Accelerating the Introduction of

High-Octane, Low-Carbon (HOLC) Fuels in the United States

Vision: North American vehicle powertrain technologies, fueled by higher octane/lower carbon fuels, will be deployed at scale to help attain 2025 greenhouse gas emission standards.

Timeline:

- **2018:** Final Determination of Mid-term Evaluation, and potential EPA rulemaking, in conjunction with NHTSA fuel efficiency rulemaking.
- **2020:** Future fuels (high octane/low carbon) needed to meet future transportation sector GHG reduction targets are introduced to consumers.
- **2025:** Future fuels to support 2050 fleet are broadly available

Infrastructure Developments

- On August 30, 2016 Wayne Fueling Systems made an announcement that they would manufacture all new fuel dispensers as UL certified for E25.
- In 2015, the USDA announced the start of the Biofuel Infrastructure Partnership, which has resulted in more than $200 million in public and private financing for infrastructure that can dispense intermediate blends of ethanol. Simultaneously, the Prime the Pump initiative has been helping to support fuel retailers expand fuel choices to consumers, which has led to E15 being offered in 29 states and more than 1000 stations.
- Recently, Underwriters Laboratory (UL) completed an industry requested project testing fuel UL87-A dispensers for compatibility with E30 and E40. The test was overall successful, and now industry partners and UL are exploring options for expanding the UL87-A certification.

Fuel Specifications

- In 2016, ASTM International published the *Standard Specification for 100 RON Test Fuel for Automotive Spark-Ignition Engines* (ASTM-D8076). Efforts are underway to specifically define a subset of the Co-Optima bio-blendstocks to meet the requirements of the standard.

High Octane Engine & Vehicle Testing

- Oak Ridge National Lab (ORNL), DOE's Bioenergy Technology Office, the Coordinating Research Council (CRC), and various industry partners have overseen vehicle and engine testing using high-octane, mid-level blends of ethanol, coupled with standard or modified engine designs,

including a Ford EcoBoost (ORNL Report, 2015; ORNL Report, 2017; AVFL-20, 2017), a Cadillac ATS, a Mini Cooper, and other engines.

- There is currently testing underway using a high-octane, mid-level ethanol blend coupled with a modified, high-compression engine to show the benefits of coupling this fuel with the advanced, vehicle technology. Additional durability testing will complete the data package to support the adoption of a new fuel.

Future Fuels

- In June, 2017, DOE's Co-Optima initiative reached the Decision Point of 8 bio-blendstocks that meet the desirable criteria going forward. They are: Ethanol, Isopropanol, Isobutanol, N-propanol, Cyclopentanone, Diisobutylene, Furan Mixture, and Aromatics. These blendstocks will now undergo more rigorous assessment and evaluation.
- Keith Kline (ORNL) and others have done research to show that, "Applying sustainability guidelines to bioenergy will help achieve near- and long-term goals to eradicate hunger." This helps to respond to the debate of food vs. fuel, and considers instead food *and* fuel.
- Research done by Michael Wang from Argonne National Lab (ANL) and others has shown that the expected GHG emissions from land use change contribute less to the overall biofuel life cycle emissions than reported in other studies.

Why Octane is Important

- DOE and EPA have continuously endorsed the utility of higher octane in achieving more efficient performance of the nation's new car fleet that will continue to use gasoline in large volume for many decades to come;
- In 2011, the Alliance of Automobile Manufacturers recommended increasing the minimum gasoline octane rating, commensurate with increased use of ethanol to help achieve future requirements for the reduction of greenhouse gas emissions;
- The co-design of fuels and engines is an important pathway to improve fuel economy and reduce GHG emissions, just as the co-design of fuels and emissions systems was important to reducing criteria emissions;
- High octane gasoline, available for general use, could be used by automakers to support phased introduction of higher efficiency internal combustion power trains to address increasingly stringent fuel economy and emissions performance standards within the next few years. As future performance standards are considered (2025+), high-octane fuel will increasingly be needed to support deployment of compliant systems. (NOTE: Current "Premium" fuel falls short because the octane rating is not high enough and retail cost is prohibitive.);
- High octane can be provided by the use of ethanol; ethanol is the most cost-effective source of higher octane that can be generally available in the market by 2025 though use of available distribution infrastructure;
- By identifying the need to increase octane of regular gasoline, EPA would open up competition in the marketplace and allow ethanol producers and feedstock providers like American corn growers the opportunity to supply lower cost and cleaner octane;
- Increasing octane requirements would provide automobile manufacturers technology options to achieve reduction in GHG emissions, improve fuel economy of the nation's light duty fleet, lower fuel costs to consumers, and support sustainable job growth in America.