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Subject: Comments on State Plan for Alternative Transportation Fuels (06-AFP-1)
Attachments: DME white paper.doc

Good morning Dockets Unit. The Gas Technology Institute would like to submit comments on the State Plan for Alternative Transportation Fuels. We are also sending one copy by regular mail today. Please contact me (information below) if you have any questions. Thank you, Susan.(See attached file: DME white paper.doc)

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DME from California Biomass – A viable renewable fuel supplement

The California Legislature (AB2076, Shelley) requires the California Energy Commission (CEC) and the California Air Resources Board (ARB) to develop and adopt recommendations on a California strategy to reduce petroleum dependence. The legislation also requires CEC to forecast gasoline and diesel use in 2010 and 2020. Strategies to be considered include the addition of new sources, improved vehicle efficiencies, alternative fuels and advanced transportation and vehicle technologies.

California's refining industry is running at or very near capacity, producing about 17 billion gallons of gasoline and diesel fuel per year for on-road consumption. The demand for refined products could reach as much as 27 billion gallons by 2030. This increase in demand can be met by expanding the refineries in California or by importing refined or finished products into California. Currently, there is an excess world refining capacity, and no new refineries are expected for 5 or more years. California will be importing refined products to meet its growing demand.

Other possible strategies to meet California's fuel demand are the accelerated introduction of more efficient cars and trucks and use of non-petroleum or alternative fuels (either as neat or as blends in petroleum fuels). The CEC and ARB have developed a program and methodologies to evaluate and analyze these possible options. The Staffs are evaluating the costs associated with implementing these strategies that reduce petroleum in the context of the increasing projected number and use of cars and trucks.

As one alternative, renewal fuel option, Dimethyl either (DME) is a viable liquid fuel that can be easily made from a biomass-produced synthesis gas. DME is a colorless gas at room temperature and pressure, and it is a transportable liquid at about 75 psig, just like propane. Because it is non-hazardous, non-toxic, and non-carcinogenic, it is also used commercially in non-fuel applications as a propellant in perfumes and other personal care products. DME can be a diesel fuel supplement or used directly in diesel engines with minor retrofits to take care of elastomer life issues (as Denmark and China have successfully shown on operating buses and taxis). DME can also be used as a liquid petroleum gas (LPG) supplement, and for hydrogen production in distributed power or transportation applications. GE has certified the use of DME in turbines, which could be a highly efficient route to offset use of natural gas with renewable fuel in electric power generation.

Unlike cellulose-to-ethanol conversion, or mixed alcohol synthesis and distillation, DME production is via commercially available synthesis technology. According to a recent European study, DME from biomass offers the highest greenhouse gas reduction potential and among the lowest avoided CO_2 cost of any alternative fuel in a 5% fleet substitution scenario.

A study is needed to assess the feasibility of California biomass feedstocks with specific process technical and economic issues of biomass gasification to produce a synthesis gas to process into DME. Available waste biomass feedstocks for DME production would not compete with food or fiber production, and DME would have applications different from ethanol applications. The focus of this study would be to determine the feasibility and value of a subsequent demonstration biomass to DME plant to provide the information for commercial scale. Commercially, a 1,000 ton/day biomass gasifier could

provide about 4,000 barrels/day of DME. This could be used in the region that it is produced or transported elsewhere as a liquid fuel.

DME from Biomass Advantages:

- DME combusts without soot formation, with reduced NOx, and meets 2007 EPA/California emission standards
- Biomass-based DME would provide significant reductions in greenhouse gas emissions compared to natural gas
- DME fuel offers use options for transportation or CHP applications
- DME has been proven in diesel engines, and DME power turbines are available
- DME engine conversion kits are currently available
- For transport as a liquid, DME does not have the corrosive properties of ethanol
- DME production has the simplest process steps of all the liquid fuel options

The following chart is illustrative of the benefits of DME vs. diesel

DME (compared to diesel) is virtually smokeless (very low particulate emissions), with an 84% reduction in NOx, a 48% reduction in CO, and a 75% reduction in non-methane hydrocarbons.

DME is at normal atmospheric conditions a gas (boiling point -25°C) and must be handled under pressure (>5 bar) to obtain a liquid. DME contains no impurities of sulphur or metals and is under practical conditions a harmless gas from health and environmental points of view (is among others used as propelling gas in spray cans), and is also non-mutagenic. DME is synthesized from methanol or directly from synthesis gas. The synthesis gas can be made from a variety of feedstocks, including biomass. DME has as liquid an energy content (LHV) of about 19 MJ/liter (28 MJ/kg) and yields more than 10% less CO2 per energy unit at combustion compared to petrol.

DME is readily ignitable (high cetane number) and has been tested as clean burning fuel for diesel engines with low-emission characteristics. Tests with DME have yielded excellent results with extremely low emissions. The combustion of DME in diesel engines inherently reduces NOx emissions and is soot-free. Several automotive industries are developing engines and technologies for demonstration with Volvo as leading company. DME could be handled in same way as for LPG today and would initially be used in dedicated fleets with their own fuel infrastructure.

The Gas Technology Institute (GTI) is the nation's premier natural gas R&D performing laboratory. GTI performs R&D to benefit the nation's and California's natural gas and energy consumers in the areas of natural gas supply and gas from renewables and coal, energy-efficient, low-emissions end-use equipment, and natural gas transmission, distribution, and storage.