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November 23, 2010
OUR REF.: PCL1011-5507BLH CARB

California Air Resources Board
Stationary Source Division
Criteria Pollutants Branch - 6th Floor
1001 I Street
P.O. BOX 2815
Sacramento, CA 95812

To: Messrs. John Courtis and Wes Ingram

RE: Method 2B Application

Herewith, please find our application and supporting documents for a fuel lifecycle GHG emissions pathway using the Method 2B application process described in "Establishing New Fuel Pathways under the California Low Carbon Fuel Standard Procedures and Guidelines for Regulated Parties" report by ARB (California Air Resources Board) issued on March 25, 2010.

We seek a pathway for our ethanol dehydration facility located at Point Fortin on the island of Trinidad. At our facility, we convert Brazilian hydrous sugarcane ethanol to anhydrous ethanol using molecular sieves, in a similar process used by modern ethanol production facilities worldwide, including in the U.S. and Brazil. Our facility uses local natural gas for its process energy, and natural gas is the primary fuel for power. In essence our facility is an extension of the sugar cane mill in Brazil that converts cane juice into ethanol.

Ethanol in its hydrous form (nominally 5%vol water) represents 75% of the ethanol produced in Brazil currently[1], and is expected to increase in the future as the number of flex fuel vehicles in Brazil

[1] UNICA crop report for July 1, 2010: In the current harvest 9.06 billion liters of ethanol production, of which 6.8 billion liters have been hydrous, with the remainder anhydrous.

increases and demand for anhydrous ethanol (less than 1%vol water) decreases, since this is the form of ethanol that is blended with gasoline in Brazil.

We request CARB's approval of this pathway such that the carbon intensity from our facility will be added to the carbon intensity of the Brazilian sugarcane ethanol we process and that sum will be the carbon intensity of the resulting denatured ethanol used as a transportation fuel in California. Currently there are three approved pathways for Brazilian sugarcane ethanol, but in the future there may be additional pathways. We propose that (logically) our pathway be additive to both the three current Brazilian sugarcane ethanol pathways and any future Brazilian sugarcane ethanol pathways so long as the pathway descriptions are consistent.

The CARB LCFS regulations stipulate that only pathways lower in carbon intensity value than the main pathway that they deviate from can use the Method 2A application. Because our pathway increases the overall carbon intensity of the Brazilian sugarcane ethanol pathway, we are following the Method 2B application process. However, our pathway is clearly a sub- pathway of the Brazilian sugarcane ethanol pathways because, except for the few points of deviation summarized below, our pathway is identical to the Brazilian sugarcane ethanol Well-to-Wheel (WTW) [2] lifecycle analysis.

How our sub-pathway is different from the Brazilian sugarcane ethanol pathways:

Parameter	**CARB WTW Analysis Brazilian Sugarcane Ethanol Pathway**	**TBTL Sub-Pathway**
Shipping distance:Brazil to California	7,416 statute miles	8,924 statute miles
Type ethanol shipped	anhydrous ethanol	hydrous ethanol from Brazil to Trinidad, then anhydrous ethanol to California
Plant/Mill natural gas fuel use	zero	**Confidential Business Information**
Plant/Mill electricity use	zero	**Confidential Business Information**
Ethanol ship transfers	Load Brazil, Unload California	Extra unloading & loading at TBTL
Plant/Mill Emergency generator	none listed	TBTL uses emergency diesel generator

The resulting carbon intensity of the TBTL Dehydration Plant pathway is **5.54 gCO2e/MJ** based on the CA-GREET model and results obtained by CARB from the CA-GREET model in its WTW analysis of the Brazilian Ethanol Pathway.

[2] For reference, see CARB Report "Detailed California-Modified GREET Pathways for Brazilian Sugarcane Ethanol: Average Brazilian Ethanol, With Mechanized Harvesting and Electricity Co-product Credit, With Electricity Co-product Credit" September 23, 2009, Version 2.3, page 43. In this application this report is referred to at the "Sugarcane Ethanol WTW Analysis."

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The following sections of this application provide the details and documentation of our application for a new pathway under Method 2B. Portions of the following information that we consider Confidential Business Information have been clearly marked as such on each page, *but are not included in this non-confidential version of the application. In this version of the application, the points where elements of Confidential Business Information have been removed from the text or accompanying tables are indicated so as to inform the public that the complete application to the ARB contained additional information to support this application, but that such information is considered by us to be Confidential Business Information.*

We request your approval and would be glad to answer any questions you may have about our application. Following please find my contact information if you have any questions.

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Regards,
TRINIDAD BULK TRADERS LIMITED

