Siemens SCC5/6-8000H

Now that design performance of the 50-Hz 8000H combined cycle plant has been verified, Siemens is centered on expediting validation testing of 60-Hz plant design to meet scheduled delivery orders for utilities in the U.S. and S. Korea.

Operating in utility revenue service, the 50-Hz power plant is reported to have achieved 578MW net output with 60.75% efficiency (5618 Btu/kWh heat rate) at design conditions burning natural gas fuel.

During operational testing, say project test engineers, the plant routinely accomplished hot startups from zero to 570MW full load run-ups in less than 30 minutes following a 6- to 8-hour shutdown.

In addition, the plant regularly demonstrated ramp rates of 35MW per minute above a stable minimum combined cycle load of 100MW without any problem.

Unofficial reports are that by 2015, Siemens plans on upgrading performance of its 50-Hz 8000H combined cycle plant design to more than 600MW net plant output and over 61.5% efficiency.

Optimized steam cycle

Apart from the SGT5-8000H gas turbine design, say project engineers, notable advances in the water/steam cycle contributed to improving 8000H combined cycle plant efficiency and flexibility.

Live steam conditions in the steam turbine were increased to 600°C/171 bar for the high pressure (HP) section and 600°C/35 bar for the intermediate pressure (IP) section.

The low pressure (LP) turbine features a titanium last stage blade, claimed to be a first for steam turbine technology in this size.

The once-through HRSG boiler design at Irsching was specially engineered and built by Siemens to handle much higher steam flows, temperatures and pressures than earlier plants.

The design also allows greater flexibility with respect to startup, cycling and shutdown operation.

Simple cycle 8000H gas turbine ratings. The 50-Hz SGT5-8000H gas turbine is ISO rated at 375MW and 40.0% efficiency. Scaled 60-Hz SGT6-8000H design is rated at 274MW and 40.0% efficiency.

Simple Cycle	50-Hz Gas Turbine	60-Hz Gas Turbine
Design Parameters	SGT5-8000H	SGT6-8000H
ISO base load	375 000 kW	274 000 kW
Gross heat rate	8000 kJ/kWh (8530 Btu)	8530 Btu/kWh (8000 kJ)
Gross efficiency	40.0%	40.0%
Pressure ratio	19.2 to 1	19.5 to 1
Turbine speed	3000 rpm	3600 rpm
Exhaust flow	829 kg/sec (1828 lb)	1332 lb/sec (604 kg)

Source: 2012 GTW Handbook, Vol. 29

60-Hz CC plant

Siemens is now looking forward to commercial development and introduction of the 60-Hz combined cycle plant configurations designed around the SGT6-8000H gas turbine.

This machine, rated at 275MW, is a direct scale of the 50 Hz SGT5-8000H, except for the combustion system.

As a result, only limited validation test operation will be required to fully prove the entire combined cycle integrity of the 60-Hz version.

The first SGT6-8000H gas turbine unit installed in the test center at Siemens' Berlin factory has been subjected to a 6-month test program, concurrent with the manufacture and assembly of production engines.

Siemens reports that utilities have already placed introductory orders for the new 60Hz 8000H combined cycle based on its projected design performance and test results for the 50-Hz plant.

Florida Power & Light in the U.S. is building a 1250MW 3-on-1 combined cycle plant with three duct-fired HRSGs for commercial startup by mid-2013, will replace an old steam-fired station at Cape Canaveral.

GS Electric in Korea is building a 410MW LNG-fired combined plant designed around a single SGT6-8000 gas turbine, unfired HRSG and steam turbine for scheduled startp in late 2013. ■

See May-June 2010 GTW "New 60-Hz 8000H", pp 12-16 and Jul-Aug 2011 "Validation of 50-Hz 8000H" pp 14-17, by Junior Isles.

Combined cycle 8000H power plant ratings. During 50-Hz validation tests, the SCC5 combined cycle demonstrated 578MW net plant output at 60.75% efficiency, zero to full load in under 30 minutes, and 35 MW/min peak ramp rates.

Single-Shaft	50-Hz CC Plant	60-Hz CC Plant
Plant Parameters	SCC5-8000H-1S	SCC6-8000H-1S
Intro year	2011	2012
Net plant output	570,000 kW	410,000 kW
Plant heat rate	< 6000 kJ/kWh (5687 Btu)	< 5687 Btu/kWh (6000 kJ)
Net plant efficiency	over 60.0%	over 60.0%
Gas turbine output	375,000 kW	274,000 kW
Steam turbine output	195,000 kW	136,000 kW

Source: 2012 GTW Handbook, Vol. 29