California Environmental Protection Agency

Air Resources Board

Low Carbon Fuel Standard Rulemaking

April 18, 2014

Agenda

- Innovative crude production method provision
- OPGEE revisions and crude lookup table calculations
- 2012 crude average CI calculation

Current Innovative Crude Provision

- Solar steam and CCS projects implemented during or after 2010
- Crude producer applies for innovative method
- Refinery purchasing the crude receives credit
- Subject to 1.0 gCO_2/MJ threshold
- Comparison baseline method defined as production using a similar process but without the innovative technology

3

Considering Amendments To:

- Include as innovative methods
  - Onsite solar, wind, and biomass-based power generation
  - Biomass-based steam generation
- Remove or substantially reduce the 1 g/MJ threshold for CI reduction
- Allow the crude producer to receive credit
- Specify the comparison baseline and simplify the application process for some methods
- Establish a maximum innovative credit

4

Crude Producer Opt-in

- Crude producer:
  - responsible for preparing the method application
  - incurs financial risk of employing the method
  - responsible for recordkeeping following method approval
- Propose allowing the producer to opt-in as a regulated party and earn LCFS credit
- Crude producer may decline to opt-in; California refinery(s) purchasing crude may then claim the credit

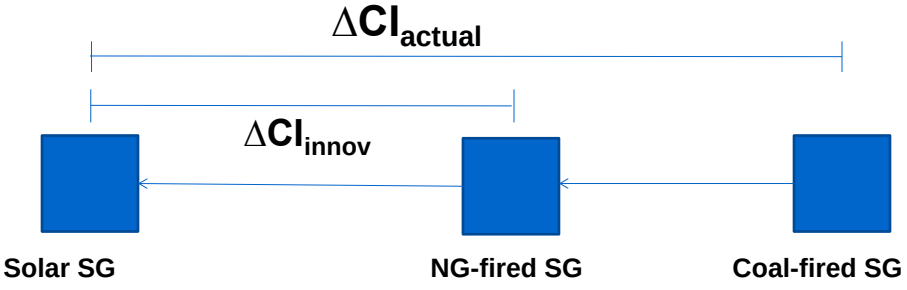
5

Innovative Method Comparison Baseline

- Innovative method credit calculated relative to a comparison baseline
- System boundaries may be limited to only those portions of crude recovery process affected by the innovative method
- Proposing to establish a required comparison baseline for steam and electricity production
- Solar and biomass-based steam: NG-fired once-through steam generator (OTSG) with an efficiency of 88 percent (LHV basis)
- Solar, wind, and biomass-based electricity: NG-fired combined-cycle power plant with an efficiency of 50.6 percent (LHV basis)

6

Example: Required Comparison Baseline



- Facility displacing coal-fired steam with solar steam will only get innovative credit for the displacement of NG-fired steam
- The CI reduction from coal-fired steam to NG-fired steam is not considered innovative
- Actual CI reduction will be reflected in crude lookup table CI calculation

Simplified Application and Default Credit

- Proposing to simplify the application and credit calculation for solar steam and solar/wind power
- Solar steam
  - Default credit of 27,550 gCO_2 per barrel solar steam
  - $Credits_{Innov}(MT) = 27{,}550 \times \frac{V_{steam} \times f_{solar}}{V_{crudeproduced}} \times V_{Innov} \times C$
- Solar and wind based electricity
  - Default credit of 485 gCO_2 per kW-hr solar/wind electricity
  - $Credits_{Innov}(MT) = 485 \times \frac{E_{electricity} \times f_{renew}}{V_{crudeproduced}} \times V_{Innov} \times C$

All Other Innovative Methods

- Comprehensive application process including:
  - ARB approval of comparison baseline
  - Detailed LCA of innovative method and comparison baseline
- $Credits_{Innov}(MT) = \Delta CI_{Innov} \times E_{Innov} \times V_{Innov} \times C$

9

Maximum Innovative Credit Allowable

- Considering a maximum allowable innovative method credit that is proportional to the base deficit incurred by the fuels produced from the crude
- $Credits_{max,innov} = \left(CI_{CARBOB} - CI_{Standard}^{Gasoline}\right) \times E_{innov} \times V_{innov} \times C$
- MCON CI value in the crude lookup table will reflect the actual CI reduction and not the maximum allowable for innovative method credit

10

Carbon Capture and Sequestration

- CO_2 EOR has potential to be an important means of sequestration and ARB staff will continue to evaluate this technology
- Credit generation for CCS projects will only be allowed after ARB has in place an approved quantification methodology for monitoring, reporting, verification, and permanence requirements

OPGEE Revisions and Crude CI's

- Minor revisions to OPGEE v1.1 since last year
  - OPGEE v1.1 Draft B and documentation posted to March 11, 2014, workshop webpage
  - Revisions discussed in Appendix E of documentation
- Draft CI values for Crude Lookup Table (Table 8) will be posted for feedback this spring
  - Over 100 internationally and nationally marketed crudes
  - Nearly 200 California oil fields
  - Default carbon intensity values

Default Crude CI Values

- Stakeholder feedback from the March workshop
- Proposing to establish default values for:
  - Thermally enhanced oil recovery
  - Bitumen or heavy oil production with upgrading
  - Country-specific conventional production
- Default value(s) used until CI value for the MCON is entered into the crude lookup table

13

2012 Crude Average CI

- Calculation of the 2012 crude average CI was posted for comment on March 20, 2014
- Comment period closed on April 4, 2014
- No comments were received
- 2012 Crude Average CI is 11.36 g/MJ
- No incremental deficit applies to fuels produced in 2014

14

Feedback Requested by May 9

John Courtis, Manager
Alternative Fuels Section
jcourtis@arb.ca.gov
916-323-2661

Jim Duffy, PhD
Alternative Fuels Section
jduffy@arb.ca.gov
916-323-0015