Curtis Mohammed
Chief Executive Officer
Attachments

Attachments

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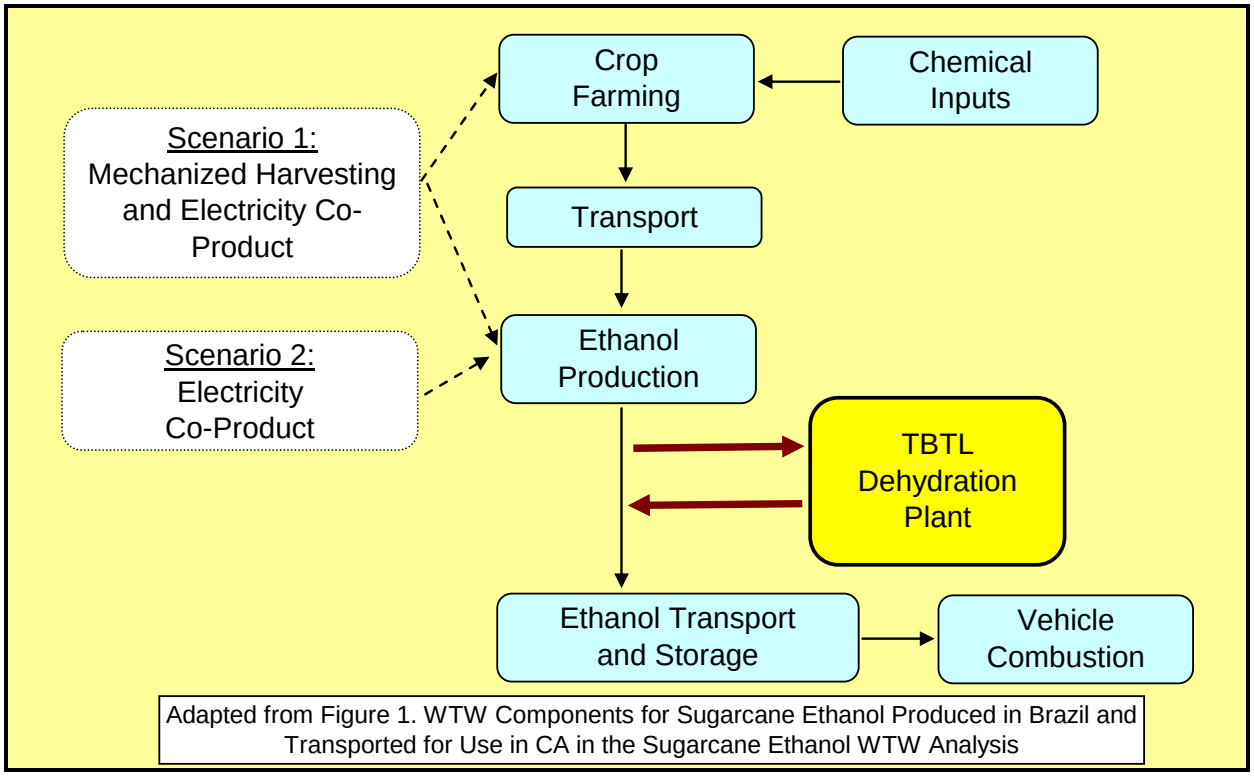
I. WTW Diagram of TBTL Sub-Pathway of the Brazilian Sugarcane Ethanol Pathways

Figure 1: WTW Components of the Brazilian Sugarcane Ethanol with the Addition of the TBTL Sub-Pathway[3]



II. TBTL Plant Information

1. Plant Location – North Guapo Cap De Ville Main Road Point Fortin, Trinidad.
2. History – Plant development started in October 2004, with the development of the site for a 50 million U.S. gallons dehydration plant (Phase 1). The construction of the plant itself started in Jan 2005. Commissioning of Phase 1 was completed in August 2005. Phase 2 construction started in March 2007 and was completed in early August 2007. Phase 2 added an additional capacity of 50 million U.S. gallons, resulting in TBTL's total

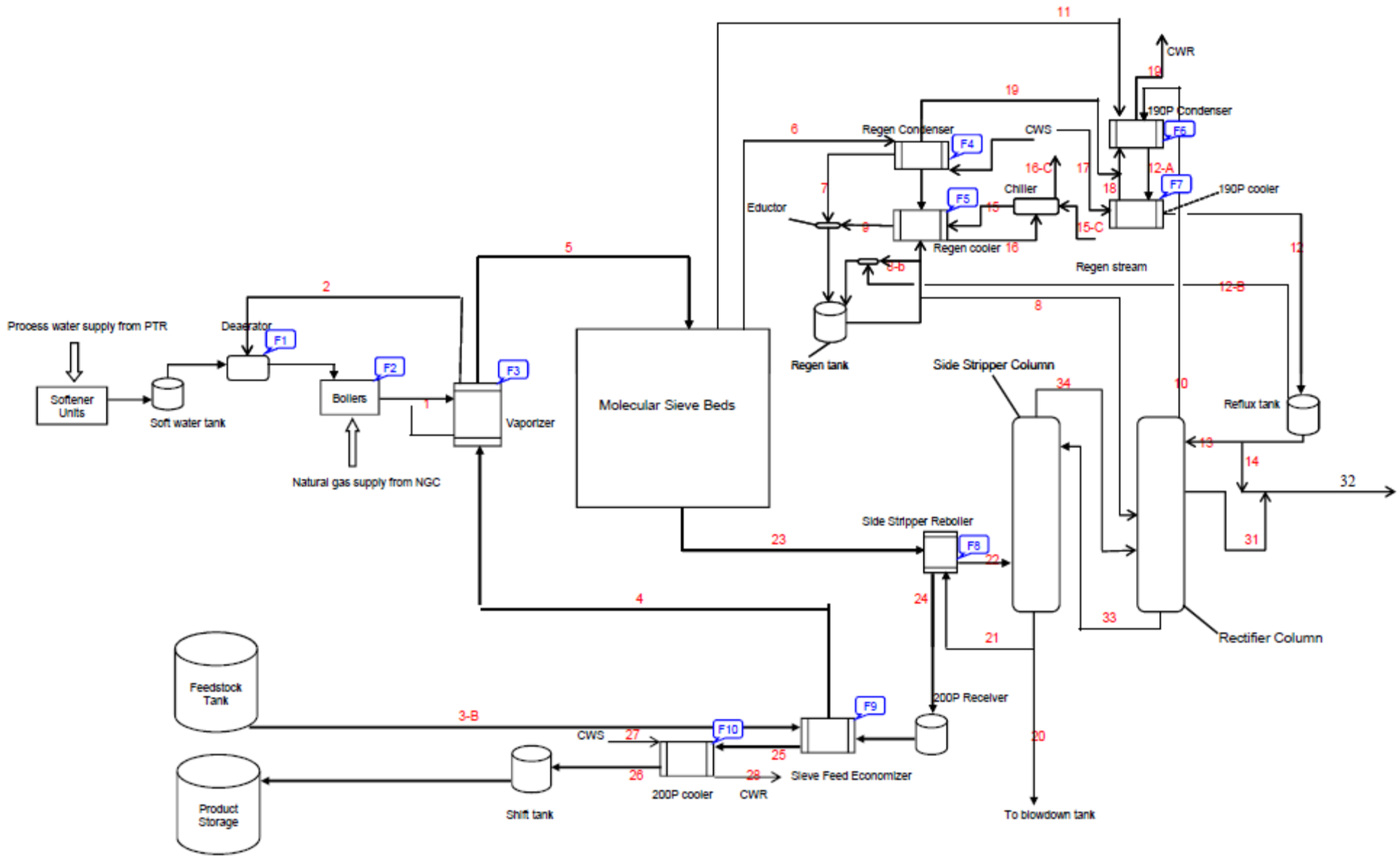
[3] see CARB Report "Detailed California-Modified GREET Pathways for Brazilian Sugarcane Ethanol: Average Brazilian Ethanol, With Mechanized Harvesting and Electricity Co-product Credit, With Electricity Co-product Credit" September 23, 2009, Version 2.3, page 3.

