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TRB Webinar: Battery Electric Trucks—Should I Stay or Should I Go?

June 20, 2024

3:00 – 4:30 PM



PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Program. Credit earned on completion of this program will be reported to RCEP at RCEP.net. A certificate of completion will be issued to each participant. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the RCEP.



Purpose Statement

This webinar will present the opportunities and challenges battery electric trucks face and compare them to others, such as hydrogen fuel cells and renewable diesel. Presenters will share the primary alternative vehicle fuel types currently pursued by industry and government and the pros and cons for each. Presenters will also discuss costs, benefits, and consequences for each from a freight perspective.

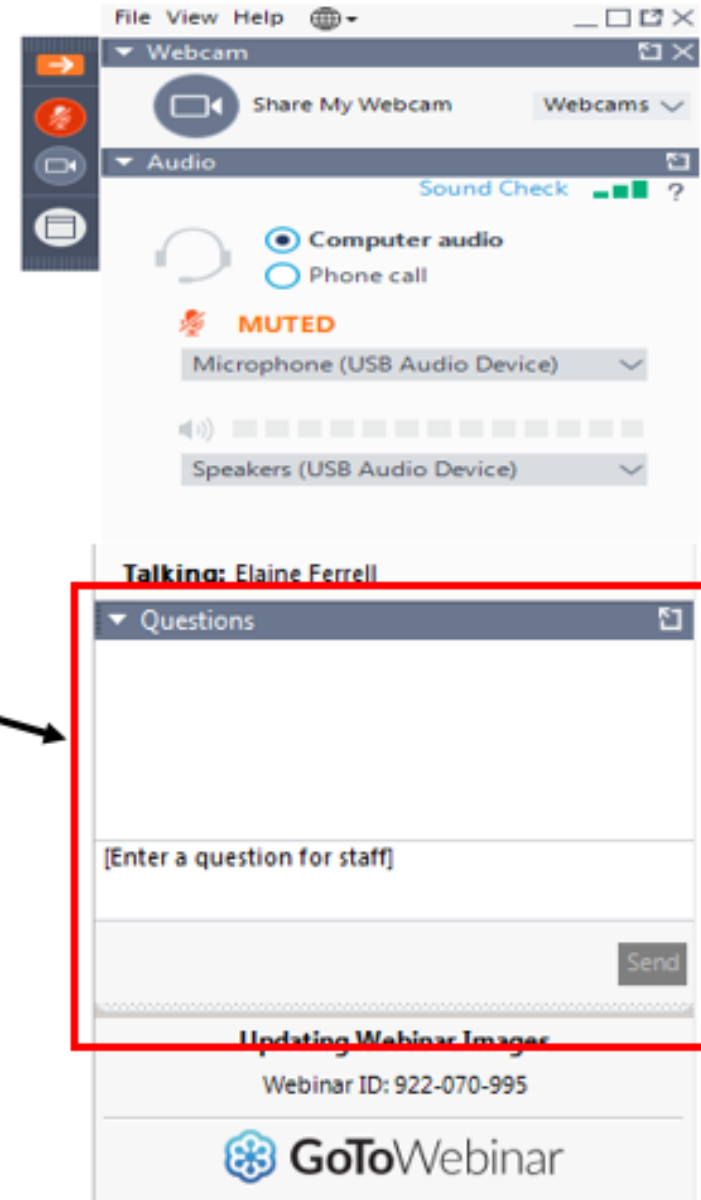
Learning Objectives

At the end of this webinar, you will be able to:

- (1) Provide a primer on different fuels and assess the full lifecycle carbon protection of various trucks
- (2) Understand the operational requirement of trucks and which energy source best fits freight business models

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters



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Battery Electric Trucks: What are the Realities?

Dan Murray
Senior Vice President

ATRI

ATRI is TRUCKING's not-for-profit research organization, whose mission is to provide the data and analysis to improve the industry's safety and productivity

All of ATRI's research is available at no cost on our website:

www.TruckingResearch.org



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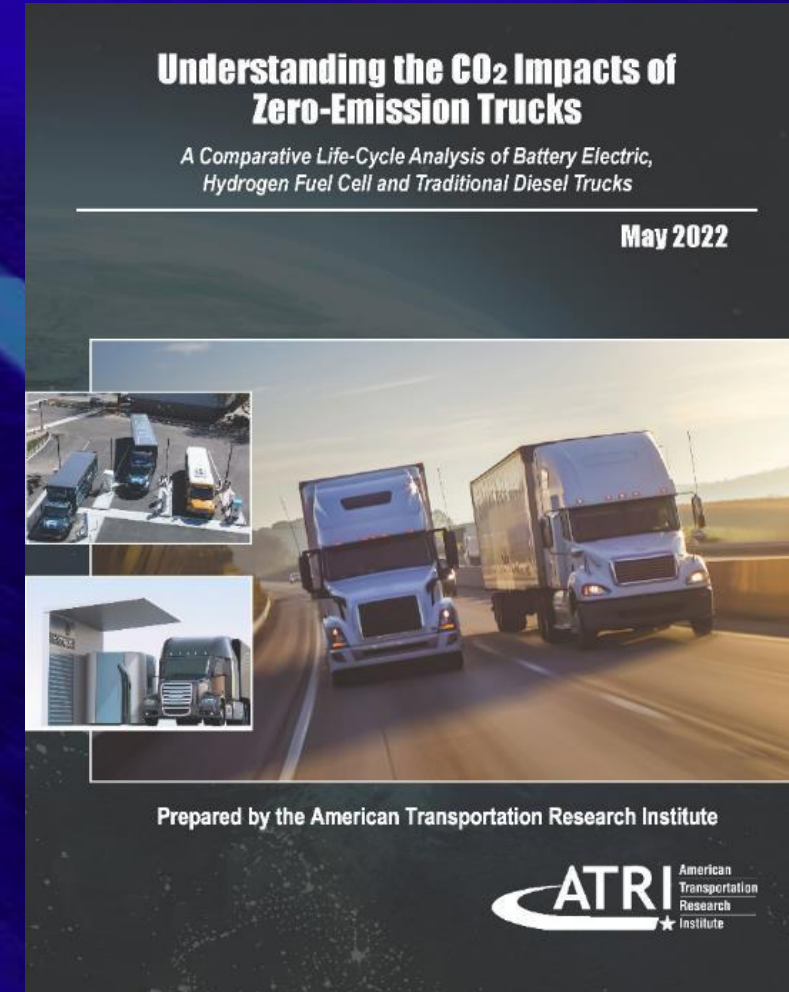


