



ATA'S TECHNOLOGY & MAINTENANCE COUNCIL

FALL MEETING & National Technician Skills Competitions

Excellence in Maintenance for Quality Control

SEPTEMBER 17-21, 2023 | CLEVELAND, OHIO | HUNTINGTON CONVENTION CENTER

<http://tmcfall.trucking.org>

#TMCFall23

Total Cost of Ownership: Zero Emission Vehicles



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*FlowBelow*TM



-
- Technology & Maintenance Council

... Turning Experience Into Practice

ATTENTION PLEASE

- In accordance with TMC Board Policy, all personal phones without a silent feature must be turned off during business sessions.
- If you must use your phone —please leave the room!



ATTENTION PLEASE

- This is an open meeting of the Technology & Maintenance Council, held in accordance with ATA Antitrust Guidelines which are listed in your meeting packet.
- Audio or video recordings are not permitted at this session. However, photography is permissible.
- The opinions expressed in this meeting are those of the individual and not necessarily the opinion of his/her company nor of TMC unless stated otherwise.

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- To minimize the possibility of antitrust problems, the guidelines detailed in your registration packet should be followed at all TMC meetings, task force and study group sessions.
- All participants in any group involved in the development of standards or recommended practices shall disclose, as stated in the antitrust/patent disclosure guidelines in your registration packet, all patents or patent applications that are owned, controlled or licensed by the Participant or Participant's employer when the Participant reasonably believes such patent or patent application may become material to the standard or RP development process.

Constructive Comments Are Always Appreciated!

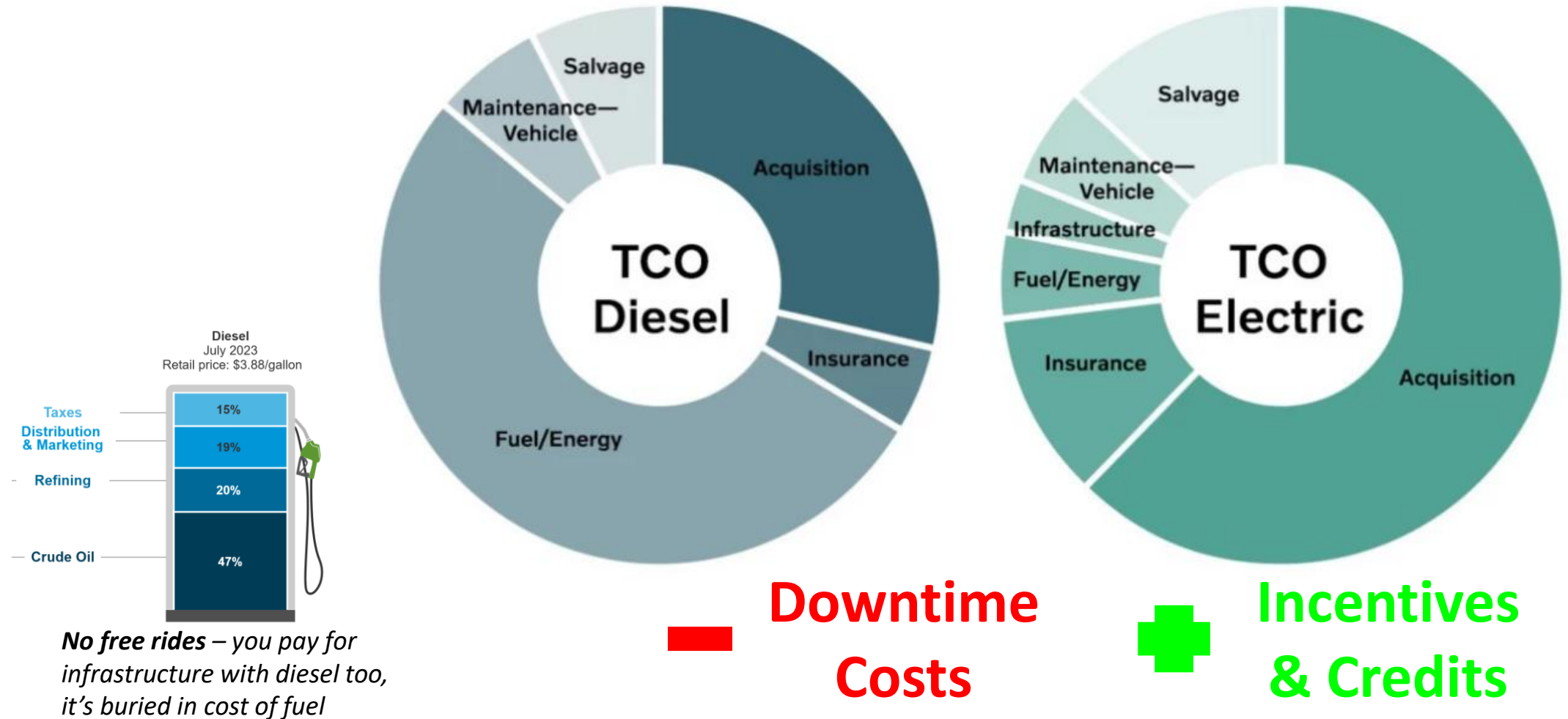
- TMC welcomes your comments, but please make certain that they are constructive and appropriate before you turn in your evaluation sheet!
- *Thank You for Your Cooperation!*

