Statement of Basis
Draft Greenhouse Gas
Prevention of Significant Deterioration
Preconstruction Permit for
Apex Matagorda Energy Center, LLC

Permit Number: PSD-TX-107055-GHG

January 2013

This document serves as the Statement of Basis (SOB) for the above-referenced draft permit, as required by 40 CFR § 124.7. This document sets forth the legal and factual basis for the draft permit conditions and provides references to the statutory or regulatory provisions, including provisions under 40 CFR § 52.21 that will apply if the permit is finalized. This document is intended for use by all parties interested in the permit.

I. Executive Summary

On November 27, 2012, Apex Matagorda Energy Center, LLC (Apex) submitted to EPA Region 6 a Prevention of Significant Deterioration (PSD) permit application for Greenhouse Gas (GHG) emissions for a proposed construction project. On May 28, 2013, Apex submitted additional information for inclusion into the application. In connection with the same proposed construction project, Apex submitted an application for a Standard Permit for Electric Generating Facilities for non-GHG pollutants to the Texas Commission on Environmental Quality (TCEQ). The project proposes to construct a bulk energy storage system that will use compressed air energy storage (CAES) to produce up to 317 MW of electrical power. The Apex facility will be located near Clemville in Matagorda County, Texas. The project proposes to use the compressed air energy storage (CAES) technology developed by Dresser-Rand to produce up to approximately 317 MW of electrical power. The Matagorda facility will consist of two expansion turbine/generating trains each rated at 158.34 MW. GHG pollutants occur primarily from the exhaust emissions from the natural gas combustion turbine trains with minor emissions from fugitive sources and an emergency generator engine. The turbines will be also use selective catalytic reduction (SCR) for reduction of nitrogen oxides and catalytic oxidation to reduce carbon monoxide. After reviewing the application and all pertinent and additional applicant's information, EPA Region 6 has prepared the following SOB and draft air permit to authorize construction of air emission sources at the Matagorda facility.

This SOB documents the information and analysis EPA used to support the decisions EPA made in drafting the air permit. It includes a description of the proposed facility, the applicable air permit requirements, and an analysis showing how the applicant complied with the requirements.

EPA Region 6 concludes that Apex's application is complete and provides the necessary information to demonstrate that the proposed project meets the applicable air permit regulations. EPA's conclusions rely upon information provided in the permit application, supplemental information requested by EPA and provided by Apex, and EPA's own technical analysis. EPA is making all this information available as part of the public record.

II. Applicant

Apex Matagorda Energy Center, LLC
3200 Southwest Freeway, Suite 2210
Houston, Texas 77027

Facility Physical Address:
County Road 417, 0.3 miles south of the intersection of County Road 417 and FM 1468
Clemville, Texas 77414

Contact:
Stephen Naeve
Chief Operating Officer
Apex Matagorda Energy Center, LLC
3200 Southwest Freeway, Suite 2210
Houston, Texas 77027
(713) 963-8104

III. Permitting Authority

On May 3, 2011, EPA published a federal implementation plan that makes EPA Region 6 the PSD permitting authority for the pollutant GHGs. 75 FR 25178 (promulgating 40 CFR § 52.2305). The State of Texas retains approval of its plan and PSD program for pollutants that were subject to regulation before January 2, 2011, i.e., regulated NSR pollutants other than GHGs.

The GHG PSD Permitting Authority for the State of Texas is:

EPA Region 6
1445 Ross Avenue
Dallas, TX 75202

The EPA Region 6 Permit Writer is:

Bonnie Braganza
Air Permitting Section (6PD-R)
(214) 665-7340
Braganza.bonnnie@epa.gov

Facility Location

The Apex Matagorda Energy Center facility is located in Clemville, Matagorda County, Texas, and this area is currently designated "attainment" for all criteria pollutants. The nearest Class 1 areas are the Wichita Mountains Wildlife Refuge, Big Bend National Park, and Breton Wilderness, which are located approximately 400 miles from the site. The geographic coordinates for this proposed facility site are as follows. Figure 1 illustrates the proposed facility location for this draft permit.

Latitude: 28° 59' 14" North
Longitude: -96° 08' 20" West

FIGURE 1
Apex Matagorda Energy Center

IV. Applicability of Prevention of Significant Deterioration (PSD) Regulations

EPA concludes that Apex's application is subject to PSD review for the pollutant GHG, as described at 40 CFR § 52.21(b)(1) and (b)(49)(v). Specifically, under the project, the potential GHG emissions are calculated to exceed the major source threshold on a mass basis, as provided at 40 CFR § 52.21(b)(1), and 100,000 tpy "CO_2-equivalent" (CO_2e), as provided at 40 CFR § 52.21(b)(49)(v). (Apex calculates CO_2e emissions of 459, 131 tpy). EPA Region 6 implements a GHG PSD FIP for Texas under the provisions of 40 CFR § 52.21 (except paragraph (a)(1)). See 40 CFR § 52.2305.

The applicant represents that the proposed project is not a major stationary source for non-GHG pollutants. The applicant also represents that the increases in non-GHG pollutants will not be authorized (and/or have the potential) to exceed the "significant" emissions rates at 40 CFR § 52.21(b)(23). At this time, TCEQ, as the permitting authority for regulated NSR pollutants other than GHGs, has issued the standard permit for electric generating facilities for non-GHG pollutants.[1]

In evaluating this permit application, EPA Region 6 considers the policies and practices reflected in the EPA document entitled "PSD and Title V Permitting Guidance for Greenhouse Gases" (March 2011).

[1] *See* EPA, Question and Answer Document: Issuing Permits for Sources with Dual PSD Permitting Authorities, April 19, 2011, http://www.epa.gov/nsr/ghgdocs/ghgissuedualpermitting.pdf

Consistent with that guidance, we have neither required the applicant to model or conduct ambient monitoring for GHGs, nor have we required any assessment of impacts of GHGs in the context of the additional impacts analysis or Class I area provisions. Instead, EPA determined that compliance with the Best Available Control Technology (BACT) analysis is the best technique that can be employed at present to satisfy the additional impacts analysis and Class I area requirements of the rules related to GHGs. The applicant submitted an impacts analysis of non- GHG pollutants to meet the requirements of 40 CFR §52.21(o), as it may otherwise apply to the project.

V. Project Description

The proposed GHG PSD permit, if finalized, would authorize Apex to construct a new compressed air energy storage (CAES) power plant in Clemville, Matagorda County, Texas to produce up to 317 MW of electrical power. The facility will be known as the Apex Matagorda Energy Center, LLC, referred to within this document as "Apex" or the "Matagorda facility". CAES technology involves two major processes:

(1) Air compression and storage, and
(2) Air release for electricity generation.

