

## Plant Assignment: Comparison of Biodiesel and Diesel Fuels for MSU Campus

### Task in Perspective

Biodiesel is a clean burning alternative fuel. It is produced by generating methyl esters from an appropriate vegetable source and blending this with conventional petroleum products. The State of Minnesota and Minnesota State University, Mankato (MSU) are very supportive of renewable fuels and biodiesel use. MSU utilizes five diesel generators. Three Caterpillar generators are used for stand-by power and two Katolite generators are used for emergency lighting and alarms. It has been determined that these generators can be run on standard diesel or biodiesel without modifications. Given the trend toward using renewable fuels, the Director of Facilities Management wants to know if there would be a cost benefit or penalty to running the generators on biodiesel versus standard diesel.



### Work Assignment

The assignment given to you by the Director of Facilities is to perform preliminary calculations to determine which fuel will be more cost effective. For this stage of comparison you should provide a clear numeric answer (\$/kW) that backs up your conclusion. You may approximate the diesel engine cycle as an ideal Carnot heat engine. For the Director's future consideration, briefly discuss the claim that biodiesel is a cleaner burning fuel. Identify the typical types and amounts of emissions from both diesel and biodiesel. Present your information in the form of a short memo. You should show all calculations, provide information on all references, and professionally format your memo.

### Additional Information

Properties of diesel fuels vary widely based on source and manufacturer. However, for this assignment you may assume that standard diesel has a heat of combustion of 19,300 Btu/lb, a combustion temperature of 2447°F, and a density of 0.85 g/cm<sup>3</sup>. Also assume that biodiesel has a heat of combustion of 17,150 Btu/lb, a combustion temperature of 2293°F, and a density of 0.88 g/cm<sup>3</sup>. The surroundings can be assumed to be maintained at 70°F. The heat of combustion is the maximum amount of usable energy removed from the fuel during combustion.

