Method 2A and 2B Application Form

I. Application Submission Date: December 14, 2010 (REV Dec 22, 2010)

II. Company Contact Information

a. Company Name: **Clean Energy**

b. Mailing Address:

Address Line 1	**3020 Old Ranch Parkway, Suite 400**
Address Line 2	
City	**Seal Beach**
State/Province	**CA**
Zip/Postal Code	**90740**

c. Main Company Phone Number: **(562) 493-2804**

d. Secondary Company Phone Number: **(562) 493-7226**

e. Fax number: **(562) 493-4532**

f. Company Web Site URL: www.cleanenergyfuels.com

g. Primary Method 2A/2B Contact Person:

Name: **Michael L. Eaves**

Position/Title: **Asst. VP Technology Advancement**

Email Address: *meaves@cleanenergyfuelows.com*

Office Phone Number: **(562) 493-7226**

Mobile Phone Number: **(562) 370-7226**

Fax Number: **(562) 493-4532**

h. Consultant/Third Party Application Preparer:

Name: **Michael Jackson**

Position/Title: **Senior Director, Transportation Technology**

Affiliation/Firm: **TIAX LLC**

Email Address: *Jackson.michael@tiaxllc.com*

Office Phone Number: **(408) 517-1560**

Mobile Phone Number: **(408)230-2014**

Fax Number: **(408) 517-1551**

Consulting entity's web site URL: *www.tiaxllc.com*

i. LCFS Reporting Tool Organization ID code (if known): **NA**

j. U.S. Environmental Protection Agency (U.S. EPA) Company ID (if known): **NA**

k. U.S. EPA Facility ID (if known): **NA**

III. Pathway Information

a. Pathway application type. Applicants are encouraged to discuss their pathway application types with ARB staff before proceeding. Please check one box only.

☐ Method 2A: Sub-pathway ☒ Method 2B: New Pathway

b. Brief description of proposed pathway. Please emphasize the important innovations and/or distinctive characteristics associated with the proposed pathway or sub-pathway

The LNG plant is located in Ehrenberg Arizona and operated by Desert Gas Services LLC(DGS) – 3 miles from the California border. Clean Energy purchases the LNG output of the plant and transports it into California for use as a transportation fuel. The current CARB LNG pathways specify a LNG plant within California and within 50 miles of the market. This application is qualify an out of state LNG plant that is located greater than 50 miles from the market.

The LNG plant in Ehrenberg is a conventional pressure letdown facility similar to more than 60 utility peakshaving facilities operational across the U.S. for utilities to produce LNG and store during summer months and gasify and inject gas into the pipeline system in cold winter days. Peakshaving plants are of two types: 1) pressure letdown without auxiliary refrigeration (Ehrenberg) and 2) pressure letdown with mixed refrigerant cooling. The Ehrenberg plant is a pressure letdown facility where gas from a transmission pipeline is compressed to high pressures. The pressure is lowered across a Joule Thompson valve generating extremely low temperatures capable of liquefying the gas and producing LNG. In the process of cooling, higher boiling point hydrocarbons are separated from the LNG leaving 98+% methane LNG. In the process, about 30% of the incoming natural gas is converted to LNG. The other 70% of the natural gas is compressed and reinjected to the pipeline.

[**See Attachment #1 for additional details**]

Attachment #1
Additional Pathway Discription

The Ehrenberg LNG plant has two 900 electric driven compressors that provide all the compression for the facility. There are two other gas fired process heaters in the process: 1) a 2.5 million Btu/hr gas heater to regenerate the dryers needed to take water out of the natural gas, and 2) a 2.5 million Btu/hr process boiler needed to regenerate the amine system that pulls out carbon dioxide in the incoming natural gas. [Boiler permits found in Attachment #2 and #3]

The Ehrenberg plant should be considered a high efficiency LNG process. CARB has modeled an 80% efficient plant and a 90% efficient plant in the LNG pathways. Clean Energy has a purchase contract with DGS to buy the LNG output from the plant. Under the terms of the purchase agreement, DGS has to conduct production capacity tests of the plant which includes measurement of the electrical demand of the plant as well as production on LNG. These production tests were conducted on December 8, 9, and 10th. The following data was obtained.

