ORIGINAL

PETITION FOR VARIANCE
BEFORE THE HEARING BOARD OF THE
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

PETITIONER: LOS ANGELES DEPARTMENT OF WATER AND POWER

CASE NO: 1263-78

FACILITY ID: 800074

FACILITY ADDRESS: 6801 East 2nd Street

[location of equipment/site of violation; specify business/corporate address, if different, under Item 2, below]

City, State, Zip: Long Beach, CA 90803

1. TYPE OF VARIANCE REQUESTED (more than one box may be checked; see Attachment A before selecting)

☐ INTERIM ☐ SHORT ☒ REGULAR ☐ EMERGENCY ☐ *EX PARTE* EMERGENCY

2. CONTACT: Name, title, company (if different than Petitioner), address, and phone number of persons authorized to receive notices regarding this Petition (no more than two authorized persons).

Katherine Rubin
Director, Environmental Affairs
111 N. Hope Street, Room 1050
Los Angeles Zip 90012
☎ (213) 367-0436 Ext.
Fax (213) 367-4710
E-mail katherine.rubin@ladwp.com

Nick Karno
Deputy City Attorney
222 N. Figueroa Street, 10th Floor
Los Angeles, CA Zip 90012
☎ (213) 367-4530 Ext.
Fax (213) 367-4588
E-mail nick.karno@ladwp.com

3. RECLAIM Permit ☒ Yes ☐ No Title V Permit ☒ Yes ☐ No

4. **GOOD CAUSE:** Explain why your petition was not filed in sufficient time to issue the required public notice. (Required only for Emergency and Interim Variances; see Attachment A)

N/A

5. Briefly describe the type of business and processes at your facility.

Persons with disabilities may request this document in an alternative format by contacting the Clerk of the Board at 909-396-2500 or by e-mail at clerkofboard@aqmd.gov.

If you require disability-related accommodations to facilitate participating in the hearing, contact the Clerk of the Board at least five (5) calendar days prior to the hearing.

[ALL DOCUMENTS FILED WITH CLERK'S OFFICE BECOME PUBLIC RECORD]

Los Angeles Department of Water and Power (LADWP)

LADWP is the largest municipal utility in the nation and supplies water and electric services to 3.8 million residents and businesses in the City of Los Angeles. As a vertically integrated power system, LADWP both owns and operates the majority of its generation, transmission, and distribution systems. A five-member Board of Water & Power Commissioners is appointed by the Mayor and establishes policy. Together, LADWP and the City of Los Angeles have been at the forefront of California utilities in adopting aggressive clean energy initiatives. To that end, LADWP has set goals to meet renewable energy targets, while at the same time maintaining a reliable and cost-effective power supply for customers.

Haynes Generating Station

LADWP's Haynes Generating Station (Haynes) is a natural gas-fired steam electric generating facility located on 122 acres in the City of Long Beach. Haynes currently operates two conventional steam generating units (Unit 1and Unit 2), two combined-cycle units (Unit 9 and Unit 10), and 6 simple cycle units (Units 11-16). Haynes has a generating capacity of 1,666 megawatts, enough to power approximately one million homes.

Unit 11, which is the subject of this Petition, is a 102.7 MW natural gas fired simple cycle combustion turbine equipped with a Selective Catalytic Reduction (SCR) system and a carbon monoxide (CO) oxidation catalyst to control NOx and CO. (See **Exhibit 1**, photo of Unit 11) Unit 11 was commissioned in 2013 and its emissions are monitored by a Continuous Emissions Monitoring System (CEMS).

6. List the equipment and/or activity(s) that are the subject of this petition (see Attachment A, Example #1). **Attach copies of the Permit(s) to Construct and/or Permit(s) to Operate for the subject equipment. For RECLAIM or Title V facilities, attach *only* the relevant sections of the Facility Permit showing the equipment or process and conditions that are subject to this petition. You must bring the entire Facility Permit to the hearing.**

Equipment/Activity	Application/ Permit No.	RECLAIM Device No.	Date Application/Plan Denied (if relevant)*
Combustion Turbine Unit 11	5596040	D159	n/a

*Attach copy of denial letter

7. Briefly describe the activity or equipment, and why it is necessary to the operation of your business. A schematic or diagram may be attached, in addition to the descriptive text.

Unit 11 is listed under Section D of Hayne's Title V Permit to Operate and is a GE Power Systems Model LMS100P simple cycle natural gas turbine. (See **Exhibit 2**, GE Power Systems LMS Brochure.) There are approximately 78 General Electric Model LMS100Ps in service, including in El Paso, Texas.

Haynes' six Model LMS100P units were purchased in 2015 because of their efficiency, flexibility, and faster startup times that meet fluctuating grid conditions and allow LADWP to integrate more renewable energy in its generation mix. Because of its ability to quickly generate power, Unit 11 is usually run as the sun sets to offset the daily tapering off of renewable energy at that time. With Unit 11 currently out of service, its continuing inoperability affects the stability of the entire LADWP power system.

Haynes is one of three major coastal power plants (along with Harbor Generating Station and Scattergood Generating Station) that work together to support 2,839 MW of installed capacity, thus providing approximately 85 percent of the total generating capacity within the Los Angeles anc 39% of the total generating plant capacity owned by LADWP.

For all of these reasons, Unit 11 is a vital component in LADWP's portfolio of in-basin generating facilities because it provides a more flexible and economical way to integrate a diversified energy portfolio while ensuring voltage support and grid reliability.

8. Is there a regular maintenance and/or inspection schedule for this equipment? Yes ☒ No ☐

If yes, how often: Annually Date of last maintenance and/or inspection: 01/09/23-02/22/23

Describe the maintenance and/or inspection that was performed.

Unit 11 has scheduled annual maintenance outages. During these scheduled outages, routine repairs and maintenance are performed on Unit 11 equipment, requiring the unit to be offline in order for the work to be done. The last maintenance outage was January 9, 2023 to February 22, 2023.

The following activities are typically performed during the scheduled maintenance outages:

1. Perform offline engine wash.
2. Borescope inspection of Unit, including the Booster, Supercore, Power Turbine, accessory gear box, inlet plenum.
3. Replace oil filters.
4. Inspect pumps, fans, motors, coolers, heaters, piping, and valves of auxiliary systems, include lube oil, hydraulic oil, jacking oil, water injection.
5. Inspect and replace failed instrumentation components, including probes, sensors, indicators, wiring, etc.
6. Inspect and replaced failed electrical components, including wiring, fuses, switches, etc.
7. Inspect, clean, and repair ammonia air dilution heater and vaporization heaters.
8. Inspect SCR and CO catalysts, and make necessary minor repairs.
9. Inspect Intercooler, and replace gasket and hardware if necessary.
10. Inspect air inlet filters, and replace pre-filters.
11. Perform generator inspection, including generator cooler, heater, fan, turning gear, oil system, etc.; and make necessary repairs.

9. List all District rules, and/or permit conditions from which you are seeking variance relief (if requesting variance from Rule 401 or permit condition, see Attachment A). Briefly explain how you are or will be in violation of each rule or condition (see Attachment A, Example #2).

Rule	Explanation
Permit Condition D29.8 …The test shall be conducted at least once every year. If a source test results show a violation of the NH3 limit the future source tests shall be conducted quarterly. The source test frequency may be reduced to annually only after four consecutive quarterly tests. demonstrate compliance.	The CO Relative Accuracy Test Audit (RATA) is due by the end of the fourth quarter on June 30, 2023 and the ammonia slip test is due by December 31, 2023. The CO RATA and ammonia slip tests must be performed while the unit is operating. Since Haynes Unit 11 is inoperable and repairs cannot be completed by the due dates, Unit 11 will not be in compliance with these Title V permit conditions and SCAQMD Rules beginning July 1, 2023 for CO RATA requirement and December 31, 2023 for ammonia slip test requirement.
Permit Condition D82.3 "… The CEMS shall be installed. The CEMS shall be operated in accordance with an approved AQMD Rule 218 CEMS plan application…."	
Permit Section E – Administrative Conditions "2. Operator shall maintain all equipment in such a manner that ensures proper operation of equipment."	
Rule 203(b) "The equipment shall not be operated contrary to the conditions specified in the permit to operate."	

14. Explain why it is beyond your reasonable control to comply with the rule(s) and/or permit condition(s):

It is beyond the LADWP's reasonable control to perform the CO RATA by June 30, 2023 and the ammonia slip test by December 31, 2023 due to unexpected failure of Unit 11's supercore and ensuing damage to other parts. (See **Exhibit 3**, photos of some of the damaged supercore blades in Unit 11.) Unit 11 has not been available to run since it first stalled on February 27, 2023, and LADWP has now confirmed with GE Power Systems that comprehensive repairs are required and will not be completed in time to meet the June 30, 2023 and December 31, 2023 testing deadlines.

Unit 11's supercore is the main "core" engine of the LMS100 gas turbine and is the most fundamental and necessary part of power generation. The supercore consists of a High Pressure Compressor, the combustor, the High Pressure Turbine, and the Intermediate Pressure Turbine. The supercore's function is to compress inlet air, mix it with fuel gas, combust the air-gas mixture, and finally exhaust the resulting hot gas after combustion. This exhaust hot gas then drives the High Pressure Compressor (HPC), which in turn forces the Low Pressure Compressor (LPC) in front of the supercore, powering the Power Turbine that drives the generator to make electricity.

