Siting, Transmission and Environmental Protection Division

	FILE:	
PROJECT TITLE: **HECA**		**Docket:08-AFC-8A**

TECHNICAL AREA(S): Greenhouse Gases and SB 1368 Compliance

☒ **Telephone**		☐ **Meeting Location:**

NAME:	Gerry Bemis, et al.	**DATE:**	5/10/13	**TIME:**	10 am
WITH:	HECA, Applicant and SJV APCD				
SUBJECT:	SB 1368 Compliance and Applicant Response to USEPA Comments on the SJVAPCD's Preliminary Determination of Compliance				

COMMENTS:

Purpose of Teleconference:

Ms Julie Mitchell, Air Quality consultant for HECA, requested a telephone conference so that they could discuss with Energy Commission staff and San Joaquin Valley Air Pollution Control District staff the applicant's concerns about an April 11, 2013 letter from the US EPA commenting on the Preliminary Determination of Compliance (PDOC) prepared by the SJV APCD. In preparation for the telephone conference, on May 9, 2013, Ms Mitchell provided a spreadsheet with new information describing how the proposed project would comply with California's Emissions Performance Standard regulations developed under SB 1368.

Participants:

URS (representing HECA): Julie Mitchell, Jenn Garlock
Fluor (project engineering): Jim Loney
HECA: Bob Middlemore
SJVAPCD: Leonard Scandura, Homero Ramirez, Alan Phillips
Energy Commission: Gerry Bemis, Will Walters (consultant), Nancy Fletcher, Ed Brady

Gerry Bemis cautioned participants that the meeting was to focus only on exchange of technical information. All were cautioned that there could be no effort to change anyone's approach to evaluating this proposed project. In addition Gerry Bemis stated a report of conversation (ROC) would be completed documenting the meeting.

Discussion of Applicant's SB1368 Calculations:

Ms. Mitchell stated that HECA had refined their SB1368 compliance evaluation. A summary of the refined approach is included in a new spreadsheet. She said it was a more refined approach than that presented in the Amended AFC. She said that they considered the appropriate scope of the carbon dioxide (numerator of the SB 1368 equation) and the megawatt-hours produced by the facility (denominator of the SB 1368 equation). Details were provided in the spreadsheet (attached to this ROC).

The SJVAPCD stated that they have reconsidered their approach to reviewing GHG BACT requirements and concluded that the 400 lb/MWh limit in the PDOC was outside their scope of authority and would be removed from the Final DOC. This satisfies the applicant and resolves several issues in the US EPA comment letter of April 11, 2013. The SJVAPCD stated they would not monitor for compliance with SB 1368. The air district staff stated they need monitoring, verification and reporting to ensure that the sequestered carbon dioxide would remain under ground (later, Gerry Bemis alerted the SJVAPCD staff that Energy Commission staff is very interested in this issue, and there will be a chapter in the Preliminary Staff Analysis detailing concerns with this issue, including monitoring, verification and reporting requirements. The district looks forward to reviewing this chapter as soon as possible.). The SJVAPCD indicated that ensuring 90% capture of the carbon dioxide coming out of the gasifier, and limiting the allowable hours per year that the carbon dioxide could be vented during upset conditions, should be sufficient for their GHG/BACT purposes as long as the sequestered carbon dioxide remains out of the atmosphere.

Ms. Mitchell stated that they separated the project into 3 components for purposes of evaluating compliance with the SB 1368 emission performance standard: power, fertilizer, and “common”. The common component includes operations associated with both syngas production and CO_2 compression at the HECA site only. Only CO_2 emissions and megawatts associated with power production are used by the applicant in their evaluation of the emissions performance standard. Approximately two thirds of the syngas produced would be used for power production and the other one third would be used for fertilizer production. Therefore the common component needs to be subdivided into one portion for power production (about 2/3 of output) and the other portion (1/3) attributed to fertilizer production. These syngas allocations are based on the clean syngas exiting the Rectisol® unit, on a lower heating value BTU basis. In addition there are two modes of operation for the electricity production plant referred to as “on-peak” and “off-peak.” On-peak is used when the plant is maximizing power production and off-peak describes expected operations when electricity production is reduced and fertilizer production is maximized. The plant is expected to operate 16 hours per day in the on-peak electricity production mode and 8 hours per day in the off-peak electricity production mode.

An example of how to derive net MW capacity (used to determine MWh expected by the applicant to be produced by the facility) is as follows:

338.7 MW = 412.5 (gross MW allocated to power) -12.7 MW (auxiliary power consumption) – 0.713*85.7 MW (% of syngas allocated to power times common power consumption).

The MWh calculation was based upon an assumed 8,000 hrs/year of operation. Energy Commission staff requested a detailed breakdown of the power consumption and production values for all components, especially equipment assigned to “power” “fertilizer” and “common” components. Specifically, backup information is needed for all the numbers presented in the spreadsheet regarding power consumption and syngas allocations.

