CAFE Model

Overview and recent changes

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Office of the Secretary of Transportation
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CAFE Model Purpose

- Estimate potential impacts of CAFE standards
  - Manufacturers' potential responses
  - Physical impacts (e.g., travel demand, fuel use, emissions, safety)
  - Associated costs and benefits
  - Sensitivity to changes in inputs
  - Role of uncertainty
- Inform decisions regarding CAFE standards
- Provide analysis for rulemaking documents
  - Regulatory Impact Analysis (RIA)
  - Environmental Impact Statement (EIS)

CAFE Model History (2002-2006)

- 2005-2007 Light Truck (LT) Standards
  - First version of model
  - No consideration of attribute-based standards
  - NAS-like approach to technology effectiveness accounting
  - Limited accounting for cadence and technology sharing
  - Partial integration of compliance simulation and effects calculations
- 2008-2011 LT Standards and CAFE "Reform"
  - Consideration of attribute-based standards
  - Some accounting for cadence and sharing
  - Introduced phase-in caps
  - Full integration of compliance simulation and effects calculations
  - Provisions for "goal seeking" (e.g., maximizing net benefits)
  - Provisions for uncertainty analysis (using Monte Carlo simulation)

CAFE Model History (2007-2012)

- 2011-2015 Passenger Car (PC) and LT Standards
  - Introduced pairwise "synergy factors" (as in EIA's NEMS)
  - More refined accounting for different engine types, etc.
  - More refined accounting for cadence and technology sharing
- 2012-2016 PC and LT Standards
  - Introduced accounting for multiyear planning effects
  - Integrated emissions calculations for Environmental Impact Statements (EISs)
- 2017-2021 and Augural 2022-2025 PC and LT Standards
  - Began performing simultaneous analysis of PC and LT fleets
  - Introduced accounting for CAFE credits
  - Introduced ability to estimate a fuel cost response
  - Introduced ability to vary light truck market share in response to fuel price

Role of Full Vehicle Simulation

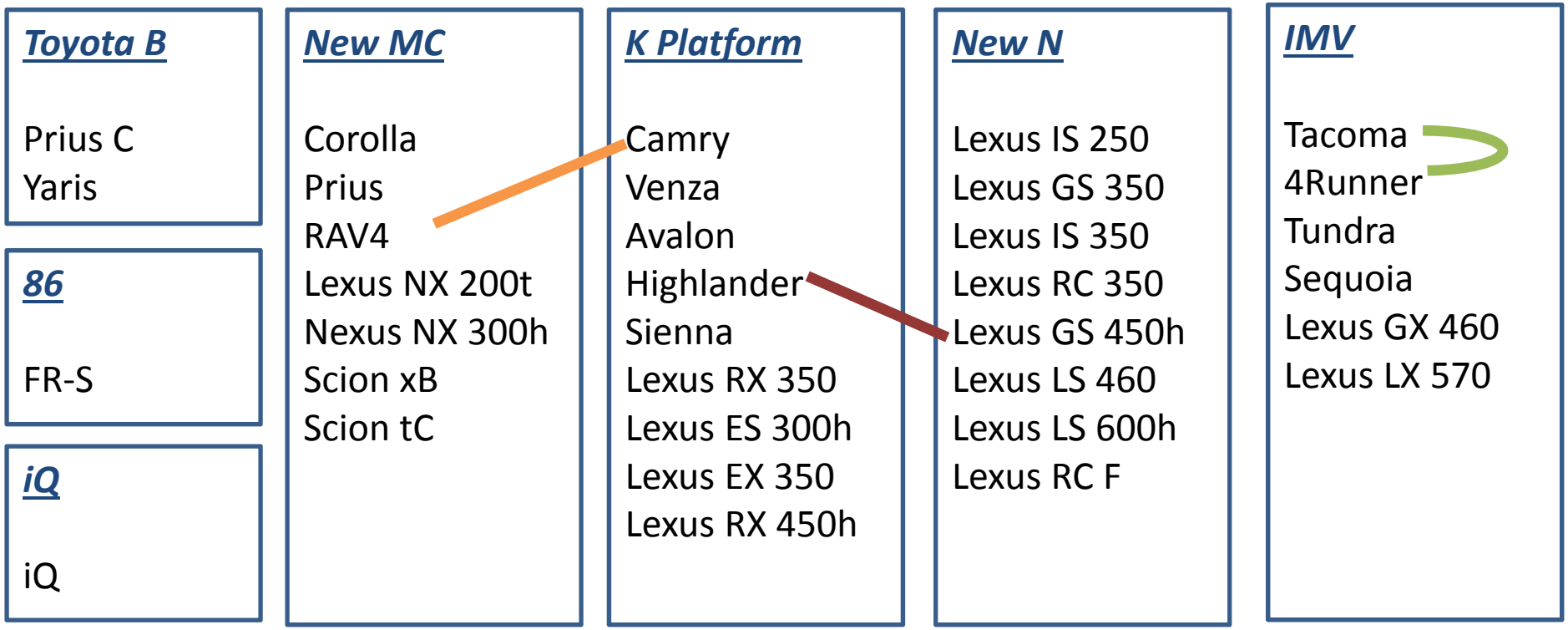
- CAFE model inputs defining the analysis fleet are the foundation
  - Forward-looking representation of manufacturers' products
  - Each vehicle has initial fuel economy level and preexisting technology content
  - DOT's analysis will start with model year 2015 fleet
  - Volumes projected forward using information from EIA and Global Insight
- CAFE model inputs define available fuel-saving technologies
  - Cost to add technology
  - **Impact on vehicle fuel consumption**
- CAFE model estimates how manufacturers could (not "should", "will", or even "are likely to") respond to existing or new CAFE standards
  - Inputs define fuel prices, buyers' willingness to pay for fuel economy
  - Inputs define standards, credit provisions, etc.
- Using other inputs, CAFE model calculates impacts of this response
  - Travel demand
  - Fuel consumption, GHG and criteria emissions
  - Highway safety
  - Monetized social costs and benefits

