EXHIBIT A

Excerpts from MCAQD Response to Comments

Maricopa County

Air Quality Department

Permitting Division
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March 23, 2016

Travis Ritchie
Staff Attorney
Sierra Club Environmental Law Program
85 Second Street, 2nd Floor
San Francisco, CA 94105

Dear Sir or Madam:

On April 14, 2014 the Maricopa County Air Quality Department (MCAQD) received an application for a Significant Revision to Title V Air Quality Permit # V95007: APS Ocotillo Power Plant, 1500 East University Drive, Tempe, Arizona 85281. In March 2014 a proposed permit was issued and a public hearing was held on April 7, 2015 to receive comments relating to this permit. Attached is the MCAQD response to comments received on that proposed permit.

In December 2015 a revised proposed permit was issued for the Significant Revision and on January 16, 2016 a second public hearing was held. MCAQD received no comments on the revised proposed permit.

After careful consideration of all of the comments received, no substantive changes were made to the final proposed permit. The department has issued the Title V Air Quality Permit as listed above.

We appreciate the interest and concern expressed by the citizens of Maricopa County in helping to ensure that each permit issued by the department meets all legal requirements. A summary of the comments and the department's written responses is attached to this letter.

Within 30 days after this notice announcing this final permit decision (i.e., April 21, 2016), any person who filed comments on the proposed permit for the APS Ocotillo Power Plant or participated in any of the public hearings for the APS Ocotillo Power Plant may petition EPA's Environmental Appeals Board (EAB) to review any condition of the final permit. Persons who did not file comments or participate in the public hearings may petition for administrative review only to the extent of changes from the proposed to the final permit decision. The petition must include a statement of the reason(s) for requesting review by the EAB, including a demonstration that any issuesbeing raised were raised during the public comment period to the extent required by the regulations at 40 CFR Part 124 and when appropriate, a showing that the conditions in question are based on 1) a finding of fact or conclusion of law which is erroneous, or 2) an exercise of discretion or an important policy consideration which the EAB should, in its discretion, review. Please see 40 CFR

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124.19 and visit http://www.epa.gov/eab/ for important information regarding the procedures for appeal of a PSD permit decision to the EAB.

This PSD permit for the APS Ocotillo Power Plant shall become effective 30 days after this notice of the final permit decision (i.e., April 22, 2016), unless a petition for review is properly and timely filed with the EAB per 40 CFR 124.19 or 40 CFR 49.159(d). In the event that a petition for review is filed with the EAB, construction of the facility is not authorized under this permit until resolution of the EAB petition(s). See 40 CFR 124.16.

I would like to thank you again for your interest in matters affecting Maricopa County's air quality. If you have any questions regarding this letter or the attached responses, please contact me at (602) 506-1842.

Sincerely,

Richard A. Sumner
Permitting Division Manager, Maricopa County Air Quality Department

MCAQD Response to Public Comments received on the APS Ocotillo Power Plant Significant Permit Revision 2.1.0.0.

INTRODUCTION:

The Arizona Public Service (APS) Ocotillo Power Plant is located at 1500 East University Drive, Tempe Arizona, 85281, in Maricopa County. The Plant has been in operation since 1960, and currently consists of two steam boiler generating units and two simple cycle gas turbine generators (GTs). The Ocotillo Power Plant is a major stationary air emission source as defined in County Rules 210 and 240, and operates under Title V Operating Permit V95-007.

APS has proposed the Ocotillo Modernization Project (the Project), which would install five new natural gas-fired GE Model LMS100 simple cycle GTs (GT3 through GT7) and associated equipment, including a hybrid Partial Dry Cooling System and two 2.5 MW emergency generators. As part of the Project, APS will retire the two existing steam electric generating units and associated cooling towers before commencing commercial operation of the proposed new GTs. The existing GT1 and GT2 will no longer have dual-fuel capability and will only burn Pipeline Natural Gas.

APS is continuing to add renewable energy, especially solar energy, to the electric power grid. However, because renewable energy is an intermittent source of electricity, a balanced resource mix is essential to maintain reliable electric service. This means that APS must have firm electric capacity which can be quickly and reliably dispatched when renewable power, or other distributed energy sources are unavailable. The proposed LMS100 GTs have the quick start and power escalation capability that is necessary to meet changing power demands and mitigate grid instability caused by the intermittency of renewable energy generation.

The Maricopa County Air Quality Department's (MCAQD) overall assessment of the Project is as follows:

- The Ocotillo plant will utilize highly efficient simple-cycle gas turbines.
- The PSD permitting requirements apply to the Project only for carbon monoxide (CO), particulate matter less than 100 microns (PM), particulate matter less than or equal to 2.5 microns ($PM_{2.5}$), and greenhouse gas (GHG) emissions. The proposed control technologies and emission limits for these pollutants represent the Best Available Control Technology (BACT) for simple-cycle gas turbines.
- After the first new GT commences operation, the Ocotillo Plant will no longer be a major source of particulate matter less than or equal to 10 microns (PM_{10}).
- The nonattainment NSR permitting requirements do not apply to the Project.
- The air quality impacts of the Project are insignificant when compared to EPA impact thresholds.