production capacity of 100 million U.S. gallons per annum. To date, TBTL has produced over 200 million U.S. gallons of undenatured anhydrous fuel ethanol.

3. Technology: TBTL's dehydration process, which is based on molecular sieve separation, was designed by Industry Consultants and Marketing (ICM), whose registered office is located in Colwich, Kansas, USA. The utilities' engineering was done by EXKLAR, located in New York, USA.
4. Feedstock Type - TBTL's feedstock is predominantly Brazilian hydrous cane ethanol with and ethanol concentration of 95% by volume, with the remainder being water.
5. Product - The plant capability can cater for both the US market (99.5 % ethanol strength), and also the European market (99.8% ethanol strength).
6. Process fuel - Natural gas recovered and processed in Trinidad.
7. Power supply - Power is supplied by the local utility company Trinidad & Tobago Electricity Commission (TTEC). The fuel used to produce power at TTEC in Trinidad is indigenous natural gas. In the event of a power outage from TTEC, TBTL has a diesel emergency generator system to bridge momentary power disruptions and provide power for a safe and orderly shutdown if the power outage is of an extended nature.
8. Process Flow Description - Hydrous ethanol is received from ocean going tankers into tankage to await processing. From the tanks, hydrous ethanol is pumped to our dehydration units. In the dehydration unit, hydrous ethanol is vaporized by heat exchange with steam generated in our boilers from natural gas. Hydrous ethanol vapors flow through the vessels containing molecular sieve, which selectively removes H2O from the stream. The dried ethanol vapors are cooled and condensed first by heat exchange with the incoming hydrous ethanol and finally with cooling water before being pumped to anhydrous ethanol tanks. From the anhydrous ethanol tanks the ethanol is loaded onto ocean going tankers that deliver the ethanol to California.

9. Process Flow Diagram: Figure 2: TBTL Process Block Flow Diagram

Stream numbers refer to the Energy and Material Balance that follows the Process Description table on the next page.



The Energy and Material Balance is considered Confidential Business Information and is not included in the non-confidential version of this application

Table 1: Process Description

190P	Hydrous ethanol feedstock
200P	Anhydrous ethanol product
F1	Hot steam condensate from the vaporizer is recycled to be used in the de-aerator. Besides providing useful heat for de-aeration, it enables TBTL to save on its water consumption costs, as well as its chemical treatment costs. The de-aerator also acts as a pre-heater for the boiler feed water.
F2	Each boiler is equipped with an economizer, which is simply a heat exchanger that transfers heat from the boiler exhaust gases to the incoming boiler feed water. This is one way of ensuring increased system efficiency (up to 5%) since the major heat loss from a boiler is usually the stack loss.
F3	The vaporizer is of critical importance to TBTL's dehydration process since the sieve feed must be in super-heated vapor form before entering the molecular sieve beds. It is a shell and tube heat exchanger by which steam generated from the boilers heats and vaporizes the 190P ethanol feed. The resulting steam condensate is re-used in the de-aerator.
F4	The regen condenser is a plate and frame heat exchanger which condenses the hot regen vapours obtained from the beds' regeneration cycle. Cooling water is used as the cooling medium.
F5	The regen cooler is also a plate and frame heat exchanger which aims at further cooling the condensed regen liquid by using chilled water as the cooling medium. The cooled regen liquid is primarily used as the motive fluid for the dehydration and distillation eductors.
F6	The 190P condenser is a shell and tube heat exchanger. The rectifier column overheads, as well as the fluid obtained from the beds' depressure cycle are condensed using cooling water as the cooling medium.
F7	The 190P cooler serves to further cool the condensed liquid from the 190P condenser so that it can be used as reflux (cooling) for the rectifier column in order to maintain the correct column temperature profile.
F8	The side stripper reboiler is also a shell and tube heat exchanger of critical importance to efficient distillation operation, as it provides the heat necessary for distillation. Heat from the hot 200P vapours (obtained as product from the molecular sieve beds) is transferred to the side stripper bottoms, so that hot vapours are generated to ensure efficient distillation.
F9	The Sieve Feed Economizer is a plate and frame heat exchanger. It allows heat from the hot 200P liquid (obtained by condensation of the 200P vapors in the reboiler) to be transferred to the incoming 190P feedstock. As mentioned before, this feedstock must be vaporized before entry to the sieve beds. The economizer therefore acts as a pre-heater as it allows the feed to be pre-heated before vaporization can occur, thus resulting in reduced steam consumption in the vaporizer, and hence cost savings.
F10	The 200P cooler is the final heat exchanger before the 200P product reaches storage. It is a plate and frame exchanger which cools the 200P liquid (leaving the Sieve Feed Economizer) so that it can be stored at an ambient temperature to minimize evaporative losses. Cooling water is used as the cooling medium.
⟶	Bold lines/arrows:- indicate the main 200P production process flow.
→	Unweighted lines/arrows:- indicate the removal of residual ethanol by the rectification process (downstream processing operations).