Vehicle simulation results inform these inputs

More on Estimating OEMs' Potential Response to CAFE Standards

- Specific case to demonstrate approach
- Showing information related one OEM
  - Draws from material presented to NAS in 2013 (see NHTSA MTE micro-site)
  - Could have focused on another OEM
  - **Not meant to convey anything positive or negative about this OEM!**

More on Shared Platforms and Engines
Examples from Toyota 2015 Fleet



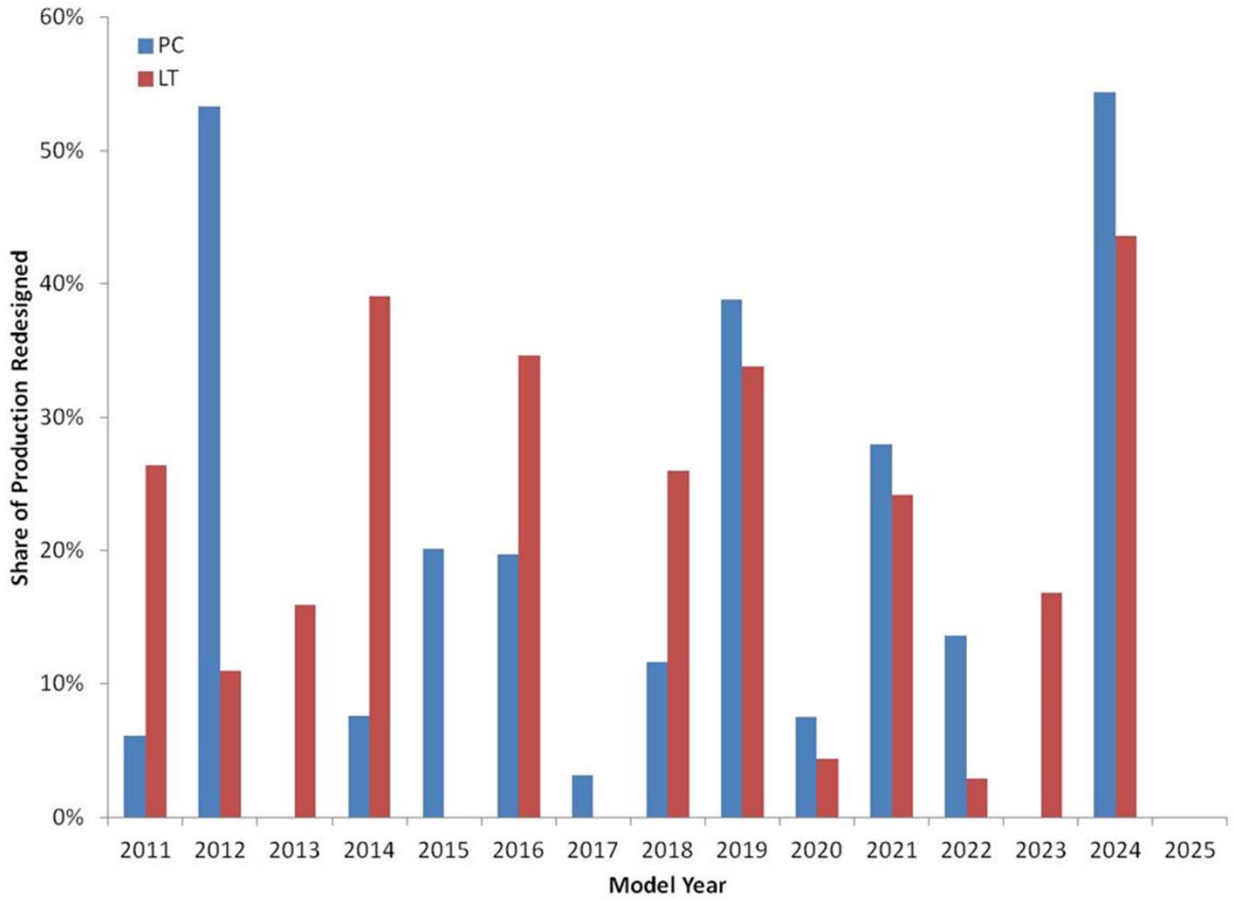
Engines

- Engine 2AR-FE (2.5L I4)
- Engine 2GR-FXE (3.5L Atkinson V6)
- Engine 1GR-FE (4.0L V6)