Research Advisory Committee

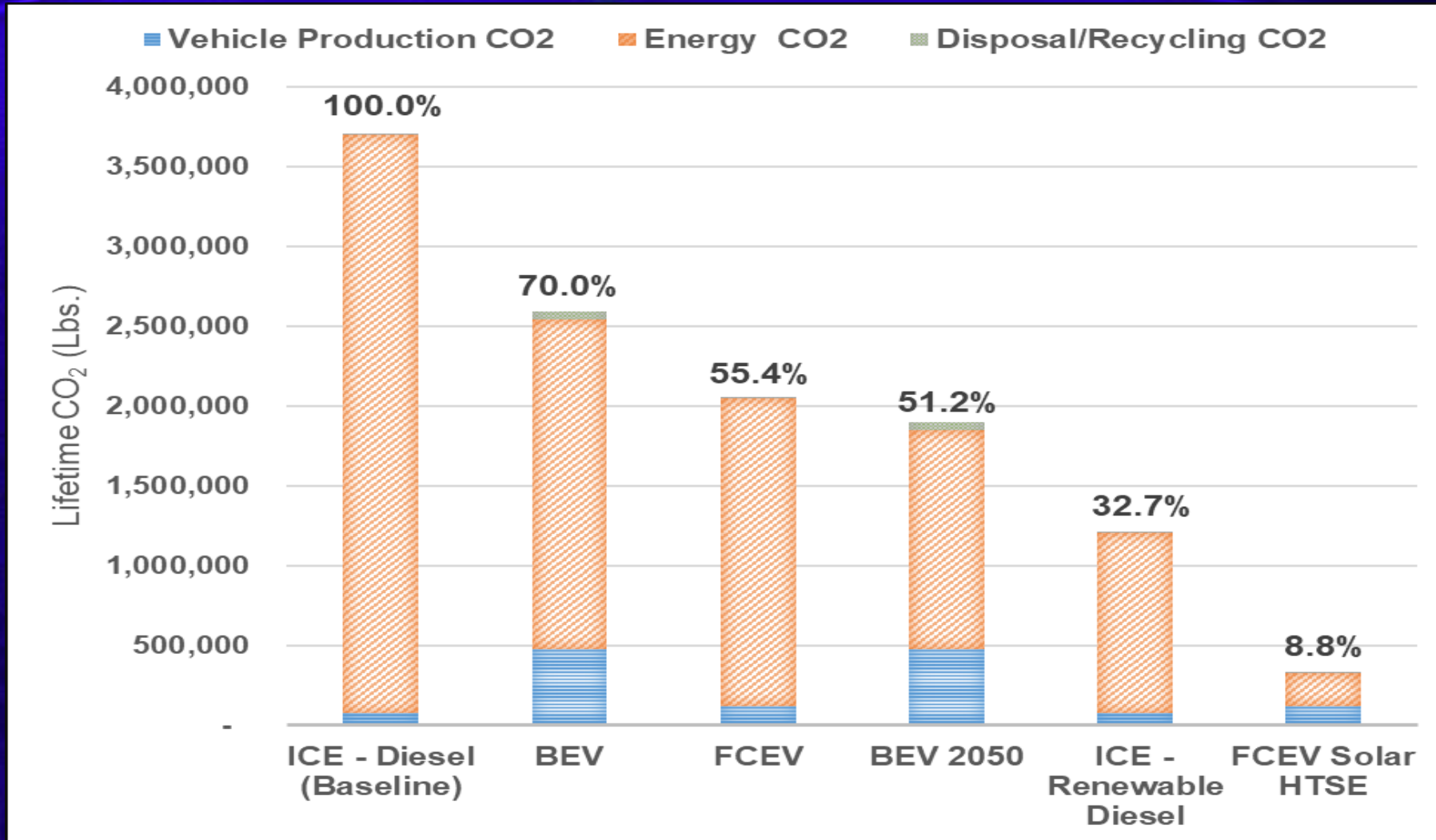


Understanding the CO₂ Impacts of Zero-Emission Trucks

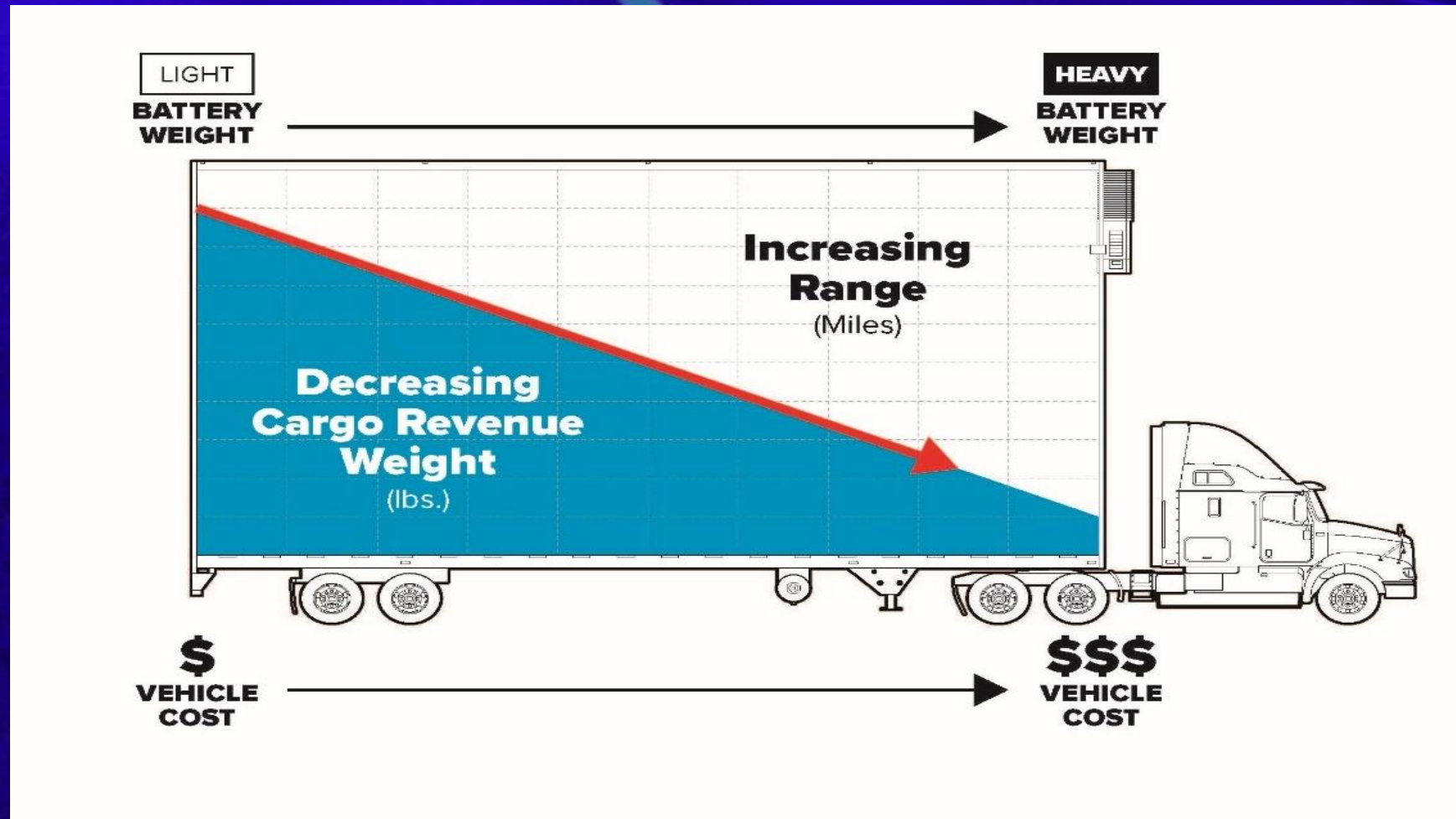
- **Life-cycle CO₂ emissions study for:**
 - ◆ **Internal combustion engine (ICE) trucks powered by diesel**
 - ◆ **Battery electric vehicle (BEV) trucks powered by electricity**
 - ◆ **Fuel cell electric vehicle (FCEV) trucks powered by hydrogen**
- **Compares CO₂ emissions across from the full vehicle life-cycle:**
