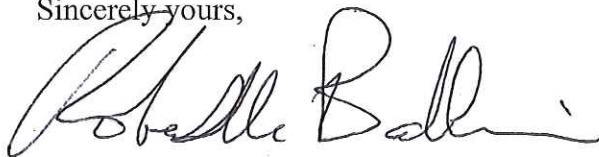


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As you know we (NREL) have been very active in assisting CARB with formulation of methods that can be used to estimate biogenic carbon distribution from FCC co-processing. Based on our work on co-processing with Petrobras and Ensyn, we have developed the 'mass balance method'<sup>1</sup> that we believe allows refiners to estimate the fate of bio-oil and allocate new carbon to products from co-processing in the FCC in terms of differences in yield. This method is straightforward, can be applied with only limited process data that is readily available, and does not require analysis of products for the presence of <sup>14</sup>C – a significant benefit to the refining community. We support inclusion of this method in CARB's proposed rulemaking as outlined in the most recent staff briefing whitepaper<sup>2</sup> and the exclusion of allocation by <sup>14</sup>C tracking.

We have followed with interest the efforts of CARB to set standards and methodologies for the assignment of biogenic carbon to products for FCC and other refinery unit operations. We look forward to continuing to support these efforts to develop appropriate procedures based on sound scientific and engineering principles.

Sincerely yours,



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<sup>1</sup> M. Talmadge et al. Analysis for co-processing fast pyrolysis oil with VGO in FCC units for second generation fuel production. Presented at Co-Processing Working Group Sacramento, CA, December 13, 2016

<sup>2</sup> Co-processing of low carbon feedstocks in petroleum refineries, Staff Whitepaper, California Air Resources Board, May 30, 2017