SUMMARY OF THE PROPOSED PERMIT AND PUBLIC PARTICIPATION PROCESS:

MCAQD first proposed to issue an air quality permit for the Project on March 4, 2015. MCAQD issued a proposed draft air permit and Technical Support Document (TSD) along with notice of a 30-day public comment period (from March 4, 2015 to April 3, 2015). MCAQD also issued a notice for a public hearing scheduled for April 7, 2015 (the public hearing notice stated that comments on the permit and TSD would be received up to April 10, 2015). The administrative record for these documents was made available on the MCAQD web page, as well as for public inspection upon request.

During this public participation process, MCAQD received two sets of comments, one from Sierra Club and one from Ryley, Carlock and Applewhite, on the draft permit and TSD. MCAQD requested supplemental information from APS to help MCAQD address these comments, and APS submitted the additional information in an updated application package on September 25, 2015. MCAQD consulted with EPA Region 9 during the review and analysis of the supplemental information. MCAQD developed a revised draft air permit and TSD that addressed all submitted comments, as well as incorporating any new requirements such as 40 CFR 60 Subpart TTTT (the Clean Power Plan for Greenhouse Gases).

On December 15, 2015, MCAQD proposed to issue a revised air quality permit for the Project. MCAQD issued a proposed draft air permit and Technical Support Document (TSD) along with notice of a 30-day public comment period (from December 16, 2015 to January 22, 2016). MCAQD also issued a notice for a public hearing scheduled for January 19, 2016. The administrative record for these documents was once again made available on the MCAQD web page, as well as for public inspection upon request.

MCAQD did not receive any comments during the second public comment period and hearing.

While the two original sets of comments received from Sierra Club and Riley Carlock and Applewhite have been addressed in the revised draft permit and TSD, and some of these comments are now moot, MCAQD has prepared this Response to Comment (RTC) document that lists the previously submitted comments and provides the County's responses. The first set of comments and responses are for the Sierra Club comments, followed by the Riley Carlock and Applewhite comments.

SIERRA CLUB COMMENTS AND MCAQD RESPONSES:

Comment: The Permit Does Not Satisfy BACT for GHG Emissions from the Gas Turbines:

RESPONSE: Before responding to the Sierra Club's comments that steam injection, dry low-NO_x (DLN) combustors, combined cycle combustion turbines, batteries, or other energy storage options could either be used in addition to or in place of the proposed LMS100 CTGs, MCAQD has reviewed U.S. EPA's longstanding policy regarding BACT analyses and the scope of control technology options which the review agency may consider, especially as they relate to a proposed project's basic purpose or design.

In the EPA Environmental Appeals Board (EAB) decision on Prairie State Generating Station, PSD Appeal No. 05-05, the EAB explained (at pages 27-28) adherence to the facility's "basic purpose" or basic design," as defined by the applicant, is the touchstone of EPA's policy on "redefining the source":

> … Congress intended the permit applicant to have the prerogative to define certain aspects of the proposed facility that may not be redesigned through application of BACT and that other aspects must remain open to redesign

> through the application of BACT. The parties' arguments, properly framed in light of their agreement on this central proposition, thus concern the proper demarcation between those aspects of a proposed facility that are subject to modification through the application of BACT and those that are not.
>
> We see no fundamental conflict in looking to a facility's basic "purpose" or to its "basic design" in determining the proper scope of BACT review, nor do we believe that either approach is at odds with past Board precedent.

This EAB decision was upheld by the 7th Circuit.[1]

When EPA issued guidance in 2011 specifically for greenhouse gas emissions, it confirmed that a BACT analysis should not redefine the source's purpose:[2]

> While Step 1 [of a BACT process] is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include lower pollution processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility.

The EAB has consistently rejected the need to redefine the underlying source concept in the context of past permitting proceeding very similar to Ocotillo. In their challenges to a PSD permit issued for the Pio Pico Energy Center, the petitioners unsuccessfully asserted before the EAB that EPA had erred in eliminating combined-cycle gas turbines in step 2 of its BACT analysis for greenhouse gases. Like Ocotillo, Pio Pico is a simple cycle gas-fired facility designed to back up renewable generation.

As the EAB recognized in its Pio Pico decision, consistent with long standing EPA guidance, a permitting authority can consider peaking facilities, intermediate load facilities, and base load facilities to be different electricity generation source types. The EAB explained how "plants operating in 'peaking mode' typically remain idle much of the time, but can be started up when power demand increases … and, unlike base load plants, typically use simple-cycle rather than combined-cycle units as well as smaller turbines."[3]

The EAB concluded that EPA did not define "source type" too narrowly in its BACT analysis for Pio Pico. The EAB also concluded that EPA's selection of a GHG BACT emission limit based on 50% load (which was not the most stringent emission rate in the record) was consistent with the definition of BACT. Thus affording EPA the discretion to set the emission limit at a level that ensures the facility can achieve consistent compliance over time. As the EAB explained, "permit writers retain discretion to set BACT levels that do not necessarily reflect the highest possible control efficiencies but, rather, will allow permittees to achieve compliance on a consistent basis."[4] Further, the EAB determined that the petitioners

[1] *Sierra Club v. EPA*, 499 F.3d 653 (7th Cir. 2007).

[2] U.S. EPA, EPA-457/B-11-001, *PSD and Title V Permitting Guidance for Greenhouse Gases* 26 (Mar. 2011) (citing *Prairie State*, 13 E.A.D. at 23).

[3] *In re Pio Pico Energy Center*, PSD Appeal Nos. 12-04 through 12-06, slip op. at 63 (EAB Aug. 2, 2013).