Facility performance information in the spreadsheet was derived from new computer modeling of how HECA would perform, with the new modeling conducted in March 2013 but not presented to the Energy Commission until May 9, 2013. It represents expected facility operation at a nominal ambient temperature of 65 °F. HECA representatives have also done updated modeling at ambient temperatures of 97 °F (a typical hot day) and 39 °F (a typical cold day). Energy Commission staff requested that all this information be made available to participants in this proceeding. The equation above is based upon the gasifier producing sufficient syngas for 416 MW of gross electrical power, with 412.5 MW worth of gas going to electrical power production and 3.5 MW going to fertilizer production, all at 65 °F.

HECA stated that electrical power increases at higher ambient temperatures due to the interaction of the gasifier and its components with the gas turbine. Normally, the output of a gas turbine is less at higher ambient temperatures due to the inlet air being less dense at higher temperatures, but HECA is expected to have the opposite effect, which is counter intuitive.

Energy Commission staff requested that HECA document performance data for all three reference temperatures noted above, and HECA representatives said they would do so. They have to use several computer models to perform these evaluations; some models are proprietary to the component supplier and only the output of them is available to HECA, which uses a spreadsheet to incorporate all these models into their analysis. Staff also stated that annual average conditions were appropriate for SB 1368 compliance purposes, but that other conditions also needed to be documented. Staff also requested all the detailed back-up computations to understand these data. Staff stated that they believe the SB 1368 evaluation needs to include electricity consumed in the air separation unit.

In evaluating compliance with SB 1368, HECA evaluated the facility's compliance under three conditions and got results as follows:
Early Operations = 300 lbs CO_2/MWh;
Mature Operations = 227 lbs CO_2/MWh;
Mature Operations without upsets = 153 lbs CO_2/MWh.

HECA expects early operations to last approximately 2 years, and used the early operations condition as the basis of emissions for their air quality permit appication. Early operations has hydrogen-rich gas available for the gas turbine 65 to 75 percent of the time (when CO_2 venting is allowed for 504 hrs/yr), where mature operations has hydrogen-rich gas available about 85 percent of the time. When upset conditions occur during mature operations, they constitute no more than 120 hrs/yr of venting. Without upsets, there is no natural gas used and no CO_2 venting.

Energy Commission staff stated that the approach identified with this new spreadsheet is very different from the Amended AFC and requested the applicant to document extensively what their new approach was, and stated that the theory behind it needs careful explanation within the context of the regulations implementing SB 1368. Staff expects that the analysis should be carbon-based ("follow the carbon"). This new documentation needs to fully disclose both the CO_2 emissions (numerator) and the MWh (denominator) in determining compliance with SB 1368 Requirements.

The applicant requested a detailed e-mail so that they could respond to this request and Energy Commission staff agreed to provide that as soon as possible.

The applicant stated that they include consumption of power necessary to initially compress CO_2 for delivery to offsite enhanced oil recovery (EOR) under auxiliary power consumption category in their spreadsheet. They stated that recompression in the oil field for any CO_2 produced during EOR operations was outside the scope for SB 1368 evaluation. However, they did not disclose how much of the "common" auxiliary power (which totals 85.7 MW in the spreadsheet) was attributable to initial CO_2 compression.

In addition Energy Commission staff asked for clarification regarding the maintenance and start up periods when the plant would be offline. The applicant stated during plant maintenance the plant is not intending to operate using natural gas; however the plant may have the ability operate if needed using natural gas during this period, as long as hours/year limits using natural gas are met. Additional information regarding reliability and specific operating hours would be provided separately.

Discussion of US EPA Comments on PDOC

Since the SJVAPCD will remove their 400 lbs/MWh performance requirement, discussion of the US EPA comments on that portion of the Preliminary Determination of Compliance (PDOC) was not needed. Instead, the district will be satisfied with verification of 90% carbon dioxide capture (from the syngas) and a limit on allowable hours/year of CO_2 venting, along with assurances that the captured CO_2 would not be allowed to escape into the atmosphere once it leaves the HECA property.

Energy Commission staff asked the SJVAPCD staff to consider using the PSA/DEIS section dealing with carbon capture and storage for their monitoring, reporting and verification needed to ensure that the captured CO_2 would remain out of the atmosphere. The applicant agreed that they would prefer this approach.

cc: John Heiser, dockets	**Date:** 5/10 /13	**Signed:**
		Name Gerry Bemis

Applicant's Document Submitted May 9, 2013

May 10, 2013

SB1368 Calculations

For comparison to the California Senate Bill (SB) 1368 Greenhouse Gases Emission Performance Standard (EPS) of 1,100 lb CO_2/per hour (MWh), CO_2 emissions and electricity production were calculated following CEC's "Regulations Establishing and Implementing a Greenhouse Gases Emission Performance Standard for Local Publicly Owned Electric Utilities" (CEC, 2012). SB 1368 is a standard that regulates the emissions of CO_2 on a lb/MWh basis of power produced and sold to publicly owned electric utilities, this standard does not regulate the power or CO_2 emissions from the Manufacturing Complex.

