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## Unlocking the Promise of Ethanol: Promoting ethanol while protecting air quality

Oil is the Achilles' heel of America's security and our economy, and it threatens the environment we want to leave to our children. America's cars, trucks, and buses account for 27 percent of U.S. global warming pollution. High-blend ethanol fuel, properly used, can help achieve air quality standards and break our oil addiction.

About 3 percent of our current gasoline supply is ethanol. The recently enacted Energy Policy Act of 2005 directs fuel producers to nearly double sales of ethanol-blend fuel from 2006 to 2012, and a number of states have enacted or are considering minimum-use mandates. Combined with vehicle efficiency and smart growth, an aggressive plan to develop and deploy advanced biofuels—especially ethanol produced from the cellulosic plant matter (switchgrass, willows, wheat straw, and corn stover)—could eliminate virtually all our demand for gasoline by 2050. Immediate action could reduce global warming pollution by 1.7 billion tons per year—22 percent of total U.S. emissions in 2002.

Currently ethanol is mostly used as an additive to gasoline in low blends up to 10 percent ethanol and 90 percent gasoline. However, the use of ethanol as an additive presents air quality challenges. NRDC research points to two key policy approaches to achieve clean air standards

while advancing the use of biofuels and breaking our addiction to oil:

- Carefully manage the use of low-blend ethanol as an additive to reduce harmful emissions.
- Push for a rapid transition to the use of ethanol as a gasoline alternative, with a focus on making it accessible to consumers.

### Low-blend ethanol harms air quality

Although originally introduced into gasoline specifications to combat ozone formation, ethanol in low blends can actually contribute to pollution. Studies by the California Air Resources Board and the Environmental Protection Agency (EPA) have concluded that low ethanol blends (E-5.7 in California) in the current fleet of vehicles increase ground-level ozone pollution by increasing emissions of two pollutants that lead to ozone formation—nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs)—more than they

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decrease the ozone-forming impact of a third pollutant—carbon monoxide (CO).

Fortunately, newer vehicles, especially those that meet the current California Low Emission Vehicle II program and EPA Tier 2 emission standards, are equipped with engine and pollution control technologies that dramatically reduce these pollution impacts. Unfortunately, it takes 15 years or more for these vehicles to become the dominant technology on the road, so the air pollution liabilities with using low-blend ethanol will persist for many years unless proper safeguards are put into place.



technology to minimize NO<sub>x</sub> emissions. With the proper incentives, FFVs can ultimately take a large bite out of oil dependence.

There are about 5 million flexible-fuel vehicles on U.S. roads today, but due to the scarcity of E-85 pumps and a lack of awareness among owners, practically all of them are being run on gasoline. E-85 needs to be made more widely available, and the remaining 212 million gasoline cars and trucks should be replaced with FFVs. States can take the lead in making both happen.

### Recommendations for making ethanol a safe and realistic fuel alternative

Ethanol is good for blending, so it is likely to continue to be mixed into gasoline even in areas with severe air pollution problems. But any increase in ozone-forming pollution can and should be fully offset through more stringent and cleaner gasoline standards.

Because state and federal ambient air quality standards set thresholds for ozone levels, states are in a position to reach and maintain air quality standards by properly managing the use of ethanol blends. Some guidelines for state-level ethanol management are listed below:

- Prioritize aggressive measures to promote ethanol use in high blends, especially in areas that fail to meet ozone standards.
- Provide the maximum flexibility to refiners to blend ethanol in the winter, when smog formation is not a problem.
- Opt out of the provision that allows conventional (i.e., non-reformulated) gasoline to have higher vapor pressure (and thus higher evaporative emissions) when blended with ethanol.

### Pollution impacts of low ethanol blends

**Nitrogen Oxides.** Low ethanol blends boost the fuel-oxygen content and create an air-rich fuel, which, when combusted in traditional engines, results in higher levels of NO<sub>x</sub>. This effect is especially prevalent in vehicles built before the mid-1990s that cannot automatically adjust the amount of oxygen in the fuel before it is burned.

**Volatile Organic Compounds.** Low blends increase evaporative VOC emissions in two ways: by raising the vapor pressure of the blended fuel and by increasing "permeation." The change in vapor pressure can be controlled by changing the gasoline used in the blending. Permeation occurs when hydrocarbons from the gasoline migrate through the rubber and plastic components of a vehicle's fuel system, such as the fuel tank and hoses. Ethanol changes the properties of the fuel, allowing more VOCs to permeate the components and evaporate into the atmosphere. Recent studies suggest that if not accounted for by other changes in the fuel, this effect would substantially increase emissions. In Los Angeles, an area that currently suffers from a deficit of measures to reduce ozone pollution enough to meet clean air laws, these emissions could increase that deficit by about 10 percent.

**Carbon Monoxide.** Low blends of ethanol reduce CO emissions, but the ozone liabilities of permeation emissions outweigh the benefits from reduced carbon monoxide. While increased oxygen levels in fuels provide a beneficial effect of reducing the emissions of CO, this pollutant is only a relatively weak precursor to ozone.

### Rapid transition to high blends will unlock ethanol's potential

By far the best way to avoid the air quality problems associated with ethanol is to use it as a high blend, such as E-85. High-blend ethanol fuels reduce evaporative emissions compared to low blends. E-85 is burned in flexible-fuel vehicles (FFVs) specifically calibrated to run on any fuel from regular gasoline to E-85. FFVs also have improved fuel systems that help minimize permeation and the latest oxygen-sensing