[4] *Id.* at 78 (internal quotation marks omitted).

did not demonstrate that EPA failed to use its considered judgment when it incorporated safety factors, or compliance margins, into the GHG BACT emission limit that was not the most stringent control efficiency.

EPA has addressed the issue of whether a peaking facility must consider incorporation of energy storage into a project in the BACT analysis. In EPA's Response to Comments on the Red Gate PSD Permit for GHG Emissions, PSD-TX-1322-GHG, February 2015,[5] issued for a peaking facility to be comprised of reciprocating internal combustion e ngines ("RICE"), EPA determined that "energy storage cannot be required in the Step 1 BACT analysis as a matter of law." *Id.* at 1 (explaining that "'incorporating energy storage' in Step 1 of the BACT analysis for a [RICE] resource would constitute the consideration of an alternative means of power production in violation of long-established principles for what can occur in Step 1 of the BACT analysis") (citing *Sierra Club v. EPA*, 499 F.3d 653, 655 (7th Cir. 2007)). EPA concluded that energy storage, either "to replace all or part of the proposed . . . project," would fundamentally redefine the source. *Id.* at 2.

Like the Project, the purpose of the Red Gate project was to provide reliable, rapidly dispatchable power to support renewables and the transmission grid. Because "energy storage first requires separate generation and the transfer of the energy to storage to be effective . . . [it] is a fundamentally different design than a RICE resource that does not depend upon any other generation source to put energy on the grid." *Id.* Energy storage could not meet that production purpose for the duration or scale needed. *Id.* at 2-3. As EPA observed, "[t]he nature of energy storage and the requirement to replenish that storage with another resource goes against the fundamental purpose of the facility." *Id.* at 3. Similarly, in another PSD permit for a peaking facility, this time with natural gas-fired simple cycle units, EPA also concluded that energy storage would not meet the business purpose of the facility and therefore should not be considered in the BACT analysis. [6]

Based on these previous EPA determinations and EAB decisions, MCAQD has determined that combined cycle combustion turbines, batteries, and other energy storage options would fundamentally redefine the source, and therefore will not be considered in the BACT analysis. Nonetheless, these alternative means of power production are further discussed in the following responses to comments.

Comment: Step 1 of BACT analysis is incomplete because it fails to identify good combustion practices such as steam injection, dry low-NO_X (DLN) combustors and steam injected gas turbines (STIG) that could be used on the same LMS100 model turbines as proposed for the project.

RESPONSE: The General Electric (GE) paper *New High Efficiency Simple Cycle Gas Turbine – GE's LMS100*™ cited in the comment is a 2004 paper which preceded the first commercial operating

[5] *Response to Public Comments* for the South Texas Electric Cooperative, Inc. – Red Gate Power Plant PSD Permit for Greenhouse Gas Emissions, PSD-TX-1322-GHG (Nov. 2014), https://archive.epa.gov/region6/6pd/air/pd-r/ghg/web/pdf/stec-redgate-final-rtc.pdf.

[6] Responses to Public Comments, Draft Greenhouse Gas PSD Air Permit for the Shady Hills Generating Station at 10-11 (Jan 2014), https://www.regulations.gov/#!documentDetail;D=EPA-R04-OAR-2013-0647-0028.

date for an LMS100 CTG in June 2006[7]. GE has never built an LMS100 CTG with steam injection (either SAC or STIG variations) and does not currently offer the LMS100 with these designs[8]. Therefore, these technologies are not an "available control option" for the LMS100 CTGs and may be eliminated, for consideration as a BACT option in Step 1 of the BACT analysis.

Dry Low NO_X (DLN) combustion is available for the LMS100 CTGs and under certain operating conditions can achieve the same NOx emission rate as water injection, equal to a CTG exhaust prior to the SCR systems of 25 ppmdv at 15% O_2. However, while water injected LMS100 CTGs can achieve the NO_x emission rate of 25 ppm continuously down to 25% of load, the DLN equipped units cannot achieve this NO_x emission rate at loads below 50% of load. Furthermore, the DLN equipped CTGs produce much greater carbon monoxide (CO) emissions and other products of incomplete combustion than the water injected CTGs. As a result, the DLN equipped CTGs can only meet the CO BACT emission limit down to 75% load, while the water injected CTGs can also achieve the CO BACT limit continuously down to 25% of load. Because the periodic operation of a CTG at reduced load levels is a major design criterion for the Project, utilizing DLN would require changing the basic purpose and design of the facility, and was therefore properly dismissed under Step 1 as redefining the source. In addition, the significant lack of turndown capability for the DLN equipped CTGs makes the DLN equipped LMS100 CTGs technically infeasible for these peaking units. Therefore, even if DLN were retained in Step 1, DLN would be dismissed under Step 2 as technically infeasible.

DLN equipped LMS100 CTGs also have a lower peak electric generating capacity than the water injected units. The peak electric output at 105°F is reduced significantly; from 109.9 MW (gross) for the water injected CTGs to only 97.2 MW for the DLN equipped CTGs. This is a significant reduction in peak generating and ramping capacity which directly affects the ability of the project to meet its basic design requirements. This is another reason for dismissal of DLN Technology under Step 1 of BACT.