More detailed information regarding how the CO_2 emissions and power use is portioned between the power production, syngas production and Manufacturing Complex were used to revise the SB 1368 EPS calculations. The methodology and assumptions for allocating carbon dioxide emissions between the production of power and the Manufacturing Complex are outlined below.

This allocation is required because the common portion of the plant produces syngas and only a portion of the syngas is used to produce power, the remainder is used in the production of fertilizer. CO_2 emissions and power attributable to the production of fertilizer are excluded from the calculation of the EPS. The power output calculations are approximated for On-Peak and Off-Peak operation, from which the daily average is estimated based on 16 hours and 8 hours of operation per day, respectively.

The plant is divided into three sections. The common section produces clean syngas. The clean syngas flows to the remaining sections: the Manufacturing Complex section and the power section. The CO_2 emissions from the production of the syngas are allocated between the fertilizer production and power production according to the respective portion of clean syngas used. The allocation is performed on a lower heating value basis.

Gross power generation has been attributed to the power block except for the portion of power generated which is attributable to the steam used by or produced by the Manufacturing Complex. Steam integration with the Manufacturing Complex increases the output of the steam turbine above that which would be achieved without steam integration. The power attributable to steam integration with the Manufacturing Complex is noted and subtracted from the gross generator output to give the portion attributable to the power block.

The auxiliary loads are also segregated into the three sections noted above. The common auxiliary loads are further allocated to power or manufacturing according to the portion of clean syngas used by the power block or fertilizer units.

Power net output is the gross generation allocation to power less the auxiliary loads attributable to power. The Manufacturing Complex power consumption is the gross generation allocation to fertilizer less the auxiliary loads attributable to fertilizer. The daily average net output of syngas fired power production was multiplied by 8,000 hours of operation per year to obtain the megawatt-hours of power produced per year. Natural gas fired power generation was calculated at 336 hours per year (two weeks) times 300 MW net output. The total net power output is the sum of power generated from operation on syngas plus power generated from operation on natural gas. Conservatively the net output does not include the power output during startup or shutdown operations.

The CO_2 emissions are split according to the respective portion of clean syngas used. The CO_2 emitted when burning natural gas in the turbine to produce power is allocated only to the power block. The CO_2 emitted from the urea unit vent or when burning natural gas in the ammonia start-up heater is allocated only to the Manufacturing Complex. The remaining CO_2 emissions are considered common and split between the power section and Manufacturing Complex.

Annual CO_2 emissions and power output were estimated for the three operating scenarios, as described below:

- Early Operations - expected to last approximately 2 years, during which time hydrogen-rich fuel availability will be approximately 65 to 75 percent. During this period, all sources are expected to be operated at maximum operating conditions, including two plant start-ups and shut-downs. The CO_2 vent is included with maximum permitted venting emissions of up to 504 hours at full capacity. Power output includes 8,000 hours/year of syngas operation and 336 hours/year of natural gas operation.

- Mature Operations - expected to occur after the first 2 years of commercial operation, when the hydrogen-rich fuel availability will be approximately 85 percent. At this stage, significantly less venting is expected to occur; thus, CO_2 vent emissions are estimated based on approximately 10 days of venting at 50 percent capacity (or 120 hours of venting at 100 percent capacity). All other sources are operated at maximum operating conditions, including two plant start-ups and shut-downs. Power output includes 8,000 hours/year of syngas operation and 336 hours/year of natural gas operation.

- Steady State Operations - which occur in the same time frame as mature operations; that is, after the 2 years of early operation. In this scenario, emissions are estimated based on maximum operating conditions, excluding start-ups, shut-downs and CO_2 venting. Emissions from operation of the CTG/HRSG on syngas are included; no natural gas use is included. Power output includes 8,000 hours/year of syngas operation.

Table 1 compares the CO_2 emissions of the Project with the SB 1368 emission standard for the three scenarios. CO_2 emissions from the electricity production at HECA are approximately 150 lb/MWh during steady-state operations on hydrogen-rich fuel. The maximum CO_2 emissions during early operations, including emissions from natural-gas operation, start-up, shut-down, and CO_2 venting, would be approximately 300 lb/MWh. Detailed calculations can be found in the spreadsheet.