During the air compression and storage process, electric motor driven compressors are used to inject air into an underground cavern for storage under high pressure. Electricity is generated by releasing the high-pressure air, heating it with natural gas combustion and expanding the air through sequential turbines (i.e., expanders), which in turn drive an electrical generator.

The site for the plant was selected to accommodate the high pressure storage of air in local underground caverns. The compressed air storage for Apex will be created by drilling a "cavern well" with a cemented well casing at a terminal depth of approximately 3,750 feet. Fresh water withdrawn from local groundwater wells will be pumped down the well to dissolve salt, creating the storage cavern. Salt brine withdrawn from the cavern during this "leaching" process will be injected into existing permitted brine disposal wells on nearby property. This leaching process is carefully controlled to produce a cavern of the desired capacity and shape. The cavern is expected to operate over a wellhead static pressure range of approximately 1,900 to 2,830 pounds per square inch absolute (psia). If full, the cavern will support approximately 100 hours of generation at near full rated output without recharge.

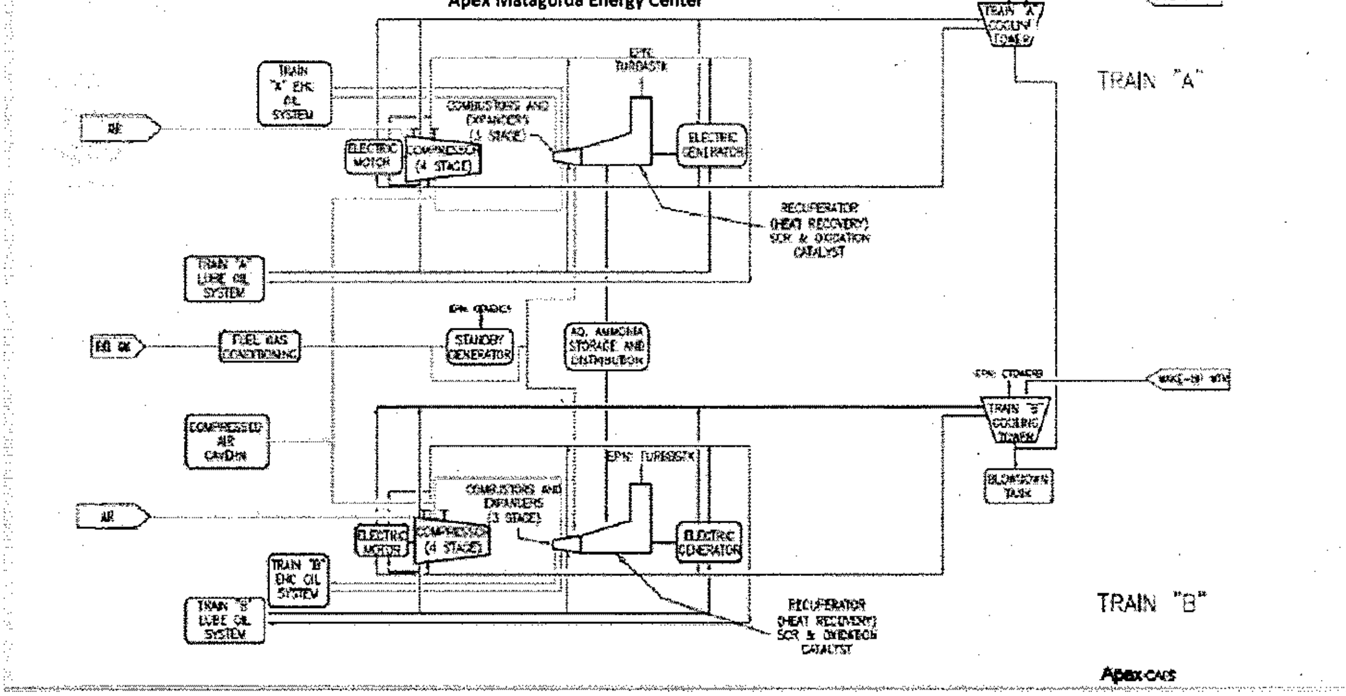
The CAES plant is a hybrid peaking power process using the energy of high pressure compressed air supplemented by natural gas fired multistage expansion turbines to generate electricity. The CAES plant compresses air utilizing grid power during off peak hours to store compressed air and then releases it to generate power to the grid during peak demand. Even though the CAES design includes the features similar to an industrial turbine, the design significantly differs from a conventional gas turbine. While the operation of the expander section for the conventional gas turbine operates at about the same pressure (254 psia) as the lowest pressure (third stage) expander for the CAES turbine/generator, a conventional gas turbine has a compressor and expander operating on a single shaft, resulting in a much narrower turndown ratio than the Apex CAES design. The separation of the compression and expansion functions allows for greater operating flexibility for Apex to meet the Electric Reliability Council of Texas (ERCOT) market demands for energy during peak hours. The CAES multistage turbines operate from a 10% load range to full load at 100% with the ability to reach the required output within 5 minutes.

The Matagorda facility will be comprised of two Dresser-Rand CAES compression trains, each consisting of a set of multi-stage compressors driven by a dedicated 150 MW (nominal rating) electric motor. Each compression train will be capable of producing up to 1.4 million pounds per hour of air at a compressor outlet pressure of up to 2,830 psia. The process flow diagram for the Matagorda facility is shown in Figure 2. It depicts the compressors operating at design basis compression under summer ambient conditions and assuming a "near" full cavern. Compression occurs in four stages. Because compression of air results in an increase in temperature, it is necessary to cool the air between the stages. Such cooling is accomplished via two heat rejection processes – an "air to air" heat exchanger and conventional shell and tube air to water heat exchangers, with the cooling duty split approximately 50/50 between each cooling method. Heated water from this process will be cooled in a conventional mechanical draft cooling tower. Make-up water to the cooling tower will be sourced from fresh water wells to be drilled in advance of plant operation to provide water for the cavern leaching process or from the Lower Colorado River. Cooling tower blowdown will be discharged to Tres Palacios River. Maximum daily water consumption is expected to be approximately one million gallons. Annual water requirements are expected to be approximately 400 acre feet.

For power generation, the Matagorda facility will utilize two Dresser Rand expansion turbine/generator trains (FIN/EPN TURBTRNA/TURBASTKA, TURBTRNB/TURBASTKB), each rated at 158.34 MW output at full load. The total generating capacity of the plant will be 317 MW (nominal power rating). High pressure air from the cavern passes sequentially through the three expanders, performing work (accompanied by a reduction in pressure) as the air flows through each stage of expansion.