After the February 27, 2023 stall event, LADWP conducted a boroscope inspection of Unit 11 with GE Power Systems representatives. (See **Exhibit 4**, excerpt from the Boroscope Inspection Report.) After careful research and review, LADWP has determined that Unit 11 had a catastrophic event when blades from stages 3, 4, and 6 in the high-pressure compressor broke off and caused extensive damage as it disintegrated and traveled downstream into the engine.

LADWP's determination regarding the catastrophic failure of Unit 11's supercore is supported by the Boroscope Inspection Report and visual inspections of the machinery, which have demonstrated that damage can be seen in the HPC starting from stages 3 and downstream, along with impact damage to the High Pressure Turbine, Intermediate Pressure Turbine, and the Power Turbine.

General Electric's LMS100 gas turbine was designed with a modular supercore or main engine. This means that the supercore part was designed to be removable and replaceable, because the supercore is where inlet air is at its highest pressure point (~575-580psi) and where combustion occurs, therefore it is where the most stress and damage can happen. This modular design was intended to allow for an extracted supercore to be sent off for maintenance, while a spare supercore could be installed and the unit restored back to service.

Haynes purchased two additional supercores (878-137 and 878-125), when Units 11-16 were first purchased in 2016. At this time, both supercores are damaged and awaiting repairs at the GE Power Systems Houston Service Center, the only facility that is capable of repairing the supercore. (See YouTube Video regarding GE Power Systems Houston Service Center at https://www.youtube.com/watch?v=orZz3WCeGok.)

LADWP believes that supercore 878-125 will be the first of the two damaged spare supercores to be returned. Supercore 878-125 has been with Houston Service Center since 2020 for repairs/replacement of cracked nozzles and was previously due to return to Haynes in July or August 2021. However, prior to shipping, GE performed a final inspection and found that one of the bearing housings in the supercore had developed rust, possibly due to the extended period it has been sitting in the shop. Thus, supercore 878-125 is awaiting new additional repairs and replacement of the bearing housing. The supercore, which is currently slated to be installed in Haynes Unit 15 is now expected to return to Haynes on May 15, 2023.

The damaged supercore 878-140 in Unit 11 will not be removed until a working spare is immediately available to replace it to ensure proper functioning of the machine. The damaged spare supercore 878-137 is expected to be returned in Quarter 2 of 2024. Once the damaged supercore 878-140 in Unit 11 is removed and sent to the Houston Service Center, LADWP anticipates it will be at least a year before it can be repaired. Due to the specialized nature of the repairs needed, LADWP is unable to perform the repairs or commission any other company to perform the repairs. LADWP is required to send the parts to a GE Power Systems facility and has to abide by their repair schedule.

15. When and how did you first become aware that you would not be in compliance with the rule(s) and/or permit condition(s)?

After the catastrophic event on February 27, 2023, LADWP immediately contacted GE Power Systems to get an update status on the repair of supercore 878-137. GE Power Systems notified Haynes management that a new supercore was not available, and that parts needed to repair supercore 878-137 won't be available until 2024.

Even after delivery of a repaired supercore, LADWP will require a minimum of six weeks for installation. For these reasons, LADWP determined that Unit 11 could not be reassembled and restarted in time to meet the June 30, 2023 deadline to conduct the CO RATA and the December 31, 2023 deadline to conduct the ammonia source test, as required by the Title V Permit Conditions and Rules listed in Item No. 9.

16. What actions have you taken since that time to achieve compliance?

After Unit 11 stalled, LADWP immediately halted operations and contacted GE Power System to conduct the boroscope inspection. Once GE Power Systems and LADWP determined the nature and extent of the damage, LADWP immediately engaged General Electric to engage in discussions to repair and/or replace the supercore. After describing the urgency of the situation, GE Power Systems notified LADWP that an operable supercore could not be delivered to Haynes until 2024. As a result of the communications from GE Power Systems, Haynes employees contacted the Environmental Affairs Air Quality Group to request support in securing a variance.

With the delivery now expected in 2024, LADWP has planned and scheduled for the repairs and installation to begin immediately upon delivery of the repaired supercore. To that end, LADWP has already taken inventory of necessary tools and parts, and also created a working timeline for the repairs.

Below are the remaining tasks (including but not limited to the installation, repairs, engine restart, and CO RATA and ammonia slip source testing for Unit 11) that can only commence following the delivery of the repaired supercore and could potentially take more than six weeks to complete:

1. Extract the damaged supercore. 3-5 days.
2. Extract the Power Turbine. 3-5 days.
3. Install replacement Power Turbine. 3-5 days.
4. Install replacement Supercore. 3-5 days.
5. Alignment of the booster - supercore - power turbine train. 1-2 weeks.
6. Reconnect mechanical, electrical, instrumentation in the Unit 11. ~1 week.
7. Reassembly of the Unit 11 package, including package roof, inlet air ducts, various piping, etc. ~1 week.
8. Haynes Unit 11 Restart.
9. CO RATA and ammonia source tests.

Depending on the extent of the damage, the restoration process of a supercore wreckage can add more than a month of delay to the typical timeframe for repairs.

17. What would be the harm to your business during and/or after the period of the variance if the variance were not granted?

Economic losses: $365,000+

Number of employees laid off (if any): None

Provide detailed information regarding economic losses, if any, (anticipated business closure, breach of contracts, hardship on customers, layoffs, and/or similar impacts).

The permanent inability to operate Unit 11 would result in almost incalculable costs to the residents of the City of Los Angeles. The cost of the unit itself and the ensuing stress on LADWP's ability to generate power would result in hardships to all of LADWP's customers because they would shoulder the burden of paying for all of these costs.

[YOU MAY ATTACH ADDITIONAL PAGES IF NECESSARY]

Also, LADWP could be subjected to fines and penalties if this variance is not granted. Although Unit 11 is now offline for repairs, LADWP is required to operate and maintain the CEMS, pursuant to the AQMD Rules and Title V permit conditions listed in Item No. 9 of this petition. Thus, LADWP could be subject to a Notice of Violation for the entire duration that the CO RATA and ammonia slip tests are not successfully performed. For a potential one-year time period, LADWP could face a penalty of up to $1,000/day or approximately $365,000 for the entire period the tests have not been performed.

18. Can you curtail or terminate operations in lieu of, or in addition to, obtaining a variance? Please explain.

LADWP has already terminated Unit 11's operations since February 27, 2023, and it is not possible to curtail operations because the unit is out of service.

Even with operations temporarily terminated, LADWP will still require a variance. While this petition is seeking relief from complying with the CO RATA testing due date of June 30, 2023 and ammonia slip test due date of December 31, 2023, LADWP recognizes that Unit 11 must be brought back to service as soon as possible before the CO RATA and ammonia slip source testing can be conducted.

19. Estimate excess emissions, if any, on a daily basis, including, if applicable, excess opacity (the percentage of total opacity above 20% during the variance period). If the variance will result in no excess emissions, skip to No. 20.

Pollutant	(A) Total Estimated Excess Emissions (lbs/day)	(B) Reduction Due to Mitigation (lbs/day)	(C)* Net Emissions After Mitigation (lbs/day)
None	N/A	N/A	N/A

* Column A minus Column B = Column C

Excess Opacity: 0 %

20. Show calculations used to estimate quantities in No. 19, **or** explain why there will be no excess emissions.

There will be no excess emissions because Unit 11 is not operational and is out of service.

21. Explain how you plan to reduce (mitigate) excess emissions during the variance period to the maximum extent feasible, or why reductions are not feasible.

N/A

22. How do you plan to monitor or quantify emission levels from the equipment or activity(s) during the variance period, and to make such records available to the District? **Any proposed monitoring does not relieve RECLAIM facilities from applicable missing data requirements.**

During the variance period, LADWP will continue to monitor and record emissions through CEMS, which will be operational during the repair of Unit 11.

23. How do you intend to achieve compliance with the rule(s) and/or permit condition(s)? Include a detailed description of any equipment to be installed, modifications or process changes to be made, permit conditions to be amended, etc., dates by which the actions will be completed, and an estimate of total costs.

Compliance will be achieved through relief from the administrative requirement to complete the CO RATA and ammonia slip source tests by **June 30, 2024.** If the variance is granted, the CO RATA and ammonia slip source tests will be scheduled as soon as is practical following the successful return of Unit 11 to normal operation.

24. State the date by which you expect to achieve final compliance: June 30, 2024. The LADWP requests that the variance take effect on July 1, 2023. We request one year of variance coverage in order to provide time to perform the follow up repairs and validate the integrity of the repairs prior to returning the unit to normal operation and performing the ammonia source tests.

If the regular variance is to extend beyond one year, you **must** include a **Schedule of Increments of Progress**, specifying dates or time increments for steps needed to achieve compliance. See District Rule 102 for definition of Increments of Progress (see Attachment A, Example #3).