Revised Table 1
Annual CO_2 Emissions for SB 1368 Emission Performance Standard

Operating Parameter	Early Operations (Maximum Permitted)	Mature Operations	Steady-State Syngas Operations
Total CO_2 Annual Emissions Attributable to Power Production (ton/yr)	386,494	290,865	188,228
Net Power Output (MWh)	2,565,374	2,565,374	2,464,574
CO_2 EPS (lb/MWh)	301	227	153

Source: HECA, 2013.

Notes:

- Early operations emissions include two periods of start-up and shut-down, natural gas use in the CTG, and 504 hours of CO_2 venting.
- Mature operations emissions include two periods of start-up and shut-down, natural gas use in the CTG and 120 hours of CO_2 venting.
- During steady-state operation, the CTG and duct burners will fire only hydrogen-rich fuel and PSA off-gas; no start-ups and shut-downs, no natural gas backup use and no CO2 venting.

$CO_{2\,=}$ carbon dioxide
MWh = megawatt hours
lb/MWh = pounds per megawatt hours

Applicant's Spreadsheets Submitted May 9, 2013

(Data are for 65 °F)

SB1368 Emission Performance Standard — Emissions Summary

Hydrogen Energy California LLC — *5/10/2013*
HECA Project

HECA Annual CO2 Emissions for SB1368 Emission Performance Standard

Sources of CO2	Total	Power	Fertilizer	Allocation
	CO2 Emissions (tons/yr)			
CTG/HRSG burning syngas/PSA off-gas	283,104	183,734	99,369	C
CTG/HRSG burning natural gas	49,291	49,291	-	P
CO2 Vent	193,394	125,512	67,881	C
Flares pilot	564	366	198	C
Flares SU/SD	8,531	5,537	2,995	C
Thermal Oxidizer standby	6,322	4,103	2,219	C
Thermal Oxidizer SU/SD, maintenance	337	219	118	C
Emergency Engines	115	-	-	exempt
Auxiliary Boiler	27,283	17,707	9,576	C
Ammonia Start-Up Heater	459	-	459	F
Urea Absorber Vents	128	-	128	F
Nitric Acid Unit	0	-	-	F
Fugitives	39	25	14	C
Total Emissions attributable to each Section				
Total Early Operations	569,566	386,494	182,957	
Total Mature Operations	422,218	290,865	131,238	
Total Steady State Operations	290,271	188,228	101,928	

Syngas allocation by section (daily average)		
P	Power	64.9%
F	Fertilizer	35.1%
C	Common	

HECA Power Generation for SB1368 Emission Performance Standard

Power Balance	Unit	On-Peak	Off-Peak	Daily Average
Power Generation				
Gross Output	MW	416.0	315.2	382.4
Allocation to Power	MW	412.5	303.9	376.3
Allocation to Fertilizer	MW	3.5	11.3	6.1
Auxiliary Power (consumption)				
Common	MW	(85.7)	(86.0)	
Power	MW	(12.7)	(12.4)	
Fertilizer	MW	(52.1)	(65.6)	
Syngas Allocation				
To Power Block	%	71.3%	52.1%	64.9%
To Fertilizer	%	28.7%	47.9%	35.1%
Power Allocation				
IGCC Net Output (w/o Fertilizer)	MW	338.7	246.6	308.1
IGCC Net Output	MW-hr/year			2,464,574
Natural Gas-Fired Net Power Output	MW			300
Natural Gas-Fired Power Production	MW-hr/year			100,800
Fertilizer Power Consumption	MW	(73.2)	(95.5)	(80.6)

SB1368 Emission Performance Standard

	Early Operations (Maximum Permitted)	Mature Operations	Steady-State Syngas Operations
Total CO_2 Annual Emissions Attributable to Power Production (ton/yr)	386,494	290,865	188,228
Net Power Output (MWh)	2,565,374	2,565,374	2,464,574
CO_2 EPS (lb/MWh)	301	227	153

Notes:
Emissions presented include CO2 from the turbine during startups and shutdowns.
Emissions from the emergency engines are exempt from the SB1368 standard.
The annual power output does not include the megawatts generated during startup and shutdown, thus the EPS may be conservatively high.

Scenario definitions:

Early Operations - expected to last approximately 2 years, during which time hydrogen-rich fuel availability will be approximately 65 to 75 percent. During this period, all sources are expected to be operated at maximum operating conditions, including two plant start-ups and shut-downs. The CO2 vent is included with maximum permitted venting emissions of up to 504 hours at full capacity.

Mature Operations - expected to occur after the first 2 years of commercial operation, when the hydrogen-rich fuel availability will be approximately 85 percent. At this stage, significantly less venting is expected to occur; thus, CO2 vent emissions are estimated based on approximately 10 days of venting at 50 percent capacity (or 120 hours of venting at 100 percent capacity). All other sources are operated at maximum operating conditions, including two plant start-ups and shut-downs.