Date of Test	12/8/2010	12/9/2010	12/10/2010	Average
Gallons Produced	47,091	45,328	42,738	**45,052.33333**
Kilowatts Hours	65,000	64,000	64,000	**64,333.33333**
Kwh / Gallon	1.380306216	1.411930815	1.497496373	**1.429911135**

Data shows the average electrical consumption of the plant at 1.43 kWh/gallon. This electrical demand should qualify the plant as a high efficiency plant.

Clean Energy transports the LNG from Ehrenberg into California. Of the four plus loads per day of LNG transported from the facility, two and one-half loads come to California and the remainder transported to the Phoenix area. Distribution of the California loads is as follows:

Destination	Loads/day	Distance to Market
Blythe	½ load	5 miles
Palm Springs	1 load	125 miles
San Bernardino/ Riverside	1 load	175 miles

On a weighted average miles per load basis, the average distance to market for these three delivery points is 121 miles to market. Clean Energy modeled 125 miles in GREET.

Clean Energy has a contract with Trimac Transportation Services to deliver LNG for Clean Energy. Clean Energy owns the LNG tankers. Trimac provides the trucking. Under the Clean Energy contract, Trimac must use natural gas trucks to deliver our LNG. Trimac's trucks are Kenworth trucks with Westport HPDI dual fuel engines. The HPDI (high pressure direct injection) technology uses 10% (or less) diesel to initiate compression ignition. 90% of the

Attachment #1 (cont.)
Additional Pathway Discription

90% of the fuel consumed in the engine in natural gas (LNG). The HPDI technology can't operate on diesel fuel alone. In discussions with CARB concerning this application, Clean Energy has been requested proof of the 90/10 fuel split.

In response to this request, Clean Energy offers the following definition adopted by CARB in 2003 (from Mail-Out MSC 03-05).

> **Section 1956.2(b)(4): Definition of Heavy-duty Pilot Ignition Engine**
> As previously stated, as the result of public comments, the original text including HDPI in the alternative fuel definition has been removed. To allow for HDPI use as an alternative fuel engine, staff added the following definition to section 1956.2(b)(4):
>
> "Heavy-duty pilot ignition engine" means an engine designed to operate using an alternative fuel, except that diesel fuel is used for pilot ignition at an average ratio of no more than 1 part diesel fuel to 10 parts total fuel on an energy equivalent basis. An engine that can operate or idle solely on diesel fuel at any time does not meet this definition.

Clean Energy believes this definition of HPDI technology and qualification as an alternative fuel engine for Carl Moyer programs and Proposition 1B funding is sufficient to prove the low carbon transportation claims of this application.

c. For Method 2A Applications only

1. Reference pathway (Existing fuel pathway to which the proposed new sub-pathway is most closely related). The carbon intensity of the reference pathway must be higher by at least 5 gCO_2e/MJ than the carbon intensity of the proposed pathway described in this application. Show all pathway information exactly as it appears in the LCFS Lookup Table:

   Fuel: LNG

   Pathway Description: LNG from Ehrenberg AZ Plant

   Carbon Intensity Values (gCO_2e/MJ): 76.25

   Direct Emissions: 76.25

   Land Use or Other Indirect Effect: None

   Total: 76.25

2. Compositional differences (if any) between the fuel produced by the new sub-pathway and the reference pathway identified in item c, 1, above).

There are essentially no compositional changes between the fuel product produced in the reference pathway and the Ehrenberg pathway. Product gas is represented by the Liquid to Storage Sample Stream #2 in attachment A of this submittal. The methane composition of LNG is 98.984%. Ethane composition is 0.463%. Nitrogen composition is 0.448%. All other hydrocarbons combined total 0.106%. This composition is similar/identical to LNG compositions from LNG plants in California (Clean Energy's Boron plant produces LNG with 99+% methane composition).

d. Final carbon Intensity of the proposed pathway or sub-pathway: **76.25 gmCO2e/MJ**

e. Annual volume of fuel that would be produced using the proposed new sub-pathway (millions of gallons per year [MGY]). **Ehrenberg plant is rated at 45,032 gallons/day or 15.61 MGY at a 95% availability factor.**

1. This production volume is expected to be achieved within how many years from the start of production? **Plant began operation in 1st Quarter 2010. Currently at design capacity**

2. Does the applicant expect this volume be achieved by a single or by multiple facilities?

   [X] A single facility [ ] Multiple facilities

3. If the applicant expects this volume to be achieved by multiple facilities, would all facilities be owned by a single firm? **NA**

   [ ] Single firm [ ] Multiple firms

f. Lower Heating Value of the fuel to be produced from new sub-pathway (megajoules per gallon):

g. The range of production volumes over which the proposed pathway carbon intensity value is valid. The values reported below must be supported in the documentation accompanying this application.