Since 2013, three peaking power plants consisting of 19 water-injected LMS100 simple cycle CTGs have commenced commercial operation in California. These plants are the Walnut Creek Energy Park (City of Industry, 5 units), the CPV Sentinel Energy Project (Riverside County, 8 units), and the Haynes Generating Station Repowering Project (6 units). In 2013, a water-injected LMS100 CTG also commenced commercial operation at El Paso Electric Company's Rio Grande Power Plant in Sunland Park, New Mexico. In addition, the Pio Pico Energy Center (San Diego County) received a PSD construction permit for 3 water-injected LMS100 simple cycle CTGs in 2013. The water-injected LMS100 CTGs have been selected for these peaking power plants because of their very high efficiency when operating in simple cycle mode, their fast start times, high turndown rates, flexible operation, and high peak electric output, especially under high ambient temperature conditions. In fact, MCAQD is not aware of any situation where DLN-equipped units have been permitted for the type of peaking operations required for this Project. Therefore, the water-injected LMS100 CTG is an

[7] Available at http://site.ge-energy.com/prod_serv/products/tech_docs/en/downloads/ger4222a.pdf.

[8] E-mail from Phil Tinne, GE Power & Water, to Scott E McLellan, Arizona Public Service dated May 14, 2015, in which Mr. Tinne states "I confirm that we have not developed steam injection for the LMS100, either for NOx control or power supplementation, thus it is not on our option list."

available control option that is demonstrated, available and applicable. Thus meeting the design and operational thresholds for Steps 1 and 2 of the BACT analysis.

Comment: BACT Step 1, identify all options, analysis is incomplete because energy storage options were not identified.

RESPONSE: The Comment stated that there are several types of energy storage technologies available including batteries, compressed air energy storage (CAES), liquid air energy storage (LAES), pumped hydro, and flywheels. As explained above, incorporating energy storage into the project would fundamentally redefine the source. Thus it would not meet the project purpose. Indeed, it is an alternative means of power production, the consideration of which "would stretch the term 'control technology' beyond the breaking point." *Sierra Club*, 499 F.3d at 655. Put simply, "energy storage cannot be required in the Step 1 BACT analysis as a matter of law."[9]

The use of energy storage technology was considered by APS in its planning process for the significant expansion of the APS renewable energy portfolio which resulted in the proposed Project. However, energy storage was not selected at the end of the planning process because it could not meet the Project's basic needs and purpose. As with the Shady Hills and the Red Gate projects discussed above, the use of energy storage would not fulfill the site-specific purpose and need of the Project, which is to provide up to 500 MW of peak electric generating capacity for potentially extended periods of time at an existing plant site.

Even if there were an off-site generation source available for charging energy storage at the Ocotillo site, and even if it were appropriate to consider energy storage options in Step 1 of the BACT analysis, as explained further below, there is no available energy storage option that could supply a maximum power output of 500 MW for a potentially extended period of time, which is what this project requires. Therefore energy storage would also be eliminated at Step 2.

APS, in order to assure reliability, must build a system that can meet not only a short peak demand, but also several short peak demands in a row, an extended peak demand, or even several extended peak demands. If the utility is reliant upon stored energy for some or all of its peaking power, be it battery, CAES, hydro pumping or other storage technologies, at some point the stored energy may run out before it can be recharged, making the solution unreliable for meeting the full demand. Accordingly, energy storage is not compatible with the purpose and design of a true peaking facility such as the Project to provide rapid, reliable power. This is why energy storage has been addressed and dismissed in most PSD permits for peaking facilities across the United States.

Battery Storage. The two largest grid-connected battery storage systems that we considered are the 32 MW lithium-ion battery-based Laurel Mountain Wind Farm (W. Virginia) and the 36 MW lead-acid battery-based Notrees Battery Facility (Texas). The Laurel Mountain facility has 8.0 MWh of energy storage (and output). The Notrees facility has 9.0 MWh of energy storage. Conversely the Project will be designed for a maximum energy output of approximately 500 MWh. Thus the required

[9] Red Gate PSD Permit Response to Comments, at 1.

electric energy output of the Project is some 50 times larger than the largest battery storage facilities currently in service.

The comment failed to present any information showing that a battery storage facility, or any other energy storage facility currently in service, can provide the required maximum power capacity of 500 MW for multiple days. The suggestion by the commenter that a natural gas combined cycle unit combined with battery storage could reduce GHG emissions by 30% is not technically feasible, since there are no commercially demonstrated, available and applicable battery storage units on the scale of the proposed Project. Therefore, the battery storage option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project – to provide between 25 MW to 500 MW of electrical energy as needed[10] on an immediate basis, and potentially for an extended period of time. The comment requires redefining the source, and under Step 2 because it is not technically feasible at this time to produce up to 500 MW of electrical energy using this technology, and may not even be technically feasible at much lower capacities.

LAES: LAES, also called cryogenic energy storage (CES), uses low temperature (cryogenic) liquids such as liquid air to store energy. This technology is being developed by Highview Power Storage in the United Kingdom. However, we are not aware of any commercially operating LAES facilities with the electric power output scale of the proposed Ocotillo Power Plant. Therefore, like batteries, the LAES option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project, which is to generate and provide to the grid 25 to 500 MW of electricity as needed.

It is important to note that contrary to the comments received, energy storage technologies are not "zero emissions" technologies. The "round trip" energy efficiency of LAES is expected to be 50 – 60%[11]. Therefore, while this technology may have near zero emissions at its site, the technology simply stores energy produced elsewhere with attendant emissions. If that energy were produced, for example, at a natural gas-fired combined cycle facility with a GHG emission rate of 1,000 lb CO_2/MWh, the net emission rate after the LAES storage would be 1,670 to 2,000 lb CO_2/MWh. Thus, even if this technology were technically feasible, it may not have a lower GHG emission rate than the proposed project and would have it be dismissed in Step 4 as causing an unusual energy penalty and environmental impact.