Steady State Operations - which occur in the same time frame as mature operations; that is, after the 2 years of early operation. In this scenario, emissions are estimated based on maximum operating conditions, excluding start-ups, shut-downs and CO2 venting. Emissions from operation of the CTG/HRSG on syngas are included; no natural gas use is included.

Hydrogen Energy California LLC *5/10/2013*
HECA Project

GHG emissions are numerically depicted as metric tons (tonne) of carbon dioxide equivalents (CO_2e). CO_2e represents CO_2 plus the additional warming potential from CH_4 and N_2O. CH_4 and N_2O have 21 and 310 times the warming potential of CO_2, respectively.

Natural Gas GHG Emission Factors

CO_2 =	53.06	kg/MMBtu =	116.98	lb/MMBtu
CH_4 =	0.001	kg/MMBtu =	0.002	lb/MMBtu
N_2O =	0.0001	kg/MMBtu =	0.00022	lb/MMBtu

Diesel GHG Emission Factors

CO_2 =	10.15	kg/gal =	22.38	lb/gal
CH_4 =	0.0004	kg/gal =	0.001	lb/gal
N_2O =	0.0001	kg/gal =	0.0002	lb/gal

CO_2, CH_4, and N_2O emission factors are taken from Appendix C of the California Climate Action Registry (CCAR) General Reporting Protocol Version 3.1 (Jan 2009)

Turbine - Burning Hydrogen-Rich Fuel - released to HRSG and Feedstock Dryer Stacks

Operating Hours		8012	hr/yr			
Heat Input (HHV)		2,537	MMBtu/hr			
CO_2 =	163,244	tonne/yr				
CH_4 =	288	tonne/yr =	6,043	tonne CO_2e/yr		
N_2O =	2.03	tonne/yr =	630	tonne CO_2e/yr	Total tonne CO_2e/yr =	169,917

Syngas GHG Emission Factors		
CO_2 =	17.7	lb/MMBtu
CH_4 =	0.03	lb/MMBtu

HRSG heat input rate is based Case 5, average ambient temperature and peak load.
Operating hours include startup and shutdown operations
Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Duct burner - Burning Hydrogen-Rich Fuel - released to HRSG and Feedstock Dryer Stacks

Operating Hours		8000	hr/yr			
Heat Input (HHV)		165	MMBtu/hr			
CO_2 =	10,603	tonne/yr				
CH_4 =	19	tonne/yr =	393	tonne CO_2e/yr		
N_2O =	0.13	tonne/yr =	41	tonne CO_2e/yr	Total tonne CO_2e/yr =	11,036

Syngas GHG Emission Factors		
CO_2 =	17.7	lb/MMBtu
CH_4 =	0.03	lb/MMBtu

Duct burner heat input rate is based Case 5, average ambient temperature and peak load.
Duct burner not operated during turbine startup and shutdown
Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Duct burner - Burning PSA Offgas - released to HRSG and Feedstock Dryer Stacks

Operating Hours		8,000	hr/yr			
Heat Input (HHV)		149	MMBtu/hr			
CO_2 =	83,053	tonne/yr				
CH_4 =	146	tonne/yr =	3,073	tonne CO_2e/yr		
N_2O =	0.12	tonne/yr =	37	tonne CO_2e/yr	Total tonne CO_2e/yr =	86,163

Syngas GHG Emission Factors		
CO_2 =	153.6	lb/MMBtu
CH_4 =	0.3	lb/MMBtu

Duct burner heat input rate is based Case 5, average ambient temperature and peak load.
Duct burner not operated during turbine startup and shutdown
Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Turbine - Burning Natural Gas - released to HRSG Stack

Operating Hours		351	hr/yr			
Heat Input (HHV)		2,401	MMBtu/hr			
CO_2 =	44,729	tonne/yr				
CH_4 =	0.84	tonne/yr =	18	tonne CO_2e/yr		
N_2O =	0.08	tonne/yr =	26	tonne CO_2e/yr	Total tonne CO_2e/yr =	44,772

HRSG heat input rate is assumed to be the maximum heat input rate firing natural gas. Hours of operation include startup and shutdown.

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HECA Project

Auxiliary Boiler

Operating Hours		2,190	hr/yr			
Heat Input		213	MMBtu/hr			
CO_2 =	24,758	tonne/yr				
CH_4 =	0.47	tonne/yr =	10	tonne CO_2e/yr		
N_2O =	0.05	tonne/yr =	14	tonne CO_2e/yr	Total tonne CO_2e/yr =	24,782

Emergency Generators (2)

Operating Hours		50	hr/yr			
Heat Input		2,922	Bhp			
CO_2 =	3,341	lb/hr =	76	tonne CO_2/yr		
CH_4 =	0.13	lb/hr =	0.063	tonne CO_2e/yr		
N_2O =	0.03	lb/hr =	0.2315	tonne CO_2e/yr	Total tonne CO_2e/yr* =	152

The following conversions were used to convert from lb/gallon to lb/hp-hour; and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu; and 7,000 Btu/hp-hour.

