Gradoia, they have plans to expand the technology to other platforms.

Reportedly, single-flow "A" series steam turbine prices range anywhere from $15 million to $20 million FOB, including the HEAT steam turbine, its electric generator, all controls and auxiliaries.

The A series advanced steam turbines are available in 50 Hz in both single-shaft or multi-shaft combined cycle plant configurations and in 60 Hz for multi-shaft plant applications only.

Reasoning here, say company marketing specialists, is that in the 60-Hz US market, buyers generally specify multi-shaft combined cycle arrangements, i.e. separate gas turbine and steam turbine generator sets.

In such applications, the gas turbine genset is often equipped with a bypass stack to provide capability to run simple cycle for maximum plant flexibility with a peaking option. Multi shaft is also seen as a preference in some parts of Europe and Asia.

On the other hand, especially in southern Europe, a single-shaft arrangement with the gas turbine and steam turbine driving opposite ends of a single electric generator is favored as being a more reliable design.

Simple cycle gas turbine operation is not considered a good idea, due in part to sensitivity to environmental regulations.

Operation

The "A" series, which is designed for rapid start-up, features a compact design that maximizes power density in crowded utility and industrial plant areas. Machines are constructed with a separate HP casing and a combined IP/LP casing.

Axial exhaust arrangement with a high efficiency LP hood and diffuser allow simple system arrangements to save installation and construction costs.

A wide range of last-stage buckets accommodate site-specific backpressure conditions, says GE, with 60-Hz models available with up to 40-inch buckets (48 inches for 50-Hz designs.) Valve design improvements include enhanced low pressure-drop combined stop and control valves.

Future models

Industry sources figure that later HEAT designs will be introduced for H-technology gas turbines powering 50/60-Hz combined cycle plants with a triple pressure plus reheat configuration.

Unofficially, it is reported, General Electric's HEAT models may eventually cover a unit output range of 85 to 300 MW – perhaps even higher.

The company's larger "D" series steam turbines could also be done in the HEAT configuration for 50- or 60-Hz single shaft and multi shaft combined cycle configurations.

The D series is specifically designed for a wide range of inlet steam conditions up to and including heavy HRSG supplementary firing.

Unit power ratings currently run from 120-425 MW. Maximum steam conditions are 1920 psig/1050°F/ 1050°F. Arrangement is a combined HP/IP section and double-flow LP section.

Basic design is made up of a pre-assembled single-shell HP/IP section which reduces site installation time. This design feature would be retained in the HEAT units.

Diaphragms are pre-installed, the rotor is pre-installed and aligned and balanced. All units ship with a standardized instrumentation package for operation and monitoring.

Like the smaller A units, there is a wide range of last-stage buckets to accommodate site-specific backpressure conditions. Max length is 40 inches for 60 Hz units and 48 inches for 50-Hz units.

TransCanada Turbines operating new LM6000 "power station" test facility

Quick changeout test cell design allows rebuilt/reconditioned turbine testing at full load using cold end drive and feeding power into the gridójust like your site installation.

Last year, turbine repair and overhaul specialist TransCanada Turbines, opened a new cold-end drive test facility for General Electric LM6000 PA and PC gas turbines..

Unique facility is located at an actual power generating station, specifically the Cavalier Power Station near Strathmore in Alberta, Canada, which is owned and operated by EnCana, an independent oil and gas and energy company.

The facility allows TCT to test against a live power grid, using a real package with systems and controls identical to actual customer conditions. Cold-end drive testing on the grid duplicates the engine's actual operation on-site and can be used for full load and partial load testing.

Most other test facilities emulate LM6000 performance using a hot end drive test bed. TCT says theirs is the only one in the world that employs cold-end drive, which is the standard LM6000 design drive configuration.

Works on weekends

TCT management worked out an agreement with EnCana executives, where it has access to Cavalier test facility during off peak power periods, which are typically on weekends.

The EnCana Cavalier Power Station is a 115-MW natural gas-fired combined cycle power plant (two LM6000, two OTSG heat recovery boilers and one steam turbine generator) which supplies electricity to the Alberta grid.

TCT, working with Fern Engineering and Wood Group Power Solutions, modified an existing LM6000 PC package into a quick changeout test cell, and adapted it to accommodate the shorter PA engines also.

This reduced the time required to remove, reinstall and align an engine from 36 hours down to 12 hours.

Test cell design has all quick disconnect connections for everything but the natural gas supply, which uses the standard ANSI bolting flange.

TCT constructed a 2,400 sq ft preparation building adjacent to the existing EnCana package with a 15-ton crane and a specialized monorail system to aid in engine removal and installation.

A subskid was designed to provide a mounting stand for the engine to facilitate quick alignment and to support the quick disconnect interface connections.

Controls modified

The standard GE Mark VI Speedtronic control system was replaced by a Woodward MicroNet Control System, which is capable of operating all versions of the LM6000.

In addition to the new control system, TCT added extra instrumentation for engine troubleshooting and performance calculation.

New data acquisition system, which is based on Yanos aerospace engine test log sheet (ETLS) technology, performs all data archiving, performance calculation, log sheet reports, trending and diagnostics.

Using this system, test engineers can produce immediate test results and make a comparison to average "new engine" performance.

Addition of Yanos remote client software also enables the company to provide on-line calibrations and calculation of performance numbers.

First tests

TCT's first test of an LM6000 PA engine was completed in January 2004. The company had successfully completed its first LM6000 PC test in 2003.

Pete Watson, President of TCT, says, iThe system is set up so that what our customers witness during testing of their turbines, either in person or via the Internet, should be the same as what they will receive at their plant when the engine is reinstalled.

"What it boils down to is that cold-end drive testing on the grid duplicates the engine's actual operation on-site. Hot end drive testing is not how the LM6000 typically operates.

"We can also test engines before beginning a repair to confirm the fault diagnosis and evaluate performance issues," he concludes.

Final reports

Using Microsoft SQL server, complex database queries are developed to create "views" of data that cross the boundaries of TCT's systems.

Test engineers report that these systems can quickly gather test data, details of new/repaired parts and even labor hours to produce final reports to customers.

In terms of troubleshooting, this system can quickly create plots versus other selected engines in TCT's historical database.

Engineers can then relate performance to build data, create cost benefit analysis and optimize workscopes which will lead to improved test cell pass rates and reduced overhaul costs.

Twelve-hour swap. Specialized quick disconnects, engine crane and monorail handling systems allows test engineers to remove, reinstall and align an LM6000 for weekend full load testing using standard cold end drive and producing MWs at a functioning power plant site installation.