 - ◆ **Vehicle production**
 - ◆ **Energy production and consumption**
 - ◆ **Vehicle disposal/recycling**



Key Findings



BEV Truck Conundrum

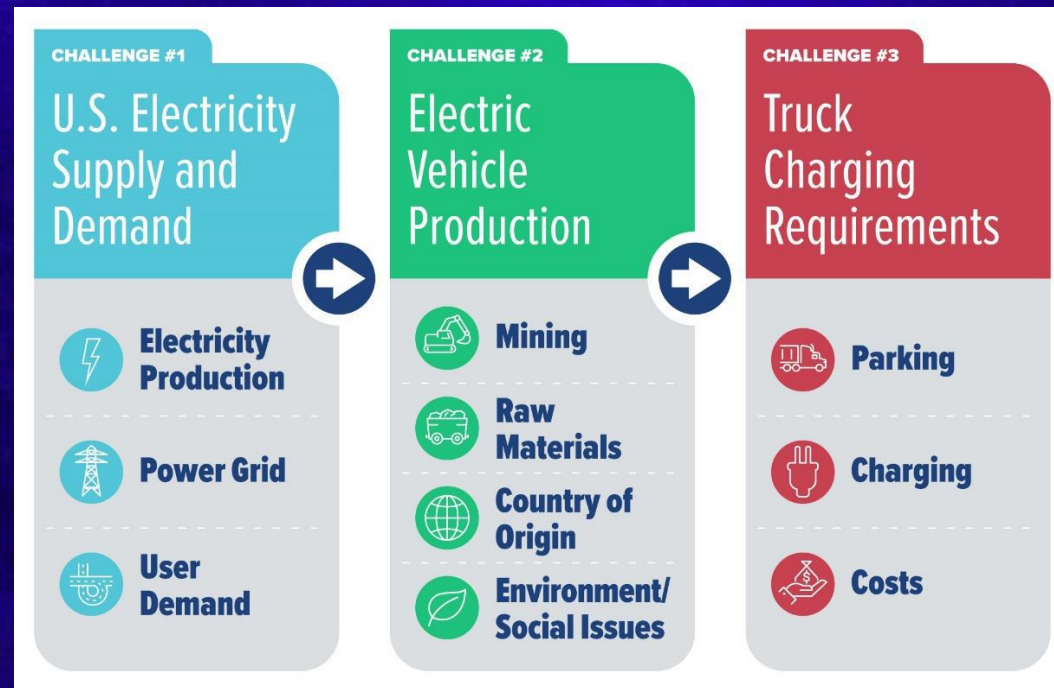


Realities

- **Vehicle costs – new Class 8 BEV truck could cost over \$425,000**
- **No refueling infrastructure**
- **CO₂ emissions are still substantial**
- **Material sourced from outside U.S.**
 - ◆ **Lithium, graphite, cobalt, manganese and nickel**