III. Carbon Intensity of the TBTL Dehydration Plant Sub-Pathway Components-

The carbon intensity value (CI) of the TBTL Dehydration Plant sub-pathway was calculated using the CA-GREET model. The following table summarizes the CI of the TBTL Dehydration Plant sub-pathway and the components of the pathway.

Table 2: Carbon Intensity Increment of the TBTL Dehydration Plant Sub-Pathway over the Carbon Intensity of Brazilian Ethanol Pathways Direct to California from Brazil

TBTL Dehydration Plant Pathway Total Incremental CI over Brazilian Ethanol Pathways Direct to California								
	Total Incremental CI of TBTL Dehydration Plant Pathway	Ethanol Production				Ethanol Transportation and Distribution		
		Total Ethanol Production	Components of Ethanol Production			Total Transportation and Distribution	Components of Transportation and Distribution	
			Natural Gas	Electricity	Leaking VOC		Additional Distance	Hydrous from Brazil to Trinidad
	grams/Gallon							
Energy								
VOC		2.29	0.05	0.01	2.24			
CO		0.24	0.19	0.06				
CH4		0.80	0.71	0.08				
N2O		0.003	0.00	0.00				
CO2		409.39	347.61	61.78				
Converted to g/mmBtu	***g/mmBtu***							
Energy						1,305.60	703.47	602.13
VOC		30.01	0.59	0.08	29.35	0.10	0.06	0.05
CO		3.19	2.46	0.73		0.24	0.13	0.11
CH4		10.42	9.33	1.09		0.12	0.06	0.05
N2O		0.04	0.03	0.01		0.00	0.00	0.00
CO2		5,363.37	4,556.29	809.78		110.01	59.27	50.74
	gCO2e/mmBtu							
Converted to gCO2e/mmBtu		5,735.22	4,803.49	842.09	92.39	114.38	61.63	52.75
	gCO2e/MJ							
Converted to gCO2e/MJ	**5.54**	5.44	4.55	0.80	0.09	0.11	0.06	0.05

<u>Natural Gas and Electricity Components of the TBTL Dehydration Plant Sub-Pathway</u>

The TBTL Dehydration Plant uses natural gas for process fuel and purchases electricity from the local utility for its normal power needs. The local utility company uses natural gas as the primary fuel to generate electricity. In this pathway, it is assumed that the fuel lifecycle green house gas emissions pathway ("GHG pathway") of the natural gas produced and processed in Trinidad is approximately equal to the GHG pathway of natural gas produced and processed in the U.S. Since the amount of natural gas used for fuel and for power by the TBTL Dehydration Plant is relatively low per gallon of anhydrous ethanol produced, any differences should be insignificant. If anything, the Trinidad natural gas GHG pathway should be less than the U.S. natural gas GHG pathway because of the islands predominant use of indigenous natural gas for energy, where as in the U.S. a large fraction of energy use is dependent on coal and petroleum, which have a higher GHG pathway than natural gas.

The calculations indicate that the CI of the natural gas and electricity components of the TBTL Dehydration Plant Sub-Pathway is 5.35 gCO2e/MJ.

Diesel Fuel Component of the TBTL Dehydration Plant Sub-Pathway

Although small (less than 0.01 gCO2e/MJ), for completeness, the diesel fuel component of the TBTL Dehydration Plant sub-pathway has been calculated. The TBTL Dehydration Plant sub-pathway consumes diesel fuel in two sections. When hydrous ethanol is delivered by ship from Brazil to the TBTL facility in Trinidad, the primary energy source on the ship for pumping the hydrous ethanol from ship to shore is diesel fuel. Since ships do not measure or monitor the energy involved because is such an insignificant amount, it has been assumed that the energy needed to pump from ship to shore is approximately equal to the energy needed, per gallon, to pump from the shore to the ship at TBTL. This assumption should give a reasonable approximation because the difference in elevation, piping distances and pressure drop through the valves should be approximately the same for the two systems (discharge and loading). The TBTL plant engineer provided the data and calculation in the following table. Two cases are shown, one with the rated pressure drop through the loading system (145 psig) and the other at the actual pressure drop through the loading system (80 psig) as measured by the pressure gauge on the pump discharge. The larger energy use case based on the rated energy consumption as been used, and this should compensate for any higher differences in system pressure drop or elevation in the ship to loading system compared to the discharge system from the ship.

The following table details the calculation of the energy from diesel fuel used to pump hydrous ethanol from ship-to-shore.