Flywheel energy storage (FES). Flywheel energy storage (FES) uses electric energy input to spin a flywheel and store energy in the form of rotating kinetic energy. An electric motor-generator uses

[10] See the U.S. EPA's *Response to Public Comments* for the South Texas Electric Cooperative, Inc. – Red Gate Power Plant PSD Permit for Greenhouse Gas Emissions PSD-TX-1322-GHG, page 7, available at http://www.epa.gov/region6/6pd/air/pd-r/ghg/stec-redgate-final-rtc.pdf. EPA states with respect to the use of batteries as a BACT control option, "Thus, the option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the project – to provide up 225MW of energy for necessary time periods – and it may also be eliminated at Step 2 of the BACT analysis because it does not meet the technical requirements of the project – to provide such power for multiple days."

[11] For example, the document *Liquid Air Energy Storage (LAES): Pilot Plant to Multi MW Demonstration Plant, Highview Power Storage*, LAES technology benefits include "60% efficiency in stand-alone mode. Integrates well with other industrial process plant (utilizing waste heat/cold) to enhance performance e.g. 70%+" Note that the Ocotillo Power Plant does not have waste heat/cold available to achieve the higher potential efficiency.

electric energy to accelerate the flywheel to speed. When needed, the energy is discharged by drawing down the kinetic energy using the same motor-generator. Because FES incurs limited wear even when used repeatedly, FES are best used for low energy applications that require many cycles such as for uninterruptible power supply applications. Temporal Power, in collaboration with the Ministry of Energy and NRStor, developed the first grid-connected flywheel energy storage facility in Ontario, Canada. This is a 2 MW system primarily designed for short term energy balancing on the power grid. We are not aware of any larger FES systems installed to date. Therefore, like batteries and LAES, the flywheel energy storage option has not been developed on a scale needed for the Project and may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project.

Compressed air energy storage (CAES). Compressed air energy storage (CAES) stores compressed air in suitable underground geologic structures when off-peak power is available, and the stored high-pressure air is returned to the surface to produce power when generation is needed during peak demand periods. There are two operating CAES plants in the world; a 110 MW plant in McIntosh, Alabama (1991) and a 290 MW plant in Huntorf, Germany (1978). Both plants store air underground in excavated salt caverns produced by solution mining. Other geological structures, such as basalt flows, may also be feasible CAES geologic formations. However, the Ocotillo Power Plant does not have any suitable geological structures in the vicinity of the plant. Like the other energy storage options, the CAES option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project, and it can also be eliminated at Step 2 of the BACT analysis as technically infeasible.

Pumped hydroelectric storage. Pumped hydroelectric storage projects move water between two reservoirs located at different elevations to store energy and generate electricity. When electricity demand is low, excess electric generating capacity is used to pump water from a lower reservoir to an upper reservoir. When electricity demand is high, the stored water is released from the upper reservoir to the lower reservoir through a turbine to generate electricity. Pumped storage projects have relatively high round trip efficiencies of 70 to 80%. However, there are no available water reservoirs at or near the Ocotillo Power Plant, and water resources in the Phoenix area are scarce. Therefore, this technology is not an "available control option" at the Ocotillo Power Plant and may be eliminated as a BACT option in Step 1 of the BACT analysis. Even if this option could be considered under Step 1, it can also be eliminated at Step 2 of the BACT analysis as technically infeasible.

Comment: The BACT analysis fails to identify smaller units that could operate at 100% efficiency rather than 102 MW turbines operated at 25% load.

RESPONSE: The commenter suggests that the project should use smaller turbines or a combination of smaller and larger turbines, or even a combination of smaller turbines, larger turbines, and some form of four possible energy storage options. However, the commenter has not provided any specific project designs which could meet the purpose and needs of the project using a combination of smaller turbines also would not reduce CO_2 emissions from those produced by the proposed Project. Therefore, a detailed analysis that considers the myriad of permutations of possible turbines that might be used is not warranted.[12] Moreover, the EAB has concluded that relevant EPA guidance indicates that, in a BACT analysis, a permitting authority is only required to identify "general *types or categories* of control technologies" in Step 1, which it then ranks in Step 3. The guidance does "not suggest that the analysis should also identify and rank specific equipment *models* that are available for each type of technology considered."[13] (See also, Prairie State Generating Company, PSD Appeal No. 05-05 "It is not EPA's intent to encourage evaluation of unnecessarily large numbers of control alternatives for every emissions unit.")

In any case, APS did consider the use of smaller turbines in the initial planning stages of the Project. But at the outset, it should be noted that the LMS100 is the most efficient simple cycle combustion turbines commercially available. The use of an intercooler combined with higher combustor firing temperatures allows the LMS100 to achieve a simple cycle thermal efficiency of approximately 44% at 100% load operation. The LMS100 is the first production gas turbine in the power generation industry to employ this technology. The result is that the LMS100 GTs are among the most efficient, and therefore the lowest CO_2 emitting simple cycle gas turbines which are commercially available at this time.[14] It is contradictory for the commenter to argue that APS should be required to utilize the most efficient energy processes and technology possible, yet also argue that APS should instead install smaller, less efficient combustion turbines.