Charging Infrastructure Challenges for the U.S. Electric Vehicle Fleet

- Analysis of three distinct challenges for EVs – with a focus on trucking



Charging Infrastructure Challenges for the U.S. Electric Vehicle Fleet

December 2022



Prepared by the American Transportation Research Institute

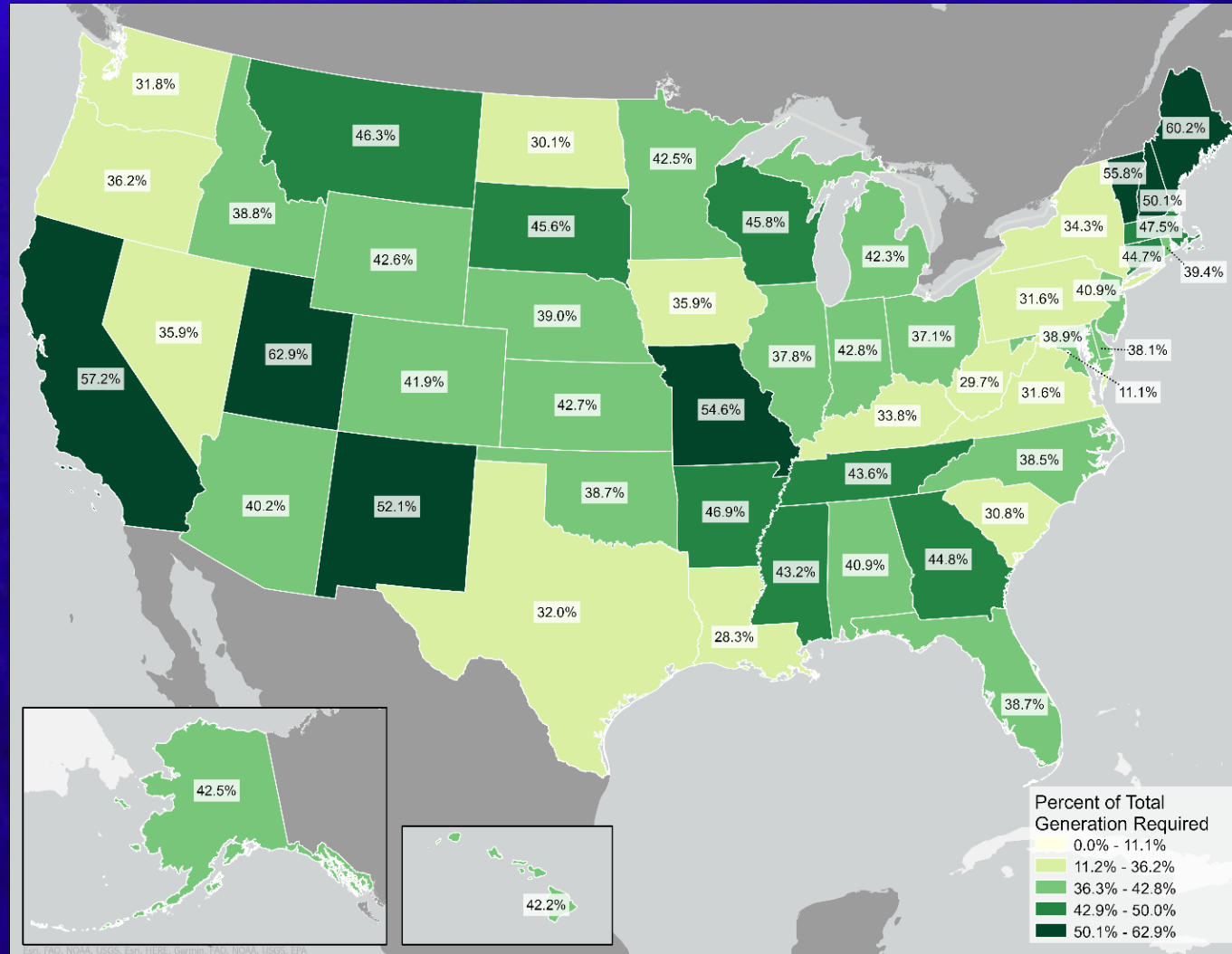


U.S. Electricity Supply and Demand

■ U.S. Vehicle Fleet

- ◆ **Autos: >253 million cars/light duty trucks**
 - **Electricity Needs: 1,039.9 billion kWh representing 26.3% of total U.S. consumption**
- ◆ **Trucks: >12 million medium- and heavy-duty trucks**
 - **Electricity Needs: 553.5 billion kWh representing 14% of U.S. consumption**
 - **10.6% for 2.95 million combo trucks**
- ◆ **Total: 1,593.8 billion kWh representing 40.3% of U.S. consumption**

U.S. Electricity Supply and Demand



CALIFORNIA FLEX ALERT

- SET THERMOSTATS TO 78 DEGREES OR HIGHER
- AVOID USE OF MAJOR APPLIANCES
- TURN OFF UNNECESSARY LIGHTS
- AVOID CHARGING ELECTRIC VEHICLES