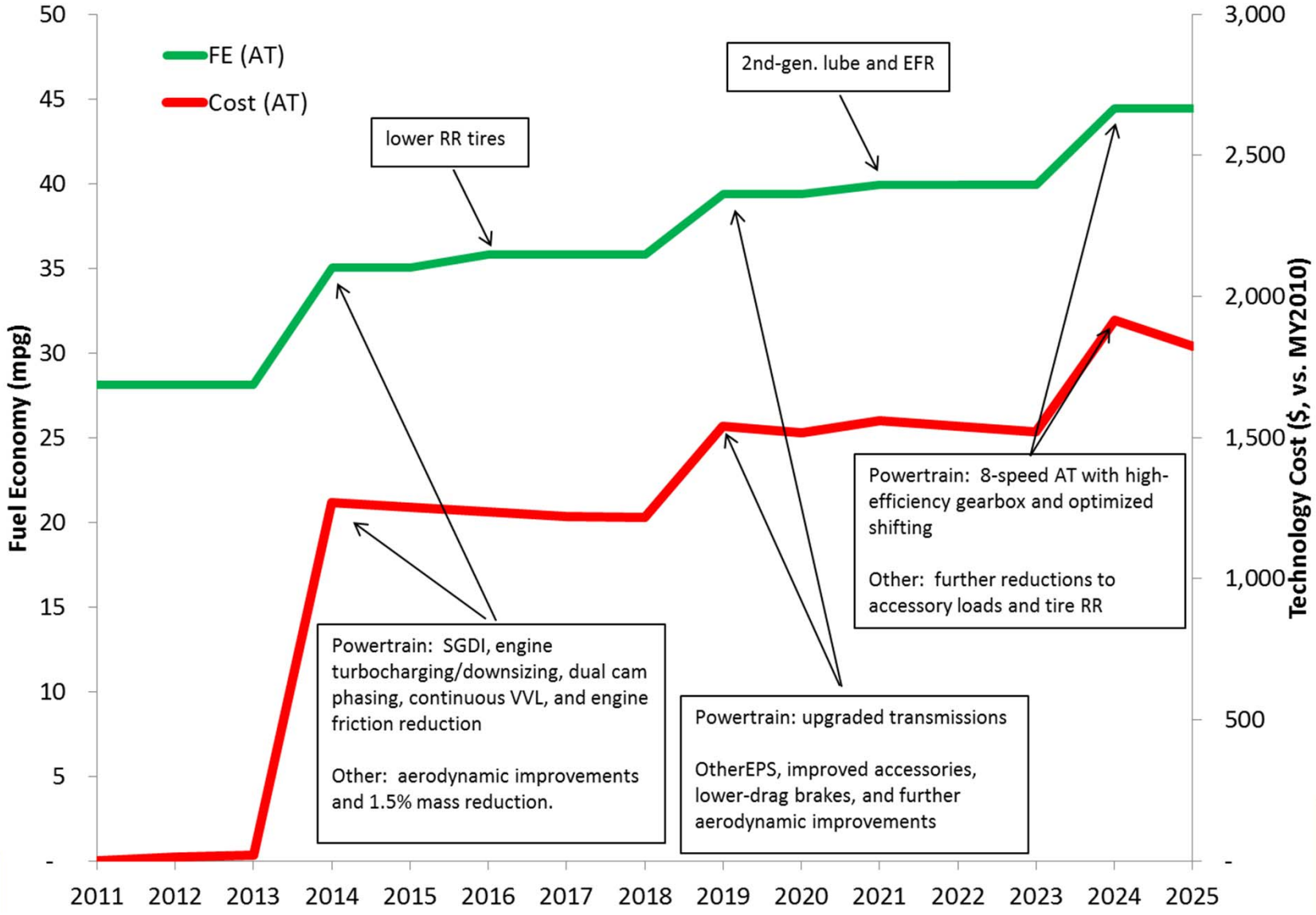
Note

- shared vehicle platforms shown
- some shared engines shown
- shared transmissions not shown

