Co-processing in Petroleum Refineries: 4th Work Group Meeting

CALIFORNIA AIR RESOURCES BOARD

INDUSTRIAL STRATEGIES DIVISION
TRANSPORTATION FUELS BRANCH
OCTOBER 16, 2017
SACRAMENTO, CA

Meeting Participation

Posted materials can be found on the LCFS Meetings webpage

- https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm

Watch and listen via the Webcast:

- https://video.calepa.ca.gov/

Ask questions or provide feedback during the working meeting

- Email sierrarm@calepa.ca.gov
- Participate via conference call
  - Toll Free: 888-469-3315
  - Toll/Outside the United States: -210-234-0016
  - Participant Code: 7939153

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Agenda Outline

- Welcome
- Acknowledge contributions from expert panel members
- Review core objectives of the work group
- Guidance for co-processing in hydrotreaters or hydrocrackers
- Discussion
- Next steps and future meetings

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Core Objectives of the Work Group

- Establish guidelines for quantification of low carbon fuel volumes from co-processing
- Evaluate greenhouse gas emissions of co-processing operations and corresponding carbon intensities of low carbon fuels produced
- Develop guidance to facilitate certification of carbon intensity for co-processed low carbon fuels
- Develop monitoring and verification protocols for co-processed fuels

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Progress to Date

- Three work group meetings so far
- Developed a draft co-processing discussion paper with input from experts and stakeholders
  - Describes the framework to estimate:
    - Renewable volumes from co-processing in FCC units and hydrotreaters/hydrocrackers
    - GHG emissions from co-processing in these units
- Developed templates for calculating GHG emissions of renewable fuels from co-processing

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Framework for Renewable Volume Quantification

- Applicants can use one of the methods below:
  - Mass balance method
    - Compares mass of inputs and outputs with and without co-processing
  - Carbon mass balance method
    - Assigns renewable carbon content to finished fuels based on the carbon content of low carbon feedstock and the amount of carbon in other output streams. Carbon balance prior to co-processing would still be needed.
- C^{14} analysis
  - Staff is evaluating its suitability in quantification of renewable fuel volumes, particularly at low blend percentages of low carbon feedstock

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Framework for GHG Quantification

- Co-processing in FCC units
  - Energy content-based allocation at process unit-level
  - Incremental allocation (hybrid approach)
- Co-processing in hydrotreaters/hydrocrackers
  - Incremental allocation (hybrid approach)

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Feedback from Previous Meetings

- General support for mass balance and carbon balance methods
  - Common practice in the refining industry
  - Can be addressed with existing refinery equipment and analytical methods
  - Challenges with use of C^{14} analysis
- Seek clarity on CI calculation methods for co-products such as LPG, jet fuel and naphtha
  - LCA approach using energy allocation is generally applicable for most co-products
  - Excel-based co-processing CI calculation templates provided
- Request for a temporary fuel-pathway code for LPG
  - Included in draft regulatory package as a Lookup Table CI

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Feedback (contd.)

- Support for consideration of supply chain mass balancing for commingled renewable fuels
  - Possible if such volumes can be verified and tracked
- Seek clarity on use of direct measurements using dedicated meters vs. engineering estimates/modelling
  - Direct measurement is the suggested approach although there is some leeway for estimates for certain inputs/outputs
- Monitoring and verification should utilize already verified data through MRR or other regulatory programs to avoid duplicity
  - MRR data may not provide unit specific emissions information required to calculate pathway CI for co-processed fuels

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DATA COLLECTION/GENERATION FOR CO-PROCESSING PATHWAY CERTIFICATION

Draft Guidance for Data Generation for Low Carbon Fuel Produced from Co-processing in Hydrotreaters or Hydrocrackers

- Draft guidance based on two active applications in the Alternative Fuels Portal
- Provides details of data and other requirements from applicants to quantify low carbon fuel volumes
- Provides details of data and other requirements from applicants to calculate CI for low carbon fuels

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Co-processed Fuel Pathway Certification Process

- Will be processed as Tier 2 Fuel Pathways
  - Complexity of co-processing operations, mixed feedstocks and challenges in quantification of CI and fuel volumes
  - Quantification methods may benefit from the use of models outside the CA-GREET framework
  - Subject to all applicable requirements for Tier 2 pathways described in Section 95488 of the LCFS regulation