Furthermore, it is not possible to design or operate the power plant in a manner that would allow smaller CTGs to operate at 100% load at all times or even for the majority of the time and still meet the basic Project requirements. As we have noted in the analysis in the permit application, the increase in renewable energy sources such as wind and solar on the electric grid and the intermittent nature of these sources is placing increased demands on grid stability. The new units need the ability to start quickly, change load quickly, and idle at low load, as well as be able to provide up to 500 MW in total. This capability is not only very important for normal grid stability, but also absolutely necessary to integrate with and fully realize the benefits of distributed energy, such as, solar power and other renewable resources.

The Project requires quick starting, fast ramping units which can stabilize the grid over a range of 25 to 500 MW to allow for this increased renewable energy profile. Therefore, the commenter is incorrect that "A 25 MW turbine, for example, could be operated at 100% load, rather than operating a 102 MW unit at 25% load."[15] This operating scenario would not provide the fast ramp rate that the Project design requires. The LMS100 design can achieve a ramp rate of 50 MW per minute required for the project, over the range of 25 MW to 100 MW. However, if smaller turbines were utilized it

[12] *See In re City of Palmdale*, PSD Appeal No. 11-07, slip op. at 47 (EAB Sept. 17, 2012) (noting that requiring a permitting authority to "analyze a myriad of potential [plant] configurations … would impose a heavy burden on the [permitting authority] that goes well beyond the permitting authority's obligations to consider and respond to public comments and to satisfy statutory and regulatory obligations in setting a BACT emissions limit that protects public health and the environment.").

[13] *In re La Paloma Energy Center*, PSD Appeal No. 13-16, slip op. at 16 (EAB Mar. 14, 2014).

[14] In the press release for the California CPV Sentinel Energy Project, May 16, 2013, available at http://geenergyfinancialservices.com/press_releases/view/393 GE states "GE's LMS100® aeroderivative gas turbine, which uses advanced intercooling technology, is the world's most efficient simple–cycle gas turbine."

[15] Commenter's proposal would appear to also redefine the source to be a base-load facility running at 100%.

would require starting additional units; thus requiring 10 minutes or more to achieve another 25 MW of electric output. This is not adequate to meet the grid stability requirements.

Also, to meet the Project requirements, the use of smaller turbines would mean that additional numbers of less efficient turbines would need to be operated simultaneously at low loads and electric power ramp rate for the proposed LMS100 CTGs of 50 MW per minute per CTG would be required. For example, if the Project were designed to use 50 MW turbines, two less efficient 50 MW turbines would need to be operated at low loads. Replacing a more efficient turbine with a less efficient turbine would actually *reduce* plant efficiency and *increase* GHG emissions for the plant.

Comment: Step 2, which eliminates technologically infeasible options, as part of the GHG Top-Down Analysis is flawed. The Commenter takes the position that combined cycle units would work just as well as the simple cycle units and be more efficient.

RESPONSE: The Project is being proposed to provide quick start and power escalation capability over the range of 25 MW to 500 MW to meet changing and peak power demands and mitigate grid instability caused by the intermittency of renewable energy generation. Electric utilities primarily use simple-cycle combustion turbines as peaking units, while combined cycle combustion turbines are installed to provide baseload capacity. The proposed LMS100 CTGs can provide an electric power ramp rate equal to 50 MW per minute per CTG which is critical for the project to meet its purpose. When all 5 proposed CTGs are operating at 25% load, the entire project can provide approximately 375 MW of capacity (i.e., from 125 to 500 MW) in less than 2 minutes. While fast-start combined cycle units are available for some applications, the commenter has not shown that any of the combined cycle units can provide this very fast response time over a range of 25 MW to 500 MW, which is a design requirement for *this* Project.

Baseload and combined cycle units are unable to respond rapidly to the large swings in generation which can be caused by a sudden drop in generation from renewable energy sources. As stated in the BACT analysis (page 38) “The long startup time for combined cycle units is incompatible with the purpose of the Project, which is to provide quick response to changes in the supply and demand of electricity requiring these turbines to startup and shutdown multiple times per day. Therefore, the use of combined cycle GTs is technically infeasible for the Project.” This conclusion is consistent with the U.S. EPA Region 9 evaluation and conclusion regarding the technical feasibility of combined cycle units for the Pio Pico Energy Center.[16] This conclusion is also consistent with the U.S. EPA Region 4 conclusion regarding the use of combined cycle units at the EFS Shady Hills Project. In that case EPA stated, “Based on the short startup and shutdown periods the simple cycle combustion turbines (SCCTs) offer, along with the purpose of the Project, CCCTs were considered a redefinition of the source and therefore, not considered in the BACT analysis.”[17]

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[16] See *Responses to Public Comments on the Proposed Prevention of Significant Deterioration Permit for the Pio Pico Energy Center*, U.S. EPA, November 2012, and also the *Fact Sheet and Ambient Air Quality Impact Report For a Clean Air Act Prevention of Significant Deterioration Permit, Pio Pico Energy Center*, PSD Permit Number SD 11-01, June 2012, pages 16 – 17.

[17] EPA’s EFS Shady Hills LLC Project (PSD-EPA-R4013) – Response to Comments, at 5.