Figure 2

Apex Matagorda Energy Center



Each expansion train at the Matagorda Energy Center will use three expanders, operating on a single shaft, connected to the generator during the expansion/generation process. High pressure (HP) air from the cavern passes sequentially through the three expanders (accompanied by a reduction in pressure) as the air flows through each stage of expansion. The Matagorda facility uses a HP topping turbine as the first stage of expansion followed by the HP intermediate stage and the low pressure (LP) stage of expansion operates at an inlet pressure of 228 psia.

At maximum generator output, approximately 400 lbm/second of air from the cavern header passes through a recuperator, where the air is preheated to a temperature of 600°F (degrees Fahrenheit) before entering the topping turbine at a turbine inlet pressure of approximately 2,170 psia (at full rated output). Air is expanded in the topping turbine, resulting in a temperature and pressure drop. The air next flows to one of two HP combustors. Pipeline quality natural gas is burned with the preheated air (from the recuperator) in the combustors, and the resultant heated gases enter the HP expanders at approximately 1,000°F and 800 psia. The gases exit the HP expanders to the last stage LP combustor, where additional natural gas is burned to increase the gas temperature for further expansion in the LP expander. Energy efficiency for this process is increased by making use of the heat from the flue gas to preheat the air to the combustors via the recuperator. The gases from the recuperator exhaust to the stack (EPN TURBASTK & TURBBSTK).

The addition of a topping turbine is a design feature unique to the Matagorda facility and is made possible by the high pressure of the cavern at the plant. Apex chose this location on the basis of numerous site-specific geological and economic parameters, including ERCOT power market considerations, which is distinctively different from the existing CAES installation in McIntosh, Alabama (or at other sites which have been studied for CAES installation).

The proposed Apex Matagorda Energy Center will also have a 740 kW emergency generator engine fired with natural gas (rich burn) and will utilize non-selective catalytic reduction (NSCR) for NOx reduction. The permit will restrict operation of the generator, including maintenance and reliability testing, to 50 hours per year.

There will be minor GHG fugitive emissions from equipment leaks and sulfur hexafluoride from the circuit breakers. Also there will be maintenance emissions from the natural gas pipeline/metering station that will vent four times a year.

Non-GHG emitting equipment consists of the cooling towers that cool compressed air and a 10,000 gallon 19% aqueous ammonia solution used for SCR to control NOx emissions from the combustors. The ammonia tank will be filled by vapor balance and will not have open vents; therefore, the ammonia delivery system only has fugitive emissions.

VI. BACT Analysis

The BACT analyses for this draft permit were conducted in accordance with EPA's *PSD and Title V Permitting Guidance for Greenhouse Gases* (March 2011), which outlines the steps for conducting a "top-down" BACT analysis. Those steps are listed below.

1) Identify all available control options;

2) Eliminate technically infeasible control options;

3) Rank remaining control technologies by control effectiveness;

4) Evaluate the most effective controls (taking into account the energy, environmental, and economic impacts) and document the results; and

5) Select BACT.

Before discussing the BACT for the individual pieces of equipment, Apex provided a discussion on the need for grid level energy storage in the power (ERCOT) market for a quick response capability to supply electricity during peak demand. The CAES plant compresses air utilizing grid power during off peak hours to store compressed air and then releases it to generate power to the grid during peak demand. Apex indicates that at this time there are only two technologies, CAES and hydroelectric, that are commercially available and can provide sufficient storage capacity to be of value at the bulk power level. Apex conducted an evaluation of more than 20 potential sites in west and southeast Texas to identify potential cavern creation opportunities before selecting the Matagorda Energy Center site. The Matagorda Energy Center site was chosen for development of a CAES facility due to the presence of suitable geologic conditions, existing gas and electric transmission lines crossing the property, existing infrastructure to support cavern creation, and availability of groundwater as a water source.

Other commercially available technologies such as conventional gas turbine generation, wind, and solar are intermittent power sources and do not always provide the grid operator's need for flexible "standby" resources capable of responding quickly to deviations in system frequency. Therefore these technologies will not be evaluated in this BACT discussion, since Apex determined that the proposed project utilizing CAES meets all the Matagorda Energy Center requirements for economic operation within the ERCOT market. This is consistent with EPA's March 2011 *PSD and Title V Permitting Guidance for Greenhouse Gases,* which states, "EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant…", and "…the permitting authority should keep in mind that BACT, in most cases, should not regulate the applicant's purpose or objective for the proposed facility…" (p. 26). Nonetheless, it should be noted that the Apex Matagorda Energy Center is intending to provide secure, reliable capacity to the grid, assisting the grid operator in coping with the intermittent nature of solar and wind generation and other renewable generation.

Applicable Emission Units for BACT Analysis

The units/activities that directly or indirectly emit GHG emissions are:

- Gas Expansion Turbines (EPNs: TURBASTK and TURBBSTK)
- Fugitives (EPN: FUG1))
- Natural Gas Maintenance Purges (EPN: MAINT1)
- Emergency Generator (EPN: GENENG1)

1. Gas Expansion Turbines (EPNs: TURBASTK and TURBBSTK)

The Apex Matagorda Energy Center will have two expansion turbine trains, with each train having a separate exhaust stack with a CO_2 analyzer. The turbines will utilize pipeline quality natural gas for combustion. Apex has estimated that the facility will have a maximum annual throughput of 7,807,409 MMBtu of natural gas for the combined trains with total CO_2 emissions of 456,296 tpy. This does not include natural gas usage at other sources such as the emergency generator. The combustion turbines will be using SCR and oxidation catalyst which will increase the GHG pollutants by a small amount.

The estimated emissions from the turbines of N_2O and CH_4 as CO_2e comprise about 0.54% of the total CO_2e from the turbines. Therefore the BACT analyses will focus primarily on technology to reduce CO_2 emissions. As part of the PSD review, Apex provided a five-step top-down BACT analysis for the combustion turbines in the GHG permit application. EPA has reviewed Apex's BACT analysis for the gas expansion turbine trains, which has been incorporated into this Statement of Basis, and also provides its own analysis in setting forth BACT for this proposed permit as summarized below.

Step 1 – Identify All Available Control Options

- *Carbon Capture Sequestration (CCS)* – CCS is an available add-on control technology that is applicable for all of the site's affected combustion units.
- *Use of a Low Carbon Fuel for Combustion*
- *Electrical Generation Conversion Efficiency* – the formation of GHGs can be mitigated by design and selection of ultra-efficient combustion units.
- *Operational Energy Efficiency* – Good combustion, operating and maintenance practices are a potential control option for improving the fuel efficiency of affected combustion units.