FOX 13

6:49 90°

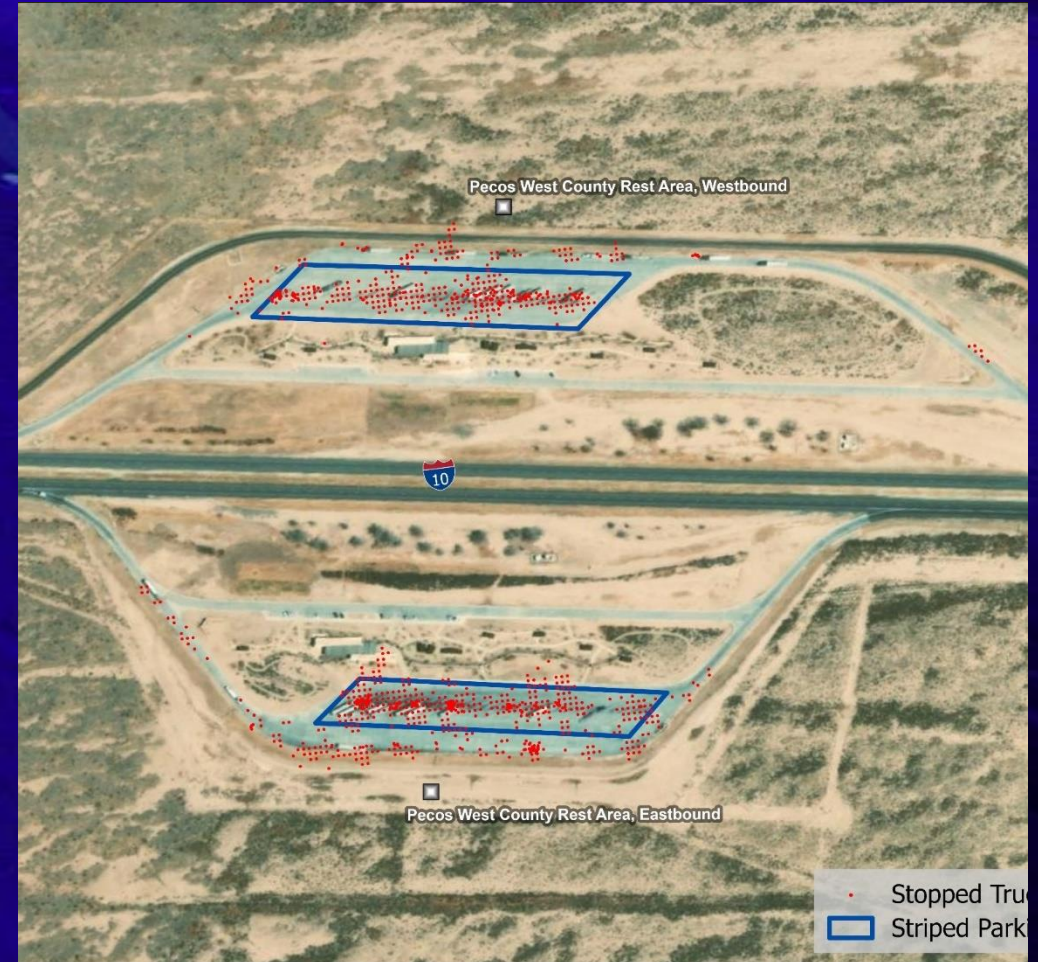
Long-Haul Truck Charging Requirements

- Final delivery point – truck parking locations
 - ◆ 313,000 spaces – 1 for every 11 truck drivers



Parking Case Study

- Requires enough daily electricity to power more than 5,000 U.S. households for 126 truck charging events







Renewable Diesel (RD) – A Catalyst for Decarbonization

- RD emissions are less than half that of battery electric vehicle (BEV) trucks
- BEV trucks have substantial operational constraints related to range and weight
- A BEV transition is 5.8 times more expensive than an RD transition – costing \$987 billion more for the same environmental outcome

Renewable Diesel – A Catalyst for Decarbonization

April 2024



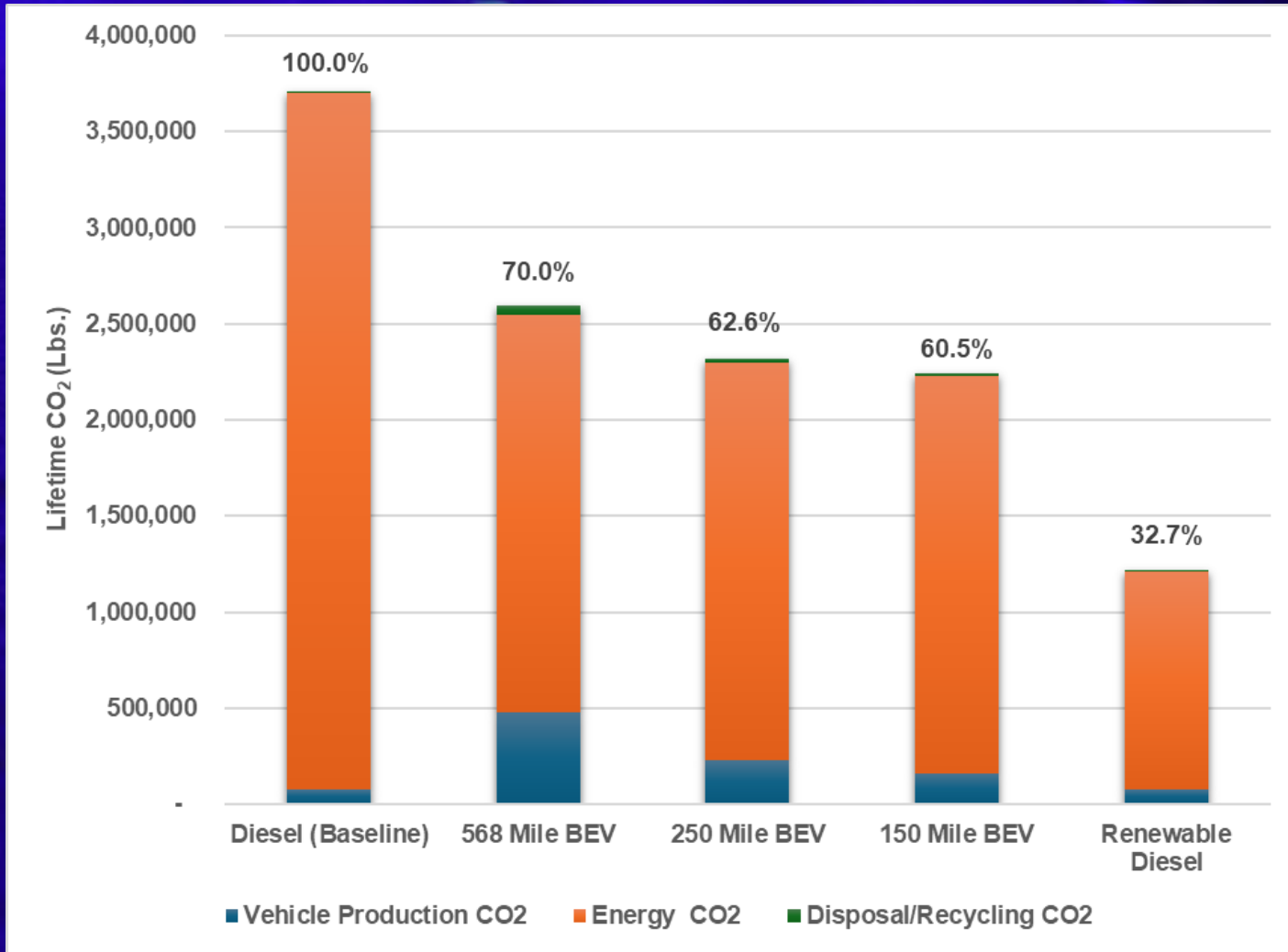
Prepared by the American Transportation Research Institute

