



Concept for an Emissions Credit Mechanism for Off-Road Hybrids in Tier 5 Rulemaking

August 8, 2022

Outline

- Background
- Stakeholder Feedback Regarding Off-Road Hybrids
- Off-Road Hybrid Availability
- Credit Mechanism Concept
- Emissions Credit Application Process
- Next Steps

Background

- Tier 5 Rulemaking Workshop (November 3, 2021)
 - Introduced initial concepts for off-road hybrids
 - Requested feedback on whether there is a demand for a dedicated off-road hybrid powertrain certification procedure and whether the heavy-duty on-road hybrid powertrain certification procedure is sufficient for certifying off-road hybrid powertrains
- Staff evaluated feedback and is considering Oxides of Nitrogen (NO_x) emissions credit concepts:
 - Default NO_x credit level of 5% of existing emission standard (Tier 4 final or Tier 5)
 - Data requirements and approval process to occur during certification application process

Off-Road Hybrids—Meetings with Stakeholders

- **Meetings with major Original Equipment Manufacturers (OEM) on Tier 5 rulemaking**
 - California producers vary in size: small, medium and large volume producers.
 - Some plan to focus their resources on zero-emission equipment rather than hybrids.
 - Some plan to introduce hybrids into specific equipment/applications.
 - Some indicated very limited customer demand for hybrids.

Off-Road Hybrids—Availability

- **Literature review**
 - Variety of hybrid systems ranging from demonstration to commercial products
 - Different types of hybrid architecture and rechargeable energy storage system
 - Wide range of applications
 - Most hybrids are reporting 20%-25% fuel savings (manufacturers' claims)
 - No report of NO_x emissions benefits

Credit Mechanism Concept

- **Available to credit hybrid systems if they are:**
 - Able to achieve a minimum of 20% fuel consumption reduction
 - Coupled with engines compliant with California Air Resources Board (CARB) emission standards
 - Tier 4 final standards currently
 - Tier 5 when proposed standards become effective
 - Provide either:
 - Fuel consumption data AND engineering argument supporting the potential for NO_x emissions reductions based on the reductions in fuel consumption from the hybrid system compared to an equivalent conventional equipment, or
 - Emissions data demonstrating NO_x emissions reductions of the hybrids

Credit Mechanism Concept (continued)

- Default credit level would be set at 5% of existing NO_x emissions standard (Tier 4 final or Tier 5) if all three conditions listed in previous slide are met.
- Higher credit level, with a maximum level of 10% of existing NO_x emissions standard, could be considered by CARB staff if OEM provides actual NO_x emissions test data demonstrating higher NO_x emissions reduction levels for the hybrids.
- CARB staff is evaluating possible carbon dioxide (CO₂) emissions credit, that could be similar in concept to the proposed NO_x emissions credit.
- CARB certification staff will review OEM certification applications and assign appropriate NO_x and, as applicable, CO₂ emissions credit level.
- CARB staff will monitor and take enforcement actions as necessary to ensure NO_x and, as applicable, CO₂ emissions from hybrids are at or below the allowed credit levels.

Emissions Credit Application Process

- Manufacturer submits application for CARB certification to sell off-road hybrid equipment in California
 - Names of applicants: Engine OEM and hybrid system manufacturer
 - Description of engine and hybrid system
 - Requested level of NO_x emissions credit level (default 5%, up to 10%)
 - Fuel consumption data and, if applicable, NO_x emissions data
- CARB staff assigns an appropriate NO_x, and CO₂ as applicable, emissions credit level for the hybrid system based on review of data provided
 - If application is for a range of hybrid equipment, NO_x, and CO₂ as applicable, credit will be based on the worst-case scenario
- CARB staff issues Executive Order
 - Two-party (engine OEM and hybrid system manufacturer)
 - Certified Family Emission Limit (FEL) for the hybrid system
 - Assigns which party gets the NO_x, and CO₂ as applicable, emissions credit—based on whichever party is claiming for the credit on the certification application

Flow Chart of Credit Application Process

Step 1:
Manufacturer
submits application

- Manufacturers submit application to CARB certification for NOx, and CO2 as applicable, emissions credits for off-road hybrids equipment
- Named applicants, engine and hybrid system description, NOx, and CO2 as applicable, credit level requested
- Fuel consumption and/or NOx, and CO2 as applicable, emission data

Step 2: CARB staff
reviews application

- Reviews and verifies information provided by manufacturer on the certification application
- Contacts manufacturers if additional information is needed

Step 3: CARB staff
issues Executive
Order

- Two-party certification
- Assigns FEL and NOx, and CO2 as applicable, emissions credit levels
- Names party receiving the NOx emissions credit

Next Steps

- **Request for comments**
 - Credit mechanism concept
 - Should staff consider other incentives (instead of and/or in addition to)?
 - Should credits be restricted to certain types of hybrids, or should it be based solely on emissions performance?
- **Request for data**
 - NO_x/CO₂ emissions data (comparing hybrids versus conventional)
 - NO_x/CO₂ emissions trade-off data
 - Duty cycle
 - Fuel consumption data
- **Regulatory**
 - Next workshop in November
 - Board hearing in 2024/2025