Carbon capture and storage is a GHG control process that can be used by facilities emitting CO_2 in large concentrations, including fossil fuel-fired power plants, and for industrial facilities with high-purity CO_2 streams (e.g., hydrogen production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing).[2] CCS systems involve the use of adsorption or absorption processes to remove CO_2 from flue gas with subsequent desorption to produce a concentrated CO_2 stream. The three main capture technologies for CCS are pre-combustion capture, post-combustion capture, and oxyfuel combustion (IPCC, 2005). Of these approaches, pre-combustion capture is applicable primarily to gasification plants where solid fuel such as coal is converted into gaseous components by applying heat under pressure in the presence of steam and oxygen (U.S. Department of Energy, 2011). At this time, oxyfuel combustion has not yet reached a commercial stage of deployment for gas turbine applications and still requires the development of oxy-fuel combustors and other components with higher temperature tolerances (IPCC, 2005). Accordingly, pre-combustion capture and oxyfuel combustion are not considered available control options for this proposed gas turbine facility; the third approach, post-combustion capture, is available to gas turbines.

With respect to post-combustion capture, a number of methods may potentially be used for separating the CO_2 from the exhaust gas stream, including adsorption, physical absorption, chemical absorption, cryogenic separation, and membrane separation (Wang et al., 2011). Many of these methods are either still in development or are not suitable for treating power plant flue gas due to the characteristics of the exhaust stream (Wang, 2011; IPCC, 2005). Of the potentially applicable technologies, post-combustion capture with an amine solvent such as monoethanolamine (MEA) is currently the preferred option because it is the most mature and well-documented technology (Kvamsdal et al., 2011), and it offers high capture efficiency, high selectivity, and the lowest energy use compared to the other existing processes (IPCC, 2005). Post-combustion capture using MEA is also the only process known to have been previously demonstrated in practice on gas turbines (Reddy, Scherffius, Freguia, & Roberts, 2003). As such, post-combustion capture is the sole carbon capture technology considered in this BACT analysis.

[2] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *PSD and Title V Permitting Guidance for Greenhouse Gases*, March 2011, <http:/www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf> (March 2011)

Once CO_2 is captured from the flue gas, the captured CO_2 is compressed to 100 atmospheres (atm) or higher for ease of transport (usually by pipeline). The CO_2 would then be transported to an appropriate location for underground injection into a suitable geological storage reservoir, such as a deep saline aquifer or depleted coal seam, or used in crude oil production for enhanced oil recovery (EOR). There is a large body of ongoing research and field studies focused on developing better understanding of the science and technologies for CO_2 storage.[3]

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible for this project, except for CCS.

- **Carbon Capture and Storage (CCS)**

Apex estimated the CO_2 concentration in the turbine exhaust stacks would be in the range of 1.7 – 3.5%, based on fuel consumption and stack flow of 99,000 to 453,000 acfm at a temperature of 230^0F. CCS has not been demonstrated in practice on emissions streams like this that are more dilute in CO_2 concentration derived in a peaking capacity mode with a limited number of operable hours in any given year. EPA expects that the technical challenges of capturing a 3.5% or less concentrated CO_2 stream are exacerbated when a combustion turbine unit is operated intermittently and therefore the CO_2 stream is more cyclic in nature rather than steady state. Currently, the technical feasibility of operating a CCS system in a "start/stop" mode has not been demonstrated. Fluor has built a new demonstration project in Germany to capture CO_2 in a flue stream from a coal-fired power station where the key feature of the pilot plant is a "one button start/stop" concept that allows the plant to automatically come on line when the power plant operator wants to capture CO_2. Since this type of "start/stop" operational process has not yet been demonstrated for combustion turbine power plants that operate intermittently when dispatched for peak demand electricity, we do not believe CCS is technically feasible for proposed Apex project.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

Other than CCS, which was eliminated in Step 2 above, the remaining technologies to reduce GHG are being evaluated for this project and we will rank these measures in Step 4.

Step 4 – Evaluation of Control Options in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

Use of a Low Carbon Fuel

Apex proposes to use natural gas for combustion in the turbine expanders. The only other low carbon combustion fuel is hydrogen and this is not commercially available at this particular site. Typically hydrogen gas is a byproduct process vent gas in large chemical and refining plants and enters the plant fuel grid system. In this project, there are no processes that produce hydrogen and therefore natural gas is the commercially available low carbon fuel for combustion.

Energy Efficiency Design Measures for the Turbines/Generators

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[3] U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory *Carbon Sequestration Program: Technology Program Plan*, <http://www.netl.doe.gov/technologies/carbon_seq/refshelf/2011_Sequestration_Program_Plan.pdf>, February 2011

The Matagorda facility is designed to utilize high-efficiency, state-of-the-art, expansion turbines and associated combustors. Table 4 lists designs of CAES power generation plants.

Table 4

	Apex	Chamisa CAES[1]	McIntosh[2]	Huntorf[2]
Power Production Capacity, MW	317 (total of 2 trains)	280 (total of 2 trains)	110	290
Heat Rate at Maximum Production, BTU	4,262 (gross)-4,390 (net)	4,389 (gross)-4,502 (net)	4,555	6,175
Design Recuperator Efficiency,%	90	90	70	N/A (no
No. of Expanders	3	2	2	2
Cavern Pressure,	1,900-2,830	940-1,800	1,100	600-1,000
Hours of Storage	100	36 - 48	26	3-4

1. *Chamisa is a current Region 6 permit application that is being processed for a permit*
2. *Both of these plants are operating*
3. *The Apex and Chamisa heat rates do not reflect the 3% adjustment for performance degradation*

Energy efficiency is normally expressed in terms of heat rate. The Apex turbine trains have an estimated heat rate of 4,390 BTU/kWh at maximum load and 4,773 BTU/kWh at low load (HHV basis). The heat rates have been adjusted to reflect 3% degradation between system overhauls (per Dresser-Rand guidance). The energy efficiency for Apex is reflective of heat input divided by generator output measured at the generator terminals. Performance figures for Apex reflect site conditions at 60°F. There are two CAES facilities in operation worldwide: McIntosh in Alabama and the Huntorf facility in Germany. The addition of a topping turbine is a design feature not present in the two operational CAES plants and allows for greater efficiency. Huntorf, completed in 1978, is a 290 MW facility designed and built by Brown Boveri Corporation (now a component of Asea Brown Boveri (ABB)). Huntorf was originally built to provide peaking power service, as well as black-start capability for nuclear power units in the region. Today the plant has increasingly seen use to help balance wind generation in northern Germany. Huntorf was constructed without a recuperator in order to minimize system start-up time. The table above also lists one proposed facility (Chamisa CAES at Tulia, LLC) currently going through the construction permitting process. The Chamisa facility will have a two stage expander like McIntosh.