List Increments of Progress here:
N/A

25 List the names of any District personnel with whom facility representatives have had contact concerning this variance petition or any related Notice of Violation or Notice to Comply.

Li Chen Ext. 2426

Crystal Villanueva Ext. 2561

The undersigned, under penalty of perjury, states that the above petition, including attachments and the items therein set forth, is true and correct.

Executed on 5/2/2023, at Los Angeles, California

Signature

Katherine Rubin
Print Name

Director of Environmental Affairs
Title

[YOU MAY ATTACH ADDITIONAL PAGES IF NECESSARY]

EXHIBIT 1

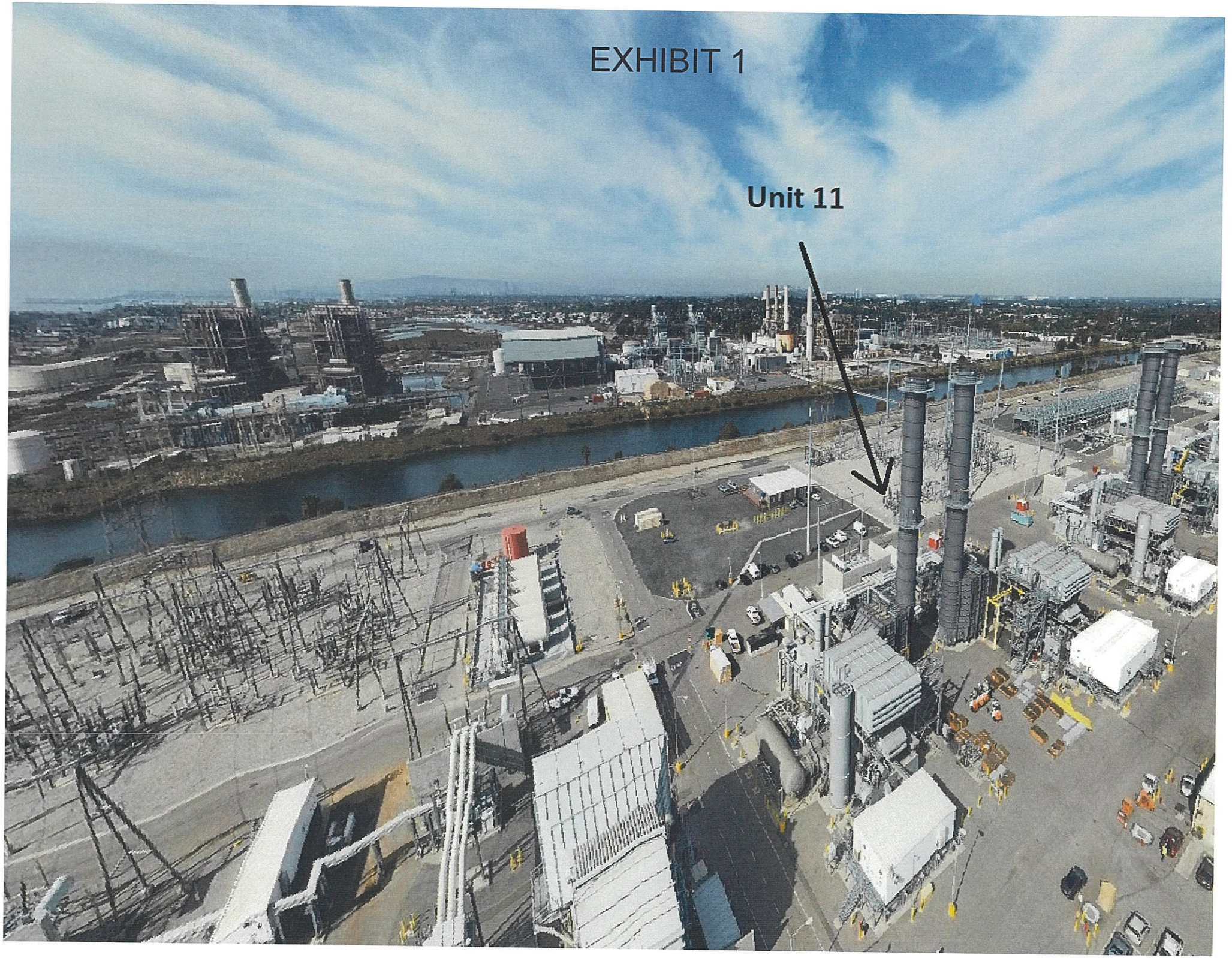


EXHIBIT 2 - GE Power Systems LMS100 Brochure

The Tradition of Excellence Continues . . .

GE's New Gas Turbine System: Designed to Change the Game in Power Generation

LMS100™

GE Power Systems

GE Power Systems
2707 North Loop West
Houston, TX 77008
Telephone 1-713-803-0900
www.gepower.com

GEA13640 (3M, 11/03)

GE Power Systems

Only **GE** has the Imagination and Ability to Combine the...

Best of Both Worlds. LMS100

GE Aircraft Engines Technology

GE Power Systems Technology

A New Beginning

LM → LMS ← *MS*

New High Efficiency Gas Turbine
For the Power Generation Industry

■ The LMS100™ is the first intercooled gas turbine system developed especially for the power generation industry, utilizing the best of two technologies – heavy-duty frame gas turbine and aeroderivative gas turbine technology. The LMS100 will deliver 100MW at 46% thermal efficiency. This efficiency is 10 % higher than GE's highest simple cycle efficiency gas turbine available today. It is specifically designed for cyclic applications providing flexible power for peaking, mid-range and baseload.

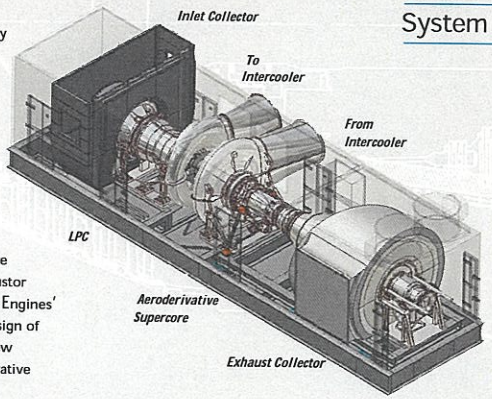
Flexible Power: High Efficiency

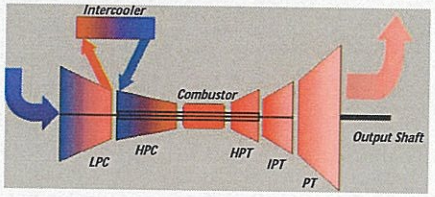
High Part-Power Efficiency, 50% Power	39%
High Simple Cycle Efficiency	46%
High STIG Efficiency	50%
High Combined Cycle Efficiency	54%

GE's New Gas Turbine Power Generation System

Only GE Can Bring You the Best of Both Worlds

The LMS100 features a heavy-duty low pressure compressor derived from GE Power Systems' MS6001FA heavy-duty gas turbine compressor; its core which includes the high pressure compressor, combustor and high pressure turbine is derived from GE Aircraft Engines' CF6-80C2® and CF6-80E1® aircraft engines. The design of the new 2-stage intermediate pressure turbine and new 5-stage power turbine is based on the latest aeroderivative gas turbine technology. The exhaust and aft shaft for hot-end drive are designed using heavy-duty gas turbine practices.





The compressed air from the Low Pressure Compressor (LPC) is cooled in either an air-to-air or air-to-water heat exchanger (intercooler) and ducted to the High Pressure Compressor (HPC). The cooled flow means less work for the HPC, increased overall efficiency and power output. The cooler LPC exit temperature air, used for turbine cooling, allows higher firing temperatures, resulting in increased power output and overall efficiency.

The Right Solution.

Rugged Design With Proven Components. **LMS100**

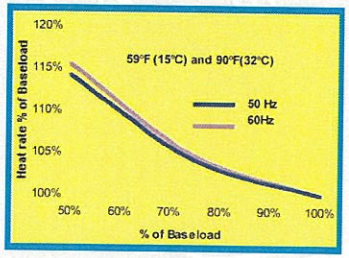
LMS100 Addressing Industry Needs

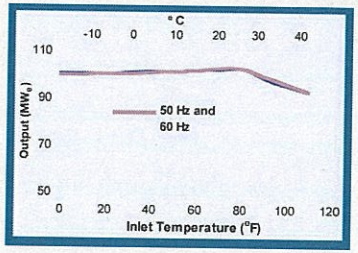
When asked to describe their requirements for future power generation facilities, customers identified the following items as high on their priority list:

- 100 MW blocks of power
- High efficiency at full and part-power
- Cycling capability
- Fast start
- Peaking capability
- Sustained hot-day power
- Fuel flexibility
- Low emissions

All agreed that a new gas turbine which met these requirements would be an important addition to their generation mix.

- The LMS100 has been designed to specifically address all of these needs, changing the game in the power generating industry.





