AERODERIVATIVE OR INDUSTRIAL GAS TURBINES?

Gas turbines are at the heart of many modern power stations and often at the centre of large and complex claims. Alistair Lamb, Managing Director - Singapore, Integra Technical Services considers the two main types of gas turbine and some key claims considerations.

A gas turbine is the engine that provides the energy to generate electricity. They are constructed from compressor, combustion and turbine sections. Air entering the compressor is increased in pressure (and reduced in volume) through multiple stages of rotating compressor blades and static vanes. Compressed air is then mixed with fuel (gas or liquid) and ignited. The combusted fuel and air mixture is finally directed through the turbine where it expands through a series of rotating blades and static vanes and induces turbine shaft rotation.

Some gas turbines have a secondary turbine (known as the Power Turbine or PT) which is not directly connected to the gas turbine shaft but is, also, induced to rotate by the expanding exhaust gases. The electrical generator is directly coupled to the gas turbine shaft or to the PT shaft depending on the configuration.

Gas turbines developed from illustrious beginnings in the aviation sector to their more common contemporary use in power generation. Frank Whittle is considered as the father of modern turbines, with his 1930 patent. Whittle tried to stress the great simplicity of his design to Rolls-Royce, to which their reply was "…we'll soon design the bloody simplicity out of it". And so, the turbine age began.

The aviation industry has relied on gas turbines since the 1930s but industrial gas

turbines did not lag much, with the first gas turbine power plant at Brown Boveri, Switzerland, starting in 1939.

Aeroderivative gas turbines, as the name suggests, are derived from aircraft engines. If you look at a modern jet engine you will see the front fan blades, should you look behind these you would see the turbine engine core (the part used for power generation).

Military and aerospace investment gave aeroderivative gas turbines an early advantage, but industrial units have narrowed the gap. Whilst aeroderivative offer many advantages, power limitations and emissions issues make them less popular for large power generation. Coupled with this, they are more complicated (multiple independent shafts, higher pressure ratios, cutting edge technology/materials etc.), sensitive to upsets (e.g. poor fuel) and require operators to work at higher standards.

AERODERIVATIVE AND INDUSTRIAL GAS TURBINE COMPARISONS

	AERODERIVATIVE	INDUSTRIAL/HEAVY/FRAME
TYPICAL POWER	<60MW	Up to 400MW
MANUFACTURER	Rolls-Royce, GE, Pratt & Whitney	Siemens, Solar, Alstom
EXAMPLE MODELS	Rolls-Royce RB211 Trent	GE Frame 5/7/9
EFFICIENCY	37-42%	28-34%
CAPEX (USD PER MW)	1.1million - 1.5million	0.4million - 1.3million
CHARACTERISTICS	Lightweight, efficient, small footprint, exotic materials, high pressure ratio, poor emissions	Heavy/bulky but more powerful and simpler engineering, low pressure ratio, good emissions
INTERNAL DESIGN	Multiple independent shafts to run at optimal speed with PT matched to generator speed	Single shaft fixed to generator speed, multiple variable compressor vanes to control airflow
TYPICAL USE	Offshore platforms, processing facilities, and LNG plants as simple cycle peaking plants	Baseload applications or as part of Combined Cycle GT (CCGT) or Cogen plants
OPERATIONS COMMENTS	Quick to ramp up and react to load changes, expensive OPEX	Slower ramp due to temperature growth, rapid starts affect Equivalent Operating Hours (EOH)
MAINTENANCE COMMENTS	Modular design, easy inspection, fast cooldown, 24-48 hour change-out, easier transport, overhaul off-site at dedicated facility, sensitive to issues such as poor fuel	20-28 day change-out, overhaul at site with large team, long cooldown periods

CLAIMS CONSIDERATIONS

Whether you are dealing with an aeroderivative or industrial gas turbine claim, there are many common issues which should be addressed. Care should be taken to understand the equipment as there may be additional considerations which must be taken into account.

Here is a sample list of questions you could ask:

- What is the operating profile compared to design i.e. peak gas turbine running as base load?
- How does the operating hours or equivalent operating hours (EOH) stack up against the Original Equipment Manufacturers' (OEM) maintenance schedule?
- Are there any Long Term Service Agreements (LTSA) in place and how would such a contract impact the claim decisions?
- Is the gas turbine repairable or is replacement necessary? Cost must be a consideration; however, lead times are also key.
- Where would repairs be undertaken? Where is the best off-site aeroderivative overhaul facility (if any) and are there any logistical concerns?
- For industrial on-site repair, what is the availability of manpower, parts, tooling etc.?
- Does the OEM offer a lease engine option?
- Are there any special considerations, such as availability of long-lead items, or exotic components?
- Are there any alternative remedial solutions e.g. temporary repair, alternate sourcing of parts and/or equipment, expedited repair, fabrication and/or delivery?

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