McIntosh was placed in commercial operation in 1991 as a single train CAES facility, rated at 110-MW output. McIntosh used a novel "motor/generator", whereby a single electrical machine fulfilled dual roles as a motor for compressing and as a generator when operating in the expansion mode. As with Apex the compressor is electric driven with no GHG emissions and the expanders are natural gas combustors from Dresser-Rand. It should also be noted that the cavern air storage pressures are considerably higher for the Apex plant which also provides for additional storage for extended power generation.

The expander train design features the HP and LP expanders and associated combustors at Apex, which are very similar to the McIntosh equipment with one exception – the Apex design has an additional HP topping turbine to accommodate the higher cavern well-head pressure. Also, the Apex HP expander will operate at a higher full load inlet pressure than McIntosh (800 psia vs. 630 psia at McIntosh), and, the Apex combustors will use SCR for NO_X control unlike the McIntosh plant.

The most important contributor to optimizing the energy efficiency for Apex is the improved recuperator efficiency at Matagorda Energy Center (90% for Apex versus 70% for McIntosh). Other design changes have a meaningful impact on output (and hence capital cost on a $/kW basis) and specific air consumption, but they do not affect heat rate materially. The heat rate advantage of Apex in table 4 above supports a determination that Apex will have energy conversion efficiency higher than CAES units currently in existence.

As shown in table 4, the heat rate for Apex represents a 31 percent improvement in comparison to Huntorf and a 6 percent improvement in comparison to McIntosh. The design heat rate for Apex (not adjusted for equipment degradation) was used for this computation, to be consistent with data available for the other two operating and one proposed CAES installations.

Separating the compressor from the combustion expander and generator has additional advantages such as utilizing an electric compressor with no GHG emissions during non-peak hours for the compression of air and, when necessary for additional power generation, having both operations (compression and generation) at the same time.

Operational Energy Efficiency

Additional BACT considerations are good operating and maintenance practices to ensure complete combustion of the natural gas fuel maximize heat recovery by monitoring the exit flue gas parameters to optimize the air/fuel ratio in the combustors. The design and maintenance will take into consideration insulation materials to minimize heat loss from the expanders, combustors, ducts, and the recuperator. Heat loss from the expanders and combustors will be further mitigated by the fact that these components will be housed within a building, i.e., not exposed to the elements.

Step 5 – Selection of BACT

The following are the specific BACT limits and conditions for the combustion turbines.

1. BACT output limit of 558 lbs CO_2/MWh) for both trains on a 12-month rolling average.
2. Combustion efficiency of 4773 BTU/kWh for all combustors on a 12-month rolling average.
3. Good maintenance practices according to the vendor's recommendation attached to the permit.
4. Insulation and maintenance of insulation on all combustors and recuperators for minimizing heat loss.
5. Process controls and instrumentation to optimize fuel/air rations and minimize fuel gas use.
6. Maximum heat input to the turbine will not exceed 695MMBtu/hr.

The proposed BACT limit of 558 lbs CO_2/MWh directly measures and reflects the overall process efficiency of the gas expansion turbine trains. The limit proposed takes into account the range of loads from the lowest sustainable load of 25% to 100% load, which reflects the highest production rate of CO_2 over the full operational range. These values reflect a maximum 3% deterioration in turbine performance between overhauls. Over the operating range of 44% to 100% load, the vendor performance data indicates a heat rate of 4,390 to 4,499 Btu (HHV)/kWh, inclusive of the aforementioned degradation adjustment. At lower loads, the heat rate would gradually increase to a maximum of 4,773 Btu (HHV)/kWh) at the lowest sustainable load (11%), which is the permit limit in the draft permit.

2. Emergency Engine (EPN: GENENG1)

In addition to the two combustion turbine trains planned for the Matagorda Energy Center, one natural gas-fired emergency generator (nominal 1,053-BHP engine with estimated emissions of 23 CO_2e tpy) will operate at the plant.

Step 1 – Identification of Potential Control Technologies

The available control technologies for the natural gas generator are identical to those identified for the combustion turbines. These options include:

- Carbon Capture and Storage Systems (CCS)
- Generator Engine Design Efficiency
- Use of a Low Carbon Fuel

Step 2 – Elimination of Technically Infeasible Alternatives

- *Carbon Capture and Storage* – As discussed above, CCS for GHG control has been eliminated as a not technically feasible control option for an emergency generator that has intermittent operations for only 50 hours/year. Therefore, CCS is eliminated from further consideration for natural gas emergency generator engine GHG reduction.
- *Generator Engine Design Efficiency* – The natural gas generator engine for the Matagorda Energy Center will incorporate a high-efficiency design. The table below provides a comparison of similar sized gas fired units from different manufacturers. The annual CO_2e emissions difference between the two units is approximately 1.1 tons per year. The Caterpillar unit selected by Apex, prior to add-on NSCR controls, provides lower NOx and VOC emissions than the Waukesha counterpart. With the addition of NSCR controls, the NOx, VOC, and CO emissions are substantially lower. Thus, the criteria pollutant emissions reductions were determined to be an acceptable trade-off, with more overall benefit to the environment, than a slightly better efficiency (Btu/bhp-hr) with the Waukesha unit.

	Selected Generator Caterpillar G3516SITA	Similar Generator Waukesha VHP7100G
kW (bhp)	740 (1,053)	725 (1,025)
Btu/bhp-hr	7,391	7,223
Fuel Use (scf/hr)	8,600	8,181

- *Efficient Use of Energy* – The natural gas generator engine will not be operated continuously, but only during maintenance testing and during emergencies for backup power generation. Therefore, energy will be utilized in an efficient manner.
- *Use of Low Carbon Fuel* – The generator will use natural gas for fuel instead of diesel that is typically used for emergency generators. The use of natural gas yields the lowest emissions of GHG.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

The remaining technically feasible GHG control technologies for the Matagorda Energy Center are "Efficient Use of Energy" and "Use of Low Carbon Fuel." These technologies are equally important toward minimizing GHG emissions.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

The remaining technically feasible GHG control technologies are "Efficient Use of Energy" and "Use of Low Carbon Fuel." These technologies will be implemented for the generator engine.

Step 5 – Selection of BACT

The following are the BACT requirements for the diesel-fired emergency generators:

- *Low Carbon Fuel* – The emergency engine will be natural gas-fired.
- *Efficient Use of Energy*: Good combustion practices for compression ignition engines include appropriate maintenance of equipment, periodic testing, and operations within the recommended air to fuel ratio, as specified by its design. Engines have an operational limit of 50 hours per year and will meet the NSPS 40 CFR 60 JJJJ requirement.