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Renewable Diesel Basics

- **RD is a fuel that is produced to be “chemically identical” to petroleum diesel**
 - ◆ Mixed into petroleum diesel or used as a standalone, drop-in fuel
 - ◆ RD is different from biodiesel
- **RD is made from numerous feedstocks**
 - ◆ Used cooking oil
 - ◆ Soybean, corn and canola oil
 - ◆ Tallow
- **RD is not a fossil fuel**

Environmental Benefits



BEV Transition is 5.8 Times More Expensive

	Transition Costs in Billions of Dollars over 15 Years			
	Vehicle Change	Infrastructure Change	RD Subsidy/Facility (at \$2 /gallon)	Total
BEV Costs	\$594.30	\$596.00	-	\$1,190.30
ICE RD Costs	-	-	\$203.72	\$203.72

Questions?

Dan Murray

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Battery Electric Trucks



Denise Kearns
U.S. Environmental Protection Agency
SmartWay Transport Partnership

Overview, covered today



- 🌿 EPA Clean Trucks program
 - 'NO_x' Rule
 - Light- Medium-Duty (LD/MD) Vehicle Final Rule
 - Heavy-Duty (HD) Final Rule
- 🌿 Federal and State Grant Incentives
 - Ports, Onroad, School Bus
- 🌿 EPA SmartWay Partnership
 - Program and technology overview
- 🌿 Path Forward



DTNA's O'Leary: EV Infrastructure Buildout Still Lagging

CEO Says No Significant Change Seen in the Industry Over the Past Year

The Multibillion-Dollar Bet That Truckers Will Ditch Diesel for Electricity

Opposition grows to speedy electric truck transition

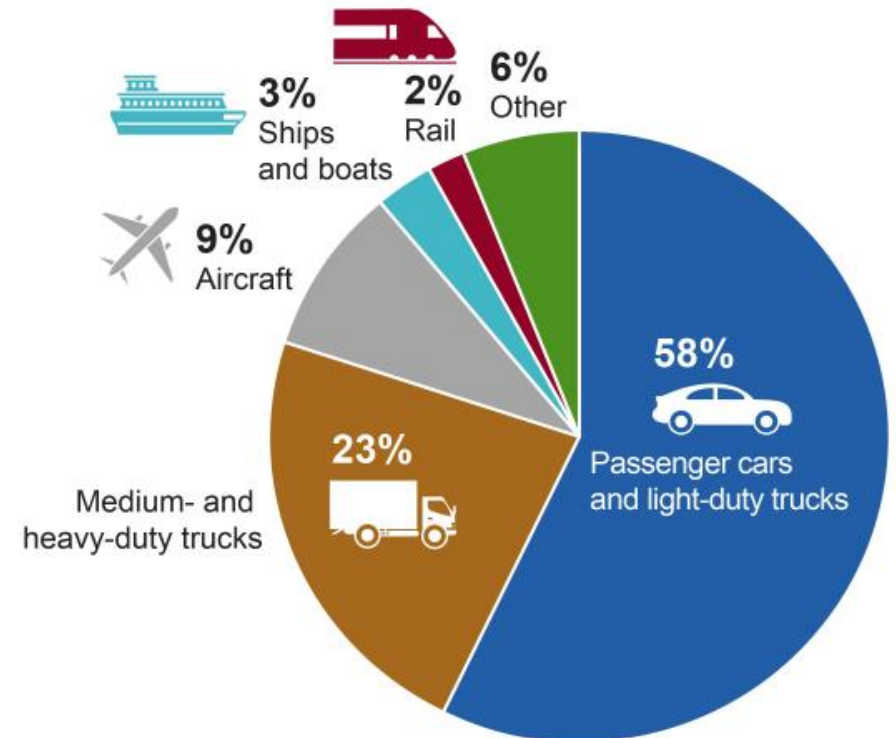


Public Health, Environmental Impacts



- 🌿 Commercial trucks are 2nd largest GHG emissions source in transportation sector
- 🌿 Significant source of local & regional air pollution
- 🌿 Community issues
 - Air Quality, noise, traffic and safety
- 🌿 Increasingly stringent emission standards
- 🌿 Corporate Risk Planning and Citizenship
 - Climate planning
 - Community member
 - Driver Health

2021 GHG Emission from Transportation
(by mode)



EPA Clean Trucks Program



- 🌿 Sets stronger NO_x, particulate matter standards for HD trucks beginning model year (MY) 2027-2032
- 🌿 Sets stronger GHG/fuel economy standards for LD and MD commercial vehicles beginning MY 2027-2032
- 🌿 Sets stronger GHG/fuel economy standards for HD vehicles beginning MY 2027-2032

