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Subject: Comments on Second Draft of AB118 FY10-11 Investment Plan

The CEC's AB118 FY10-11 Investment Plan (IP) provides a critical opportunity to accelerate the development and commercialization of alternative non-petroleum fuels. Unfortunately, the current IP excludes the crucial fuel pathway of Renewable Methanol (RM) which needs to be included in some fashion.

Fundamentally, RM is defined as methanol which does not derive from fossil hydrocarbon resources. As a practical matter, RM is also defined as fuel which derives from CO<sub>2</sub> feed stocks rather than conventional CO-based feed stocks which are the source of conventional Natural Gas (NG)-to-methanol synthesis plants. From a policy perspective, renewable methanol offers well-to-wheel (WTW) greenhouse gas (GHG) reduction benefits far greater than conventional methanol. Given the scale of petroleum fuel use at present, all possible low and zero carbon pathways should be reflected in the plan. It is therefore noteworthy that the latest version of the IP does not include RM.

There are many reasons to consider amending the IP to include a specific reference to RM. One of the key opportunities provided by RM is that it is derived from CO<sub>2</sub> sources which are not associated with fossil fuels. The CO<sub>2</sub> feed stocks for RM can be derived from diverse biological and non-biological sources, including recycled glycerine from biodiesel production, CO<sub>2</sub> from industrial facilities and renewable geothermal CO<sub>2</sub> sources. Due to its feedstock diversity, RM fuel could also provide a means of avoiding a possible "biofuel limit," which could prove important to minimize possible competition between certain types of biofuel production and food or agricultural production. For example, unlike traditional ethanol from corn or possibly other food-derived or bio-derived ethanol pathways, there is little serious prospect for indirect land use effects from RM pathways.

There are several important recent initiatives regarding RM which should be considered as a foundation for amending the CEC's IP to incorporate RM. Dr. George Olah, Nobel Laureate, has done pioneering work on the use of CO<sub>2</sub> as a feedstock for methanol production.<sup>1</sup> Based on the work of Dr. Olah and others, Lotus has published SAE papers outlining the rationale for Renewable Methanol from CO<sub>2</sub> feed stocks and has demonstrated its use in optimized vehicles.<sup>2</sup> Mitsui Chemicals has built a pilot scale facility in Japan which is producing 10 tons per year of CO<sub>2</sub> based methanol. BioMCN in the Netherlands has been producing methanol from the CO<sub>2</sub> derived from biosources – specifically glycerin derived indirectly from recycled biodiesel feedstocks – in a commercial facility since early 2008. Carbon Recycling International in Iceland has recently broken ground on the construction of a renewable CO<sub>2</sub>-to-methanol first phase industrial scale plant designed for 2 million liters per year of RM from geothermal energy and CO<sub>2</sub>, along with renewably produced hydrogen via electrolysis. Methanex is seriously exploring the development of RM commercial pathways. The Palo Alto Research Center is working on the efficient capture of atmospheric CO<sub>2</sub> for RM production which could offer the means of directly recycling atmospheric GHG emissions for liquid fuel production. Such a long term “Holy Grail” may be of profound importance as difficulties and barriers to other GHG strategies such as carbon sequestration become better understood. Commercial-intent demonstration vehicles for port off-road and ultimately on-road applications have attracted serious commercial interest and support from the world's 5<sup>th</sup> largest containerized shipping company, the nation's largest class 8 engine manufacturer, the nation's 2<sup>nd</sup> largest port truck OEM, and the world's largest methanol producer.

The long term significance of RM includes its possible use in zero-combustion direct methanol fuel cells (DMFCs) such as those developed by Oorja and commercially deployed by Nissan at their Smyrna, Tennessee facility as replacement for battery powered forklifts. The possible hybridization of RM-fueled DMFC units with on-road battery-equipped vehicles could combine the ease of liquid refueling with zero or near-zero WTW carbon intensity.

The IP would be greatly strengthened if it recognized all of these recent developments and opportunities.