The LMS100 is the Right Solution:

- Outstanding full- and part-power efficiency
- Low hot-day lapse rate
- High availability — aero modular maintenance
- Low maintenance cost
- Designed for cycling applications
  - *No cost penalty for starts and stops*
  - *Load-following capability*
- 10 Minutes to full power
  - *Improves average efficiency in cycling*
  - *Potential for spinning reserve credits*
  - *Reduced start-up emissions*
- Synchronous condenser capability

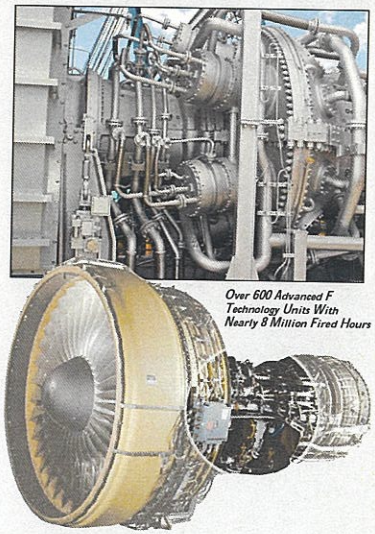
LMS100 Product Features

The LMS100 features an inlet and an LPC comprised of the first six stages of the MS6001FA compressor. These stages are followed by an aerodynamically designed volute which ducts the low pressure compressed air into the intercooler. This LPC provides high airflow capacity for the LMS100 Gas Turbine System.

Cooled air from the intercooler is ducted back through another aerodynamically designed volute into the aero supercore. The high efficiency aeroderivative supercore consists of:

- a high pressure compressor (HPC) based on the CF6-80C2 aircraft engine compressor, strengthened for the high (42:1) pressure ratio of the LMS100;
- a combustor which can be either a standard annular combustor (SAC) or an advanced dry low emissions (DLE2) combustor;
- a high pressure turbine (HPT) derived from the CF6-80E1 aircraft engine;
- a 2-stage intermediate pressure turbine (IPT) designed to drive the LPC through a mid-shaft and flexible coupling.

Following the IPT is a 5-stage aerodynamically coupled power turbine (PT) that has been designed specifically for the LMS100. The exhaust frame and aft drive shaft are based on a rugged heavy-duty gas turbine exhaust design.



Over 600 Advanced F Technology Units With Nearly 8 Million Fired Hours

3,786 CF6-80 Engines in Operation With More Than 103 Million Operating Hours

Industrial Example of a Finned Tube Heat Exchanger

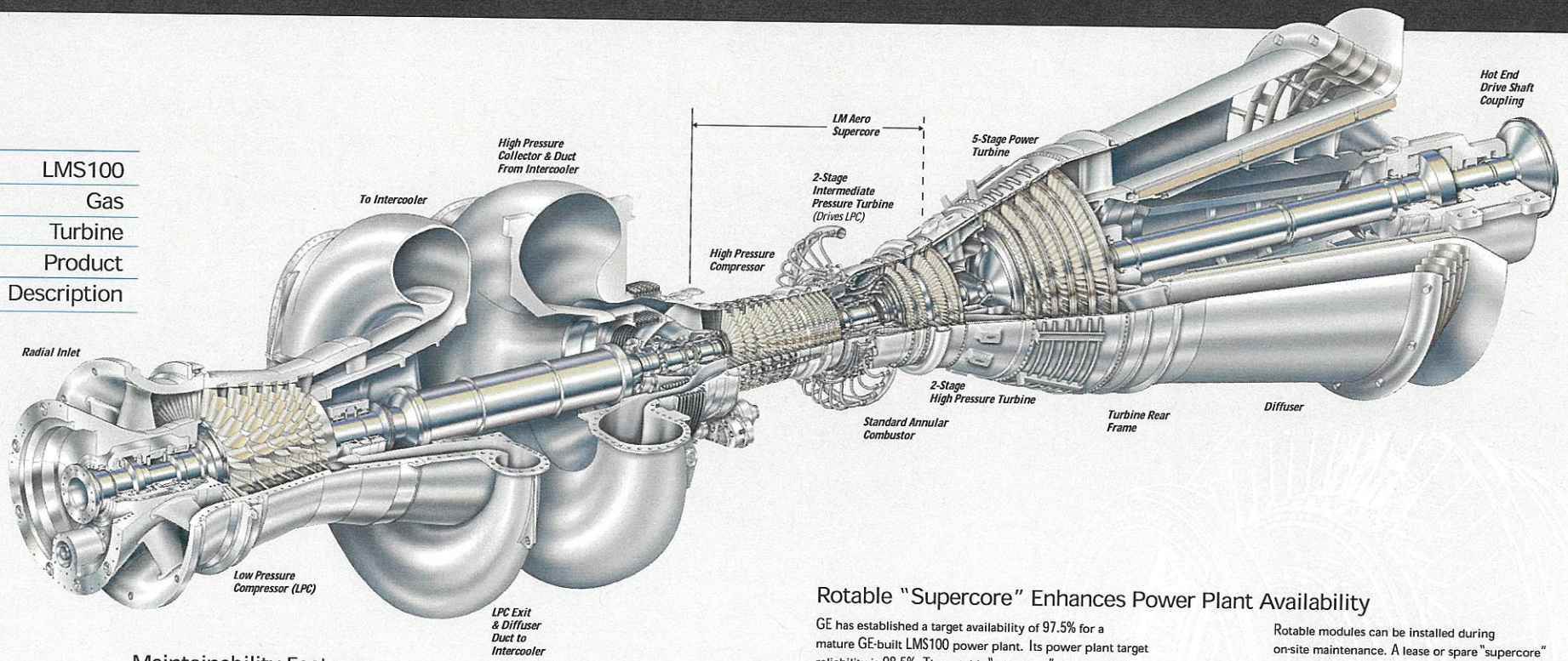
The LPC air is ducted to an air-to-air or air-to-water heat exchanger where it is cooled before being ducted to the HPC. Both designs are industry standard heat exchangers with significant operating hours in multiple industries and are designed to the API 660 and TEMA C standards.

Industrial Example of a Tube & Shell Heat Exchanger

Designed for Availability and Maintainability.

LMS100

LMS100 Gas Turbine Product Description



Maintainability Features

- Modular construction permits replacement of the aero components without total disassembly.
- Multiple borescope ports allow on-condition monitoring without turbine disassembly.
- Condition based maintenance and remote diagnostics.
- Split casing construction of the LPC and aeroderivative compressor allows detailed on-site inspection and blade replacement.
- Hot-section field maintenance can be done in several days.
- Accessories are externally mounted for ease of on-site replacement.

Rotable "Supercore" Enhances Power Plant Availability

GE has established a target availability of 97.5% for a mature GE-built LMS100 power plant. Its power plant target reliability is 98.5%. The rotable "supercore" consists of the HPC, Combustor, HPT and IPT modules.

Rotable modules can be installed during on-site maintenance. A lease or spare "supercore" and a power turbine module can be installed in 24 hours when depot maintenance is required.

LMS100 Service Intervals

The expected service intervals for the LMS100 based upon normal operation include:

- On-site hot-section replacement.....25,000 fired hours*
- Depot maintenance; overhaul of hot section and inspection of all systems, power turbine overhaul ...50,000 fired hours*
- Next on-site hot section replacement .....75,000 fired hours*
- Depot maintenance.....100,000 fired hours*

**Note: These are actual fired hours; no multipliers for cycling are needed.*

Maintenance Services

All warranty and follow-on services for the LMS100 will be provided by GE Power Systems on-site or at its several depot locations around the world. These services can include Contractual Service Agreements, Lease Engines, Spare Parts, Rotable Modules, Training and Training Tools.

Package Design

The LMS100 gas turbine package system was designed for reliable operation, easy access for maintenance and quick installation. The auxiliary systems are pre-assembled on a single skid and factory tested prior to shipment. The auxiliary skid is mounted in front of the turbine base plate utilizing short flexible connectors reducing mechanical interconnects by 25%. The complete gas turbine driver package can be shipped by truck.

LMS100 Plant System Design

While the actual plant layout will be site dependent, it will contain basic elements which include an inlet, an auxiliaries skid containing a water wash system, lube oil system and starter system, a turbine skid, an intercooling system, a generator, silencers, exhaust system and a control system.

Control System

Significant emphasis has been placed on controls design for increased reliability of the entire power plant. The LMS100 control system will have dual channel architecture with a cross-channel data link providing redundancy which will allow multiple failures without engine shutdown. A fiberoptic distributed I/O system located outside the module will be unaffected by electromagnetic or radio frequency interference which will eliminate noisy wiring. Site interconnects are reduced by 90% compared to the typical gas turbine control system.

Fuels

The LMS100 SAC will be equipped with dual fuel capability so that it can burn either natural gas or distillate fuels. The LMS100 DLE will operate on gas fuel.

Emissions Control

The LMS100 gas turbine system has all the advantages of an aeroderivative gas turbine in achieving low emissions. The LMS100 gas turbine with the SAC combustor (using water or steam for NO_x control) and the advanced DLE combustor (DLE2) are designed to achieve 25 ppm NO_x. This represents a 7 to 18% reduction in mass emissions rate (lbs/kwh) vs. the LM6000. In locations where less than 25 ppm NO_x is required a low temperature SCR can be used. The high efficiency of the LMS100 results in exhaust temperatures below 800°F (427°C) which permits the use of low temperature SCRs without tempering air.