3. Fugitive Emissions (EPN: FUG1)

In addition to the combustion sources planned for the Matagorda Energy Center, there are hydrocarbon emissions from leaking piping components, which include methane emissions from the natural gas pipeline. There are also sulfur hexafluoride (SF6) leaks from circuit breakers. Although this is a small source with an estimated 248 tpy CO_2e or 0.05 percent of the total site emissions, for completeness, fugitive emissions are addressed in this BACT analysis.

a. CH_4 Fugitives from piping and equipment components

Step 1 – Identification of Potential Control Technologies for GHGs

The available control technologies for process fugitive emissions are as follows

- Installing Leakless Technology and high quality components and materials of construction to minimize fugitive emission sources
- Implementing a Leak Detection and Repair (LDAR) Program using traditional flame ionization detector (FID), new infrared (IR) camera technology or handheld analyzer to detect methane emissions.
- Comprehensive Maintenance program consisting of a monthly walk-through to check for leaks, with repairs or replacement completed within 15 days and records documenting the program and leaks made available upon inspection.

Step 2 – Elimination of Technically Infeasible Alternatives

Leakless Technology – Apex will use welded piping where possible, high quality components and materials for design and construction of the Matagorda Energy Center. The cost of implementing this will be included in the cost of construction. Other components such as flanges and valves inherently cannot be leakless, and the facility cannot be constructed, operated or maintained without the use of flanges and valves. Therefore installing leakless technology is technically infeasible for controlling process fugitive GHG emissions from flanges and valves.

LDAR Programs – LDAR programs are a technically feasible option for controlling process fugitive GHG emissions from components in natural gas service.

The *Comprehensive Maintenance* program is feasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

All the above BACT technologies with the exception of leakless design for flanges and valves are technically feasible and effective to minimize GHG emissions.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

LDAR Programs – There are varied levels of stringency in LDAR programs for controlling volatile organic compound (VOC) emissions. However, because of the extremely small amount of GHG emissions from the fugitive sources, an LDAR program would not be considered for control of GHG emissions alone but in conjunction with an already existing LDAR program. This evaluation does not compare the effectiveness of different levels of LDAR programs.

Although technically feasible, the use of an LDAR program to control the small amount of GHG emissions from the fugitive sources at the Matagorda Energy Center is not cost effective.
Based on an estimate from an LDAR company, assuming that this site would be similar to a smaller gas plant subject to 40 CFR Part 60, Subpart KKK with around 600 quarterly components to monitor the cost would be as follows:

- $16,000 for the first year, which includes tagging and initial monitoring
- $12,000 for annual monitoring

Control costs are evaluated based on cost effectiveness calculated as annual cost per ton of pollutant removed. Additional costs would be incurred for multiple calibrations of the IR camera if used to also detect leaks of SF_6 which have not been included. Based on this cost estimate, Apex believes the use of an LDAR or LDAR like program would not be cost effective for the Matagorda Energy Center. The comprehensive equipment maintenance program will have similar reduction percentages and costs can be rolled into normal operations without additional capital. Apex suggests the comprehensive equipment maintenance program will be more cost effective. Therefore, an LDAR program can be eliminated based on economic feasibility

Comprehensive auditory, visual and olfactory (AVO) *Maintenance Program* – Another option for minimizing fugitive emission is to apply a comprehensive equipment maintenance program. The cost of this program would be rolled into the normal operation and maintenance of the facility. The comprehensive equipment maintenance program will have similar reduction percentages to a LDAR program and the associated costs can be rolled into normal operations without additional capital. Therefore, an LDAR program can be eliminated.

The comprehensive maintenance program proposed by Apex will include periodic inspections for leaks using AVO methods to find leaks. Elements of the program include at a minimum the following:

- Daily walk through using AVO to identify leaks;
- First attempt to repair within 5 days and repair or replace within 15 days;
- Exceptions for components that require a process unit shut down or waiting on parts to repair or replace;
- Records of leaks and repairs shall be kept and made available upon request.

Step 5 – Selection of BACT

BACT is determined to be the comprehensive maintenance program as proposed by Apex using AVO to determine leakers on a daily basis.

b. SF_6 Insulated Electrical Equipment

SF_6 is commonly used in circuit breakers associated with electricity generation equipment. The capacity of the circuit breakers associated with the proposed plant is currently estimated to be 2,190 lb of SF_6.

Step 1 – Identification of Potential Control Technologies for GHGs

- *Evaluating alternative substances to SF6 (e.g., oil or air blast circuit breakers);*
- *Use of new and state-of-the-art circuit breakers that are gas-tight and require less* SF_6
- *Implementing a leak detection program, such as a LDAR program or an equivalent program to identify and repair leaks and leaking equipment as quickly as possible.*

Step 2 – Elimination of Technically Infeasible Alternatives

According to the report NIST Technical Note 1425[4], SF_6 is a superior dielectric gas for nearly all high voltage applications. It is easy to use, exhibits exceptional insulation and arc-interruption properties, and has proven its performance by many years of use and investigation. It is clearly superior in performance to the air and oil insulated equipment used prior to the development of SF_6 insulated equipment. The report concluded that although "…various gas mixtures show considerable promise for use in new equipment, particularly if the equipment is designed specifically for use with a gas mixture…it is clear that a significant amount of research must be performed for any new gas or gas mixture to be used in electrical equipment". Therefore, there are currently no technically feasible options besides the use of SF_6.

The traditional LDAR program using a Flame ionization detector (FID) will not detect SF_6. An Infrared camera can detect leaks of SF_6 if calibrated for SF_6. The alternate leak detection program of a low pressure alarm, lockout and inventory accounting program (40 CFR § 98.303(a), Equation DD-1), is an alternate operation for the enclosed pressure circuit breakers.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

The remaining control options are not mutually exclusive and are all evaluated in Step 4.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with

Consideration of Economic, Energy, and Environmental Impacts

Energy, environmental, or economic impacts are not addressed because the use of alternative, non-greenhouse gas substance for SF_6 as the dielectric material in the breakers is not technically feasible.

Step 5 – Selection of BACT

The following are the specific BACT requirements for the SF_6 Insulated Electrical Equipment:

- The use of state-of-the-art enclosed-pressure SF_6 circuit breakers. The circuit breakers will be designed to meet the latest of the American National Standards Institute (ANSI) and C37.013 standard for high voltage circuit breakers.[5]
- Installation of a low pressure alarm and low pressure lockout device. This alarm will function as an early detector that will detect potential fugitive SF_6 emission problems before a substantial portion of the SF_6 is released. The lockout prevents any operation of the breaker due to the lack of "quenching and cooling" SF_6.
- Adoption of an inventory accounting program per 40 CFR §98.303.

