Bio-Truck Facts

**History:** In 2003, when the price of gasoline reached $2 per gallon, Wayne Keith of Springville, Ala., decided it was too expensive to continue running his 1984 Ford truck on gasoline. He used the truck daily for transportation and to haul hay, cattle and equipment. The engine in this pickup is 460 cubic inches, and mileage on gasoline is only eight to nine miles per gallon. By 2005 Wayne had designed and constructed his first generation pickup-mounted gasifier to power the Ford on wood instead of gasoline. However, this equipment was not very user-friendly, and heavy on wood. So in 2007, Wayne designed, constructed and installed an improved second generation gasifier on a smaller truck. Finally, in 2008 he developed a further improved third generation gasifier on a third pickup. This most recent version is much more user friendly, and will be the lead vehicle for the Coast-to-Coast and Back Renewable Energy Tour (Sept. 29-Oct. 17) and the one that will participate in the Berkeley to Las Vegas race (Oct. 11-13). Wayne has traveled about 20,000 miles on wood in each of his first two trucks for a total of 40,000 miles, and has not traveled anywhere on petroleum fuels for more than two years. This indicates that the wood powered Bio-Trucks are truly work vehicles, and definitely not toys.

**Tour models:** The third-generation gasifier is mounted on a 1991 Dodge Dakota V8 pickup, which will lead the tour and participate in the race. The second-generation gasifier is on a 1987 Dodge Dakota pickup that has a V6 engine. This vehicle will be a backup for both the tour and the race. It was necessary to use older model trucks because the technology is difficult to install on more recent models which mostly have advanced fuel injection systems.

**Technology/Equipment:** The technology that enables solid material like wood to be used as a fuel for the Bio-Truck is known as gasification, which is essentially partial combustion. Complete combustion is what occurs in an open fire which has an abundant supply of air, and therefore, oxygen. When a fire like this burns, the carbon and hydrogen contained in the material being burned get oxidized (oxygen from the air is added to them), to form mostly carbon dioxide (CO₂) and water vapor (H₂O). These gases are released into the air, and the inert material, known as ash, remains on the ground in solid form. If combustible material like wood or grass is placed in an enclosed vessel (known
as a gasifier) into which passage of air (and therefore, oxygen) can be restricted, it can be ignited but restricted to only partial combustion/oxidation. The result is that instead of water vapor, hydrogen is released, and instead of carbon dioxide, carbon monoxide is released. This mixture of gases is known as synthesis gas, or syngas: mainly a mixture of carbon monoxide and hydrogen, but it also contains small amounts of carbon dioxide and methane. A downdraft gasifier is located behind the cab of the Bio-Truck. The temperature in the gasifier is between 2,000 and 3,000 degrees F. The syngas flows out of the bottom of the gasifier into a gas radiator (the black “rails” mounted around the payload) to cool it down and condense it. From there the gas is run through a filter to clean it, and then directly through the carburetor to the engine. The energy content of the gas is about 200 BTU/cubic foot, compared to 1,000 BTU/cubic foot for natural gas.

**Speed and Mileage:** The race V8 Dodge Dakota travels about one mile per pound of wood and can reach more than 80 miles per hour on a level road when traveling on wood only. The V6 pickup gets about one-and-a-half miles per pound of wood, and can do about 65 miles per hour.

**Emissions:** Because all plants, including trees, obtain their carbon from CO2 in the air, when plant material is burned the carbon is simply returned to the atmosphere where it came from. Therefore, the Bio-Truck is carbon-neutral because it is just releasing carbon into the atmosphere where it came from. In contrast, the use of gasoline or diesel made from oil involves taking carbon from below the ground (oil wells) where it is harmless, and adding it to the pool of greenhouse gases in the atmosphere, thus increasing the risk of global climate change. For this reason it is imperative that we reduce the use of fossil fuels as soon as possible. When stationary, there may be a small amount of smoke emitted from the gasifier, but there are no visible emissions when the trucks are in motion. Tailpipe emissions have not yet been measured, but this will be done before the tour.