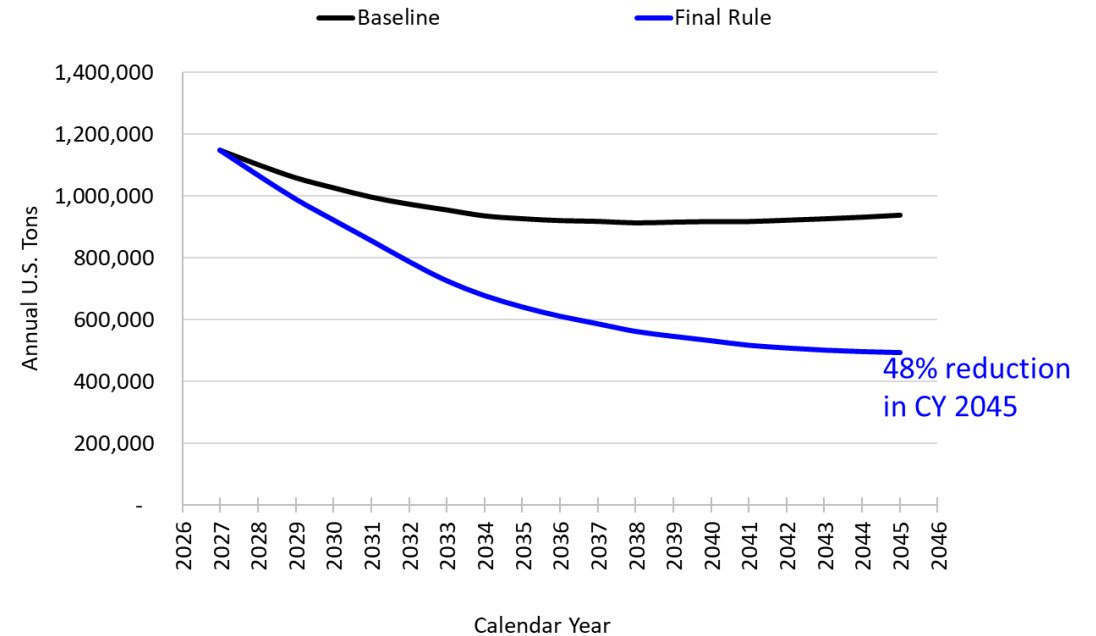
EPA Clean Trucks Program: EPA Criteria Pollutant Rule for HD Engines & Vehicles “NO_x Rule”



Heavy-Duty NO_x Rule

- Tightened NO_x and criteria pollutant emission standards, updated test cycles, compliance crediting, extended useful life and warranties for heavy-duty vehicles
- Significant reductions in onroad NO_x emissions, PM and other pollutants

Final Rule Reductions in Heavy-Duty Highway NO_x Emissions Inventory



EPA Clean Trucks Program: Light- and Medium-Duty Vehicle Multipollutant rule




- Multipollutant Standards for Light- and Medium-Duty Vehicles
 - Covers passenger vehicles *and* commercial MD pick-up and delivery service vehicles
 - Performance-based emissions standards for GHG and criteria pollutants
 - Manufacturers choose mix of technologies (gasoline, diesel, hybrids, electric)
- MD GHG standards
 - Fleet average of 274 grams CO₂/mile by 2032
 - A 44% reduction from current standards


Medium-Duty Vehicles – Example Projected PEVs (BEVs+PHEVs)

	2027	2028	2029	2030	2031	2032
Vans	3%	4%	24%	44%	64%	76%
Pickups	3%	4%	8%	17%	15%	26%
Total	3%	4%	14%	27%	32%	43%

PHEVs make up 2/3 of the PEV projections for MD pickups, and 11 % of the total MD fleet PEVs

EPA Clean Trucks Program: Heavy-Duty GHG Phase 3 Rule

-  HD GHG Phase 3 Rule
 - Vocational Vehicles
 - Day cab tractors
 - Sleeper cab tractors
 - Performance-based emissions standards for GHGs and criteria pollutants
 - Manufacturers choose mix of technologies (advanced internal combustion engines, hybrid, battery electric and hydrogen vehicles)

-  Note staggered start/phase-in of standards
 - 2027: Light and Medium Vocational begins'
 - Day cab tractors
 - Heavy vocational
 - Sleeper cab tractors

Example Technology Pathway 1						
Model Year:	2027	2028	2029	2030	2031	2032
Light Heavy Vocational: ZEV	17%	22%	27%	32%	46%	60%
ICEV	83%	78%	73%	68%	54%	40%
Medium Heavy Vocational: ZEV	13%	16%	19%	22%	31%	40%
ICEV	87%	84%	81%	78%	69%	60%
Heavy Heavy Vocational: ZEV			13%	15%	23%	30%
ICEV			87%	85%	77%	70%
Day Cab Tractors: ZEV		8%	12%	16%	28%	40%
ICEV		92%	88%	84%	72%	60%
Sleeper Cab Tractors: ZEV				6%	12%	25%
ICEV				94%	88%	75%

EPA Air Grants and Funding Opportunities



- Annual Appropriations
 - Diesel Emissions Reductions Act (DERA) State, Tribal and Territories Grants
- Bipartisan Infrastructure Law
 - Clean School Bus Program
- Inflation Reduction Act Appropriation
 - Clean Heavy-Duty Vehicles Grant Program
 - Clean Ports Program
 - Climate Pollution Reduction Grants
 - www.epa.gov/inflation-reduction-act



SmartWay overview



Launched by freight industry leaders in 2004 as a voluntary market-based program aiming to:

- Improve U.S. freight efficiency, lower emissions impacts
- Provide partners with tools for purposes of standardized emissions benchmarking, reporting system
- Highlight freight industry's efforts to reduce emissions
- Provide partners with tools for purposes of standardized emissions benchmarking, reporting system
- Clean America's air, reduce dependence on oil



Light Duty
Class 2b-3



Medium Duty
Class 4-6



Heavy Duty
Class 7-8



Rail,
Intermodal



Barge, Ocean Going
Vessels



SmartWay Engagement – Partner Fleets Deploying EV in Freight Movement



Fleets perceive risks in the transition to EVs – Even the fleets that are starting early

Fleet perceived risks

1. Getting the vehicles and not being able to get the power.
2. Charging cycles and can 1 EV replace 1 diesel truck.
3. What are the “soft impacts” for the drivers and community?
4. How do I compare the total-cost-of-ownership or the system (vehicle and charger) efficiency?
5. Right vehicle, wrong application.
6. How will EV tire management and maintenance costs differ from diesel vehicles?