Based on the above, there are several important policy findings which should be considered for incorporation into the IP:

- Renewable Methanol (RM) should be considered a distinct and important alternative fuel pathway, which potentially offers significant GHG reduction

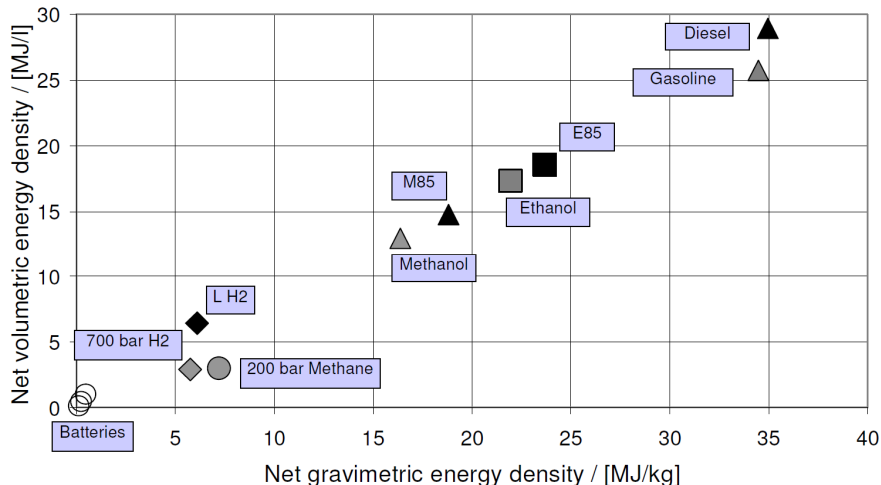
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<sup>1</sup> George Olah, Alain Goeppert and G.K. Surya Prakash, “Chemical Recycling of CO<sub>2</sub> to Methanol and Dimethyl Ether: From Greenhouse Gas to Renewably Carbon Neutral Fuels and Synthetic Hydrocarbons”, Journal of Chemistry Perspective, American Chemical Society, Volume 74 Number 2, January 16, 2009.

<sup>2</sup> R. J. Pearson and J.W.G. Turner, Lotus Engineering, and M.D. Eisaman and K.A. Littau, Palo Alto Research Center, “Extending the Supply of Alcohol Fuels for Energy Security and Carbon Reduction”, SAE # 2009-01-2764, 2009.

benefits compared to more conventional alcohol fuel pathways such as corn-based ethanol.

- A separate line item should be established for “renewable methanol from CO<sub>2</sub> feed stocks” in the plan to allow for possible resource prioritization.
- If a separate line item for RM is not deemed appropriate, at a minimum, some type of specific category should be created for “renewable fuels from CO<sub>2</sub> feed stocks” which would explicitly include renewable methanol as one of the possible pathways.
- The CEC should recommend that the California Air Resources Board, in coordination with the CEC, develop a specific well-to-wheels carbon intensity analysis of RM from CO<sub>2</sub> sources.
- The IP should formally recognize the significant near and medium term value of additional non-petroleum sources of liquid alternative fuels, based on their inherently superior volumetric and gravimetric specific energy, as illustrated in the figure below.<sup>3</sup>



- A contingency scenario should be identified which maximizes the development support for liquid alternative fuel options as substitutes for petroleum-derived fuels. Such a contingency plan should be developed as soon as possible in response to the current moratorium on Gulf of Mexico oil production and its possible short, medium, and long term effects on deepwater oil production. It is noteworthy that deepwater sources represent the large majority of current and projected offshore Gulf of Mexico production.

In light of these climate change and energy security factors, there is a strong need to develop a diverse range of alternative fuels. Renewable methanol is one of the options which should be considered seriously for future funding support. It is essential for the CEC to fully embrace the notion of fuel neutrality by not excluding methanol from explicit consideration. In particular, renewable methanol from CO<sub>2</sub> feed stocks offers important

<sup>3</sup> Ibid, SAE 2009-01-2764.

GHG reduction benefits combined with liquid fuel utility and complete independence from deepwater petroleum resources. This potential should not be ignored by delaying the updating of the IP until its next cycle.

At this moment of clarity regarding the unanticipated deleterious effects of petroleum fuel dependency on the Gulf region economy and its fragile ecosystem, it is especially important that CEC reflect on the reasons for such current dependency. The direct value of non-petroleum-based alternative liquid fuels such as renewable methanol can play a significant role in addressing such vulnerabilities. Locking out any reference to renewable methanol in the latest IP finalized this year by the CEC is therefore distinctly not in the state's interest, nor of that of the nation.

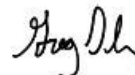
We thank the Commission for its consideration of these comments.



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