LOCOMOTIVE EMISSIONS REDUCTION PROJECT

PROJECT DESCRIPTION:

The SG proposal offers California a unique opportunity to address the long-term issue of locomotive emissions. As railroad locomotives are not under the jurisdiction of the California Air Resources Board (CARB), this significant source of emissions has not been adequately studied, and no economically viable solutions or new Best Available Control Technology (BACT) for locomotives have been developed. The problem is significant, in 1995, there were as many as 1500 locomotives in California generating a tremendous volume of emissions with over 36,000 tons of N0x generated in non-attainment air basins alone each year.

The proposal calls for 48 General Electric locomotives to be used for 1,000 hours a year for five-years under a peaker power contract with the CCPCFA. This represents a good opportunity to test a variety of alternative fuel sources and emission control devices, impossible to test if the locomotives were operating in regular service. As the engines will be operating at a constant notch-8 (maximum output) and will be hooked-up to very sensitive electric meters, the impacts of each change on performance can be carefully monitored and air emissions easy to identify. We propose to work with CARB the BNSF Railway and the California Shortline Railroad Association (CSLRA) in providing information on performance and emission results. In addition, Prof. Mohamed Farsch-chi at U.C. Davis, who is heading the CARB study to develop SCR for heavy-duty trucks, is willing to participate in reviewing the locomotive SCR development program as a reviewer or observer for CARB.

The project will use clean-air Biodiesel as the primary fuel source for the project. The Project proposes to demonstrate that this renewable fuel can be used to replace diesel and reduce air pollutants in a locomotive without significant modifications. Working with CARB, SG can test a variety of mixes of this fuel with other fuels such as Ethanol to see if we can obtain even greater emission savings.

The proposed use of roughly 7.5 million gallons of Biodiesel each year will accelerate the construction of a biodiesel plant in California. Presently the fuel has to be shipped by rail from Florida. Not only would this create significant cost savings for California users, but also provide California farmers a new customer for Soybean and Canola products. In short, implementing this proposal can help create the infrastructure for this production of this alternative fuel in California, and provide the detailed documentation for the railroad industry that can support its use here throughout the state. Railroads will be invited to inspect the Project while they are in operation to see exactly how these emission-reducing strategies work in the field.

In addition, SG will develop Selective Catalytic Reduction (SCR) control systems that will compliment the other measures employed. Based on our analysis, it is anticipated that we will see total reductions of as much as 90% of N0x. The development of a suitable SCR system poses little technical risk, as SCR has been demonstrated on a

variety of diesel engines. Considerable effort would be required to develop and package a system suitable for a locomotive application. This study will provide the long-term evaluation of such systems to demonstrate that they can be successfully employed on locomotives.

Finally, the SG proposal calls for the installation of BACT including SCR on five operating locomotives of the Sierra Railroad Company. The emission savings from these engines are expected to offset the entire emissions generated by the project. In addition it will add valuable field data demonstrating the effectiveness of the BACT on locomotives in motion.

KEY ELEMENTS OF PROPOSAL:

Emissions Reduction Plan: The primary thrust of this project is to create electricity while demonstrating methods to reduce emissions from locomotives through the combination of Biodiesel and Selective Catalytic Reduction (SCR). Diesel emissions from locomotives are unregulated in California. This project will provide methods for the industry to voluntarily reduce emissions. The problem preventing any railroad converting to Biodiesel and SCR has been the lack of definitive studies on the impacts of these changes to locomotives. [Please see attached summary]

Utilizing Energy: To properly test the impacts of the proposed changes, the locomotives will need to be tested over a number of years. As the initial SCR devices will be unwieldy, they could not be attached to a locomotive in motion. In addition, monitoring emissions and horsepower would be virtually impossible in motion. This would mean that any such study would require the locomotives to be parked running and the resulting electricity generated dumped into "resistor banks" which converts electricity into waste heat. We feel that utilizing that electricity as planned is a far more appropriate plan.

Zero NET Emissions: Based on 1,000 hours of operation, the project anticipates creating roughly 50 tons of N0x emissions a year for five years at each site. This is half the 100-ton limit allowed in Tuolumne County for each site. SG proposes to go beyond the AQMD regulatory requirements and offset the 500 tons over five years with air emission reductions in operating locomotives, resulting a net emissions of zero for the project. We have included in our proposal sufficient funds to convert five additional locomotives operated by Sierra Railroad Company to fully offset the entire emissions of the project. Essentially, with a 90% reduction in emissions it would take retrofitting only 5 operating locomotives with SCR to offset the emissions created by 48 units running with full SCR. These operating units will also be used to demonstrate the technologies developed and to field test SCR in a working railroad environment.

Environmental Benefits: In addition to the other benefits of the project it is important to recall that unlike a Natural Gas power facility, this project does not require any water for on-site cooling. In addition, the project does not increase the state's reliance on a carbon-based fossil fuel. The other advantage is that the project can be easily removed at the end of its useful life leaving nothing behind.

ATTACHED DOCUMENTS (PROVIDED AT MEETING):

1. **ABB-** Confirmation that they will furnish and install necessary inverters and substation being responsible for overall technical delivery of project. Additional technical information is provided regarding the project.

2. **World Energy-** Letter of Commitment from the world's largest supplier of Biodiesel to provide fuel and describes many of the environmental benefits. In addition, US Dept. of Energy provides information about Biodiesel.

3. **Sierra Railroad Company-** Confirmation that tracks will be made available for project, tank cars of Biodiesel will be delivered and commitment to convert five operating locomotives to SCR and Biodiesel for both running tests and sufficient offsetting emission reductions for entire project.

4. **Tuolumne County-** Overall letter of support for the project in general and support for the placement of the proposed project in their county.

5. **Johnson Matthey-** Confirmation that they will provide the SCR systems required which will achieve at least a 90% reduction in emissions.

6. **Engine, Fuel and Emissions Engineering-** Letter of support for concept of emission reduction in locomotives and confirmation of 1.5 grams/bhp targets.

7. **Transportation Involves Everyone-** Letter of Support from local organization involved in environmental alternatives in transportation.

8. **Earth Island Institute-** Letter of Support from this well-known environmental organization encouraging support for this project.

9. **General Electric Locomotive Division-** Technical Information regarding the B30-7A locomotive and their electrical output.

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