Table 3: Estimate of Diesel Fuel Used to Transfer Ethanol from Ship-to-Shore

Calculate the diesel fuel used for ship to shore based on the energy used to transfer from shore to ship				
Assume that the energy needed to pump from shore to ship is approximately equal the energy needed from ship to shore				
Anhydrous Transfer from TBTL Product Tank to ship				
Assume that the energy needed to pump from shore to ship is approximately equal the energy needed from ship to shore				
Pump Data				
P4003/4	Basic Data	Symbol and Calculation		
Rated Capacity	5000 bbls/hr	A		
Flow Rate	3500 gpm	B		
Head	418 ft	C		
RPM	1480 rpm	D		
Catering for one shipment of 4,000,000 usg				
	Units	Symbol and Calculation	Rated	Actual
Specific Gravity of ETOH	sp.gr	E	0.80	
Pumping Volume	usg	F	4,000,000	
Pumping rate	gpm	G	3,500	
Pumping rate	lbpm	H = (G x 800 x 2.204) / 264.17	23,361	
Discharge pressure	psi	I = (C x E) / 2.31	145	80
Head	ft	J = I x 2.31 / E	418	231
Hydraulic Horsepower	hp	K = (H x J)/ 33,000	296	164
Power Input	KW	L = K x 0.747	221	122
Pump Efficiency (assumed)		M	0.60	0.60
Brake horsepower	hp	N = K / M	493	273
Power Input	KW	O = N x 0.747	368	204
Power Input per usg	KW	P = O / F	0.0000921	0.0000509
Conversion factor	btu/KW	Q	3,412.2	3,412.2
Power Input, btu/usg	btu/usg	R = P x Q	0.31	0.17
Calculation of the diesel fuel needed to pump hydrous ethanol from ship to shore				
Assume that the energy needed to pump from shore to ship is approximately equal the energy needed from ship to shore				
Hydrous ethanol feedstock	gallons	S	41,371,494	41,371,494
Diesel btu per year		T = R x S	13,001,501	7,185,040
Diesel LHV	btu/gal, LHV	U	128,450	128,450
Diesel, gallons/year	gallons	V = T / U	101	56

From this calculation, it is estimated that during the one-year, Production Period, 101 gallons of diesel fuel was used as energy for the ship-to-shore transfer of hydrous ethanol.

The three emergency generators located at the TBTL facility to provide emergency power also use diesel fuel. The emergency generators are operated whenever there is a momentary disruption in power from the local utility, or it the disruption in power is for a longer period, the emergency generators are operated to allow for the safe and orderly shutdown of the TBTL facilities. Most of the diesel fuel used by the generators is for the weekly operation of the generators to assure they are in working order should they be needed in an emergency. During

the weekly preventative maintenance operation, the diesel generators are run at a no-load condition. When used during a power disruption, the load varies but based on actual data appears to average well less than full load. However for the purposes of calculating the emergency generator diesel fuel use, it has been assumed that the generators are at full load whenever they are operated. The TBTL facility tracks the number of hours the generators are operated. Coupled with the manufacturer's data on fuel consumption per hour at different load conditions, the amount of diesel fuel consumed has been calculated.

Table 4: Calculation of Diesel Fuel Used by TBTL Emergency Generators

Calculation of Diesel Fuel Used by the TBTL Emergency Generators during 2009			
Item	**Units**	**Amount**	**Symbol and Calculation**
Generator at 100% fuel rate	gal/hr	36.00	A
TBTL actual Generator fuel rate	gal/hr	11.78	B
Generator at no load fuel rate	gal/hr	6.02	C
Full Load operating hours during 2009	hours	5.50	D
No Load operating hours during 2009	hours	44.89	E
Number of generators	generators	3.00	F
Diesel Fuel Consumption for 2009 @100% load	gallons	1,405	G = (A x D + C x E) x F
Diesel Fuel Consumption for 2009 @ actual load	gallons	953	H = (E x D + C x B) x F
GREET model factor for non-road diesel, btu/gal	btu/gal, LHV	128,450	J
Millions of btu/year from diesel generators	mmbtu/year	180.44	K = (G x J) / 1,000,000
Gallons of ethanol produced in 2009	gallons	39,400,900	L
Diesel generator btu/gal of anhydrous ethanol	*btu/gal, LHV*	*4.58*	*M = (K / L) x 1,000,000*

From this calculation, it is estimated that during the one-year, Production Period, 1405 gallons of diesel fuel was used as energy for the operation of the TBTL emergency generators.

Summing together the diesel used for the ship-to-shore transfer of hydrous ethanol and for the emergency generators, a total of 1,506 gallons of diesel (101 + 1405) are estimated to have been used in the Production Period.

The CA-GREET cane ethanol module was used to calculate the CI of the diesel component of the TBTL Dehydration Plant sub-pathway because it provides a more direct means of varying the diesel fuel input variable than the corn ethanol module. It is assumed that the GHG pathway of the diesel consumed on the ship and at TBTL are approximately the same as the GHG pathway of the diesel used in Brazil for the cane ethanol pathway. Because the amount of diesel used per gallon of anhydrous ethanol produced, even if there were significant differences in the GHG pathway of the diesel fuel, the difference in CI results would likely be insignificant.

Table 5: CA-GREET Cane Ethanol Input Variables for the TBTL Diesel Fuel Component

Table 5 contains Confidential Business Information and is not included in this non-confidential version of the application.

The residual fuel used in the cane ethanol plant was established by CARB in the Brazilian Sugarcane Ethanol WTW analysis. The following table shows the calculation of the amount of energy from diesel, in btu/gal, used in the above table of CA-GREET model inputs.

Table 6: Calculation of CA-GREET Cane Ethanol Module Input Variables

Calculation of Input Values for the New Pathway CA-GREET Model : TBTL Dehydration Plant, Diesel Fuel Use (Cane Ethanol Mill Module)							
	Numerator or First Value			Denominator or Second Value		Calculated Input Value	
Input Value Description	Amount	units	Operator	Amount	units	Amount	units
Diesel used for emergency generators and pumping hydrous to shore	1,405	gallons (em gen)	plus	101	gallons (pump)	1,506	gallons
Diesel fuel use	1,506	gallons	multiplied by	128,450	btu/gal	193,436,938	btu
Diesel fuel use per gallon of anhydrous ethanol produced	193,436,938	btu	divided by	39,400,900	gallons	4.91	btu/gal

The CA-GREET cane ethanol model was run first with just the residual fuel energy use to calculate a baseline CI. Then the diesel fuel energy was added in the cane ethanol module and the CA-GREET model was run a second time. The difference of these two CA-GREET runs calculates CI of the diesel fuel component of the TBTL Dehydration Plant sub-pathway.