Combined cycle CTGs have other technical problems which also make them technically infeasible for this Project. When a fast start, combined cycle CTG is started from a full stop, as is typical for a peaking unit, the CTG is simply operating in the simple cycle mode. The large frame CTGs typically used in combined cycle applications do not have the high turndown ratio that can be achieved with aero-derivative CTGs like the LMS100. Large frame CTGs also have longer startup times. The LMS100 CTGs have an intercooler which is not used in large frame CTGs, the large frame CTGs are not as efficient when operated in simple cycle mode. Therefore, constructing a combined cycle unit and then operating the combined cycle unit as a peaking unit would mean that the combined cycle unit would operate primarily in the simple cycle mode and would result in more GHG emissions than a plant using the proposed simple cycle CTGs.

Even a combined cycle CTG equipped with a fast start package is only capable of achieving startup within 30 minutes if the unit is already hot. If the unit is not hot, the combined cycle CTG may require up to 3½ hours to achieve full load depending upon conditions. These longer startup times are incompatible with the purpose of the proposed project, i.e., to provide a rapid Response to changes in the supply and demand of electricity. To keep the heat recovery steam generator (HRSG) and the steam turbine at a sufficiently high temperature to allow for quick startup of the CT, the facility would either have to operate continuously (and therefore it would no longer be a peaking facility) or it would have to operate an auxiliary boiler. The auxiliary boiler would need to be operated even when the peaking unit is not in service to keep the unit in hot standby. This results in additional emissions of GHGs and other pollutants. Continuous operation of an auxiliary boiler at a peaking facility would be inconsistent with the needs and maximum efficiency of a peak electric generating facility.

For the above reasons, combined cycle CTGs are not feasible for the proposed Project and must therefore be rejected in Step 1 because, consistent with EPA's statements in the EFS Shady Hills Project, combined cycle CTGs would not meet the basic purpose and need of the Project and would constitute a redefinition of the source. Combined cycle CTGs may also be rejected in Step 2 of the BACT analysis because they cannot meet the fast startup and ramp rates required for the Project and thus a technically infeasible option.

Comment: The operation of the turbines as proposed seems to be at greater frequency and for longer hours than is ordinarily the case for peaker plants and thereby justifies the operation of combined cycle units in lieu of simple cycle units. Startup and shutdown hours are not considered.

RESPONSE: The commenter stated that, "The proposed operating mode is not consistent with peaking operation, and therefore the assumption that combined-cycle units are not appropriate is unsupported. The record shows that the Applicant intends to operate the facility much more frequently and for longer hours than a traditional "peaking" unit."

The commenter also states "The assumed number of hours of operation can be back calculated from the emissions by dividing the tons per year per turbine by the pounds per hour per turbine. This calculation for the major pollutants yields an average of 3,571 hr/yr of normal operation per turbine. In addition, each turbine would undergo up to 730 startups/shutdowns per year, each lasting a total of

41 minutes (30 min startup, 11 min shutdown). This amounts to 499 hours per year per turbine of startup and shutdown. Thus, each turbine is permitted to operate 4,070 hr/yr or 46% of the time."

The operational limit in the permit, condition 19.b. of 18,800,000 MMBtu per year for all 5 turbines combined includes all periods of operation, including periods of startup and shutdown. At a maximum design heat input for each CTG of 970 MMBtu per hour, this limit is equal to 3,876 hours per year of operation. This operational limit is the basis for calculating the potential to emit for these CTGs as well as the entire Ocotillo Power Plant. However, this limit does not reflect the realistic operation of the CTGs, which is likely to be less.

The operational limit in the permit equal to 3,876 hr/yr for each CTG is consistent with the following recently issued U.S. EPA PSD GHG permits for simple cycle CTG or RICE engine peaking plants.

Recent U.S. EPA PSD GHG permit operational limits for peak electric generating units.

Plant	U.S. EPA Permit No.	Operating Limit, 12-month Average	Equivalent Limit per Unit Hours per Year
Pio Pico Energy Center	SD 11-01	3,914,556 MMBtu	4,335
EFS Shady Hills	PSD-EPA-R4013	3,390 hr/yr per CT	3,390
Red Gate Power Plant	PSD-TX-1322-GHG	67,771 hr/yr, 12 engines	5,648

With respect to operating limits, the commenter also states that "more than 90% of existing simple-cycle units operated at 2,000 hours or less…, thus showing that operation greater than 2,000 hours is not consistent with the normal operation of combustion turbines in peaking service." Once again, the operational limit in the permit, which is equal to 3,876 hr/yr of full load operation for each CTG, is the basis for calculating potential emissions from the Project, but it does NOT reflect the expected typical operation, but rather worst-case operation. Combined cycle and other baseload electric generating units are typically permitted based on 8,760 hours per year of operation at their maximum rated capacity as the basis for the *potential* emissions from the facility. Yet a baseload unit may not actually operate at or even get close to this maximum, worse-case operating level.

The data presented by the commenter does not mean that a peaking unit may *never* need to operate for more than 2,000 hours per year. If a peaking unit operates more frequently in a particular year than is "typical" because of higher than average demand, it does not cease to be a peaking unit. As EPA stated in its Response to comments for the EFS Shady Hills LLC Project, "If EPA were to restrict operation of the Shady Hills units to the 'typical' number of hours that a peaking unit is used, EPA would impair Shady Hills' ability to provide reliable peaking duty service during years in which circumstances requiring peak duty service occur more frequently than usual."[18] These circumstances could be due to local or regional electric generation or transmission problems, or it may be due to extreme weather conditions.

[18] See EPA's EFS Shady Hills LLC Project (PSD-EPA-R4013) – Response to Comments, page 8.

