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8 June 2007

California Energy Commission
Dockets Office, MS-4
ATTN: Docket No. 06-AFP-1
1516 Ninth Street
Sacramento, CA 95814-5512

RE: Docket No. 06-AFP-1 Alternative Fuels Transportation Plan

On behalf of Air Products and Chemicals, Inc. we are pleased to provide comments concerning "AB 1007 Scenarios – Hydrogen Fuel Cell Vehicles" and related subject presentation titled "Hydrogen Fuels/Technologies" presented at Alternative Transportation Fuel Plan, AB 1007 (Pavley) workshop on Thursday, May 31, 2007.

The foundation of the California's Alternative Transportation Fuels Plan is a full fuel cycle analysis for a variety of alternative transportation fuels. The full fuel cycle emissions are determined on a Well-to-Wheels (WtW) basis, which includes fuel production and distribution, or fuel cycle emissions, and vehicle emissions. Air Products supports the evaluation of the various transportation fuels full cycle analysis; however, the assumptions underpinning the subject WtW analysis are not readily transparent to us and inconsistent with our understanding of Argonne National Laboratory's WtW analysis contained in GREET (Greenhouse gases, Regulated Emissions, and Energy in Transportation) and Air Products proprietary internal analysis

In review of the information presented to the California Energy Commission (CEC) in "AB 1007 Scenarios – Hydrogen Fuel Cell Vehicles" report, Air Products firmly believes the report requires a deeper review and understanding in the following areas:

- **Figure 1-6: Relative GHG Emissions, WTW**
  - The GGE emissions for the FCV SMR/Pipeline to the FCV On-site SMR case in the subject analysis are being illustrated as equal. Air Products has extensive experience in supplying large scale SMR's and smaller scale distributed SMR's to the marketplace and we find these results inconsistent with our experience. Large SMR hydrogen plants tied to a pipeline (SMR/Pipeline) are orders of magnitude larger than distributed SMR's (On-site SMR) that would be placed at hydrogen refueling stations. Large SMR plants, which are principally designed for the production of hydrogen, can also produce steam and power economically which provides higher efficiency in comparison to small On-site SMR plants where it is not economically feasibly to add steam and power generation capabilities. This integration is recognized in GREET which provides up to a greater than 20% increase in efficiency and 10% decrease in GHG emissions for Large SMR plants with steam co-generation.
  - Another concern involves the inconsistency of WtW GHG Emissions for the FCV SMR/LH2 in the subject analysis when compared to a Central LH2; NA NG, Steam Co-Generation case in GREET. The resulting WtW GHG Emissions for FCV SMR/LH2 as a fraction of gasoline baseline GHG's are 62% higher in the subject analysis (~84%) as compared to calculated results (52%) using GREET.
  - Should label on graph Grid Electricity is CA Electrical Mix. The CA Grid provides lower GHG's than the US Electrical Mix which is favorable to the H2 Electrolyzer and PHEV's. For example, GHG's are estimated at 286,494 g/MM BTU in the average U.S. Grid versus 183,161 g/MM BTU's in the CA Grid, a 36% reduction for GHG's for the CA Grid.

- Did the subject analysis apply the CA Grid and lower associated GHG's to the hydrogen liquefier associated with FCV SMR/LH2 supply pathway? If not, the GHG's associated with FCV SMR LH2 should be significantly lower than illustrated.
- The baseline gasoline fuel economy in determining relative GHG emissions in the subject study is 30.3 mpg. This value is higher than the CAFE standards that exist today and higher than the 80th percentile of the gasoline baseline fuel economy contained in GREET.
- The higher gasoline efficiency used in the subject study results in representing a higher level of relative GHG emission reductions for the alternative fuel pathways in comparison to gasoline.
- Likewise, the high gasoline fuel economy assumption lowers the actual values of GHG's on an absolute g/mile basis and overstates the reduction of GHG's in comparison for today and foreseeable future.