4. Natural Gas Maintenance Purges (EPN: MAINT1)

Quarterly maintenance purges from the natural gas supply have been conservatively estimated at 1.01tpy of methane, equivalent to 25.25 tons/yr of CO_2e.

[4] Christophorous, L.G., J.K. Olthoff, and D.S. Green, *Gases for Electrical Insulation and Arc Interruption: Possible Present and Future Alternatives to Pure SF_6*. NIST Technical Note 1425, Nov. 1997. Available at http://www.epa.gov/electricpower-sf6/documents/new_report_final.pdf

[5] ANSI Standard C37.013, *Standard for AC High-Voltage Generator Circuit Breakers on a Symmetrical Current.*

Step 1 – Identification of Potential Control Technologies for GHGs

- *Use of a Flare or other Control Device*
- *Minimization of Purges*

Step 2 – Elimination of Technically Infeasible Alternatives

Both options are considered technically feasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- Flaring of maintenance purges would reduce CH_4 and other hydrocarbons by 98%, CO_2e emissions would be reduced by 81% since the combustion of the hydrocarbon emissions would result in the formation of CO_2.
- Minimizing purges would cause fewer emissions.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

Rental and operation of a portable flare once per quarter for the maintenance purge has been estimated by Apex to cost approximately $3,500 per quarter or $14,000 annually. This cost will reduce methane emissions by 98% 0.0125tpyI and is eliminated as being not economical since minimizing the duration of the purges by good design in minimizing the length of piping to be purged and limiting the purges to four per year will yield the same reductions . This is a better alternative than the environmental logistics for rental of a portable flare.

Step 5 – Selection of BACT

BACT consists of good design to minimize the length of piping to be purged and minimizing the purging to once every quarter. The purges are a necessity for safe operation of the plant.

VII. Compliance Monitoring:

Turbine Generators:

1. All continuous emission monitoring, instrumentation and metering equipment should meet specification requirements of 40 CFR § 75.10 and 40 CFR § 98.34 and subpart D requirements.
2. CO_2 analyzer in the stack to meet requirements of 40 CFR § 75.10(a)(3)-(5).
3. Monitor the fuel flow rate to the turbines to meet requirements in 40 CFR § 75.10, with an operational non-resettable elapsed flow meter.
4. Determine the specific fuel factor for the Fc and the Gross Calorific Value (GCV)(HHV) on a semi-annual basis using the equation F-7b in 40 CFR Part 75, Appendix F § 3.3.6.
5. Monitor and record the startup and shutdown events to include the duration and CO_2 emissions per event.
6. Use the CO_2 CEMS to determine compliance with the 558 lbs CO_2/MWH on a 12 month rolling average.
7. Monitor and record the MMBTU/kWh to be less than 4773 on a 12 month rolling average.

8. Monitor the fuel flow rate to each turbine combustor as not to exceed the maximum heat input of 695.1MMBtu/hr.
9. Maintain the turbines according to manufacturer's recommendation for optimum performance. Keep all records of maintenance.
10. Conduct an initial test to demonstrate the turbine efficiency according to the conditions specified in the permit. Determine and record the stack temperature, flow rate and other parameters associated with the recuperator at various turbine rates of 10%, 50% and 90% capacity.
11. Compliance during startup and shutdown activities. BACT applies during all periods of turbine operations and monitoring of the duration of the startup and shutdown activities. The fuel rate and duration of startup should be monitored during the event and should be minimized by limiting the duration of the operation. The total emission rate of 458,886 tpy CO_2e is estimated based on 365 startups/shutdowns for each turbine per year. Each startup will be limited to duration of 30 minutes and shutdowns to 3 minutes per event.
12. Regular maintenance on the turbine trains as specified in the permit and manufacturer's recommendations.

Emergency Generator:

1. Monitor and record the fuel flow rate and duration in hours used for reliability testing.
2. Monitor and record the fuel used and duration in hours used for emergency events.
3. Maintain and operate according to manufacturer's requirements. These documents should be readily available at the plant site and provided to an inspector.

Fugitive and Maintenance Emissions:

1. Keep records of the monitoring of the fugitive emissions of the natural gas pipelines to include the dates, the number of leakers, attempt at repair, and when repair was completed.
2. Keep records of the duration and number of events of pipeline purging for maintenance.
3. For SF_6, the emissions shall be calculated annually in accordance with the mass balance approach provided in 40 CFR § 98.303(a), Equation DD-1. All reports of maintenance performed and compliance with the Monitoring and Quality Assurance and Quality Control (QA/QC) procedures in 40 CFR § 98.304.
4. Keep records of the low pressure alarms and lockout occurrences and of possible releases to the atmosphere of SF_6 using the equation on 40 CFR § 98.303(a), Equation DD-1, and the action taken to fix the problem.

VIII. Endangered Species Act (ESA)

Pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1536) and its implementing regulations at 50 CFR Part 402, EPA is required to insure that any action authorized, funded, or carried out by EPA is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species or result in the destruction or adverse modification of such species' designated critical habitat.

To meet the requirements of Section 7, EPA is relying on a Biological Assessment (BA) prepared by the applicant, APEX Matagorda Energy Center, LLC ("APEX"), and its consultant, CH2M Hill, and adopted by EPA.

A draft BA has identified seventeen (17) species listed as federally endangered or threatened in Matagorda County, Texas:

Federally Listed Species for Matagorda County by the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD)	**Scientific Name**
Birds	
Northern Aplomado Falcon Piping plover Eskimo Curlew Sprague's pipet* Whooping crane	*Falco femoralis septentrionalis* *Charadrius melodus* *Numenius borealis* *Anthus spragueii* *Grus americana*
Fish	
Smalltooth Sawfish	*Pristis pectinata*
Mollusks	
Smooth Pimpleback*	*Quadrula houstonensis*
Texas Fawnsfoot*	*Truncilla macrodon*
Mammals	
Louisiana black bear Red wolf Ocelot	*Ursus americanus luteolus* *Canis rufus* *Leopardus pardalis*
Marine Mammals	
West Indian Manatee	*Trichechus manatus*
Reptiles	
Green Sea Turtle Kemp's Ridley Sea Turtle Leatherback Sea Turtle Loggerhead Sea Turtle Atlantic Hawksbill Sea Turtle	*Chelonia mydas* *Lepidochelys kempii* *Dermochelys coriacea* *Caretta caretta* *Eretmochelys imbricata*

*listed as federal candidate species

EPA has determined that issuance of the proposed permit will have no effect on any of the nine listed species, as there are no records of occurrence, no designated critical habitat, nor potential suitable habitat for any of these species within the action area.

Because of EPA's "no effect" determination, no further consultation with the USFWS is needed.

