

The Benefits of Different Biofuels

Haris Gilani, Daniel Sanchez, & Katie Harrell



What are Biofuels?

Biofuels are renewable fuels produced from sustainably sourced biomass, including plant material and animal waste. They can be liquid or gaseous and can replace fossil fuels like gasoline, diesel, or natural gas. A diversity of renewable biofuels will help California reach its goal of carbon neutrality by 2045.

Sources of Renewable Biofuels

Potential sources of renewable biofuels in California (CA) include sustainably sourced forest residues, agriculture residues, and municipal solid waste (MSW). As CA increases pace and scale of forest restoration activities to minimize wildfire risks and increase forest health and water retention, forest residues are expected to be a major source of biomass for biofuels production in the state.

Types of Biofuels

While biofuels have the potential to provide climate-friendly energy, not all biofuels are created equal. For example, ethanol is the same chemical product regardless of its source material; however, the renewable source material used (corn, forest residues, or MSW) results in very different greenhouse gas (GHGs) emission reductions. Numerous different liquid or gaseous renewable biofuels can be produced from biomass in CA, including hydrogen, ethanol, sustainable aviation fuel, gasoline or diesel, and renewable natural gas.



Hydrogen

Hydrogen is currently primarily produced from fossil natural gas. However, using sustainably sourced biomass to produce renewable hydrogen could reduce dependence on fossil fuels and support CA climate and energy goals at costs competitive with those of hydrogen produced from natural gas or coal.

Ethanol

Ethanol is a domestically produced alternative fuel commonly made from corn, but it can also be made from

forest biomass or agriculture residues. Most motor gasoline sold in the US contains about 10% ethanol by volume. Corn ethanol is estimated to have a net GHG reduction of approximately 30-40% relative to gasoline; whereas, renewable ethanol from forest residues or agriculture residues is expected to have GHG reductions exceeding 80% and can be cost competitive with other transportation fuels.

Sustainable Aviation Fuel

Aviation fuel produced from biomass feedstocks (e.g., forest residues, agriculture residues, or MSW) is very similar in chemistry to fossil jet fuel, but has an 80% lower carbon footprint than traditional jet fuel. Cost-competitive sustainable aviation fuel can be safely mixed with conventional jet fuel without any technical modifications to existing aircraft, engines, or airport fuel systems.



Gasoline or Diesel

Renewable gasoline and renewable diesel are biomass-derived transportation fuels that are chemically identical to their petroleum counterparts and, therefore, minimize compatibility issues with existing infrastructure and engines. Nearly all domestically produced and imported renewable diesel in the US is used in CA due to economic benefits under the Low Carbon Fuel Standard, making it a cost-competitive alternative to fossil diesel.

Renewable Natural Gas

Renewable natural gas (RNG) is fully interchangeable with conventional natural gas and thus can be used in natural gas vehicles as transportation fuel. In CA, a significant volume of RNG can be produced using commercially available technologies from sustainably sourced forest biomass, agricultural residues, and organic waste (or MSW). RNG can be transported through existing pipelines, which can enable a lower cost solution than trucking to delivering fuel and reduce carbon dioxide emissions in the near-term.