Accounting for Product Cadence
Example: 2012 estimates for this OEM



Role of Effectiveness Estimates
Example: One of this OEM's Sm. Pickups



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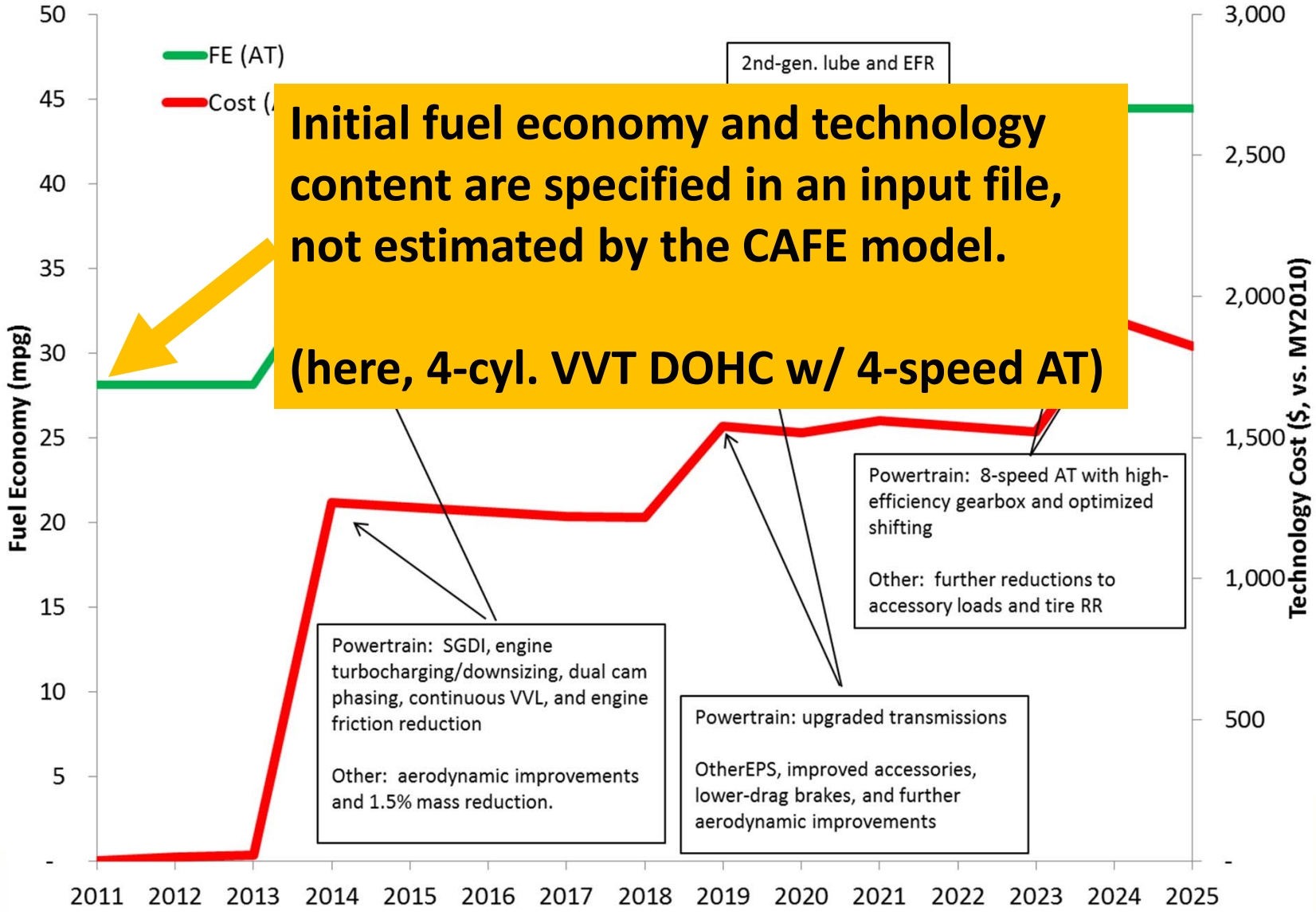
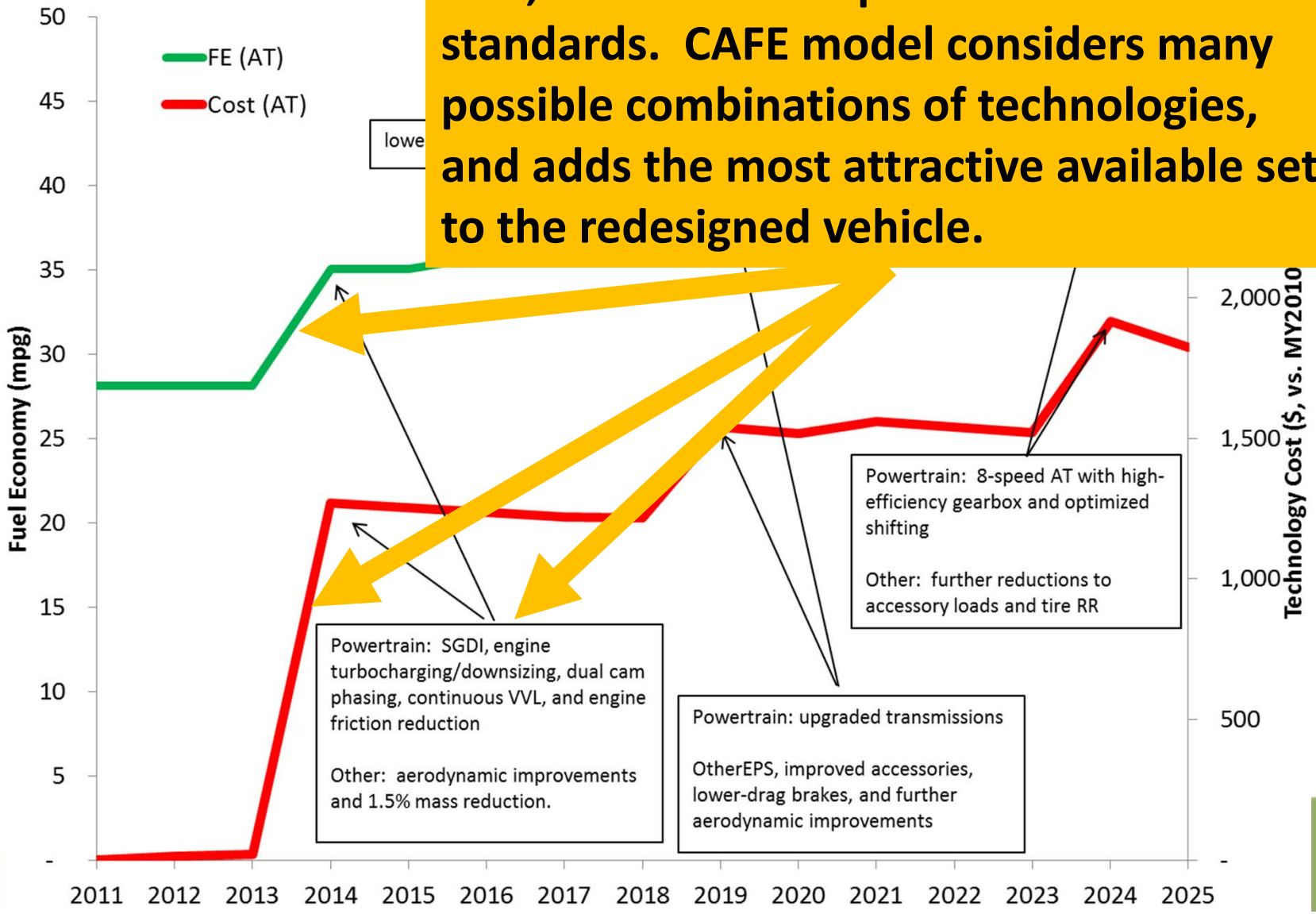


