After 2030		Mixed charging requirements
	<b>Long-haul tractors</b> primarily class 8	15.0%	No Consensus	2-2.4	Approaching range-limited commercialization, requires significant publicly accessible charging

Not shown: Motorhomes (8.0% of sales).

Sources: [ANL](#), [ANL's BEAN tool](#), [NREL](#) (2021), [NREL](#) (2022), [EDF](#), [CARB](#), [ZEV Alliance](#)