

# AFLEET Tool



# AFLEET Tool Background



# What is AFLEET Tool?

- The Department of Energy's Clean Cities Program has enlisted the expertise of Argonne to develop a tool to examine both the environmental and economic costs and benefits of alternative fuel and advanced vehicles. Argonne has developed the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool for Clean Cities stakeholders to estimate petroleum use, greenhouse gas emissions, air pollutant emissions, and cost of ownership of light-duty and heavy-duty vehicles using simple spreadsheet inputs.
- The tool uses data from Argonne's Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) fuel-cycle model to generate necessary well-to-wheels petroleum use and GHG emission coefficients for key fuel production pathways and vehicle types. In addition, Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES) and certification data are used to estimate tailpipe air pollutant emissions. Various sources are used to provide default cost data, including the Clean Cities Alternative Fuel Price Report and American Recovery and Reinvestment Act awards.



# Argonne has Supported DOE's Clean Cities with Tool Development for 15+ Years

- **AirCRED**
  - Estimated O<sub>3</sub> precursor & CO emission credits from AFVs for SIPs
- **Clean Cities AOI 4 Emissions Benefit Tool**
  - Estimated GHG & air pollutant benefits of Recovery Act grant proposals
- **GREET Fleet Footprint Calculator**
  - Estimates petroleum use & GHG footprints of medium/heavy duty vehicles & off-road equipment



# Motivation and Development of AFLEET Tool

- **Coordinators developing “Green Fleet” certification & consulting services**
  - Looking for tool to estimate the costs & benefits of AFVs
- **Focus was to build off methodologies from existing tools**
  - AirCRED
  - GREET Fleet
  - EPA’s Diesel Emission Quantifier (DEQ)
  - NREL’s Vehicle and Infrastructure Cash-Flow Evaluation (VICE) Model
  - AFDC’s Vehicle Cost Calculator
  - Clean Cities Alternative Fuel Price Reports
  - Clean Cities Recovery Act Data
- **Developed in Microsoft Excel**
  - Allows easier interface with fleet data



# “AFLEET Tool” to Analyze Costs & Benefits of AFVs

- **Examines light-duty & medium/heavy-duty vehicle:**
  - Petroleum use
  - GHG emissions
  - Air pollutant emissions
  - Cost of ownership
- **Contains 15 fuel/vehicle technologies**
  - Conventional: gasoline, diesel
  - Hybrid: gasoline HEV, diesel HEV, diesel hydraulic hybrid
  - Plug-in electric: PHEV, EREV, EV
  - Alternative fuel: B20, B100, E85, LPG, CNG, LNG, LNG/diesel pilot ignition
- **AFLEET Tool & its user manual available at: <http://greet.es.anl.gov/afleet>**






# AFLEET Tool's Structure

- **AFLEET Tool has 9 sheets**

- Instructions
- Inputs
- Payback
- Payback Outputs
- TCO
- TCO Outputs
- Footprint
- Footprint Outputs
- Background Data

- **Cell color scheme**

-  Yellow cells = key assumptions users can change with their data
-  Orange cells = key options users will select via drop-down menu
-  White cells = calculations and secondary assumptions

# AFLEET Tool's Calculation Methods - Simple Payback

- Tool has 3 calculation methods & which to use depends on your goals
- **Simple Payback Calculator**
  - Simple payback of purchasing new AFV vs. conventional counterpart
  - Average annual petroleum use, GHGs & air pollutant emissions
- **Total Cost of Ownership Calculator**
  - NPV of costs over the years of planned ownership of a new vehicle
  - Lifetime petroleum use, GHGs & air pollutant emissions
- **Fleet Energy and Emissions Footprint Calculator**
  - Annual petroleum use, GHGs & air pollutant emissions of existing & new vehicles
    - Older vehicles have higher air pollutant emission rates than newer ones





# Fleet Analysis with AFLEET Tool - Inventory Data

- **For new purchase analysis & footprinting, fleet inventory data is important**
  - Make, model & model year
  - Vocation description
  - Mileage
  - Fuel use
  - Fuel and maintenance costs
  
- **If fleet is large & heterogeneous, data helps target vehicles for replacement**
  - Replacing high fuel use vehicles
    - Faster payback with lower cost fuel
    - Larger opportunity for petroleum and GHG reductions
  - Replacing older high mileage vehicles
    - Larger air pollutant emission benefits



# Heavy Duty AFVs Can Continue to Provide Benefits

- **Heavy-duty standards has become increasingly strict**
  - Required significant improvements in engine controls & aftertreatment systems
- **Alt fuels may take advantage by having simpler/less costly aftertreatment**
  - Some AFV engines don't require PM filters or SCR systems
- **Absolute certification benefits of AFVs have diminished but still can be relative benefits**
  - In-use benefits are possible as well if diesel controls/aftertreatment don't operate properly
  - Alternative fuels may not always be better for every pollutant
    - Due to differences in engine types, controls & aftertreatment
- **CA adopted optional NOx HD standards to incentivize further reductions**
  - Can certify at 0.10, 0.05 or 0.02 g/bhp-hr
  - Carl Moyer Program provides grants for these engines



# Light Duty AFVs Can Continue to Provide Benefits

- **Light-duty standards have become increasingly strict**
  - Required significant improvements in engine controls & aftertreatment systems
- **EPA's Tier 3 passenger car and truck standard will further reduce emissions**
  - Coordinated with CA air pollutant (LEV III) and EPA GHG standards
  - Increases durability testing from 120,000 to 150,000 miles
  - By 2017, reduces gasoline sulfur content by 67%
  - By 2025, reduces NOx and VOCs by 80%, PM by 70%, CO by 75%
- **Alt fuels may take advantage by having simpler/less costly aftertreatment**
  - Gasoline direct injection may require particulate filters
  - Though stricter standards may pose challenges for some AFVs as well
- **Regulatory focus is to have zero emission vehicles (ZEVs) like BEVs and FCVs to reduce air pollutants and other environmental concerns**
  - California and 9 other states have adopted ZEV program



# Summary

- **AFLEET can help estimate the economic and environmental costs and benefits of AFVs**
  - Inform new vehicle purchases
  - Examine energy and emissions footprint of existing vehicles
- **Default data provided for key inputs**
  - Using your own makes your analysis more meaningful
- **AFLEET future plans**
  - Include new features and other cost/environmental data as available
    - Infrastructure costs
    - Externalities and other costs of petroleum use and emissions
    - H<sub>2</sub> FCVs, DME, bi-fuel CNG & LPG vehicles
    - User-friendly interface



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