

5. Analysis of Option 26 – Ethanol-Fueled Locomotive

Background

The project involves a completely new locomotive engine technology, developed by Alternative Hybrid Locomotive Technologies (AHL-TECH). This hybrid design locomotive combines internal combustion engines with battery technology. The engines are ~~is~~ spark-ignited, specifically designed to operate on ~~fuelled by bio~~ ethanol. The ethanol-hybrid stores electricity when the generator produces more power than is being used to move the locomotive. ~~The operator therefore has the option of powering the axles by running the engine or drawing on the battery.~~ This allows the locomotive's control software (known as Predictive Power Management Control – PPMC) the option of powering the axles by running the engines alone, using battery power only, or any combination of engine and battery power (engine dominant hybrid or battery dominant hybrid). The GPS enabled software can also be configured to give dominance to battery power when the locomotive is working in high pollution areas, such as within the confines of a industrial park, or within a locomotive service facility in the railyard. This hybrid technology also allows for regenerative braking, i.e., capturing energy dissipated when the locomotive is brought to a halt.

The ethanol-hybrid locomotive could potentially replace smaller locomotives (up to 2,500 hp), such as switchers. AHL-TECH is also designing a line of 3,000 to 4,300 hp ethanol-electric hybrid locomotives for heavy haul, helper, and mainline freight service.

AHL-TECH has partnered with Power-Tec Engineering to provide design and development services for the ethanol generator sets.

This technology approach would be the first locomotive with an ethanol-powered generator (eGenSet). Also, it would also be the first use of a higher-horsepower (> 500 hp) ethanol-optimized engine. ~~The AHL-TECH locomotives will be multi-genset locomotives. The locomotives will use anywhere from one to six eGenSets to produce 500hp to 3,000hp of continuous power. Coupled with the hybrid energy storage, the overall horsepower potential of an AHL-TECH locomotive is 1,000hp up to 4,400hp.~~

Technical Feasibility

The prototype ethanol-hybrid locomotive is currently under development. ~~Initial dynamometer testing of the 500hp ethanol engines is expected to be completed by early summer 2009. The first prototype locomotive, a three eGenSet hybrid, will use an existing switcher frame, cab, and trucks. The prototype MHP locomotives will use an all new frame and cab, but will use existing four- or six-axle trucks.~~

~~AHL-TECH expects to have its first commercial ethanol-electric hybrid locomotives available for purchase in 2010.~~

Potential Emission Reductions

By fueling with ethanol rather than diesel, the ethanol-hybrid system proposed by AHLTECH offers a completely new prevention technology for ~~smaller~~ locomotives. AHLTECH's ethanol-hybrid system, if successful, could be applied to switcher locomotives, which are a significant source of railyard PM and NO_x emissions in California. ~~By combining a higher number of generator sets with a larger battery storage system, a MHP locomotive for heavy haul, heavy switching, and transfer work is also possible.~~

In addition to reducing PM and NO_x, the AHL-TECH ethanol-electric hybrid locomotive could also reduce greenhouse gas emissions.

Costs

AHL-TECH estimates the ethanol-electric hybrid locomotive cost to be about \$1.5 million for a new four-axle switcher or road switcher, and \$1.8 to \$2 million for a six-axle MHP locomotive.

Cost-Effectiveness

At this time, staff does not have actual emissions data to be able to calculate cost effectiveness