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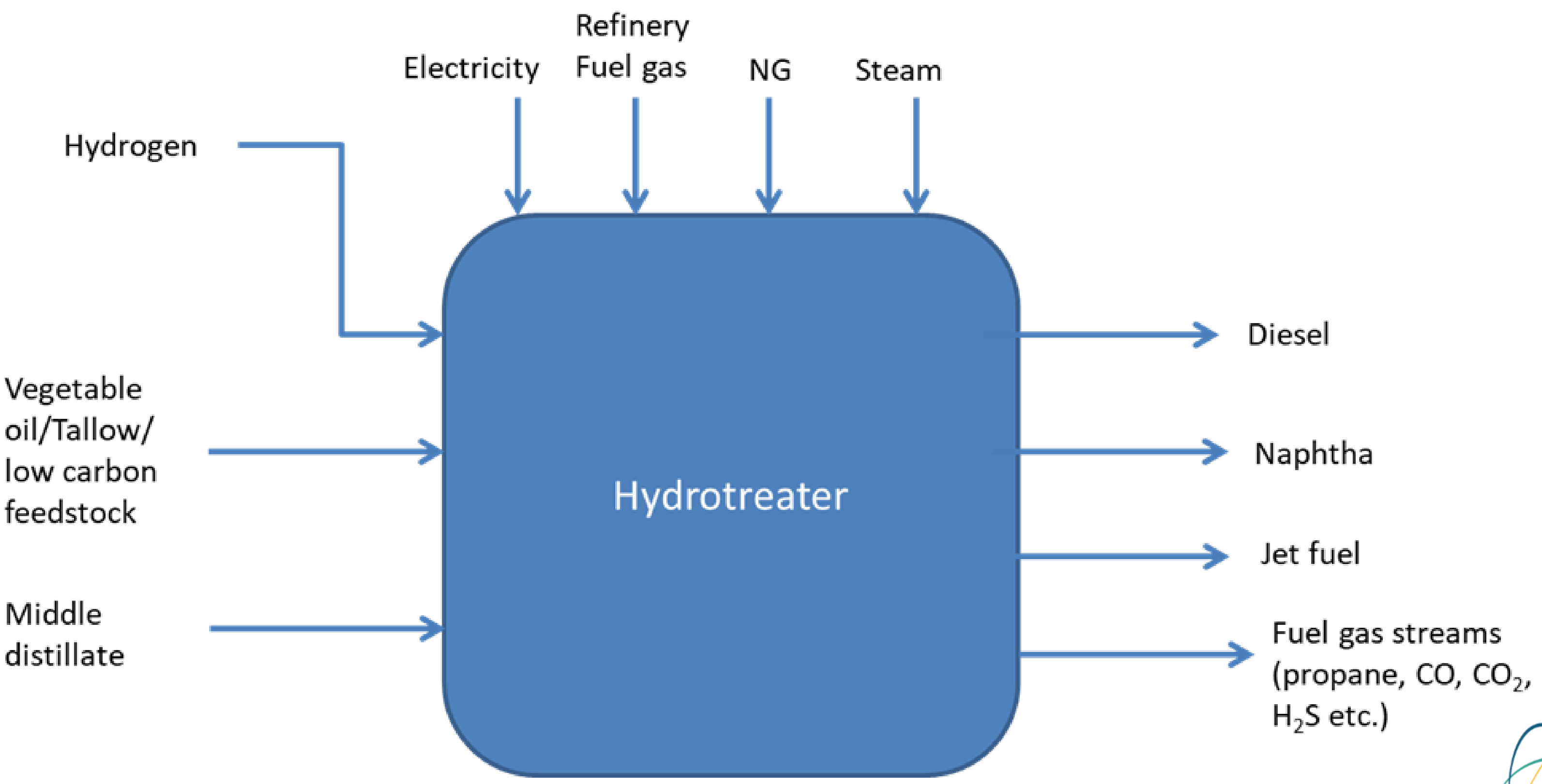
Schematic of Co-processing in a Hydrotreater



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Data Collection/Generation Process

- Establish a baseline prior to initiation of co-processing
  - Collect/measure data on feedstock inputs, product outputs including gaseous components and energy/hydrogen use
- Collect data with co-processing
  - Collect/measure data on feedstock inputs, product outputs including gaseous components and energy/hydrogen use

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Establish a Baseline

- Baseline data should be obtained for:

	Parameters to measure	Covered components	Comments
Feedstock input	Volumetric/mass flow	Middle distillate and other fossil feedstocks	Daily measurements. Suggest minimum of three months data
Product output	Volumetric/mass flow	Liquid fuels and gaseous products	Daily measurements. Suggest minimum of three months data
Elemental composition and moisture content	C, H, N, O, S, ash content and moisture content	Middle distillate and liquid fuel products	If feedstocks and product streams and process conditions remain similar to the original three months for which data was submitted, elemental composition once established may only need annual updates

Establish a Baseline: Gaseous Composition and Flow for Carbon Mass Balance Method

	Parameters to measure	Covered components	Comments
Carbon Mass Balance Method- Composition of gaseous output streams	Volumetric flow using meters and composition using GC or comparable technique	CO, CO_2, methane, ethane, propane, butane and other gaseous hydrocarbons	Sufficient number of samples taken at different intervals over a three month period to quantify uncertainty. Repeatability and reproducibility determination.