Role of Effectiveness Estimates
Example: One

Considering technology effectiveness and cost, as well as fuel prices and CAFE standards. CAFE model considers many possible combinations of technologies, and adds the most attractive available set to the redesigned vehicle.



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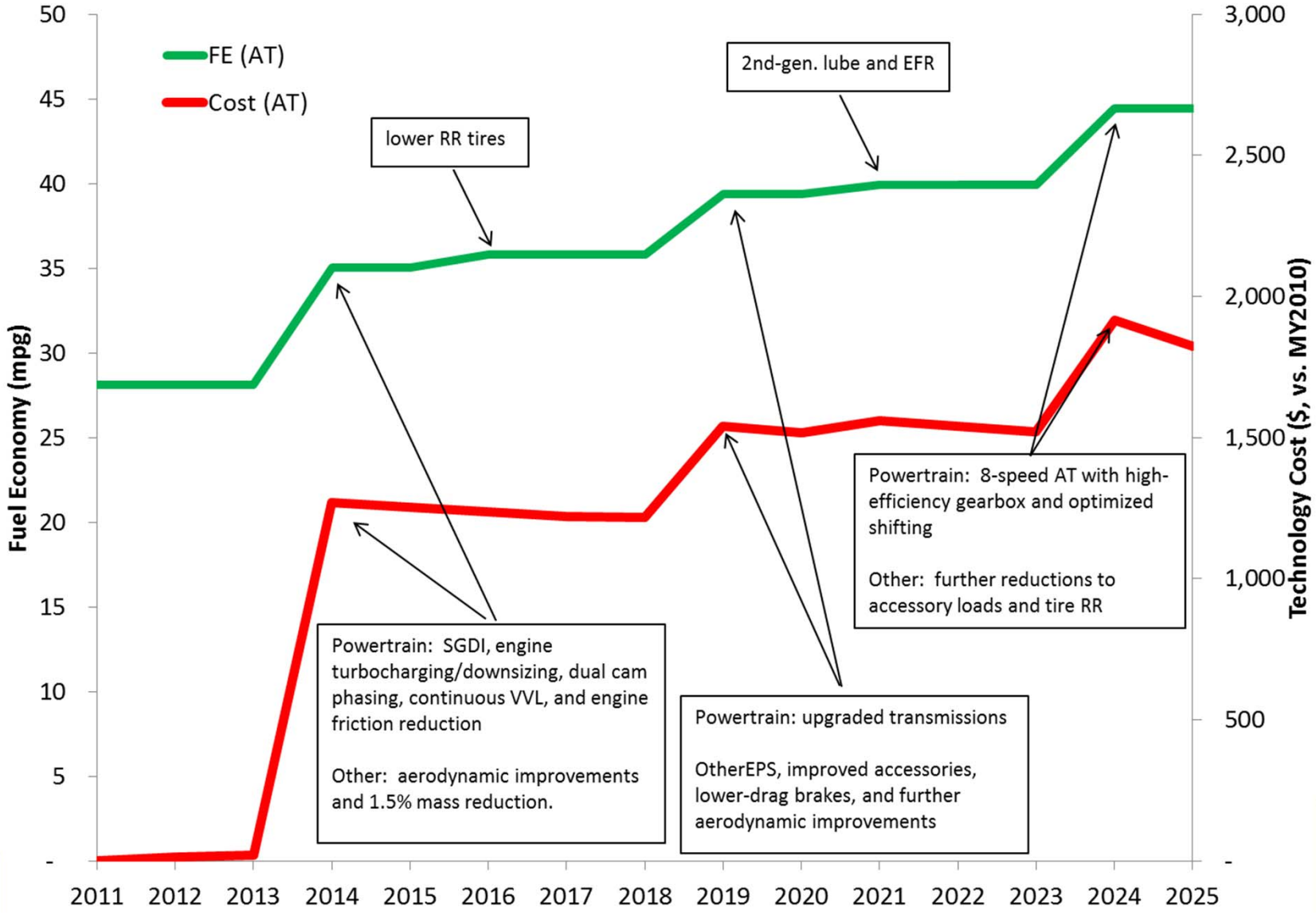
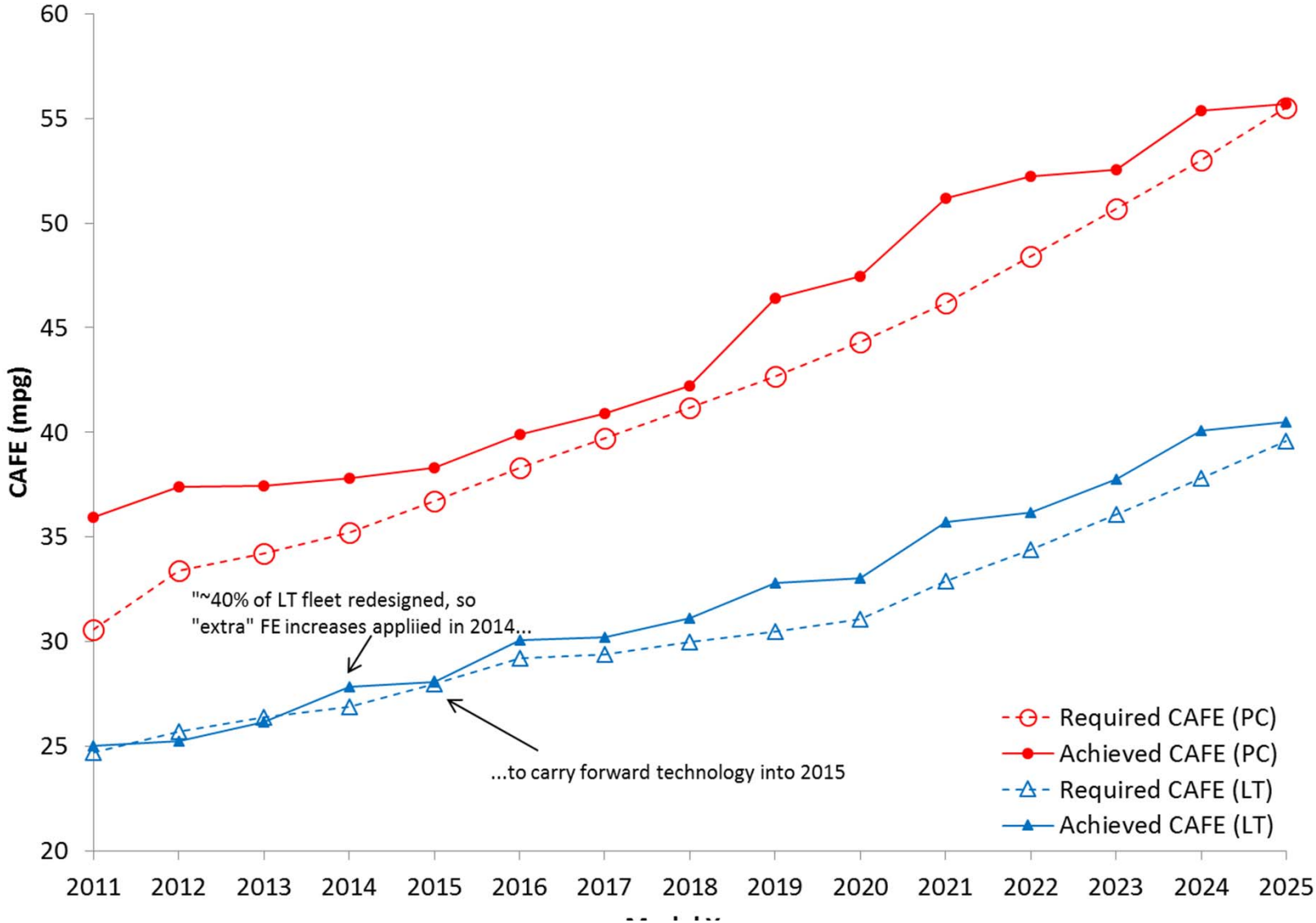
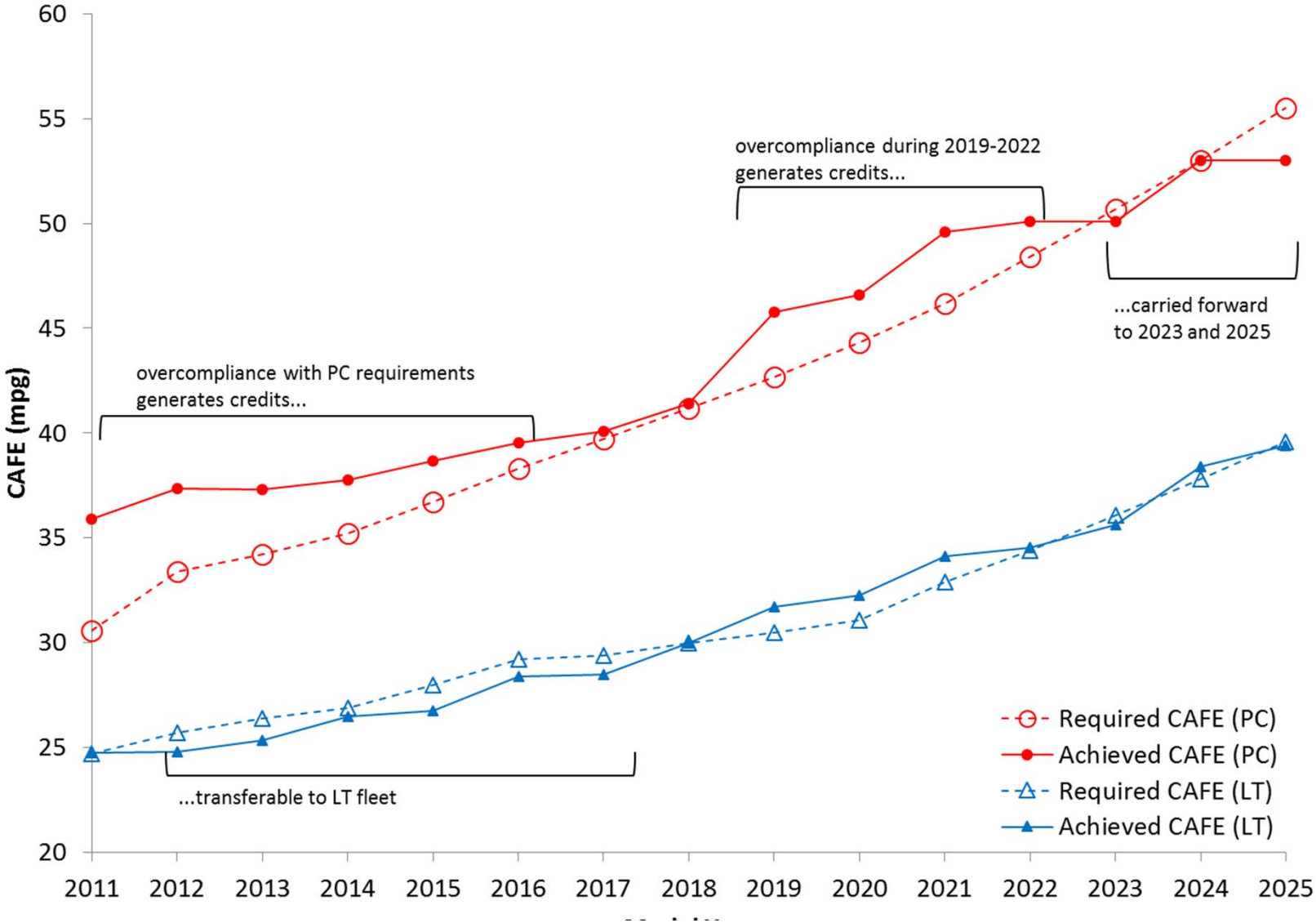