Noise Control

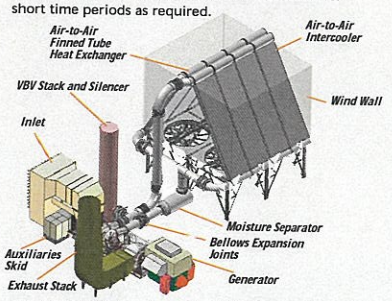
The gas turbine-generator will be rated at 85 dBA average at 3 feet (1 meter). An option for 80 dBA at 3 feet will be available.

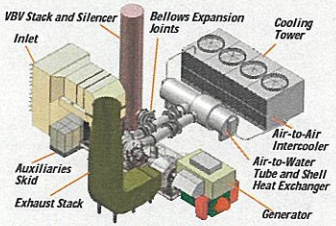
Generator

The generator is dual rated for 50 or 60 Hz applications. Either an air-cooled or TWAC configuration can be provided.

Air-to-Air Intercooler

In locations where water is scarce or very expensive, the basic LMS100 power plant will contain a highly reliable air-to-air intercooler. This unit will be a tube and fin style heat exchanger in an A-frame configuration which is the same as typical steam condensing units in general conformance with API 661 standards. Similar units are in service in the Oil and Gas industry today. In high ambient temperature climates, an evaporative cooling system can be added for power augmentation. This system would use a small amount of water for short time periods as required.





Air-to-Water Intercooler

In locations where water is readily abundant or less expensive the intercooler can be of the air-to-water type also found in many industrial applications. The intercooler would be a tube and shell type heat exchanger.

Either type of intercooler will be connected through a system of piping and expansion bellows, from the low pressure compressor volute to the intercooler and upon return to the high pressure compressor inlet volute.

LMS100 Plant System Design

LMS100 is Available in a Variety of Configurations

Four basic LMS100 configurations are available as this product is introduced. When combined with intercooler selection and duty applications, the LMS100 will offer the customer 20 different configuration choices.

LMS100 SYSTEM CONFIGURATIONS

Product Offerings	Fuel	Combustor	Diluent	Power Augmentation	NOx Level
LMS100 SAC, 50/60 Hz	Gas, Liquid or Dual Fuel	Single Annular (SAC)	Water	None	25 ppm
LMS100 SAC Steam, 50/60 Hz	Gas	Single Annular (SAC)	Steam	None	25 ppm
LMS100 SAC STIG, 50/60 Hz	Gas	Single Annular (SAC)	Steam	Steam Injection	25 ppm
LMS100 DLE, 50/60 Hz	Gas	DLE2	None	None	25 ppm

Competitive Over A Wide Output Range.

LMS100

LMS100 Applications For Power Generation

LMS100 Operational Flexibility

Economic Risks Factors	High Simple Cycle Efficiency	High Part Power Efficiency	Cycling w/o Maintenance Impact	10 Minutes Starts	Load Following Capability	Synchronous Condenser Capability	Off-frequency Support	Dual Fuel (SAC)	Modular Construction
Fuel Price Volitility	•	•						•	
Electricty Price Volitility	•	•	•	•					
Dispatch Rank	•	•	•	•	•				
Grid Stability / Support			•	•	•	•	•		
Load Demand Variations		•	•	•	•				
Plant Outage	•	•	•	•	•	•		•	

The attributes of the LMS100 make it a versatile power generation system offering customers increased operational flexibility in a wide variety of applications:

■ Simple Cycle / Peaking & Mid-Range…high efficiency, low first cost, sustained hot day power, 10-minute starts and no maintenance penalty for cycling, yield the ideal peaking solution. Throw in high part-power efficiency and load following capability to get high dispatch capability for mid-range applications.

■ STIG …steam injection for power augmentation provides significant efficiency and power improvements, as well as flexibility. With variable STIG, an operator can inject all of the steam into the gas turbine or pass the steam to process to take advantage of electricity prices or process steam value.

■ Combined Cycle …the low exhaust temperature leads to lower cost exhaust system materials, smaller steam turbines, condensers and generators, leading to a lower steam plant installed cost.

Another benefit from the lower exhaust temperature is more power from duct firing (up to 30MW).

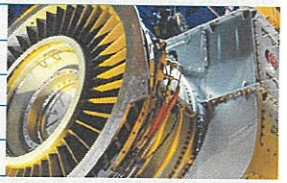
■ Combined Heat & Power …the high power-to-steam ratio allows the LMS100 to meet the steam demand served by 40-50MW gas turbines while delivering more than twice the power. Using both exhaust and air-to-water intercooler energy, an LMS100 plant can reach >85% thermal efficiency.

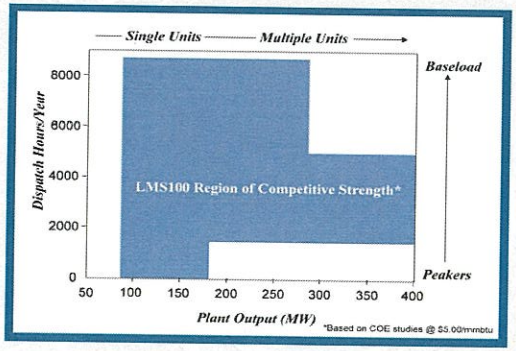
■ 50Hz and 60Hz Applications …the LMS100 can operate at 50Hz and 60Hz operation without a gearbox, reducing system complexity, plot size and cost, while increasing reliability.

■ Off-Frequency Operation …the LMS100 will operate with very little power variation for up to 5% reduction in grid frequency, allowing grid support in times of high demand and load fluctuations.

When your power generation need exceeds 100MW, the LMS100 can provide an economic solution in a multi-unit arrangement by providing high efficiency power with unmatched flexibility.

LMS100 Provides Outstanding Customer Value in 80+ MW Applications





ISO Performance Data

LMS100

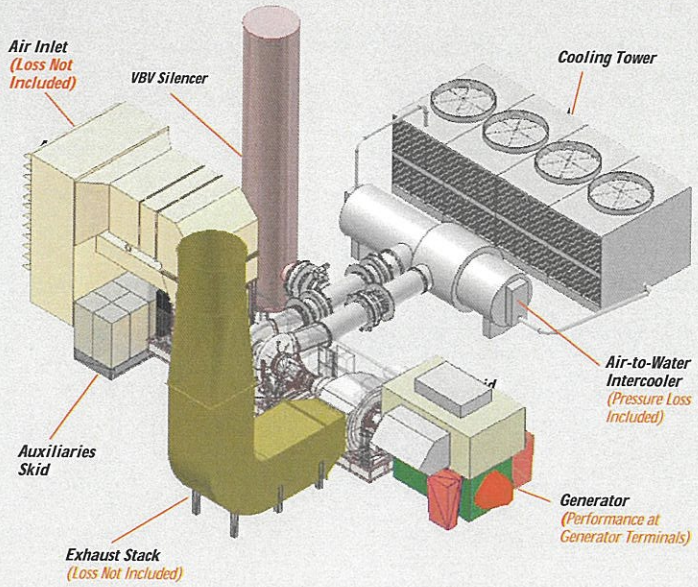
LMS100 ISO Performance Data

Simple Cycle Gas Turbine 60Hz Applications

Model	Output (MWe)	Heat Rate (BTU/KWH)	Efficiency %
DLE	98.7	7509	46
SAC (w/Water)	102.6	7813	44
SAC (w/Steam)	102.1	7167	48
STIG	112.2	6845	50

Conditions:

Performance at the generator terminals
NOx = 25 ppm
59°F, 60% Relative Humidity
Losses: 0"/0" inlet/exhaust
Fuel: Spec. Gas (LHV = 19000 BTU/lb)



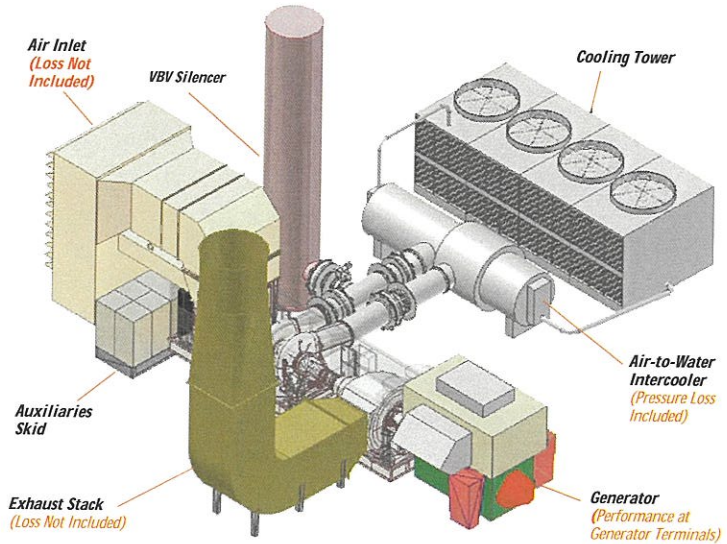
LMS100 ISO Performance Data

Simple Cycle Gas Turbine 50Hz Applications

Model	Output (MWe)	Heat Rate (**KJ**/KWH)	Efficiency %
DLE	99	7921	45
SAC (w/Water)	102.5	8247	44
SAC (w/Steam)	102.2	7603	47
STIG	110.8	7263	50