 Many fleets are advancing the understanding, privately and in collaborative forums.

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THE MESSY MIDDLE: A TIME FOR ACTION

PRESENT

- Technology immature
- Many unknowns & challenges



"MESSY MIDDLE"

- Many optimization solutions
- Growing infrastructure
- Multi-fuel choices
- Innovation & maturation
- Facts replacing estimates
- Learning curves

FUTURE 2050

- Fast charging
- Hydrogen everywhere
- Long-life, low-cost batteries
- Acceptable weights & costs



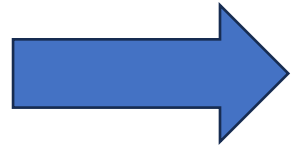
- Legacy Diesels
- Natural Gas

- Diesel Advancements
- Natural Gas
- Hybrids
- Hydrogen ICE

- Battery Electric
- Hydrogen Fuel Cells
- Renewable Natural Gas & Diesel
- More

- CBEV & HFCEV from Clean Energy

Path Forward



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Upcoming events for you

June 23-26, 2024

**2nd International Roadside Safety
Conference**

[https://www.nationalacademies.org/trb/
events](https://www.nationalacademies.org/trb/events)

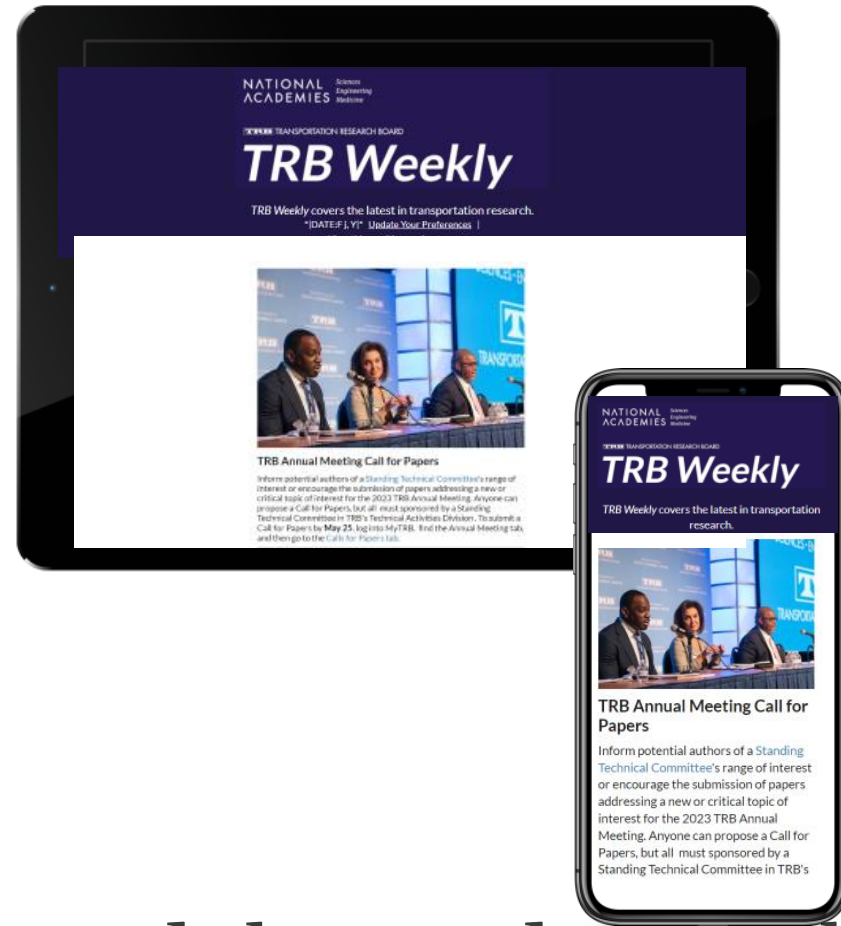


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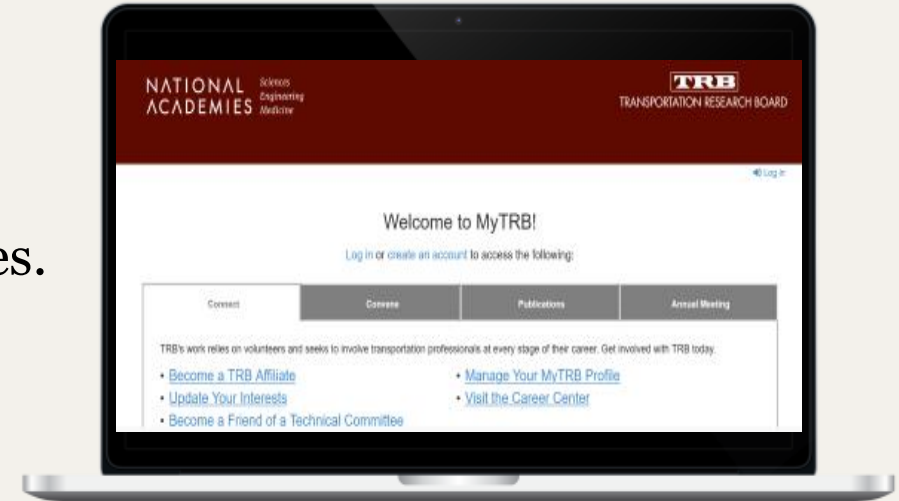


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