

# WLTP Test Procedures for Hybrid Electric Vehicle Testing

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# Outline

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- Overview of current US domestic test
- Overview of test procedure opportunities
- Keys to hybrid electric testing



# Current Test Procedures

- The United States currently regulates passenger cars utilizing 40 CFR Part 86.
- For Light Duty Hybrid Electric Vehicles, part 86 references California Exhaust Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles and 2001 and Subsequent Model Hybrid Electric Vehicles
- Room for improvement in end of test criteria, retest criteria/ testing variability, complexity reduction



# Current HEV Procedures

- Sampling/ data collection additions to conventional vehicle
  - Integrated Amp-hours (State of Charge)
  - Full double UDDS (4 bag FTP), no stabilized substitution
  - Evaporative worse case emissions still requires 3 bag FTP
- Unique Procedures
  - Dynamometer Road Load Derivation (regenerative braking disabled)
  - Regenerative braking differences (on road versus dynamometer)
  - Canister load for non-integrated canisters



# Current PHEV Procedures

- Sampling/ data collection additions to conventional HEV vehicle
  - Recharge Amp hours
- Unique Procedures (add. to conv. HEV)
  - Testing throughout entire charge deplete range
  - Charge deplete end of test criteria



# Procedure Opportunities

- End of Test Criteria (PHEV/ HEV)
  - Allow maximum effort for driver trace without terminating test
  - Charge sustain operation could be ended before CS SOC is reached
- Retest Criteria (PHEV/ HEV)
  - State of Charge correction factor
  - Energy Analysis, similar to Test Cycle Power Calculator
- All Electric Testing (EV/ PHEV)
  - Allow substitution for multiple vehicle applications of same battery using different vehicle loads



# Procedure Concerns

- Double Cold Jeopardy (PHEV)
- Test on 4wd dynamometers where applicable (all regen)
- Coast down Techniques without true mechanical neutral ( On-Road)
- Test Vehicle miles
- System Durability beyond criteria pollutant impact



# Keys to HEV Test Procedures

- Provide building blocks for array of possible CO<sub>2</sub>, criteria pollutant, and alternative fuel programs beyond worse case emissions
  - Electric range/ usage
  - CO<sub>2</sub> displacement
  - “zero emission” programs
  - Alternative fuel programs
- Level Playing Field
  - Test procedures that are unique to HEV are needed to quantify HEV operation and are not designed to benefit one technology over another

