Gaseous Hydrogen via Methane Cracking
LytEn, Sunnyvale, California
CA-GREET Model

The applicant has conducted its analysis of the carbon intensities of methane to hydrogen pathways using CA-GREET, v.1.8b (Dec. 2009) (See http://www.arb.ca.gov/fuels/lcfs/ca_greet1.8b_dec09.xls). The standard inputs and parameters specified in CA-GREET remain unchanged except as noted in the input table below. The input table below specifies the spreadsheet location of the CA-GREET inputs and the corresponding data. The relevant worksheet in the GREET model is Hydrogen.

Table 1: Changes to Input Parameters of GREET 1.8b LytEn, 33.3% Renewable, On-site

	Draft CA-GREETv1.8b	**Draft CA-GREETv1.8b**	**LytEn**
Worksheet Location	**Default Cell Value**	**LytEn Pathway Values**	
Region for Analysis	Regional LT!C2	U.S. Average (#1)	CA Marginal (#3)
Feedstock option for H_2 Production			
Central Plants	Inputs!C128	1	1
Refueling station	Inputs!C129	1	1
H_2 Plant Design Type	Inputs!C141	0	0
Feed Phase Biogas	Hydrogen!DU121:134	N/A	Redacted
Weighted Feed Phase	Hydrogen!EC121:134	N/A	Redacted
Gaseous Hydrogen Production			
- Energy efficiency	Hydrogen!AZ63	70 %	Redacted
- Share of feedstock input as feed	Hydrogen!AZ66	92.1 %	Redacted
- Steam or electricity export	Hydrogen!AZ67	0 Btu, kWh/ mmBtu	Redacted
- Transport Distance	T&D_Flowcharts!F459	750 miles	1500 miles
- Energy intensity	T&D!BR108	See cell	Redacted
Shares of process fuels			
- Natural Gas	Hydrogen!AZ72	95.1 %	Redacted
	Hydrogen!AZ76	4.9 %	Redacted

- Electricity			
H_2 Refueling Station Production	Hydrogen!I56 (new column I46:56 equals C46:56)	100%	100%
Renewable Energy Content	Hydrogen!EB113	N/A	33.3%
Natural Gas Content	Hydrogen!EB114	N/A	=100%-EB113
H_2 Production from Biogas Energy	Hydrogen!DW121:125	N/A	Redacted
H_2 Production from Biogas Emissions	Hydrogen!DW126:134	N/A	Redacted
H_2 Production from Natural Gas	Hydrogen!DS121:134	N/A	Redacted
H_2 Production equation	Hydrogen!ED121:134	N/A	Redacted
Delivery	Hydrogen!EE121:134	N/A	Redacted
- Compression	Hydrogen!DY121:134	N/A	Redacted
- Tube Trailer	Hydrogen!DZ121:134	N/A	Redacted
- Tube Trailer Case	Hydrogen!EB116	N/A	Redacted
Total	Hydrogen!EG121:134	N/A	=EE121:134+ED121:134+ EC121:134

Table 2: Changes to Input Parameters of GREET 1.8b LytEn, 100% Renewable, On Site

Parameters	**Draft CA-GREETv1.8b**	**Draft CA-GREETv1.8b**	**LytEn**
Worksheet Location	**Default Cell Value**	**LytEn Pathway Values**	
Region for Analysis	Regional LT!C2	U.S. Average (#1)	CA Marginal (#3)
Feedstock option for H_2 Production			
Central Plants	Inputs!C128	1	1
Refueling station	Inputs!C129	1	1
H_2 Plant Design Type	Inputs!C141	0	0
Feed Phase Biogas	Hydrogen!DU121:134	N/A	Redacted
Weighted Feed Phase	Hydrogen!EC121:134	N/A	Redacted
Gaseous Hydrogen Production			
- Energy efficiency	Hydrogen!AZ63	70 %	Redacted
- Share of feedstock input as feed	Hydrogen!AZ66	92.1 %	Redacted
- Steam or electricity export	Hydrogen!AZ67	0 Btu, kWh/ mmBtu	Redacted
- Transport Distance	T&D_Flowcharts!F459	750 miles	1500 miles
- Energy intensity	T&D!BR108	See cell	Redacted

Shares of process fuels			
- Natural Gas	Hydrogen!AZ72	95.1 %	Redacted
- Electricity	Hydrogen!AZ76	4.9 %	Redacted
H_2 Refueling Station Production	Hydrogen!I56 (new column I46:56 equals C46:56)	100%	Redacted
Renewable Energy Content	Hydrogen!EB113	N/A	100%
Natural Gas Content	Hydrogen!EB114	N/A	=100%-EB113
H_2 Production from Biogas Energy	Hydrogen!DW121:125	N/A	Redacted
H_2 Production from Biogas Emissions	Hydrogen!DW126:134	N/A	Redacted
H_2 Production from Natural Gas	Hydrogen!DS121:134	N/A	Redacted
H_2 Production equation	Hydrogen!ED121:134	N/A	Redacted
Delivery	Hydrogen!EE121:134	N/A	Redacted
- Compression	Hydrogen!DY121:134	N/A	Redacted
- Tube Trailer	Hydrogen!DZ121:134	N/A	Redacted
- Tube Trailer Case	Hydrogen!EB116	N/A	Redacted
Total	Hydrogen!EG121:134	N/A	=EE121:134+ED121:134+ EC121:134

