April 26th, 2007

Dear Customer,

We are pleased to enclose a major upgrade to our software suite, Version 17, with the following highlights:

(1) GT PRO and GT MASTER now include exergy accounting for the combined cycle, gas turbine, HRSG, and ST/condenser.

(2) A significant number of new components were introduced into THERMOFLEX for modeling coal gasification, and IGCC power plants. These components are fully compatible with their GT PRO and GT MASTER counterparts.

(3) A new air-swept pulverizer model was developed and is included in STEAM PRO/STEAM MASTER and THERMOFLEX.

(4) THERMOFLEX now includes the CFB model that has been part of STEAM PRO since early 2004.

(5) THERMOFLEX can now import STEAM PRO files and create an equivalent THERMOFLEX file using a procedure that mirrors that available for GT PRO files since 1996.

(6) THERMOFLEX can now import GT PRO files that include Gasification systems, and Desalination systems.

(7) PEACE cost estimates were updated to reflect increases in major equipment costs, and the continued strong demand for labor, key materials, and basic commodities including steel and concrete.

These developments along with a number of other smaller improvements are described in more detail below.

GT PRO / GT MASTER / PEACE

Exergy analysis for the combined cycle, gas turbine, HRSG, steam turbine and cooling system is reported for each run. This group of text and graphics reports provides an accounting of exergy loss in the major systems in the combined cycle plant.

GTPRO's automatic HRSG hardware design logic was revised so it is more consistent with current industry practice. This change will not affect heat balance results. However, re-running old files using this new logic will yield changes in computed boiler size, weight, and cost.

Syngas enthalpy functions were improved in the temperature range 2000 – 3500 F, 1000 – 1900 C. This may result in changes on the order of 0.1% to computed plant efficiency for old files.

A new option is available to reduce syngas cooling to maintain a minimum HPB steam generation rate in the HRSG. This feature, available on the main tab of the Gasification topic, is especially helpful when designing air-blown IGCC plants, or those gasifier systems generating syngas with very low heating values.

New deaerator choices were added to the Water Circuits topic to make it easier to model systems with integral and standalone deaerators.

GT MASTER's cooling system import feature, accessible from the main menu bar using Tools -> Import Cooling System from GT MASTER File..., was expanded. It now allows changing cooling system type, and has the ability to import selected portions of a cooling system, for example only the cooling tower. So, now a GT MASTER model originally created with an open-loop condenser can replace it with an air-cooled condenser from a different file. Additionally, a cooling tower alone can be imported from a file and added to the model to change from open-loop to condenser/cooling tower.

GT PRO and GT MASTER's GT Selection menu was revised to make finding a particular GT spec easier. An option to display historical / alternate spec names was added to make it easier to find engines previously sold by a different company, or those that have been renamed.

The GT PRO-only mode simplified financial analysis was eliminated.

Desalination vacuum steam supply steam may be set to 'external'.

Gas Turbine Data Base

The gas turbine data base, used by the various Thermoflow products was updated, as shown below. The database presently includes over 350 different engine specs.

Engines added to the database			
325	RR 501-KB7S	326	GE LM6000 PC 60 Hz
348	RR 501-KB3	327	GE LM6000 PC 60 Hz (VIGV)
		328	GE LM6000 PD 60 Hz
343	MHI 501F	329	GE LM6000 PF 60 Hz
344	MHI 701F	330	GE LM6000 PC SPRINT 60 Hz
		331	GE LM6000 PC SPRINT 60 Hz (VIGV)
345	ALSTOM GT26	332	GE LM6000 PD SPRINT 60 Hz
349	ALSTOM GT13E2	333	GE LM6000 PF SPRINT 60 Hz
		334	GE LM6000 PC 50 Hz
347	GE 9371 FB	335	GE LM6000 PC 50 Hz (VIGV)
		336	GE LM6000 PD 50 Hz

346	Westinghouse W251 B8	337	GE LM6000 PF 50 Hz
350	SGT6-5000F	338	GE LM6000 PC SPRINT 60 Hz
351	SGT5-3000E (33MAC)	339	GE LM6000 PC SPRINT 60 Hz (VIGV)
342	SGT5-2000E (33MAC)	340	GE LM6000 PD SPRINT 60 Hz
		341	GE LM6000 PF SPRINT 60 Hz
Existing engines with modified performance			
255	GE 6581B	302	GE LMS100 50 Hz (WET IC)
300	GE LMS100 60 Hz (WET IC)	303	GE LMS100 50 Hz (DRY IC)
301	GE LMS100 60 Hz (DRY IC)	304	SGT5-3000E (41MAC)

Estimated price was updated for each engine.