Table 7: CI of the Diesel Component of the TBTL Sub-Pathway

CA-GREET Cane Ethanol Mill Model with Default Energy Use (251 btu/gal) to Establish Baseline						
	IPPC factors	CA-GREET Model Output	Calculations to convert Output to g/CO2e/MJ			
	gCO2e/g	Dry Mill- Region: US Average	w/loss	Total with loss	gCO2e/mmbtu	**gCO2e/MJ**
Total energy		1,138,255	1,139,393	1,139,393		
VOC		57.537	58	58		
CO		91.501	92	92		
CH4	25	38.585	39	39	965.6	0.92
N2O	298	4.684	5	5	1,397.3	1.32
CO2	1	3,740	3,744	3,744	3,743.5	3.55
Total Plant Energy Carbon Intensity					6,106.4	**5.7881**
CA-GREET Cane Ethanol Mill Model with Default Energy (251 btu/gal) Plus TBTL Diesel Fuel Use						
	IPPC factors	CA-GREET Model Output	Calculations to convert Output to g/CO2e/MJ			
	gCO2e/g	Dry Mill- Region: US Average	w/loss	Total with loss	gCO2e/mmbtu	**gCO2e/MJ**
Total energy		1,138,331	1,139,469	1,139,469		
VOC		57.540	58	58		
CO		91.511	92	92		
CH4	25	38.591	39	39	965.7	0.92
N2O	298	4.684	5	5	1,397.4	1.32
CO2	1	3,746	3,750	3,750	3,749.6	3.55
Total Plant Energy Carbon Intensity					6,112.8	**5.7941**
TBTL Diesel Fuel Carbon Intensity Component Based on the Difference of the Two Cases Shown Above						
	IPPC factors	CA-GREET Model Output	Calculations to convert Output to g/CO2e/MJ			
	gCO2e/g	Dry Mill- Region: US Average	w/loss	Total with loss	gCO2e/mmbtu	**gCO2e/MJ**
Total energy		76.49	76.57	76.57		
VOC		0.00	0.00	0.00		
CO		0.01	0.01	0.01		
CH4	25	0.01	0.01	0.01	0.17	0.00
N2O	298	0.00	0.00	0.00	0.03	0.00
CO2	1	6.14	6.14	6.14	6.14	0.01
Diesel Component of TBTL Dehydration Plant Energy Carbon Intensity					6.3	**0.0060**

Ocean Voyage Component of the TBTL Dehydration Plant Sub-Pathway

There are two components to the CI of the TBTL Dehydration Plant sub-pathway related to the ocean voyage: distance and transporting hydrous rather than anhydrous between Brazil and Trinidad.

The actual difference in ocean voyage distance between the TBTL Dehydration Plant sub-pathway and the distance if the voyage were made directly from Brazil to California is

approximately 240 statute miles[4]. Much of this difference is due to the assumption that the hydrous ethanol from Brazil to Trinidad originates from Paranagua, a port more distant than the commonly used port of Santos.

Table 8: Ocean Voyage Distances[5]

Ocean Voyage Distances	**Statute Miles**
Paranagua to Santos	191
Santos to Point Fortin, Trinidad	3,794
Paranagua to Point Fortin, Trinidad	3,985
Point Fortin, Trinidad to Los Angeles	4,718
Los Angeles to San Francisco	420
Brazil to Los Angeles via Trinidad	8,703
Brazil to San Francisco via Trinidad	9,123
Average from Brazil to LA and SFO via Trinidad	8,913
Santos to Los Angeles, Direct	8,467
Santos to San Francisco, Direct	8,887
Average Direct from Brazil to LA and SFO	8,677
Difference Direct vs. Via Trinidad	**236**
Difference excluding Paranagua vs. Santos	45

The other difference between ocean voyage component of the TBTL Dehydration Plant pathway and the pathways based on the direct shipment of ethanol to California from Brazil is that hydrous ethanol is shipped from Brazil to Trinidad. Direct shipment from Brazil is based on anhydrous ethanol being shipped. While the U.S. ASTM specification for denatured ethanol calls for no more than 1% water by volume, in practice, anhydrous ethanol shipped from Brazil, Trinidad or elsewhere will have less than 1% water by volume to provide an allowance for any water that may be added to the ethanol in the supply chain at the import terminal or thereafter. Thus for comparing the water content of hydrous and anhydrous ethanol, a water content of the anhydrous ethanol of 0.5% water by volume is used. The hydrous ethanol typically has a

[4] Only statute miles (5,280 feet per statute mile) are used in this document when miles are referenced unless stated other wise. Ocean shippers normally use nautical miles when referring to shipping distances. There are 1.15 statute mile for each nautical mile (approximately 6,076 feet). Ocean voyage distances used in this application have been calculated using the Netpas Distance Online Software, commonly used, and accepted, by the maritime industry.

[5] Ocean voyage distances used in this application have been calculated using the Netpas Distance Online Software, commonly used, and accepted, by the maritime industry.

maximum of 5% water, corresponding to 190 proof alcohol (proof being the alcohol content multiplied times two). Thus, for each gallon of anhydrous production at TBTL, approximately 1.045 gallons of hydrous ethanol must be shipped from Brazil to Trinidad.