Conditions:

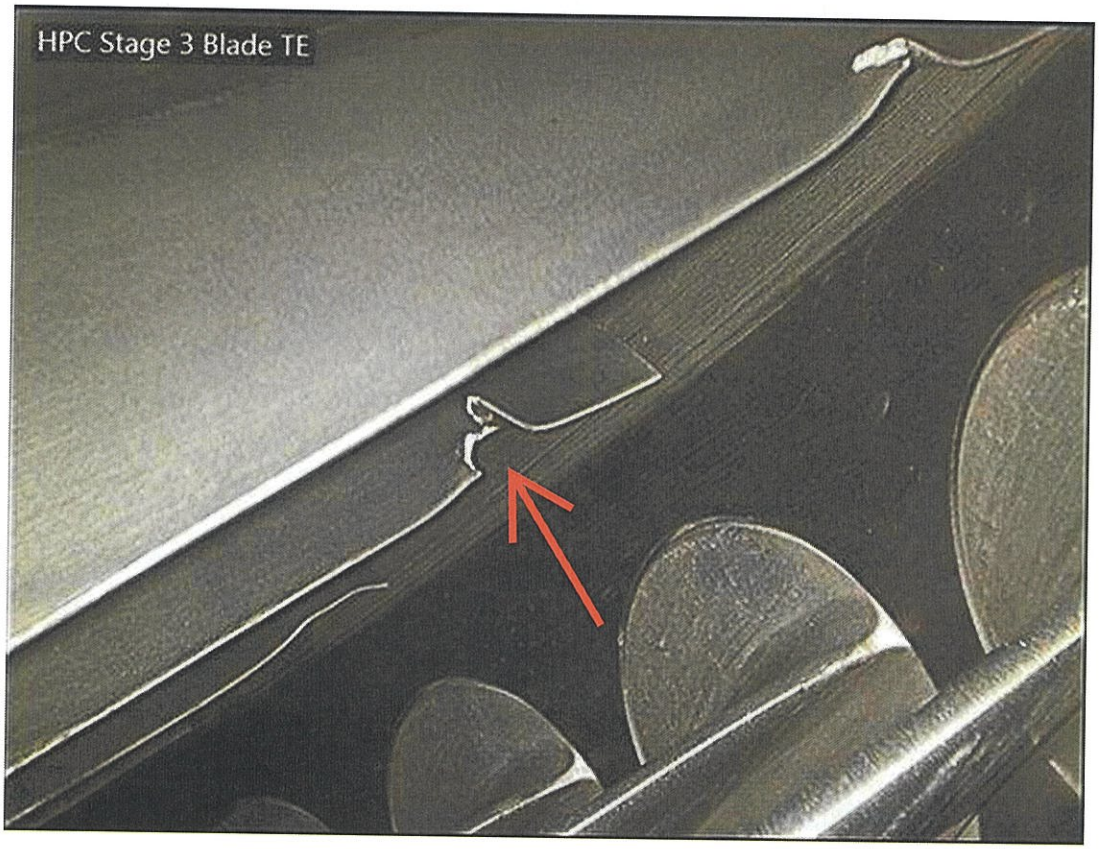
Performance at the generator terminals
NOx = 25 ppm
15°C, 60% Relative Humidity
Losses: 0mm/0mm inlet/exhaust
Fuel: Spec Gas (LHV = 44.2MJ/KG)

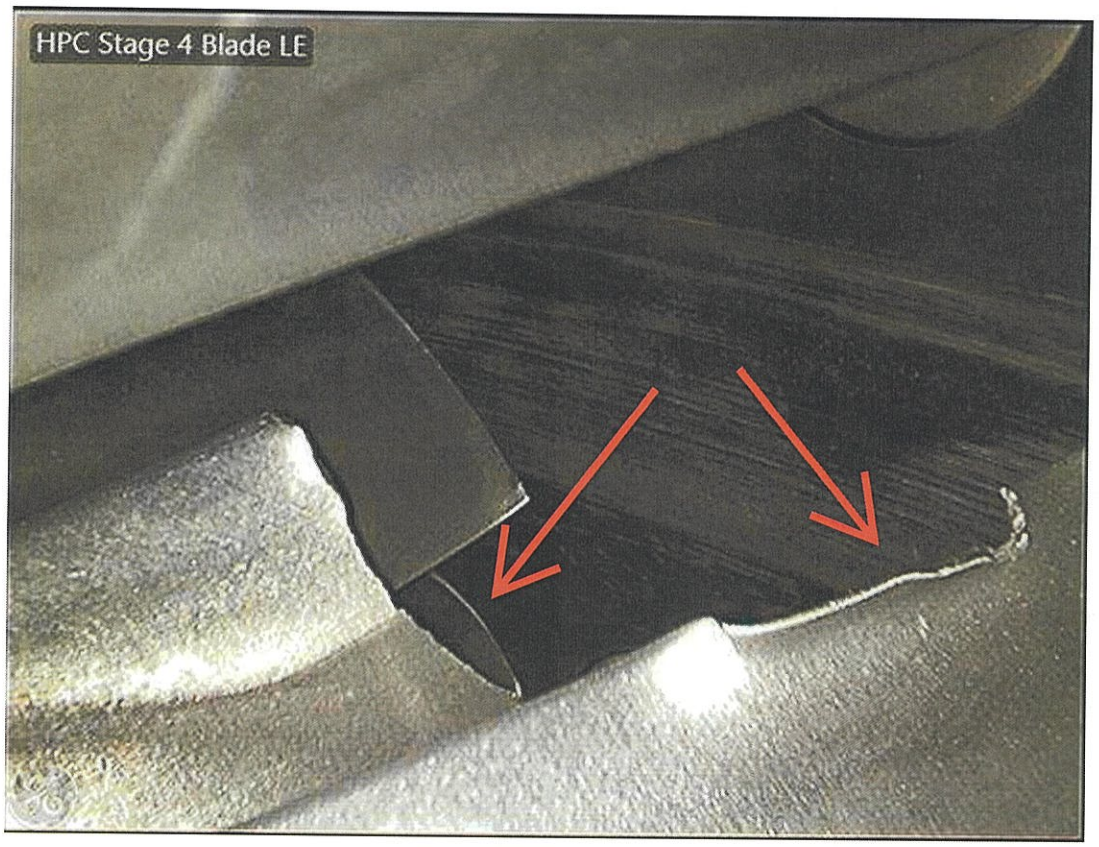


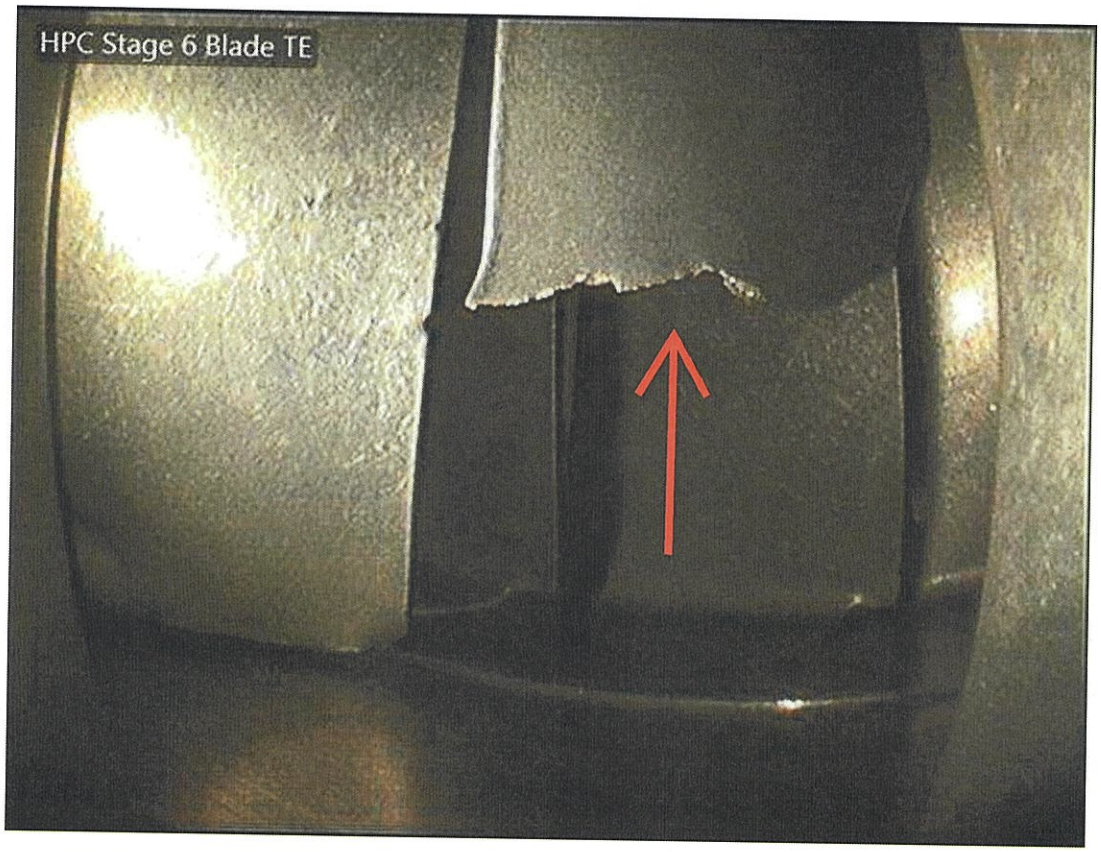
GEA13640-1 (11/03)

