Ask The Expert: Gas Turbine Reliability and Availability in Today's Market

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1. Can you tell us a little about yourself?

David Simmons, Director of Engineering, has over 30 years of experience in power plant engineering, installation, and commissioning.
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2. Why are reliability and availability important for legacy gas turbines in today's markets?

Reliability and availability are crucial to legacy gas turbines because they are called upon during peak demand and emergencies to avoid service interruptions and reduce existing baseload generation stresses. They are also frequently used to replace generation from units out of service due to planned and unplanned outages.

3. Many of the installed bases of gas turbines are as much as 50+ years old but still play an important part in the US electrical infrastructure; why is that?

The increased use of renewables, coupled with the retirement of coal and nuclear generation plants, has increased the importance of having reliable standby generation ready to run on short notice. Fluctuations in the amount of power available to the grid are leveled out using older assets to make up the difference.

4. Many gas turbines were installed with only single fuel capability, either as base load units or peaking units; however, now many units are adding an additional fuel capability; what fuel types are being added and why?

Operators see an increased requirement to have the ability to run on alternate fuel, especially units that burn only natural gas. The increased use of natural gas has created supply issues during peak demand, such as cold or hot spells.

Generators can find their natural gas supply limited or shut off when the demand from other users increases. This limits their generation capacity and availability at times of peak demand, leading to lost revenue and potential issues with grid stability. Alternately, some users who burn only liquid fuel want a cheaper and cleaner option and look to add natural gas as their primary fuel. This has the added benefit of increasing unit reliability while decreasing the maintenance and operational issues associated with burning liquid fuels.

5. What are some factors that can impact a gas turbine's availability and reliability?

Maintaining the auxiliary and support systems is vital to having a reliable gas turbine available when needed. As units age, critical systems such as the turbine controller become unreliable and obsolete. These systems must be upgraded or replaced with modern systems that are more reliable and compliant with today's cybersecurity standards. Proper fuel system maintenance is crucial to a unit's ability to start reliably when called upon.

Older systems that use oil and air for valve positioning degrade over time due to contamination and wear and should be replaced with modern systems. In addition, TTS pioneered the use of electronic valves for controlling fuel flow to gas turbines in 1991 and continues to lead innovation efforts to increase turbine reliability and performance and reduce emissions.

6. Besides the apparent engine and generator mechanical overhaul, what other types of programs can an operator employ to ensure good reliability and availability?

Regular maintenance of all turbine support systems is critical to unit reliability and availability. Older units often still have antiquated hydraulic and pneumatic controls that require regular maintenance and cleaning. Older valving and instrumentation need to be checked for operation and calibration yearly. Legacy control systems require adequate spare parts due to discontinuation and obsolescence.

Maintaining older operator interface terminals includes making sure application software is up to date and that the OEM still supports the OS. Backup liquid fuel systems should be exercised regularly to avoid coking, fuel contamination, and stagnation. The turbine oil system should be checked regularly for water intrusion, contamination, and physical property compliance with OEM requirements. Proactive monitoring of turbine operating parameters to identify sudden changes from the norm can be used to anticipate and avoid future issues.

7. What other upgrades/modifications/programs can operators implement to keep their gas turbines competitive and relevant in today's transitioning energy market?

- Modernization of legacy controls increases overall reliability:
    - Better turbine control and monitoring
    - Compliance with current Cyber Security standards
    - More reliable components with readily available spare parts
    - Historical data retention for predictive analysis and forensics
    - Electronic overspeed protection
    - Updated generator controls and excitation
- Fast start modifications to allow for units to come on-line quickly;
    - NFPA 85 compliant purge credit systems
    - Evaluation of existing purge timers based on unit configuration.
    - Optimized ignition timing, including a fire on the fly.
    - Increased unit acceleration rate
    - Optimized unit synchronization
    - Faster loading rate once online
    - Base load premix transfers for units with DLN-1 combustion systems.
- Liquid Fuel System modifications to reduce coking and other startup issues;
- Emissions reduction systems to allow for increased operating hours.
    - Dry Low Emissions combustion

- Water Injection
- Steam Injection