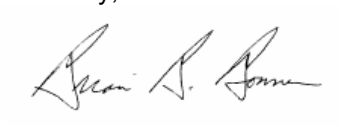
- **Figure 5-1: Vehicle Energy Efficiency Ratio (EER)**
- The EER values relative to gasoline ICEV's represented for the Hydrogen FCV and PHEV Grid Mode electric vehicle vary considerably from previously publish GREET data. The EER's for Hydrogen FCV and PHEV Grid Mode vehicles are 2.0 and 3.6, respectively. The relative Hydrogen FCV EER is reduced by 14% and 24% on a near-term and long-term basis, respectively. On the other hand, the PHEV Grid Mode electric vehicle is increased by 20% over GREET values. This adjustment in the analysis appears to favor PHEV's over Hydrogen FCV's.
- The assumption of an extremely high baseline fuel economy of 30.3 mpg in the subject analysis results in a 109.1 mpg equivalent for the pure electric PHEV Grid Mode vehicle. Considering the challenges of battery durability and performance the fuel economy of the PHEV's EER appears excessively high based on our discussions with automobile OEM's. The high gasoline mpg value combined with the high PHEV EER has implications on the GHG's associated with PHEV's stated throughout the report.
- Figure 5-1 illustrates PHEV 20 Gasoline, PHEV 40 Gasoline, PHEV 20 Electric, and PHEV 40 Electric vehicles. Associated with this figure is that the overall EER of a PHEV is a combination of the electric and gasoline performance is highly dependent on the electrical energy consumed between vehicle charging. Considering that PHEV 20 and PHEV 40 vehicles are listed throughout the report in many areas it should be stated whether the PHEV's are PHEV Gasoline or PHEV Electric vehicles.

- **Figure 5-2: Fuel Specific WTT GHG Emissions**
- The Well to Tank information depicted in the figure needs to be expanded to the complete fuel cycle Well to Wheels analysis.
- The labeling of the various modes of supply on the graph is not consistent with previous charts throughout the report. Does RFG, CA Average Crude Mix in Figure 5-2 correspond to ICE, Gasoline or Advanced ICE, Gasoline in Figure 1-6? Electric, Coal IGCC, CSS is represented in Figure 5-2 and not represented in any other area of the report. Is H2, NG SR, LH2 the same as FCV SMR/Pipeline in Figure 5-2, and so on?
- The H2 NG SR Pipeline and H2 Onsite NG SR are illustrated as being equal in levels of GHG (g/MJ). As previously noted in Figure 1-6 this is inconsistent with Air Products experience. Large SMR hydrogen plants tied to a pipeline (TIAX's H2 NG SR Pipeline or SMR/Pipeline) are orders of magnitude larger than distributed SMR's (TIAX's H2 Onsite NG SR or On-site SMR) that would be placed at hydrogen refueling stations. Large SMR plants, which are principally designed for the production of hydrogen, can also produce steam and power economically which provides higher efficiency in comparison to small (1500 kg/d) On-site SMR plants where it is not feasibly to add steam and power generation capabilities. This integration is recognized in GREET which provides up to a greater than 20% increase in efficiency and 10% decrease in GHG emissions.
- The H2 NG SR LH2 pathway is significantly overstated in level of GHG (g/MJ) on the chart relative to GREET and should be approximately 20% lower than the subject analysis.
- Utilizing the CA Electrical Grid Mix will provide further GHG reductions for LH2 production.
- The H2 Grid Electrolysis is understated in the chart and should be higher than shown. The analysis should state the efficiency associated with the hydrogen electrolzer.
- Throughout the report 70% Renewable power source is only applied to Electrolysis. The same 70% Renewable should be applied to H2 NG SR LH2 or FCV SMR LH2 in Figure 1.6. Furthermore, the LH2 pathway could be further refined with the supply of hydrogen from Biomass or other renewable sources to further reduce GHG's.

Air Products would like to thank the California Energy Commission for taking the initiative to understand the underlying facts on hydrogen as a transportation fuel and taking a leadership position to effect such. We appreciate this opportunity to submit comments concerning the draft subject analysis on the AB1007 Alternative Fuels Transportation Plan. We welcome the opportunity to discuss our comments and viewpoints further with the Energy Commission.

Please feel free to contact me at (610)481-5222 if you have any questions or would like to discuss further.

Sincerely,



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