THERMOFLEX / PEACE

Chapter 22 – GASIFICATION is included with this update and should be inserted into your manual. This chapter covers newly added components used for syngas production, cooling, and cleanup. These components are located on the new **Gasification** tab. They were derived in whole or part from models available in GT PRO and GT MASTER since TFLOW13, released in March of 2004. The new gasification components are listed below:

1. Type 1, Type 2, Type 3, and User-defined gasifier systems

2. Air separation system

3. Gas cleanup system

4. Radiant and convective syngas coolers

5. Syngas scrubber

6. CO shift, COS hydrolysis, and CO2 capture components

7. Acid gas removal component

8. Syngas moisturizer

9. Syngas separator

GT PRO models including gasification systems can now be imported into THERMOFLEX without loss of fidelity. Additionally, GT PRO models including desalination via MSF, MED, or RO can be imported into THERMOFLEX without loss of fidelity.

STEAM PRO models may now be imported into THERMOFLEX, using a similar process to that which has been available for GT PRO files since THERMOFLEX's initial release in 1995.

A **Flue Gas** tab was added to the component bar. It houses components used to process flue gasses, which had previously been located on various tabs. A physical model of a tubular air heater, typically used to preheat air in CFBs, was added and is available on this new tab. An SCR for conventional boilers was included and is located on this tab.

A Circulating Fluidized Bed (CFB) and a radiant boiler including an air-swept pulverizer were added to the **Water / Steam** tab. These components are shared with STEAM PRO / STEAM MASTER.

A General Process icon was added to the **General** tab. Similar to the Water / Steam process icon, it allows specification of flow and pressure, but for a general fluid. When the optional through-flow node is connected, this icon behaves like a flow dictator with user-selectable priority.

THERMOFLEX includes REFPROP 8.0, the most up-to-date version of the thermodynamic property library available from NIST. From the NIST program, five additional pure substances; R-21, Pentane, Isopentane, Hexane, and Benzene, were added to THERMOFLEX's refrigerant selection list. In addition, the ammonia-water fluid now has the option to use the REFPROP (NIST) formulation or the Thermoflow formulation. *Please note that computations using REFPROP's ammonia-water mixture properties can be extremely slow, as much as 1000 times slower than with Thermoflow's ammonia-water mixture properties. This is an inherent feature of the NIST property formulation, and has nothing to do with THERMOFLEX itself.*

The Edit menu now includes Undo (Ctrl-Z) and Redo (Ctrl-Y) functions to facilitate making changes to the flowsheet while in Edit Drawing mode.

A number of components were imbued with inputs to specify user-defined Emissions from combustion. THERMOFLEX provides an output summary table for all emissions generation and emissions mitigation via theSummary/Stream/Emission Tables output menu.

ASHRAE weather data is now available from the Site menu. This information includes average conditions along with winter / summer extremes for hundreds of weather stations around the world.

Reciprocating Engine Data Base

The reciprocating engine data base, used by THERMOFLEX and RECIPRO, was updated as follows:

Engines added to the database			
375	RR B35:40V12AG (Gas)	376	RR B35:40V16AG (Gas)
377	RR B35:40V20AG (Gas)		

STEAM PRO / STEAM MASTER / PEACE

Features needed to model brown-coal boilers are now available. For plants burning lignite, the brown-coal boiler configuration is now chosen by default by STEAM PRO's automatic boiler logic. Brown coal boilers recirculate hot flue gas, tempered with air. This gas stream dries and transports the fuel to a

beater mill which pulverizes it and drives it to the burners. The features needed to model this configuration are available on STEAM PRO's Boiler Thermal topic.

A more detailed combustion air heating and delivery model was introduced along with a model of an air-swept coal pulverizer. This more detailed model allows specification of fuel delivery condition after the pulverizer and determines primary air heating and heater bypass flows accordingly. At off-design, controls are in place to achieve desired fuel temperature delivered to the burners, and to control the air flow to the pulverizer in accordance with fuel transport requirements.

STEAM PRO, run in conjunction with PEACE, now has an option to automatically include/exclude FGD, ESP or baghouse filter, and SCR using current fuel characteristics and plant size for guidance.

STEAM PRO and STEAM MASTER each provide about 60 separate graphic outputs and about 50 different text reports to completely describe a run. Therefore, a new two-tiered tab system was introduced, similar to that in GT PRO and GT MASTER, to make it easier to navigate to the desired schematic or text report. Outputs are now organized into eight topical sections; System, Boiler, Steam Turbine, Feedwater System, Cooling System, Emission Control, Energy Charts, and Miscellaneous.

The tubular air heater, typically used in CFBs is now modeled using the physically-based model from THERMOFLEX.

GENERAL

Six additional South African coal specs were added. PROFUEL presently has 125 built-in solid fuel definitions available for use.

This version, along with those preceding it, does not run under Windows Vista. The process of migrating Thermoflow software to be compatible with Windows Vista is underway. We expect the next version will be compatible with Vista, to the extent possible.