California
FUEL CELL
PARTNERSHIP
DRIVING FOR THE FUTURE

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February 5, 2016

Ms. Marijke Bekken
California Air Resources Board
1001 I Street
Sacramento CA 95812

RE: Comments on the Draft Technology Assessment: Medium- and Heavy-Duty Fuel Cell Electric Vehicles

Dear Ms. Bekken,

The California Fuel Cell Partnership is pleased with the opportunity to comment on the California Air Resources Board's "Draft Technology Assessment: Medium- and Heavy-Duty Fuel Cell Electric Vehicles", as published on November 18, 2015.

Based on our experience with fuel cell powered light-duty vehicles, HD transit buses, MD and HD trucks, hydrogen fueling infrastructure implementation, the codes and standards development that underpins all of these and MD and HD truck industry stakeholder interaction to understand the challenges and opportunities ahead, we offer the comments attached to this letter.

These comments are based on our understanding of the current (pre-) demonstration phase of MD and HD fuel cell electric truck development in the context of the LD FCEV rollout in the consumer market and FCEBs operated in transit service.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Nico Bouwkamp
Technical Program Manager
California Fuel Cell Partnership

CaFCP Technical Program Comments on Nov 2015 "Draft Technology Assessment: Medium- and Heavy-Duty Fuel Cell Electric Vehicles"

For the conversation between industry and government entities on this topic to be most effective, it would be helpful if this document includes a section with definitions and explanations of the following terms:

- "*Commercial*" - MD and HD FCEVs are currently not commercially available (including fuel cell buses) through established or conventional procurement process, per the conventional understanding of "commercially available"
- "*For sale*" – A definition may clarify what "3 transit bus models for sale" comment refers to in conjunction with definition of "commercial"
- "*Near future*" – in the near future (2-3 years) there will only be demonstration programs for MD and HD FC trucks.
- "*Long term*" – Most likely the timeframe for vehicle technology benefits mentioned in this assessment document
- "Range" – This may not be the same for MD and HD FCEVs as for conventional vehicles – this is still has to be demonstrated

Assessment sources need to be specified for specific industry numbers and information. It is often not clear if these are actual data or projections. For example:

- 300 fuel cell buses worldwide
- Current cost of fuel cell buses ($1.3M)
- Two manufacturers offering fuel cell buses: are these transit bus manufacturers?

With regards to cost projections: these are difficult to make because of potential and unknown effect on payload capacity, especially because there is simply not enough practical operational data and information from actual projects that have operated vehicles. This includes preferences and typical operational expectations of vehicle and fleet operators. Based on this, it would be helpful if the assessment could more clearly and transparently indicate when projections are based on operational knowledge and experience versus modeled assumptions or unknown variables.

MD and HD hydrogen fueling infrastructure specific comments

a) It appears that in many cases, including in this draft assessment, the assumption is made that MD and HD H2 vehicles will be able to fuel at the hydrogen stations that are currently implemented throughout California. Per information from hydrogen station operators and the language of published codes and standards, the reason light duty FCEV hydrogen stations are not compatible with MD and HD FCEVs are not the high pressure or different

nozzles, but a reality in which current stations are built only for light duty passenger FCEV fueling use. Some specifics that limit MD and HD FCEV use:

- Use of LD FCEV specific adopted codes and standards (E.g. SAE J2601 fueling protocol)
- Engineering design of implemented H2 stations – designed to fill lower tank capacity (2-6kg) vehicles back-to-back, which results in a different design than when used for MD and HD FCEV anticipated needs (~10 kg/vehicle for MD FCEVs, 20-30kg/vehicle for HD FCEVs)
- Gasoline stations with co-located H2 fueling are generally not laid out to facilitate MD and HD vehicles to fuel (ingress/egress, spacing and location of dispensers, etc)

b) Fueling MD and HD FCEVs at transit FCEB fueling stations is only an option when transit agencies allow transit bus yard access, make adjustments in transit bus fueling logistics, add additional dispensers, operate MD and HD FCEVs (other than transit buses) for agency use and/or make administrative arrangements to sell fuel to non-transit entities. These sorts of access and operational changes are not small matters for transit agencies.

c) When making assumptions about the future fueling infrastructure for MD and HD FCEVs, it would be good to see a consideration of the aspects that play a role in current fueling practices for conventionally fueled MD and HD vehicle fleets – this would provide insight about what needs to be done to facilitate potential future MD and HD FCEV applications in the market.

d) A basic, reliable fueling infrastructure should be in place before a large set of potential operators will consider acquiring MD and HD FCEVs - even for demonstrating the feasibility of the technology. Therefore, the steps laid out in Section III.A.2. are unrealistic if there is not first a fueling infrastructure in place to provide fuel to operate MD and HD FCEV projects.

e) Per point “a” in this section, it is not clear what the benefit is of an analysis of LD FCEVs numbers and stations. Although related on a superficial technical level, currently it is unclear what the direct benefits are of the reported LD FCEVs numbers and LD fueling infrastructure to rollout of MD and HD FCEVs.

MD and HD fuel cell vehicle technology specific comments

a) MD and HD FCEVs may have another benefits compared to battery dominant MD and HD ZEVs: FCEVs could be lighter weight, thereby allowing for similar freight capacities as for conventionally fueled vehicles, and can be fueled within similar timeframes to conventional vehicles.

b) The challenge with H2 storage on a HD FCEV is a broader issue than placement of a sufficient number of H2 tanks: it also depends on what storage technology is chosen (and currently 35MPa is most readily used and available for this vehicle category, based on experience with transit buses). Future considerations should include higher pressures than 35 MPa and/or alternative hydrogen storage methods.

c) Because HD FC trucks are in an early stage of development, are figures II-2 and II-3 the typical integration of major subsystems on HD buses and trucks? These are two examples, not necessarily what is optimal for commercialization.

d) Unnecessary to make reference to integration of FC systems in LD FCEVs to claim that the same applies to MD and HD FCEVs – from an engineering perspective it is possible, but at what cost and return on investment (ROI) based on the annual number of vehicles sold (MD and HD truck annual sales volume for California may not make a market)?

e) Fuel economy for MD and HD FCEVs is dependent on operating cycle and what vocation it applies to, transit agencies repeatedly make this clear when comparing different technologies for application in their operating region – section II-B appears to make an unrealistic assumption (considering no operational data is available from currently operating MD and HD FCEVs for freight movement, only for HD transit FCEBs)

f) Consider removing preference language to support Type III tanks to facilitate MD and HD FCEV fast fill, the current wording is incorrect – and Type IV tanks are lower cost (CNG market/experience + LD FCEV experience reflect this). This is a vehicle manufacturer cost effectiveness determination, so it would be better to be non-preferential in this document.

g) Commercial fuel cell application in long haul trucks is currently too uncertain and far out – references should be left out or reworded to indicate such assumption.

h) MD and HD vehicle standards need to be assessed on gaps, and identified gaps addressed. Currently, the majority of existing vehicle safety codes and standards does not apply to MD and HD FCEVs, but only directly apply on light duty H2 and fuel cell vehicle systems.