Table 3: Changes to Input Parameters of GREET 1.8b LytEn, 33.3% Renewable, Tube Trailer

Parameters	**Draft CA-GREETv1.8b**	**Draft CA-GREETv1.8b**	**LytEn**
Worksheet Location	**Default Cell Value**	**LytEn Pathway Values**	
Region for Analysis	Regional LT!C2	U.S. Average (#1)	CA Marginal (#3)
Feedstock option for H_2 Production			
Central Plants	Inputs!C128	1	1
Refueling station	Inputs!C129	1	1
H_2 Plant Design Type	Inputs!C141	0	0
Feed Phase Biogas	Hydrogen!DU121:134	N/A	Redacted
Weighted Feed Phase	Hydrogen!EC121:134	N/A	Redacted
Gaseous Hydrogen Production			
- Energy efficiency	Hydrogen!AZ63	70 %	Redacted
- Share of feedstock input as feed	Hydrogen!AZ66	92.1 %	Redacted
- Steam or electricity export	Hydrogen!AZ67	0 Btu, kWh/ mmBtu	Redacted

- Transport Distance	T&D_Flowcharts!F459	750 miles	1500 miles
- Energy intensity	T&D!BR108	See cell	Redacted
Shares of process fuels			
- Natural Gas	Hydrogen!AZ72	95.1 %	Redacted
- Electricity	Hydrogen!AZ76	4.9 %	Redacted
H_2 Refueling Station Production	Hydrogen!I56 (new column I46:56 equals C46:56)	100%	Redacted
Renewable Energy Content	Hydrogen!EB113	N/A	33.3%
Natural Gas Content	Hydrogen!EB114	N/A	=100%-EB113
H_2 Production from Biogas Energy	Hydrogen!DW121:125	N/A	Redacted
H_2 Production from Biogas Emissions	Hydrogen!DW126:134	N/A	Redacted
H_2 Production from Natural Gas	Hydrogen!DS121:134	N/A	Redacted
H_2 Production equation	Hydrogen!ED121:134	N/A	Redacted
Delivery	Hydrogen!EE121:134	N/A	Redacted
- Compression	Hydrogen!DY121:134	N/A	
- Tube Trailer	Hydrogen!DZ121:134	N/A	Redacted
- Tube Trailer Case	Hydrogen!EB116	N/A	Redacted
Total	Hydrogen!EG121:134	N/A	=EE121:134+ED121:134+ EC121:134

Table 4. Changes to Input Parameters of GREET 1.8b LytEn, 100% Renewable, Tube Trailer

Parameters	**Draft CA-GREETv1.8b**	**Draft CA-GREETv1.8b**	**LytEn**
Worksheet Location	**Default Cell Value**		**LytEn Pathway Values**
Region for Analysis	Regional LT!C2	U.S. Average (#1)	CA Marginal (#3)
Feedstock option for H_2 Production			
Central Plants	Inputs!C128	1	1
Refueling station	Inputs!C129	1	1
H_2 Plant Design Type	Inputs!C141	0	0
Feed Phase Biogas	Hydrogen!DU121:134	N/A	Redacted
Weighted Feed Phase	Hydrogen!EC121:134	N/A	Redacted
Gaseous Hydrogen Production			
- Energy efficiency	Hydrogen!AZ63	70 %	Redacted

- Share of feedstock input as feed	Hydrogen!AZ66	92.1 %	Redacted
- Steam or electricity export	Hydrogen!AZ67	0 Btu, kWh/ mmBtu	Redacted
- Transport Distance	T&D_Flowcharts!F459	750 miles	1500 miles
- Energy intensity	T&D!BR108	See cell	Redacted
Shares of process fuels			
- Natural Gas	Hydrogen!AZ72	95.1 %	Redacted
- Electricity	Hydrogen!AZ76	4.9 %	Redacted
H_2 Refueling Station Production	Hydrogen!I56 (new column I46:56 equals C46:56)	100%	Redacted
Renewable Energy Content	Hydrogen!EB113	N/A	100%
Natural Gas Content	Hydrogen!EB114	N/A	=100%-EB113
H_2 Production from Biogas Energy	Hydrogen!DW121:125	N/A	Redacted
H_2 Production from Biogas Emissions	Hydrogen!DW126:134	N/A	Redacted
H_2 Production from Natural Gas	Hydrogen!DS121:134	N/A	Redacted
H_2 Production equation	Hydrogen!ED121:134	N/A	Redacted
Delivery	Hydrogen!EE121:134	N/A	
- Compression	Hydrogen!DY121:134	N/A	Redacted
- Tube Trailer	Hydrogen!DZ121:134	N/A	Redacted
- Tube Trailer Case	Hydrogen!EB116	N/A	Redacted
Total	Hydrogen!EG121:134	N/A	=EE121:134+ED121:134+ EC121:134