Establish a Baseline: Energy and Hydrogen Use

	Parameters to measure	How to measure?	Comments
Hydrogen use	Hydrogen flow	Dedicated meter with hydrogen from SMR or other production unit Or Calculate using the hydrogen balance method. Requires measuring flows and gas composition analysis of hydrogen streams entering and exiting the unit	Minimum of three months data. Gas composition analysis by GC or comparable technique. Sufficient number of samples taken at different intervals over a three month period to quantify uncertainty. Repeatability and reproducibility determination
Energy use	Electricity, natural gas, refinery fuel gas, and steam	Dedicated meters or utility invoices. Staff seeks feedback on alternative approaches if meters are not installed	Minimum of three months data

Data for Co-processing

	Parameters to measure	Covered components	Comments
Feedstock input	Volumetric/mass flow	Middle distillate or other petroleum feedstocks and low carbon feedstock	Daily measurements. Minimum of three months data
Product output	Volumetric/mass flow	Liquid fuels and gaseous products	Daily measurements. Minimum of three months data
Elemental composition and moisture content	C, H, N, O, S, ash content and moisture content	Petroleum feedstock, low carbon feedstock and liquid fuel products	Regular analysis (weekly) required until input and output data consistency has been established. If feedstocks and product streams and process conditions remain similar to the original period for which data was submitted, elemental composition once established may only need quarterly updates

Co-processing: Gaseous Composition and Flow for Carbon Mass Balance Method

	Parameters to measure	Covered components	Comments
Carbon Mass Balance Method- Composition of gaseous output streams	Volumetric flow using meters and composition analyzing using GC or comparable technique	CO, CO_2, methane, ethane, propane, butane and other gaseous hydrocarbons	Sufficient number of samples taken at different intervals over a three month period to quantify uncertainty. Repeatability and reproducibility determination

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Co-processing: Energy and Hydrogen Use

	Parameters to measure?	How to measure?	Comments
Hydrogen use	Hydrogen volumetric flow	Dedicated meter with hydrogen from SMR. Or estimate using the hydrogen balance method. Requires measuring flows and gas composition analysis of hydrogen streams entering and exiting the unit.. Or Theoretical estimate based on stoichiometric calculations but supported by measured indirect data.	Minimum of three months data. Gas composition analysis by GC or comparable technique. Sufficient number of samples taken at different intervals over a three month period to quantify uncertainty. Repeatability and reproducibility determination
Energy use	Electricity, natural gas, refinery fuel gas, and steam	Dedicated meters or utility invoices. Staff seeks feedback on alternative approaches if meters are not installed	Minimum of three months data.

Data Accuracy Requirements

- To ensure analyses requested as part of the application are representative and accurate:
  - Quantify uncertainty by calculating a mean and standard deviation for each measurement
- Staff is seeking feedback on methodologies to be considered

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Preliminary Thoughts on Monitoring and Verification

- **Biomass feedstock supply**: Monitoring and verification requirements are expected to be similar to renewable diesel/biodiesel pathways
- **Refining:** Documentation of refinery energy use within the co-processing system boundary, feedstock use and fuel production data (isotopic analysis an option, if feasible). The documentation checked by the verifiers is likely to cover the data collection/generation requirements described earlier
- **Fuel supply:** Staff recognizes the need to apply a mass/material balance method for supply of out-of-state co-processed fuels

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Questions?

Next Steps

- Stakeholder inputs requested on:
  - Data collection/generation framework
  - Repeatability and reproducibility
  - Any challenges with draft guidance provided
  - Reporting and verification of co-processed low carbon fuels
  - Other comments to assist with objectives of this work group

Next Steps (contd.)

- Next Work Group meeting potentially in 1st quarter 2018
- Would like to certify two co-processing pathways prior to next meeting
- Firm up guidance for hydrotreaters and hydrocrackers
- Expect draft guidance for co-processing in FCC units
- Address stakeholder feedback from this meeting
- Firm up guidelines related to monitoring and verification

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THANK YOU!

Feedback should be sent to
LCFSworkshop@arb.ca.gov

by November 10, 2017

Posted information from today's working meeting can be found at
https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm

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