Table 3-1
Plantwide GHG Emission Summary
Ector County Energy Center

Name	EPN	GHG Mass Emissions ton/yr	CO_2e ton/yr
Combustion Turbine 1	CT-1	283,408	283,702
Combustion Turbine 2	CT-2	283,408	283,702
Dewpoint Heater	DPT HTR	2,630	2,633
Natural Gas Fugitives	NGFUG	10	252
MSS Fugitives	MSS FUG	0.13	3
Fire Water Pump	FWP	5	5
SF_6 Insulated Equipment	SF6-FUG	0.0006	14
Sitewide Emissions:[1]		**286,054**	**286,610**

1. The sitewide emissions total uses the higher GHG emissions from the two gas turbine options.

Table 3-2

GHG Annual Emission Calculations - Simple Cycle Combustion Turbine

Ector County Energy Center

EPN	Average Heat Input[1] (MMBtu/hr)	Annual Heat Input[2] (MMBtu/yr)	Pollutant	Emission Factor (lb/MMBtu)[3]	GHG Mass Emissions[4] (tpy)	Global Warming Potential[5]	CO_2e (tpy)
CT-1, CT-2 7FA.03 Variants	1,786	4,464,432	CO_2	118.86	265,315	1	265,315
			CH_4	2.2E-03	4.9	25	123.0
			N_2O	2.2E-04	0.5	310	152.6
CT-1, CT-2 7FA.05 Variants	1,908	4,768,881	CO_2	118.86	283,408	1	283,408
			CH_4	2.2E-03	5.3	25	131.4
			N_2O	2.2E-04	0.5	310	163.0

Note

1. The average heat input is based on the HHV iso heat input at 100% load firing, at 65 ^{o}F ambient temperature.

2. Annual heat input based on 2,500 hours per year operation.

3. CH_4 and N_2O GHG factors based on Table C-2 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.

4. CO_2 emissions based on 40 CFR Part 75, Appendix G, Equation G-4

$W_{CO2} = (F_c \times H \times U_f \times MW_{CO2})/2000$

$W_{CO2} = CO_2$ emitted from combustion, tons/yr

F_c = Carbon based F-factor,1040 scf/MMBtu

H = Heat Input (MMBtu/yr)

U_f = 1/385 scf CO_2/lbmole at 14.7 psia and 68 ^{o}F

MW_{CO2} = Molecule weight of CO_2, 44.0 lb/lb-mole

5. Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.

Table 3-3
Startup GHG Emission Calculations - Simple Cycle Combustion Turbine
Ector County Energy Center

Max Hourly GHG Emissions From Turbine

EPN	Max Hourly Heat Input (MMBtu/hr)	Pollutant	Emission Factor (lb/MMBtu)[2]	GHG Mass Emissions[3] (ton/hr)	Global Warming Potential[4]	CO_2e (ton/hr)
CT-1, CT-2 7FA.03 Variants	1,880.7	CO_2	118.86	112	1	112
		CH_4	2.2E-03	0.0021	25	0.0518
		N_2O	2.2E-04	0.0002	310	0.0643
CT-1, CT-2 7FA.05 Variants	1,944.7	CO_2	118.86	116	1	116
		CH_4	2.2E-03	0.0021	25	0.0536
		N_2O	2.2E-04	0.0002	310	0.0665

Startup/Shutdown Hourly GHG Emissions From Turbine

EPN	Heat Input During Startup[1] (MMBtu/hr)	Pollutant	Emission Factor (lb/MMBtu)[2]	GHG Mass Emissions[3] (ton/hr)	Global Warming Potential[4]	CO_2e (ton/hr)
CT-1, CT-2 7FA.03 Variants	1,320.1	CO_2	118.86	78	1	78
		CH_4	2.2E-03	0.0015	25	0.0364
		N_2O	2.2E-04	0.0001	310	0.0451
CT-1, CT-2 7FA.05 Variants	1,241.8	CO_2	118.86	74	1	74
		CH_4	2.2E-03	0.0014	25	0.0342
		N_2O	2.2E-04	0.0001	310	0.0424

Note

1. *The hourly heat input data is the maximum heat rate from GE Performance Data for low load (50%) conditions*
2. *CH_4* and N_2O GHG factors based on Table C-2 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.
3. *CO_2 emissions based on 40 CFR Part 75, Appendix G, Equation G-4*

$W_{CO2} = (F_c \times H \times U_f \times MW_{CO2})/2000$

W_{CO2} = CO_2 emitted from combustion, tons/hr

F_c = Carbon based F-factor,1040 scf/MMBtu

H = Heat Input (MMBtu/hr)

U_f = 1/385 scf CO_2/lbmole at 14.7 psia and 68 ^{o}F

MW_{CO2} = Molecule weight of CO_2, 44.0 lb/lb-mole

4. *Global Warming Potential factors from Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*

Table 3-4
GHG Emission Calculations - Dewpoint Heater
Ector County Energy Center

GHG Potential To Emit Emissions From Natural Gas-Fired Dewpoint Heater

EPN	Maximum Heat Input[1] (MMBtu/yr)	Pollutant	Emission Factor (lb/MMBtu)[2]	GHG Mass Emissions (tpy)	Global Warming Potential[3]	CO_2e (tpy)
DPT HTR	45,000	CO_2	116.89	2,630	1	2,630
		CH_4	2.2E-03	0.05	25	1.2
		N_2O	2.2E-04	0.005	310	1.5
			Total:	**2,630**		**2,633**

Note

1. Annual fuel use and heating value of natural gas from Table A-10 State/PSD air permit application

2. Factors based on Table C-1 and C-2 of 40 CFR Part 98, Mandatory Greenhouse Gas Reporting.

3. Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.