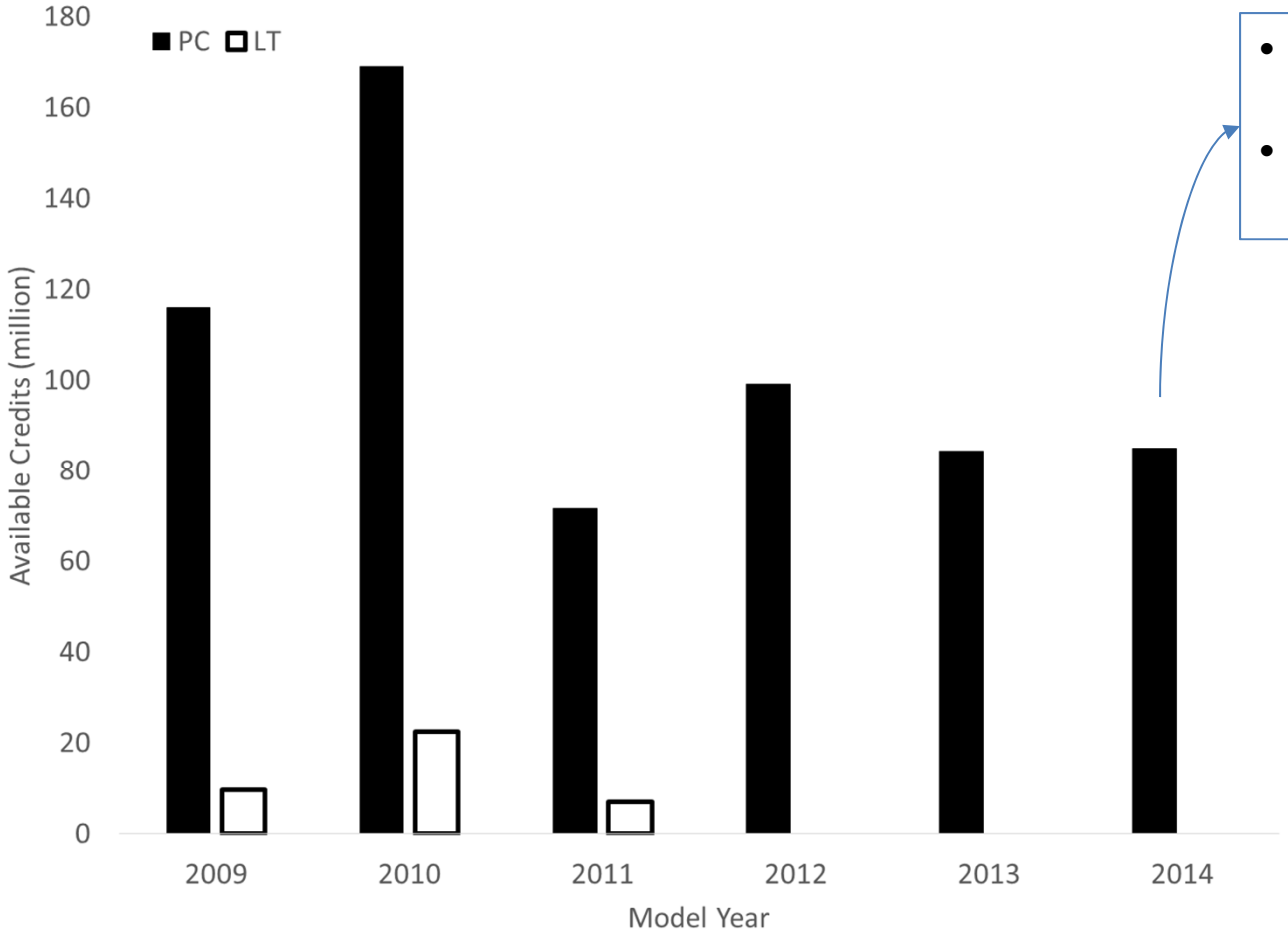
Example: 2012 Analysis for this OEM without CAFE credits



Example: 2012 Analysis for this OEM with credits (FFV, carry-forward, transfer)



CAFE Credit Balances
Example: Current Status for this OEM



- Could carry forward as far as MY2019
- Could transfer (some) to LT fleet.

From http://www.nhtsa.gov/CAFE_PIC

Model Changes Since 2012

- Supporting 2015 NPRM for HD pickups and vans
  - Better representation of shared platforms, engines, and transmissions
  - Inclusion of standards based on "work factor"
  - Representation of potential to increase payload and/or towing
- Currently Testing
  - Simultaneous analysis of light-duty vehicles and HD PUVs
    - e.g., Nissan Frontier and Pathfinder share engine with NV2500 (HD van)
  - Improved accounting for banked credits
  - Further-refined representation of technology inheritance
  - Inclusion of simulation-based database inputs to specify mpg impacts
  - Simulation of "time-based" technology improvements
  - Many other mostly minor improvements
- Also inputs
  - 2015-based analysis fleet
  - Updated fuel price forecast
  - Updated mass-safety analysis
  - Many others

Focus of today's workshop

Using Full Vehicle Simulation with the CAFE Model