GE Power Systems

EXHIBIT 3 – PHOTOS OF DAMAGED SUPERCORE BLADES






HPC Stage 6 Blade TE

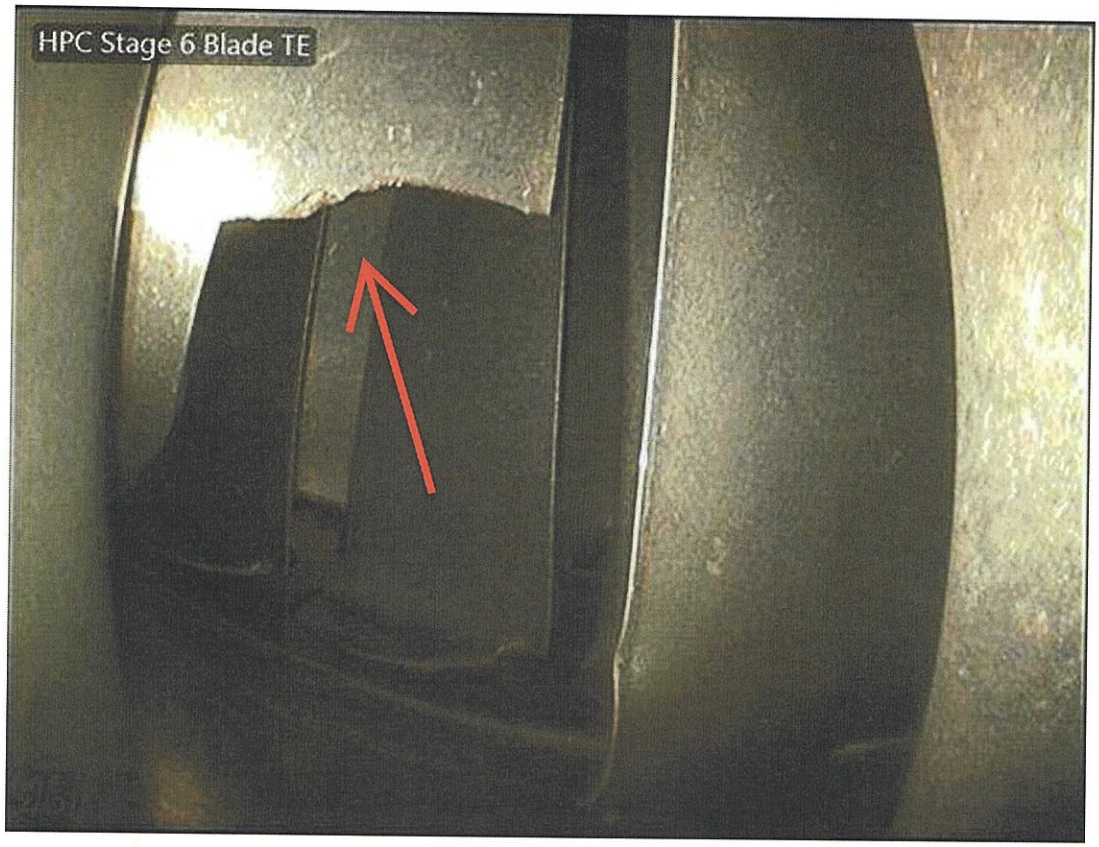

HPC Stage 6 Blade TE

EXHIBIT 4

LMS 100 PA

Borescope Inspection Report

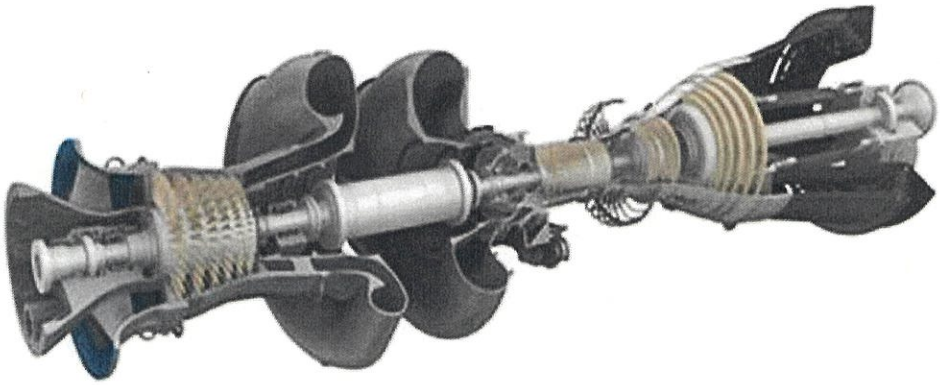
Mar 3 2029

LADWP

Site Haynes
Unit # 11
ESN 878-140

Oracle Project Number (OPN) 7309919
PowerMax Number (PMx) I01-089791

Customer Representative: Anh-Tuan Lee
GE Service Representative: Chuck McEnery



Purpose of visit:

The purpose of this visit was to perform a Periodic Borescope Inspection in reference IRW GEK 112166 Vol. II WP 4014 00 (Booster) and WP 4015 00 (Super Core)

Engine Serial Number 878-140 is **not available** for continued operation and is considered **not serviceable.**

Detail Findings Main Concerns	Engine had a compressor stall stages 3-14 have blade damage, Stg 2 HPT blade 1 L/E has crack, IPT stg 1 L/E has 1 blade dent, Power turbine stg 1 blade T/E has crack.
PAC Number (if available	
Notifications (CSL/CPM/PM/ENGR/or FieldCore SM/RM):	Mike Camp Frank Gamez

Follow Up Action Items for Engineering:

(Parts to be ordered, increased/extra inspection interval, SB or PB required, other maintenance)

Follow Up Action Items CSL/CPM/PM:

(Parts to be ordered, increased/extra inspection interval, SB or PB required, other maintenance)

Outage Data

Engine Data:

Engine/Package Hours and Fired Starts were obtained from: **Customer's Logbook, HMI Screen.**

ESN	878-140	**Engine Fired Hours**	6455
Model	LMS100 PA (SAC)	**Engine Fired Starts**	1095
Engine Cycles		**Package Hours**	

Maintenance Data

WP, SB, SL, PB, PL Performed	Manual/Revision Number	Date WP completed	Comments
WP 4014 00 (Booster)	GEK 112166 REV XX	3-3-2023	**Serviceable**
WP 4015 00 (Super Core)	GEK 112166 REV XX	3-3-2023	**Not Serviceable**

Parts Data

Description	Part Removed	SN Removed	Qty	Disposition	PN Installed	SN Installed

DETAILS AND DATA

Work performed:

(Add details as required per module serviceability and condition per GEK tables).

- **High Pressure Compressor Module (HPC)**
- **HPC Stage 1 Blade Midspans – Viewed in serviceable condition**
- **HPC Blades/ Vanes -Stages** 3-14 have blade damage unserviceable

. Stage 3 blade only: (1) Tears, nicks, and dents on leading and trailing edges Area A: Serviceable, if not more than 0.010 in. (0.25 mm) deep, and blade is not torn or bent. Torn edges not serviceable. Area B: Serviceable, if not more than 0.05 in. (1.3 mm) deep, and blade is not torn or bent. Torn edges not serviceable Not repairable Not repairable Replace blades

. Leading and Trailing edges of stages 1 through 9 Rotor Blades for: (1) Tears, nicks, and dents Any number of nicks and dents, 0.05 in. (1.3 mm) deep, if blade is not torn or bent. Torn edges are not serviceable Not repairable Replace blade

Leading and Trailing edges of stages 10 through 14 Rotor Blades for: (1) Tears, nicks, and dents within 0.30 in. (7.6 mm) of blade tip Any number of nicks and dents, 0.05 in. (1.3 mm) deep, if blade is not torn or bent. Any number of nicks and dents, 0.120 in. (3.05 mm), maximum of six blades per stage Not repairable Replace blades

- **Combustor - Viewed in serviceable condition**
- **High Pressure Turbine Module (HPT)**
- **HPT Stage 1 Nozzle - Serviceable**
- **HPT Stage 1 Blade – Missing TBC**
- **HPT Stage 1 Shrouds - RUBS**

- **High Pressure Turbine Module (HPT) Continued**
- **HPT Stage 2 Nozzle - Serviceable**
- **HPT Stage 2 Blades – L/E has crack**

. Leading Edges for: (1) Axial and radial cracks in area A because of impact damage (figures 37, 38, and 39) Any number, if cracks do not extend back to gill holes Not repairable Replace blade

- **HPT Stage 2 Shrouds - rubs**
- **HPT Borescope plugs -**

- **Intermediate Power Turbine Module (IPT)**
- **Stage 1 Blades L/E has 1 dent**
- **Stage 1 Nozzles Serviceable**
- **Stage 1 Shrouds serviceable**
- **Stage 2 Blades L/E has 1 crack on 1 blade**) Dents (large) or missing material Not serviceable Not repairable Replace blade

- **Stage 2 Nozzles serviceable**
- **Stage 2 Shrouds serviceable**
- **Power Turbine Module (PT)**
- **Stage 1 Blades has L/E crack**

Rotor Blades: a. All Areas for: (1) Cracks Not serviceable Not repairable Replace PT rotor and stator assembly

- **Stage 1 Nozzles**
- **Stage 2 Blades serviceable**
- **Stage 2 Nozzles serviceable**

- **Stage 3 Blades serviceable**
- **Stage 3 Nozzles**
- **Stage 4 Blades serviceable**
- **Stage 5 Blades serviceable**

Booster Borescope

J1 Hydraulic Hose Inspection

Inspection Area: All comments will be made at picture blocks, and details/data block section
Inspect J1 hoses per WP 4014 00.
Inspect hoses for fraying.
Inspect hoses for chaffing.
Inspect hoses for ruptures and leaks.