Table 3-5

GHG Emission Calculations - Natural Gas Piping Fugitives

Ector County Energy Center

GHG Emissions Contribution From Fugitive Natural Gas Piping Components

EPN	Source Type	Fluid State	Count	Emission Factor[1] (scf/hr/comp)	CO_2[2] (tpy)	Methane[3] (tpy)	**Total (tpy)**
NGFUG	Valves	Gas/Vapor	300	0.121	0.084	6.313	-
	Flanges	Gas/Vapor	1,200	0.017	0.047	3.548	-
	Relief Valves	Gas/Vapor	5	0.193	0.002	0.168	-
	Open-Ended Lines	Gas/Vapor	10	0.031	0.0007	0.0539	-
	Compressors	Gas/Vapor	3	0.003	0.000021	0.00157	-
GHG Mass-Based Emissions					0.134	10.08	**10.22**
Global Warming Potential[4]					1	25	-
CO_2e Emissions					0.134	252.12	**252.25**

Note

1. *Emission factors from Table W-1A of 40 CFR 98 Mandatory Greenhouse Gas Reporting published in the May 21, 2012 Technical Corrections*
2. *CO_2 emissions based on vol% of CO_2 in natural gas* *0.46%*
3. *CH_4 emissions based on vol% of CH_4 in natural gas* *95.3%*
4. *Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*

Example calculation:

300 valves	0.123 scf gas	0.0046 scf CO2	lbmole	44 lb CO_2	8760 hr	ton =	0.08 ton/yr
	hr * valve	scf gas	385 scf	lbmole	yr	2000 lb	

TABLE 3-6
Gaseous Fuel Venting During Turbine Shutdown/Maintenance and
Small Equipment and Fugitive Component Repair/Replacement
Ector County Energy Center

Location	Initial Conditions			Final Conditions			Annual Emissions		Total
	Volume[1] (ft^3)	Press. (psig)	Temp. (°F)	Press. (psig)	Temp. (°F)	Volume[2] (scf)	CO_2[3] (tpy)	CH_4[4] (tpy)	**(tpy)**
Turbine Fuel Line Shutdown/Maintenance	138	600	50	0	68	6,710	0.0018	0.13	
Small Equipment/Fugitive Component Repair/Replacement	7	50	50	0	68	3	0.00000	0.00006	
GHG Mass-Based Emissions							0.0018	0.1330	**0.13**
Global Warming Potential[5]							1	25	
CO_2e Emissions							0.0018	3.3	**3.3**

1. Initial volume is calculated by multpilying the crossectional area by the length of pipe using the following formula: V_i = pi * [(diameter in inches/12)/2]^2 * length in feet = ft^3

2. Final volume calculated using ideal gas law $[(PV/ZT)_i = (PV/ZT)_f]$. $V_f = V_i (P_i/P_f) (T_f/T_i) (Z_f/Z_i)$, where Z is estimated using the following equation: $Z = 0.9994 - 0.0002P + 3E\text{-}08P^2$.

3. *CO_2 emissions based on vol% of CO_2 in natural gas* 0.46% from natural gas analysis

4. *CH_4 emissions based on vol% of CH_4 in natural gas* 95.3% from natural gas analysis

5. *Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*

Example calculation:

6710 scf Nat Gas	0.005 scf CO2	lbmole	44 lb CO_2	ton =	=	0.0018	ton/yr CO_2
yr	scf Nat Gas	385 scf	lbmole	2000 lb			

Table 3-7
GHG Emission Calculations - Fire Water Pump Engine
Ector County Energy Center

GHG Emissions Contribution From Diesel Combustion In Fire Water Pump Engine

Assumptions:

Annual Operating Schedule:	100	hours/year
Power Rating:	250	hp
Max Hourly Fuel Use:	4.8	gal/hr
Heating Value of No. 2 Fuel Oil[1]:	0.138	MMBtu/gal
Max Hourly Heat Input:	0.7	MMBtu/hr
Annual Heat Input:	66.7	MMBtu/yr

EPN	Heat Input (MMBtu/yr)	Pollutant	Emission Factor (lb/MMBtu)[2]	GHG Mass Emissions (tpy)	Global Warming Potential[3]	CO_2e (tpy)
FWP	66.7	CO_2	163.05	5.44	1	5.44
		CH_4	6.6E-03	0.0002	25	0.006
		N_2O	1.3E-03	0.0000	310	0.014
			Total:	**5.44**		**5.46**

Calculation Procedure

Annual Emission Rate = annual heat Input X Emission Factor X 2.2 lbs/kg X Global Warming Potential / 2,000 lbs/ton

Note

1. *Default high heat value based on Table C-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*
2. *GHG factors based on Tables C-1 and C-2 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*
3. *Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*

Table 3-8

GHG Emission Calculations - Electrical Equipment Insulated With SF_6

Ector County Energy Center

Assumptions

Insulated circuit breaker SF_6 capacity:	240	lb
Estimated annual SF_6 leak rate:	0.5%	by weight
Estimated annual SF_6 mass emission rate:	0.0006	ton/yr
Global Warming Potential[1]:	22,800	
Estimated annual CO_2e emission rate:	13.7	ton/yr

Note

Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.