* Total tonnes CO_2e per year represent the contributions from both generators.

Fire Water Pump

Operating Hours		100	hr/yr			
Heat Input		556	Bhp			
CO_2 =	636	lb/hr =	29	tonne CO_2/yr		
CH_4 =	0.03	lb/hr =	0.024	tonne CO_2e/yr		
N_2O =	0.01	lb/hr =	0.0881	tonne CO_2e/yr	Total tonne CO_2e/yr =	29

The following conversions were used to convert from lb/gallon to lb/hp-hour; and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu; and 7,000 Btu/hp-hour.

Gasification Flare

Pilot Operation						
Operating Hours		8,760	hr/yr			
Heat Input		0.5	MMBtu/hr			
CO_2 =	232	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0004	tonne/yr =	0.1	tonne CO_2e/yr	Total tonne CO_2e/yr =	233
Flaring Events						
Total Operation		70,536	MMBtu/yr			
CO_2 =	3,744	tonne/yr				
CH_4 =	0.1	tonne/yr =	1	tonne CO_2e/yr		
N_2O =	0.01	tonne/yr =	2	tonne CO_2e/yr	Total tonne CO_2e/yr =	3,747

GHG emissions from flaring events are conservatively estimated using GHG emission factors for natural gas combustion.

Rectisol Flare

Pilot Operation						
Operating Hours		8,760	hr/yr			
Heat Input		0.3	MMBtu/hr			
CO_2 =	139	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0003	tonne/yr =	0.08	tonne CO_2e/yr	Total tonne CO_2e/yr =	140
Flaring Events						
Operating Hours		40	hr/yr			
Vent gas flow		4542	lb-mole/hr			
CO_2 =	3,627	tonne/yr				
CH_4 =		tonne/yr =		tonne CO_2e/yr		
N_2O =		tonne/yr =		tonne CO_2e/yr	Total tonne CO_2e/yr =	3,627

GHG emissions from flaring event based on 100% carbon content of the gas during startup.

Hydrogen Energy California LLC *5/10/2013*
HECA Project

SRU Flare

Pilot Operation

Operating Hours		8,760	hr/yr			
Heat Input		0.3	MMBtu/hr			
CO_2 =	139	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0003	tonne/yr =	0.08	tonne CO_2e/yr	Total tonne CO_2e/yr =	140

Flaring Events - natural gas assist for acid gas venting during startup

Operating Hours		40	hr/yr			
Heat Input		36	MMBtu/hr			
Throughput (inerts) - acid gas venting during startup						
CO_2 =		140000	scf/hr			
CO_2 =		16,240	lb/hr			
CO_2 =	371	tonne/yr				
CH_4 =	0.001	tonne/yr =	0.03	tonne CO_2e/yr		
N_2O =	0.00014	tonne/yr =	0.045	tonne CO_2e/yr	Total tonne CO_2e/yr =	371

Throughtput (inerts) provided from design engineers.

Tail Gas Thermal Oxidizer

Process Vent Disposal Emissions

Operating Hours		8,314	hr/yr			
Heat Input		13	MMBtu/hr			
CO_2 =	5,736	tonne/yr				
CH_4 =	0.11	tonne/yr =	2.3	tonne CO_2e/yr		
N_2O =	0.0108	tonne/yr =	3.4	tonne CO_2e/yr	Total tonne CO_2e/yr =	5,742

SRU Startup & Shutdown

Operating Hours		72	hr/yr			
Heat Input		80	MMBtu/hr			
CO_2 =	306	tonne/yr				
CH_4 =	0.006	tonne/yr =	0.12	tonne CO_2e/yr		
N_2O =	0.00058	tonne/yr =	0.179	tonne CO_2e/yr	Total tonne CO_2e/yr =	306

GHG emissions from thermal oxidizer are estimated using GHG emission factors for natural gas combustion for the assist gas.

Intermittent CO_2 Vent

Operating Hours	504	hr/yr		
CO_2 Emission Rate	767,435	lb/hr		
			Total tonne CO_2e/yr =	175,493

Assumes 504 hours per year venting at full rate.

Fugitives - Gasification Block

Operating Hours		8,760	hr/yr			
CO_2 =	32.0	tpy	31.12	tonne CO_2e/yr		
CH_4 =	0.27	tpy	5.55	tonne CO_2e/yr		
					Total tonne CO_2e/yr =	37

Detailed emission calculations are provided in Appendix M, Public Health.

Fugitives - Manufacturing Complex

Operating Hours		8,760	hr/yr			
CO_2 =	4.7	tpy	4.53	tonne CO_2e/yr		
CH_4 =	0.04	tpy	0.91	tonne CO_2e/yr		
					Total tonne CO_2e/yr =	5

Detailed emission calculations are provided in Appendix M, Public Health.