The carbon intensity of the ocean voyage components is based on calculating a factor of 0.0002414 gCO2e/MJ per statute mile from the CARB WTW Analysis of Sugarcane Ethanol published September 23, 2009. This document used the results from the CA-GREET model that shows 1,889 gCO2e/mmbtu for an ocean voyage of 7,416 miles. The mileage used in the CA-GREET model is apparently in error. Investigation into the CA-GREET model shows that the mileage used was the average mileage from Brazil to New York and Los Angeles. Instead the CA-GREET model should have the mileage to the average of San Francisco and Los Angeles. It is expected that future Brazilian cane ethanol pathways will use the correct distance, and that at some point the existing pathways will be revised to use the correct distance. Despite the error in distance, the factor of gCO2e/MJ per statute mile is correct since it is constant in the CA-GREET model regardless of distance traveled.

The table below shows that the CI of the difference in distance is 0.06 gCO2e/MJ and the difference due to hydrous ethanol being transported from Brazil to Trinidad is 0.05 gCO2e/MJ such that the CI of the combined ocean voyage components of the TBTL Dehydration Plant sub-pathway is 0.11 gCO2e/MJ.

Table 9: CI of the Ocean Voyage Components of the TBTL Sub-Pathway

Ocean Voyage Components of TBTL Dehydration Plant Pathway Using Results from the CARB Brazilian Cane Ethanol WTW Analysis, dated 23 Sept 2009			
Item	**Amount**	**Units**	**Symbol and Calculation**
Ocean miles Brazil to California (CARB WTW Analysis, Table 5.01, pg 36)	7,416	statute miles	A
Ocean voyage CO2e emissions(CARB WTW Analysis, Table 5.04, pg 39)	1,889	gCO2e/mmbtu	B
Conversion factor:	1,055	MJ/mmbtu	C
Ocean Freight CI in CARB WTW Report (calculated)	1.7905	gCO2e/MJ	D = B / C
Calculated gCO2e/MJ per statute mile	*0.0002414*	*gCO2e/MJ/statute mile*	E = D / A
Ocean voyage: Brazil to California via Trinidad (TBTL)	8,913	statute miles	F
Ocean miles direct voyage from Brazil to California	8,677	statute miles	G
Additional Miles via TBTL	236	statute miles	H = F - G
CI of additional miles from Brazil to California via Trinidad, gCO2e/MJ	0.06	gCO2e/MJ	J = E x H
Ocean miles from Brazil to Trinidad	3,985	statute miles	K
CI of Brazil to Trinidad voyage of Hydrous Ethanol	0.96	gCO2e/MJ	L = E x K
Water in hydrous from Brazil to Trinidad	5%	by volume	M
Incremental CI due to 5% water in Hydrous to Trinidad	0.05	gCO2e/MJ	N = L x M
Additional CI over the WTW pathway due to distance and hydrous ethanol	0.11	gCO2e/MJ	O = J + N

IV. Basis for the Input Values

The input values presented in this application are based on the total natural gas and power consumed by TBTL during calendar 2009. Since the input values are in terms of per gallon of anhydrous ethanol, the total of each utility value has been divided by the total gallons of anhydrous ethanol produced during calendar 2009. The total amount of anhydrous ethanol produced during 2009 includes both anhydrous ethanol for the U.S. market and other global markets. Other markets have more stringent moisture limits than the U.S. market, meaning that more energy is required to produce anhydrous ethanol at maximum moisture of 0.1%vol for the European market, than the 0.5%vol maximum moisture content for the U.S. market.

Historically the market for ethanol from CBI dehydration facilities has been intermittent. The annual average natural gas and power consumed includes the utilities needed to start and stop the facilities in between production runs.

The Brazilian Sugarcane Ethanol pathways developed by CARB are on the basis of the Brazilian sugarcane mills producing and shipping anhydrous ethanol.[6]

V. Production Range of TBTL Pathway

The new pathway should be applicable to the TBTL facilities for at least 25% to 110% of Nameplate Capacity.

[6] see the discussion of the anhydrous basis in CARB Report "Detailed California-Modified GREET Pathways for Brazilian Sugarcane Ethanol: Average Brazilian Ethanol, With Mechanized Harvesting and Electricity Co-product Credit, With Electricity Co-product Credit" September 23, 2009, Version 2.3, page 5. Also reference Table C in the same report.

VI. Sustainability of TBTL Pathway

The TBTL facility was designed and constructed using well-established modern designs and equipment (design by ICM of Colwich, Kansas) and is managed by professional staff well-qualified to assure that over time the energy efficiency of and emissions from the facility do not deteriorate. Any deterioration would result in a less profitable business. Thus the sustainability of the plant is well aligned with the business objectives of the owners.

VII. Impact on Land Use

Any difference between the land use of this sub-pathway and that of the Brazilian sugarcane ethanol pathways is negligible.

VIII. Documents supporting Annual Quantities of Ethanol, Natural Gas and Power –

All of the documents supporting the annual quantities are confidential business information. **All of the documents in this section contain Confidential Business Information and are not included in this non-confidential version of the application.**

IX. Documents supporting Lifecycle Assumptions of Natural Gas and Power

The following documents support the lifecycle assumptions for the natural gas and power used by TBTL.

TRINIDAD BULK TRADERS LTD

Cor. Eastern Main Road &
Trinity Avenue, Laventille,
Trinidad, West Indies.
P.O. Box 62, Port of Spain,
Trinidad, West Indies.
Tel.: (868) 648-2270
Fax: (868) 648-2668

July 27, 2010
OUR REF.: **PCL1008-5507BLH TTEC NG**

To Whom It May Concern,

RE: **Fuel Source for Electrical Power Supply in Trinidad**

This letter advises that the power production in the Island of Trinidad of the Republic of Trinidad and Tobago is derived from Natural Gas only. The sister isle of Tobago of the Republic is also natural gas powered with Diesel as a backup or alternate.