Thus, the operating limit for the Project should be consistent with other recent GHG limits for similar facilities, and it should be set so that it does not impair the ability of the Project to provide reliable peaking service during years in which circumstances may require more frequent operation. The draft limit equal to 18,800,000 MMBtu per year for all 5 turbines combined, including periods of startup and shutdown, is consistent with other permits and will allow sufficient operating flexibility to ensure the project can meet its purpose and need.

Comment: There are combined cycle turbines that are technically feasible to meet the projects generation purposes.

RESPONSE: As detailed above, combined cycle CTGs cannot provide the fast start and fast power ramp rates over the wide range of 25 MW to 500 MW that are required for this project. Therefore, for the same reasons that the U.S. EPA has rejected combined cycle CTGs for similar peak electric generating facilities, combined cycle units are not a technically feasible BACT option for the Project.

Comment: The ability of combined-cycle units to act as peaking units has been recognized on a number of occasions at other plants.

RESPONSE: The commenter states that "Combined-cycle units can act as peakers or load-following units by ramping up their combustion turbines very quickly, while still meeting full load simply by warming up the heat recovery steam generator in anticipation of increased demand. This point is important because the "peak" is rarely a surprise."

Again, combined cycle CTGs by there design and operating characteristics cannot provide the fast start and very fast power ramp rates that are required for this project. Further, the need for the very fast power ramp rates for this Project is precisely because the growth in intermittent renewable energy resources on the grid - and which can come on and offline very rapidly – will make the ability to anticipate peak power or large grid power supply swings much more difficult. As noted previously, APS has 1,206 MW of renewable generation and an additional 46 MW in development as of 1/1/2015. Within Maricopa County and the Phoenix metropolitan area, APS has about 115 MW of solar and an additional 300 – 400 MW of rooftop solar systems. According to an EPRI report[19], the total plant output for three large PV plants in Arizona have infrequent ramping events of 40% to 60% of the rated output for 1-minute, 10-minute, and 1-hour time intervals. Considering only the solar capacity in Maricopa County, the required electric generating capacity ramp rate required to back up these solar systems would be 165 to 310 MW per minute and per hour. The commenter also states that "It is factually inaccurate to claim that combined-cycle units are incapable of meeting the technical function of a load-following unit." That may be true, but it is irrelevant here. The Project being permitting involves peaking units, which have a ramp rate fast enough to replace intermittent renewable resources on a moment's notice, not load-following units. While combined-cycle units may load-follow in certain circumstances, they do not have the ramp rate necessary to fulfill this Project's purposes. For example, the commenter points to the Huntington Beach Energy Plant (HBEP) "peaking project" as an example of a combined cycle plant that can provide peak power. However,

[19] Electric Power Research Institute (EPRI) report, *Monitoring and Assessment of PV Plant Performance and Variability Large PV Systems*, 3002001387, Technical Update, December 2013, conclusion, page 6-1.

the HBEP is a 939 MW power plant which is almost twice the size of the proposed Project (and which is not yet operational). HBEP will consist of two power blocks each with a three-on-one configuration, i.e., each power block will have three Mitsubishi turbines, three heat recovery steam generators, and one steam turbine. As the commenter indicates, the HBEP has a maximum power island ramp rate of 110 MW/minute, or 220 MW for the entire project. For the Project, when all 5 proposed CTGs are operating at 25% load, the entire project can provide approximately 375 MW of ramping capacity (i.e., from 125 to 500 MW) in less than 2 minutes. The ramp rate capacity of the HBEP would not meet the Project needs.

Comment: Step 5 of the BACT analysis is flawed. BACT was determined at 25% load rather than all loads:

RESPONSE: The commenter has stated that "The assumption made by both the Applicant and the County that the GHG BACT limit must be set at the "worst case" scenario to allow the Ocotillo plant to operate at 25% load is improper. As discussed elsewhere, operation at 25% of the LMS100 design load, or about 25 MW, could be achieved by either using hybrid battery or other storage options, or smaller gas turbines, (e.g. 25-MW gas turbines) operated more efficiently at 100% load."

MCAQD has determined that:

1. Battery and other energy storage options are not a technically feasible option for the Project and would redefine the project,

2. Combined cycle CTGs cannot meet the purpose and need for the Project, and

3. Smaller gas turbines, on the order of 25MW capacity, would not meet the Project requirements because they cannot supply the required power ramp rates for the Project.

EPA Region 9 provided a framework for addressing the variation of turbine efficiency and resulting GHG emission rate as a function of load in its "Responses to Public Comments on the Proposed Prevention of Significant Deterioration Permit for the Pio Pico Energy Center", November 2012. EPA stated that it is not possible to predict the extent of part load operation during every year for the life of the generating facility and that facilities are designed to meet a range of operating levels. Therefore, EPA explained it is inappropriate to establish a GHG permit limit that prevents the facility from generating electricity as intended. For the Pio Pico PSD permit, EPA determined that the appropriate methodology for setting the GHG BACT emission limit was to set the final BACT limit at a level achievable during the lowest load, "worst-case" normal operating conditions. (This same methodology has been used to develop the proposed GHG BACT limit for the Project, which is based on 25% load operation.) EPA did this even though the final limit was NOT the lowest emission rate in the record.

The Sierra Club challenged the Pio Pico Permit, stating that the Permit's GHG BACT emission limit is based on the "worst-case operating conditions" and conflicts both with the definition of BACT and EPA precedent. That challenge was reviewed by the U.S. Environmental Appeals Board (EAB). In