Hydrogen Energy California LLC *5/10/2013*
HECA Project

Ammonia Synthesis Plant Startup Heater

Operating Hours		140	hr/yr		
Heat Input		56	MMBtu/hr		
CO_2 =	416	tonne/yr			
CH_4 =	0	tonne/yr =	0	tonne CO_2e/yr	
N_2O =	0.00	tonne/yr =	0	tonne CO_2e/yr	Total tonne CO_2e/yr = 417

Urea Absorber Vents

Operating Hours		8,000	hr/yr		
CO_2		32	lb/hour		
CO_2 =	116	tonne/yr			
CH_4 =		tonne/yr =	0	tonne CO_2e/yr	
N_2O =		tonne/yr =	0	tonne CO_2e/yr	Total tonne CO_2e/yr = 116

Emission rate provided by project engineers.

Nitric Acid Unit

Operating Hours		8,000	hr/yr		
N_2O uncontrolled		10.78	lb/ton NHO3		
Production rate		501	ton/day		
N_2O uncontrolled		225	lb/hour		
destruction efficiency		95	%		
N_2O controlled		11.25	lb/hour		
N_2O controlled		0.54	lb/ton NHO3		
CO_2 =		tonne/yr			
CH_4 =		tonne/yr =	0	tonne CO_2e/yr	
N_2O =	41	tonne/yr =	12,659	tonne CO_2e/yr	Total tonne CO_2e/yr = 12,659

Emission factor and destruction efficiency provided by design engineer.

230 kV Circuit Breakers

Number of Circuit Breakers		6			
SF_6 capacity		240	lb/breaker		
Annual Leakage rate		0.5%			
SF_6 =	0.003	tonne/yr =	78	tonne CO_2e/yr	Total tonne CO_2e/yr = 78

SF6 GWP = 23,900 http://www.epa.gov/electricpower-sf6/faq.html)
Sources: SF6 inventory and maximum leakage rates from electrical equipment suppliers

18 kV Circuit Breakers

Number of Circuit Breakers		2			
SF_6 capacity		73	lb/breaker		
Annual Leakage rate		0.5%			
SF_6 =	0.000	tonne/yr =	8	tonne CO_2e/yr	Total tonne CO_2e/yr = 8

SF6 GWP = 23,900 http://www.epa.gov/electricpower-sf6/faq.html)
Sources: SF6 inventory and maximum leakage rates from electrical equipment suppliers

Total tonne CO_2e/yr for Stationary Sources=	**539,971**

The following text was sent to Julie Mitchell of URS, in response to her request made during the May 10, 2013 teleconference with the HECA applicant representatives. See near the bottom of page 3 of the Report of Conversation for the request from the HECA applicant, with the request stated in the form of an e-mail. The e-mail was sent on May 17, 2013:

BACKGROUND

Since the Amended AFC was filed there have been a number of changes to project design including a change to the power output of the combustion turbine, the addition of fluxant to the gasification process and the discontinuation of exporting ammonia as a stand-alone product. In addition, the applicant presented revised SB 1368 emission calculations in an e-mail sent to staff on May 10, 2013. Therefore Energy Commission staff needs additional information to revise air quality and greenhouse gas (GHG) emissions for consistency with the assumptions and data provided in these new calculations and to account for all revisions to the project design and operation assumptions that have occurred since the Amended AFC was submitted. The following information is still needed to complete the analysis for the Final Staff Analysis/Final Environmental Impact Report. Some of the terms below such as “Power”, Fertilizer” and “Common” refer to computations in the new material presented in spreadsheets provided by e-mail on May 10, 2013.

ADDITIONAL INFORMATION NEEDED FOR FSA/FEIR:

1) Please provide a carbon balance for HECA demonstrating the complete flow of carbon from the introduction of feedstock to the coal dryer to the products (including carbon dioxide [CO_2]) and waste streams. Please provide this carbon balance for both the On- and Off-Peak operating cases. This carbon balance should be more detailed than what was previously provided in the Amended AFC and data responses, clearly identifying the carbon in all the streams between major processes and process units where carbon flows change.

2) Please provide detailed background information supporting the latest applicant-sponsored SB 1368 calculations. Please provide the following:
    - A detailed list of the project equipment indicating each piece of equipment’s power consumption value; and
    - Project equipment allocation (Power, Fertilizer or Common) for each listed piece of project equipment.

3) Please provide the gross and net megawatt (MW) assumptions for the three available ambient cases (39, 65 and 97 degrees F). Include the On-Peak, Off-Peak and Daily Average categories.

4) Please describe how the fertilizer power generation values, which appear to be different than the previously presented 5 MW value, were determined for the On-Peak and Off-Peak Cases.