	Fuel Volume	**Units (gallons; litres; joules,etc.)**
Lower bound of production volume range	**42,738**	**Gallons/day**
Upper bound of production volume range	**47,091**	**Gallons/day**

Please note that it is extremely important for the plant to operate at full capacity at all times. These plants have very little turndown capacity. Range of production is from plant performance capacity tests conducted by Desert Gas Services (DGS) for Clean Energy per the terms and conditions of Clean Energy's LNG purchase agreement with DGS. These performance tests were just run on Dec 8, 9, and 10th. The following data was collected:

Date of Test	**12/8/2010**	**12/9/2010**	**12/10/2010**	**Average**
Gallons Produced	47,091	45,328	42,738	**45,052.33333**
Kilowatts Hours	65,000	64,000	64,000	**64,333.33333**
Kwh / Gallon	1.380306216	1.411930815	1.497496373	**1.429911135**

h. Please provide any information that may be helpful in determining the land use change impacts (if any) of the proposed pathway. Although it is ARB's responsibility to perform all land use change impact analyses, the applicant may provide any information that may be useful to the ARB in completing that analysis.

IV. Application Submittal Checklist. Listed below are the documents and files that may be submitted in support of a method 2A/2B application. Check the box to the left of each document or file type included in your submittal. After each submittal category is a check box labeled "includes trade secrets." Check that box if the submittal category contains any information the applicant considers to be a trade secret. In the actual submittal, the specific information falling into the trade secret category must be clearly marked. Additional information regarding the submission of trade secrets can be found in the Instructions above.

- ☐ Life cycle analysis report
  - ☐ *Includes trade secrets*
- ☒ Engineering reports
  - ☐ *Includes trade secrets*
- ☐ Equipment technical specifications
  - ☐ *Includes trade secrets*
- ☐ Production process schematics, technical drawings flow diagrams, maps, or other graphical representations
  - ☐ *Includes trade secrets*
- ☐ Technical papers or journal articles
  - ☐ *Includes trade secrets*
- ☐ Emissions monitoring data or emissions modeling results
  - ☐ *Includes trade secrets*

☐ Spreadsheets, data files, and similar files documenting the calculations behind the fuel life cycle analysis

☐ *Includes trade secrets*

☐ Other: In the space below, describe any additional submittals. Rationales for documents submitted or omitted may also be provided.

☐ *Includes trade secrets*

Determination of the carbon intensity of the Ehrenberg LNG plant required changing several variables in GREET. The substantive changes were: 1) modeling a LNG plant electrical load of 1.43 kWh/gallon, 2) model an average transportation distance to the market via truck of 125 miles, 3) model the delivery trucks using HPDI engines that consume 90% natural gas and 10% diesel.

Clean Energy commissioned TIAX to run the calculations. TIAX has excellent familiarity with the GREET model and has done extensive GREET analyses for CARB and the CEC. Their report to Clean Energy on the carbon intensity of the Ehrenberg plant is Attachement #4 of this application.

The results of GREET modeling of the changed parameters above show a carbon intensity of 76.25 gmCO2e/MJ for the Ehrenberg plant (vs. 72.38 gmCO2e/MJ for a 90% efficient LNG plant within 50 miles of the market). The Ehrenberg LNG plant has a carbon intensity of 3.87 gmCO2e/MJ greater than the 90% plant pathway adopted by CARB but 6.88 gmCO2e/MJ less than the carbon intensity of a 80% efficient plant (83.13 gmCO2e/MJ) in the CARB LNG pathway.

Clean Energy is therefore requesting a new “Ehrenberg LNG” pathway – or CARB permission to use the current CARB LNG pathway for a 90% efficient plant already adopted.

ARB Method 2A and 2B Application Process Contacts

Name	Phone Number	E-mail Address
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