Any interested party is welcome to bring particular concerns or information to our attention regarding this project's potential effect on listed species. The final draft biological assessment can be found at EPA's Region 6 Air Permits website at http://yosemite.epa.gov/r6/Apermit.nsf/AirP.

IX. National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires EPA to consider the effects of this permit action on properties eligible for inclusion in the National Register of Historic Places. To make this determination, EPA relied on a cultural resource report prepared by William Self Associates, Inc. (WSA) on behalf of APEX's consultant, CH2M Hill, Inc. (CH2M Hill), submitted on April 18, 2013.

For purposes of the NHPA review, the Area of Potential Effect (APE) was determined to be approximately 61.3 acres of land that contains the construction footprint of the project, two water well locations, a proposed wastewater pipeline route, a proposed compressed air pipeline route, and a proposed freshwater/brine pipeline route. WSA conducted a field survey, including shovel testing, of the property and desktop review within a 0.5-mile radius area of potential effect (APE). This review included a search of the Texas Historical Commission's online Texas Archaeological Site Atlas (TASA). Based on the desktop review for the site, eight (8) architectural/archaeological sites, including an irrigation ditch and pump house that are components of a larger NHRP-eligible irrigation system, were identified; only the irrigation ditch and the pump house are potentially eligible or eligible for listing in the National Register (NR). All of the sites except for the ditch are outside of the APE. Based on the results of the field survey of the APE, one newly recorded historic-age archaeological site was identified; however, this site was recommended to be ineligible for listing on the NR.

EPA Region 6 determines that while there are cultural materials of historic age identified within the 0.5-mile radius of the project area, issuance of the permit to APEX will not affect properties eligible or potentially eligible for listing on the National Register. Additionally, no historic properties are located within the APE and that a potential for the location of archaeological resources is low within the construction footprint itself.

On December 31, 2013, EPA sent letters to Indian tribes identified by the Texas Historical Commission as having historical interests in Texas to inquire if any of the tribes have historical interest in the particular location of the project and to inquire whether any of the tribes wished to consult with EPA in the Section 106 process. EPA received no requests from any tribe to consult on this proposed permit. EPA will provide a copy of the report to the State Historic Preservation Officer for consultation and concurrence with its determination. Any interested party is welcome to bring particular concerns or information to our attention regarding this project's potential effect on historic properties. A copy of the report may be found at: http://yosemite.epa.gov/r6/Apermit.nsf/AirP

X. Environmental Justice (EJ)

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive branch policy on environmental justice. Based on this Executive Order, the EPA's Environmental Appeals Board (EAB) has held that environmental justice issues must be considered in connection with the issuance of federal Prevention of Significant Deterioration (PSD) permits issued by the EPA Regional Offices [See, e.g., *In re Prairie State Generating Company*, 13 E.A.D. 1, 123 (EAB 2006); *In re Knauf Fiber Glass*, Gmbh, 8 E.A.D. 121, 174-75 (EAB 1999)]. This permitting action, if finalized, authorizes emissions of GHG, controlled by what we have determined is the Best Available Control Technology for those emissions. It does not select environmental controls for any other pollutants. Unlike the criteria pollutants for which the EPA has historically issued PSD permits, there is no National Ambient Air Quality Standard (NAAQS) for GHGs. The global climate-change inducing effects of GHG emissions, according to the "Endangerment and Cause or Contribute Finding", are far-reaching and multi-dimensional (75 FR 66497). Climate change modeling and evaluations of risks and impacts are typically conducted for changes in emissions that are orders of magnitude larger than the emissions from individual projects that might be analyzed in PSD permit reviews. Quantifying the exact impacts attributable to a specific GHG source obtaining a permit in specific places and points would not be possible [PSD and Title V Permitting Guidance for GHGs at 48]. Thus, we conclude it would not be meaningful to evaluate impacts of GHG emissions on a local community in the context of a single permit. Accordingly, we have determined an environmental justice analysis is not necessary for the permitting record.

XI. Conclusion and Proposed Action

Based on the information supplied by Apex, our review of the analyses contained the TCEQ PSD Permit Application and the GHG PSD Permit Application, and our independent evaluation of the information contained in our Administrative Record, it is our determination that the proposed facility would employ BACT for GHG under the terms contained in the draft permit. Therefore, EPA is proposing to issue Apex a PSD permit for GHG for the Matagorda facility, subject to the PSD permit conditions specified therein. This permit is subject to review and comment. A final decision on issuance of the permit will be made by EPA after considering comments received during the public comment period.

APPENDIX

Table 1. Facility Emission Limits[1]

Annual emissions, in tons per year (tpy) on a 12-month total, rolling monthly, shall not exceed the following:

EPN	Description	GHG Mass Basis		TPY CO_2e[2,3]	BACT Requirements
			TPY[2]		
TURBASTK TURBBSTK	Combined Gas Expansion Turbine Train A and Train B	CO_2	456,296	458,734	i. BACT of 558 lb CO_2/MWh[5] on a 12-month rolling average ii. Special Condition III.A. iii. Maximum heat input to one train is 695.1MMBtu/hr. iv. Work practice standards in Section III A.
		CH_4	12.66		
		N_2O	7.12		
FUG1	Fugitives	CO_2	No Numerical Limit Established[4]	No Numerical Limit Established[4]	Implementation of AVO program. See Special Condition III.B.
		CH_4	No Numerical Limit Established[4]		
		SF_6	No Numerical Limit Established[4]		
GENENG1	Natural Gas-Fired Emergency Generator	CO_2	23	23	Good Combustion and Operating Practices. Limit to 50 hours of operation per year. See Special Condition III.C.
MAINT1[6]	Maintenance	CO_2	No Numerical Limit Established	No Numerical Limit Established	See Special Condition III.D. Maintenance purges of the natural gas pipeline is limited to 4/year.
		CH_4	No Numerical Limit Established		
Total	Facility wide			458,757	

1. Compliance with the annual emission limits (tpy) is based on a 12-month total, rolling monthly.
2. The tpy emission limits specified in this table are not to be exceeded for this facility and include emissions from the facility during all operations to include startup and shutdown activities.
3. Global Warming Potentials (GWP): $CH_4 = 25$, $N_20 = 298$, $SF_6 = 22{,}800$ as of January 1, 2014, 40 CFR 98 Table 1-A.
4. Fugitive emissions (EPN FUG1) are estimated to be 0.27 tpy CO_2, 5.56 tpy CH_4 and 0.0065 tpy SF_6 for a total of 288 tpy CO_2e. The emission limit will be a design/work practice standard as specified in this permit.
5. Electrical output shall be measured at the generator terminals.
6. Maintenance emissions are estimated to be 1.01 tpy CH_4 and 0.4 tpy CO_2, for a total of 25.65 tpy CO_2e.