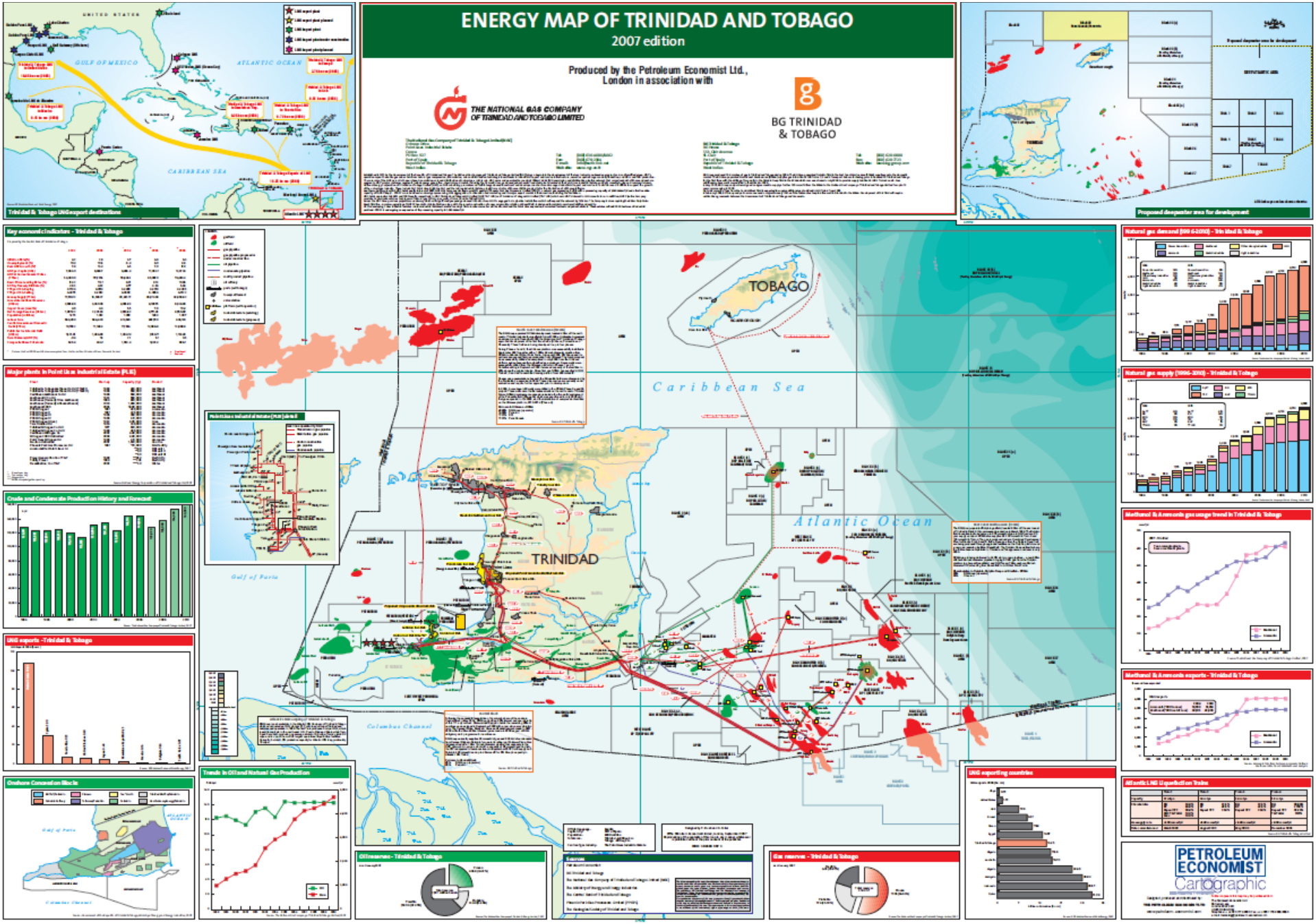
Natural Gas as the power supply for Trinidad and Tobago was a natural choice since the Republic is a natural gas-based economy and incidentally it is one of the primary suppliers of Liquefied Natural Gas (LNG) into the United States.

The sole power utility supplier in the island is the Trinidad and Tobago Electricity Commission (http://www.ttec.co.tt/) which is owned 100% by the Government of Trinidad and Tobago. Some further information on this can be viewed on the Government's website at (http://www.energy.gov.tt/energy_resources.php?mid=9).

If any further information is required then please contact us per the details above or alternatively you can email the writer at curtis.mohammed@tbtl-tt.com.

Regards,
TRINIDAD BULK TRADERS LIMITED

Curtis Mohammed
Chief Executive Officer


ENERGY MAP OF TRINIDAD AND TOBAGO
2007 edition
Produced by the Petroleum Economist Ltd., London in association with
THE NATIONAL GAS COMPANY OF TRINIDAD AND TOBAGO LIMITED
BG TRINIDAD & TOBAGO
TOBAGO
TRINIDAD
Caribbean Sea
Atlantic Ocean
Gulf of Paria
Columbus Channel
Trinidad & Tobago LNG export destinations
Key economic indicators - Trinidad & Tobago
Major plants in Point Lisas Industrial Estate (PLIE)
Crude and Condensate Production History and forecast
LNG exports - Trinidad & Tobago
Onshore Concession Blocks
Trends in Oil and Natural Gas Production
Oil reserves - Trinidad & Tobago
Gas reserve - Trinidad & Tobago
LNG exporting countries
Natural gas demand (1990-2010) - Trinidad & Tobago
Natural gas supply (1990-2010) - Trinidad & Tobago
Methanol & Ammonia gas usage trend in Trinidad & Tobago
Methanol & Ammonia exports - Trinidad & Tobago
Atlantic LNG Liquefaction Trains
PETROLEUM ECONOMIST Cartographic