TMC S.11 EV TCO

Recommended Practice Background



Total Cost of Ownership Is In The Details



No ONE-Right TCO Calculator

- MANY TCO calculators exist
- Range in complexity and usefulness depending on your needs
- The key is understanding your current operations in numbers, considering all the real cost factors you need and want to consider
- Then finding the right tool, that has been vetted by other independent users, and using it for your specific duty cycles

Factors to Consider for ZEV TCO

Traditional TCO	Emerging TCO		Future
Hard Costs Purchase/Lease Energy, Fuel & Fluids Maintenance & Parts Service Repair & Parts Insurance Driver Wages & Benefits Taxes & Fees Permits & Licenses Depreciation Residual Value or Salvage	Soft Costs Compliance Reporting Auditing & Monitoring Testing Training Waste Management Infrastructure Maintenance Hiring Staff Turnover Option Maintenance Part Inventory Maintenance Software Management Supplier Management		Societal Factors Quality of Life Environmental Justice Corporate Responsibility Employment Health
Hard Costs - Readily tracked and captured, easily defined in terms of \$'s	Soft Costs - Obscured in overhead, distorted by bundling, less tangible in terms of \$'s		Societal Factors - Challenging to measure in terms of \$'s

Example Hard and Soft Total Cost Assessment Factors NACFE

Residual Value

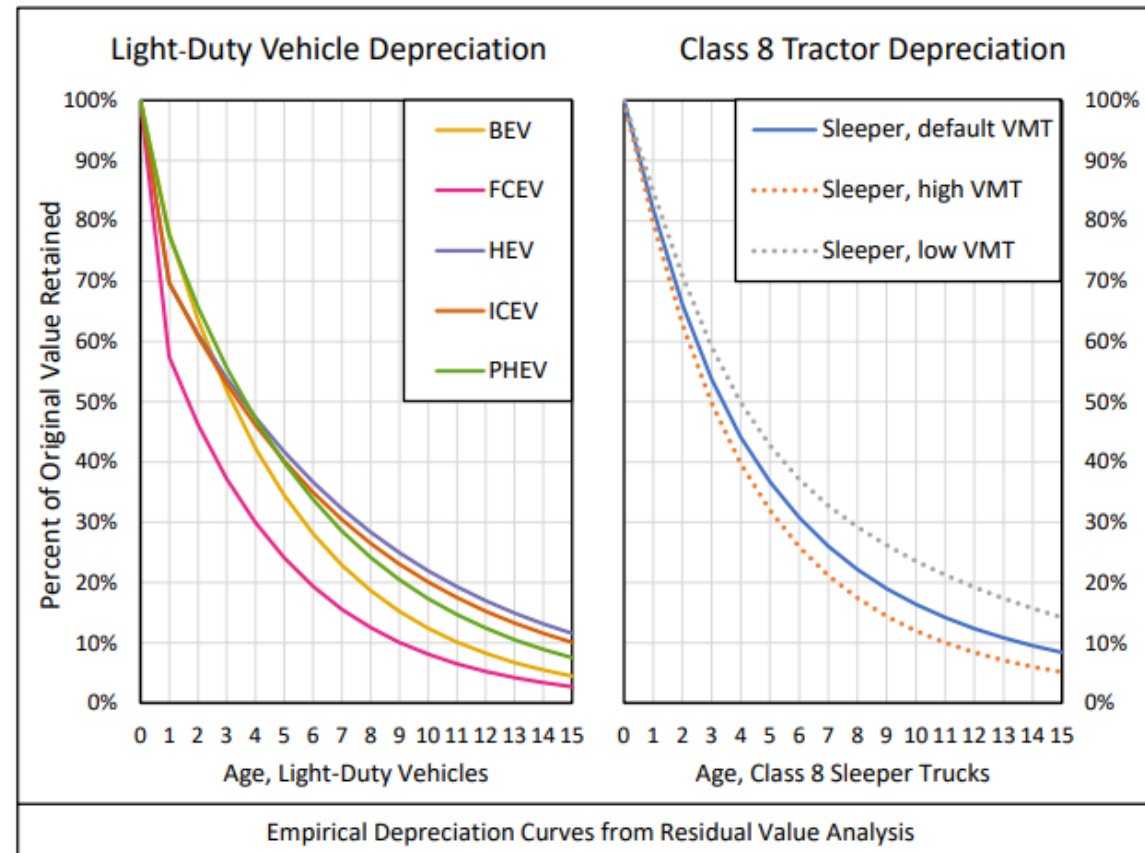


FIGURE ES-2 Depreciation trends by powertrain and size class (Car, Light truck)

Reference: Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains, Argonne National Labs: ANL/ESD-21/4, Andrew Burnham¹, David Gohlke¹, Luke Rush¹, Thomas Stephens¹, Yan Zhou¹, Mark A. Delucchi², Alicia Birky³, Chad Hunter³, Zhenhong Lin⁴, Shiqi Ou⁴, Fei Xie⁴, Camron Proctor⁵, Steven Wiriyadinata⁵, Nawei Liu⁶, and Madhur Bloor⁷