5) Please provide detailed calculations and rationale for the Syngas Allocation percentages allocated to power block and fertilizer in the HECA Power Generation for SB 1368 Emissions Performance Standard Table for each project case (On-Peak, Off-Peak, and Daily Average).

6) Please provide detailed calculations and rationale for the calculations used to determine the Syngas Allocation to Power and Fertilizer that were used to determine the CO_2 emissions by emissions source. Please confirm this value is for the Daily Average case, and provide the values for the On-Peak and Off-Peak cases.

7) Please provide additional background information explaining the syngas allocation method used to determine CO_2 emissions from the fertilizer plant. This additional detail should explain the methodology sufficiently to ensure that CO_2 emissions from the fertilizer plant are not double counted when CO_2 emissions are sequestered in the urea produced.

8) The syngas allocation by section (see spreadsheet provided by applicant for May 10, 2013 meeting, attached to TN 70829) does not include a value for the Common allocation. The CO_2 emissions from components identified elsewhere in the spreadsheet designated as "common" are calculated using the Power Allocation percentage in the spreadsheet. Please confirm or provide the correct Common allocation percentage.

9) Please provide the air separation unit's power consumption value expected for the On-Peak, Off-Peak, and Daily Average cases. This can be presented with apportionment to the power block and fertilizer plant if detailed calculations and rationale for that apportionment basis (based on use of the produced oxygen and nitrogen and its later products, hydrogen and CO_2, used for power and fertilizer production) are provided.

10) The applicant stated that the power consumption for initial CO_2 injection was sufficient to provide CO_2 at a pressure necessary for geologic sequestration.
    - Please indicate if the power consumed by the compressors on the HECA site is from onsite power or if additional power is needed to deliver the CO_2 to the initial injection point.
    - Please indicate if the assumed pressure is the same pressure that is required by Oxy Elk Hills (OEHI) to inject the CO_2 into the Stevens formation.
    - Please indicate how much pressure is lost in terms of equivalent power consumption from the CO_2 custody transfer point to the point of receipt at the OEHI central EOR facility for initial injection into the oil reservoir.

11) A review of the emissions tables indicates that there are changes to some of the emissions calculation assumptions provided in Appendix E, such as the fuel consumption in the gas turbine and duct burners.
    - Please update Appendix E as necessary to include all of these changes as well as the other recent changes to project (addition of fluxant, removal of ammonia export).
    - Please provide emissions calculation (AQ and GHG) for both the on-peak and off-peak cases clearly showing fuel flow to the combustion turbine and duct burners for each case.
    - Please show how HECA off-peak operations would impact other emission sources and provide information on changes to the major component stream flows that may occur during these operating conditions (such as, does amount of CO_2 shipped to OEHI go up during off-peak operations, or does the CO_2 concentration in the hydrogen rich fuel go up to maintain a constant CO_2 emissions profile for the HRSG and coal dryer stacks for On- and Off-Peak operations?).

12) Based on Table 2-10 provided in the Amended AFC, during maximum ammonia production, referred to as off-peak operation, production of the other fertilizer components do not increase.
    - Please provide data/calculations confirming the plant will have adequate ammonia storage facilities capable of handling the increased ammonia that would be produced during off-peak operations.
    - Please indicate if the rate of ammonia consumed by the plant varies with respect to the fertilizer products during on-peak and off-peak operations, and if so please provide the on- and off-peak operation case production rates for nitric acid, urea, and UAN production.
    - Please clearly indicate if HECA's ammonia use is higher than its production rate during on-peak operations, or if other components of fertilizer production, including the intermediate products like nitric acid, would increase with the increase in ammonia production during off-peak periods of operation.

13) Please provide a detailed list of the monitoring and recordkeeping methods and procedures that are proposed to be used to demonstrate ongoing compliance with the SB 1368 emission performance standard (EPS) during facility operations. This should include:
    - Monitoring methods and locations to establish CO_2 emissions from all onsite project sources, including fugitive emissions sources.
    - Monitoring methods and locations to establish net electricity generation values for all electricity consumed and generated.
    - Recordkeeping measures to ensure completeness and accuracy of data collected.
    - Coordination with OEHI to obtain necessary data on carbon sequestration to support the value of the sequestered CO_2 that can be used to account for the amount of CO_2 shipped to OEHI.

14) As an adjunct to GHG, please confirm the current planned and unplanned outage as the basis for reliability. Currently, our understand is as follows:

- Planned: Two 1-week planned maintenance outages with 15-hour ramping allowance for 351 hours
- Planned: Two cold-start cycles, each 4 days long for a total of 192 hours
- Unplanned: 219 hours of outage based on 91.3% equivalent availability factor (EAF), calculated as follows: (1-0.913) x 8760 = 762 hours of total outage. 762 (hours of total outage) –351 (maintenance outage hours) – 192 (cold start-up hours) = 219 hours (unplanned outage hours).