FACILITY PERMIT TO OPERATE
LA CITY, DWP HAYNES GENERATING STATION

SECTION D: FACILITY DESCRIPTION AND EQUIPMENT SPECIFIC CONDITIONS

The operator shall comply with the terms and conditions set forth below:

Equipment	ID No.	Connected To	RECLAIM Source Type/ Monitoring Unit	Emissions* And Requirements	Conditions
Process 3: SIMPLE CYCLE GAS TURBINE POWER GENERATION SYSTEM					
GAS TURBINE, UNIT 11, NATURAL GAS, GENERAL ELECTRIC, MODEL LMS100PA, INTERCOOLED, WITH WATER INJECTION, 906.6 MMBTU/HR WITH A/N: 559600 GENERATOR, GROSS AT 65 F, 102.7 MW	D159	C161	NOX: MAJOR SOURCE**	CO: 4 PPMV (4) [RULE 1703 - PSD Analysis, 10-7-1988]; CO: 2000 PPMV (5) [RULE 407, 4-2-1982]; NOX: 2.5 PPMV (4) [RULE 1703 - PSD Analysis, 10-7-1988; RULE 2005, 12-4-2015]; NOX: 25 PPMV (8) [40CFR 60 Subpart KKKK, 3-20-2009]; PM: 0.01 GRAINS/SCF (5A) [RULE 475, 10-8-1976; *RULE 475, 8-7-1978*]; PM: 0.1 GRAINS/SCF (5) [RULE 409, 8-7-1981]; PM: 11 LBS/HR (5B) [RULE 475, 10-8-1976; *RULE 475, 8-7-1978*]; PM10: 5.8 LBS/HR (4) [RULE 1303(b)(2) -Offset, 5-10-1996; *RULE 1303(b)(2)-Offset, 12-6-2002*]; SO2: (9) [40CFR 72 - Acid Rain Provisions, 11-24-1997]; SO2: 0.9 LBS/MEGAWATT-HOUR (8A) [40CFR 60 Subpart KKKK, 3-20-2009]; VOC: 2 PPMV (4) [RULE 1303(a)(1)-BACT, 5-10-1996; *RULE 1303(a)(1) -BACT, 12-6-2002*]	A63.4, A99.6, A195.8, A195.9, A195.10, A327.1, C1.4, C1.5, D29.7, D82.3, D82.4, E193.6, E193.7, E193.10, E193.13, K67.6
CO OXIDATION CATALYST, BASF, SS FOIL WITH ALUMINA WASHCOAT, MODEL CAMET, 80 MODULES, CATALYST TOTAL VOLUME: 160 CUBIC FEET A/N: 495978	C161	D159 C162			

* (1) (1A) (1B) Denotes RECLAIM emission factor
(2) (2A) (2B) Denotes RECLAIM emission rate
(3) Denotes RECLAIM concentration limit
(4) Denotes BACT emission limit
(5) (5A) (5B) Denotes command and control emission limit
(6) Denotes air toxic control rule limit
(7) Denotes NSR applicability limit
(8) (8A) (8B) Denotes 40 CFR limit (e.g. NSPS, NESHAPS, etc.)
(9) See App B for Emission Limits
(10) See section J for NESHAP/MACT requirements

** Refer to section F and G of this permit to determine the monitoring, recordkeeping and reporting requirements for this device.

SECTION D: FACILITY DESCRIPTION AND EQUIPMENT SPECIFIC CONDITIONS

The operator shall comply with the terms and conditions set forth below:

D29.8 The operator shall conduct source test(s) for the pollutant(s) identified below.

Pollutant(s) to be tested	Required Test Method(s)	Averaging Time	Test Location
NH3 emissions	District method 207.1	1 hour	Outlet of the SCR serving this equipment

The test shall be conducted and the results submitted to the District within 90 days after the test date. The AQMD shall be notified of the date and time of the test at least 10 days prior to the test.

The test(s) shall be conducted at least once every year. If a source test results show a violation of the NH3 limit the future source tests shall be conducted quarterly. The source test frequency may be reduced to annually only after four consecutive quarterly tests of demonstrating compliance.

The NOx concentration, as determined by the certified CEMS, shall be simultaneously recorded during the ammonia slip test. If the CEMS is inoperable or not yet certified, a test shall be conducted to determine the NOx emissions using District Method 100.1 measured over a 60 minute averaging period.

The test shall be conducted to demonstrate compliance with the Rule 1303 concentration limit.

[RULE 1135, 11-2-2018; **RULE 1303(a)(1)-BACT, 5-10-1996;** RULE 1303(a)(1) -BACT, 12-6-2002]

[Devices subject to this condition : C162, C168, C174, C180, C186, C192]

D82.1 The operator shall install and maintain a CEMS to measure the following parameters:

SECTION D: FACILITY DESCRIPTION AND EQUIPMENT SPECIFIC CONDITIONS

The operator shall comply with the terms and conditions set forth below:

[RULE 2012, 2-5-2016]

[Devices subject to this condition : D125, D129, D134, D142]

D82.3 The operator shall install and maintain a CEMS to measure the following parameters:

CO concentration in ppmv

Concentrations shall be corrected to 15 percent oxygen on a dry basis.

The CEMS shall be installed and operated to measure CO concentration over a 15 minute averaging time period.

The CEMS shall be installed The CEMS shall be operated in accordance with an approved AQMD Rule 218 CEMS plan application.

The CEMS will convert the actual CO concentrations to mass emission rates (lbs/hr) and record the hourly emission rates on a continuous basis.

CO Emission Rate, lbs/hr = K*Cco*Fd[20.9/(20.9% - %O2 d)][(Qg * HHV)/106], where

1. K = 7.267 *10-8 (lb/scf)/ppm
2. Cco = Average of four consecutive 15 min. average CO concentration, ppm
3. Fd = 8710 dscf/MMBTU natural gas
4. %O2 d = Hourly average % by vol. O2 dry, corresponding to Cco
5. Qg = Fuel gas usage during the hour, scf/hr
6. HHV = Gross high heating value of fuel gas, BTU/scf

[RULE 1303(a)(1)-BACT, 5-10-1996; RULE 1303(a)(1)-BACT, 12-6-2002; RULE 218, 5-14-1999]

FACILITY PERMIT TO OPERATE
LA CITY, DWP HAYNES GENERATING STATION

SECTION E: ADMINISTRATIVE CONDITIONS

The operating conditions in this section shall apply to all permitted equipment at this facility unless superseded by condition(s) listed elsewhere in this permit.

1. The permit shall remain effective unless this permit is suspended, revoked, modified, reissued, denied, or it is expired for nonpayment of permit processing or annual operating fees. [201, 203, 209, 301]
   a. The permit must be renewed annually by paying annual operating fees, and the permit shall expire if annual operating fees are not paid pursuant to requirements of Rule 301(d). [301(d)]
   b. The Permit to Construct listed in Section H shall expire one year from the Permit to Construct issuance date, unless a Permit to Construct extension has been granted by the Executive Officer or unless the equipment has been constructed and the operator has notified the Executive Officer prior to the operation of the equipment, in which case the Permit to Construct serves as a temporary Permit to Operate. [202, 205]
   c. The Title V permit shall expire as specified under Section K of the Title V permit. The permit expiration date of the Title V facility permit does not supercede the requirements of Rule 205. [205, 3004]
2. The operator shall maintain all equipment in such a manner that ensures proper operation of the equipment. [204]
3. This permit does not authorize the emissions of air contaminants in excess of those allowed by Division 26 of the Health and Safety Code of the State of California or the Rules and Regulations of the SCAQMD. This permit cannot be considered as permission to violate existing laws, ordinances, regulations, or statutes of other governmental agencies. [204]
4. The operator shall not use equipment identified in this facility permit as being connected to air pollution control equipment unless they are so vented to the identified air pollution control equipment which is in full use and which has been included in this permit. [204]