<https://publications.anl.gov/anlpubs/2021/05/167399.pdf>

Energy Costs



- Infrastructure Planning
- Infrastructure Costs for each fuel type
- Infrastructure Maintenance

Sample Unknowns

- How state and federal governments will tax EVs to mitigate the losses of current fuel taxes to generate replacement dollars for road fund and highway improvements
- Long-Term bridge law impact/adjustments due to heavier vehicles causing more damage and not paying typical diesel fuel taxes. Heavier and/or more axles to handle increased weights
- Increased asphalt damage at intersections due to increased acceleration with increased weight;
- How do heavier truck weights and corresponding axles impact driver ride (ergonomics)? Truck vibration frequencies (health and wellness) (sleeper berth-long-term)
- Repair vendor sourcing
- Ambient temperature impact on battery life and range
- Battery replacement costs short-term long-term; Useful life
- Truck Residual Values-Repair, reuse or recycle
- Pre and Post trip inspection changes
- Payload impact long-term; Full payload or diminished payloads
- Battery upgrade compatibility
- Wasted fuel versus voltage drop/loss; How much power actually makes it to the battery and is retained after the power flows through the meter?
- Warranties; what is covered and for how long?
- Equipment lead times
- How will fleets handle charging in an operational model where the driver takes the vehicle home



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