

February 22, 2022

Dear Customer,

We are pleased to release Version 30 of our software suite, with the new features and improvements summarised below. Some of the items described here were released as revisions to Version 29, optionally downloaded from our online Service Center.

## MAJOR RESTRUCTURING of THERMOFLEX / PEACE

Highly sophisticated, massive programs like the Thermoflow suite need periodic rewrites as they grow bigger and more complex and as the computing environment evolves. Without these costly rewrites, the growing code becomes too complex and less adaptable to changes in the environment, until it becomes unmaintainable, just as we saw when one of our “competitors” announced they will no longer support or update their widely used product a few years ago.

Since GT PRO/GT MASTER were first released in 1988, we have substantially rewritten and restructured them twice. STEAM PRO/STEAM MASTER have gotten the benefit of one reorganization since their first release in 1992. THERMOFLEX was first released in 1995, and the hectic pace at which we have been adding features and components to it for 25 years had precluded any major internal restructuring until 2020. To ensure its continued success for the long term, we have now completed a major rewrite of THERMOFLEX in which we have invested over 12,000 hours of uniquely experienced talent. This included revamping the internal structure of the user interface to streamline and simplify handling new and existing features and components. This has made the program better structured, more logically robust, more compact, easier to maintain, and easier to transition to entirely different computing platforms in future. As with our previous re-writes of GT PRO/GT MASTER, much of this massive effort is ‘under-the-hood’, barely noticeable, except that long time users will observe a slightly different “look and feel”.

## Changes Affecting Multiple Programs

**Gas Turbine Data Base** – The gas turbine database was updated as shown below. Some of these engine models were included in revisions to TFLOW29 available from our online Service Center.

Corporate reorganizations resulted in the following changes to OEM names used to organize engines in the GT Selection list:

- Mitsubishi Power Aero replace Pratt & Whitney Power Systems
- INNIO Jenbacher replaced GE Jenbacher
- Baker Hughes replaced GE for the Nova LT line of engines

### Engines added to the Database

741 BH NovaLT5-1	742 BH NovaLT12	743 BH NovaLT16
730 GE 7HA.03	731 MAN 20V35/44G (50 Hz)	732 MAN 20V35/44G (60 Hz)
733 MAN 12V35/44G TS (50 Hz)	734 MAN 12V35/44G TS (60 Hz)	735 MAN 20V35/44G TS (50 Hz)
736 MAN 20V35/44G TS (60 Hz)	737 MAN 18V51/60G HE	738 MAN 18V51/60G HP
739 MAN 18V51/60G TS HE	740 MAN 18V51/60G TS HP	727 SIE SGT-A65 ISI (50 Hz)

728 SIE SGT-A65 ISI (60 Hz)	729 SIE SGT-A35	744 SIE SGT-800-57
745 SIE SGT5-2000E	746 SIE SGT5-8000H	747 SIE SGT6-2000E (41MAC)
748 SIE SGT6-2000E (33MAC)	749 SIE SGT6-5000F(3)	750 SIE SGT6-8000H
751 SIE SGT6-5000F(5ee)	752 SIE SGT-800-62 (LE)	753 SIE SGT-800-62
754 SIE SGT-400 12.9MW	755 SIE SGT-400 14.4MW	

**Engines with modified performance**

655 SIE SGT6-8000H	468 WRT 18V50SG (50 Hz)	469 WRT 20V34SG (50 Hz)
470 WRT 18V50SG (60 Hz)	471 WRT 20V34SG (60 Hz)	

**Reciprocating Engine Data Base** - The reciprocating engine database used by THERMOFLEX, RECIPRO, and NOVO PRO was updated to include models for the following gensets. Engines #451-#511 were included in revisions to TFLOW29 available from our online Service Center.

**New MAN Recip Engines**

- 451, 452 - 12V35/44G TS (50, 60 Hz)
- 453, 454 - 20V35/44G TS (50, 60 Hz)
- 455, 456 - 18V61/60G (50, 60 Hz)
- 457, 458 - 18V61/60G TS (50, 60 Hz)
- 459, 460 - 18V61/60G TS (50, 60 Hz)
- 461, 462 - 6L51/60DF, "High Efficiency" (50, 60 Hz)
- 463, 464 - 6L51/60DF, "High Efficiency" (50, 60 Hz)
- 465, 466 - 6L51/60DF, "Tropical Condition" (50, 60 Hz)
- 467, 468 - 6L51/60DF, "Tropical Condition" (50, 60 Hz)
- 469, 470 - 6L51/60DF, "High Power" gas fuel (50, 60 Hz)
- 471, 472 - 6L51/60DF, "High Power" liquid fuel (50, 60 Hz)
- 473, 474 - 12V51/60DF, "High Efficiency" gas fuel (50, 60 Hz)
- 475, 476 - 12V51/60DF, "High Efficiency" liquid fuel (50, 60 Hz)
- 477, 478 - 12V51/60DF, "Tropical Condition" gas fuel (50, 60 Hz)
- 479, 480 - 12V51/60DF, "Tropical Condition" liquid fuel (50, 60 Hz)
- 481, 482 - 12V51/60DF, "High Power" gas fuel (50, 60 Hz)
- 483, 484 - 12V51/60DF, "High Power" liquid fuel (50, 60 Hz)
- 485, 486 - 18V51/60DF, "High Efficiency" gas fuel (50, 60 Hz)
- 487, 488 - 18V51/60DF, "High Efficiency" liquid fuel (50, 60 Hz)
- 489, 490 - 18V51/60DF, "Tropical Condition" gas fuel (50, 60 Hz)
- 491, 492 - 18V51/60DF, "Tropical Condition" liquid fuel (50, 60 Hz)
- 493, 494 - 18V51/60DF, "High Power" gas fuel (50, 60 Hz)
- 495, 496 - 18V51/60DF, "High Power" liquid fuel (50, 60 Hz)
- 497, 498 - 18V51/60DF TS gas fuel (50, 60 Hz)
- 499, 500 - 18V51/60DF TS liquid fuel (50, 60 Hz)

**New Siemens Recip Engines**

- 501 - SGE-18SL, gas fuel (50Hz)
- 502 - SGE-24SL, gas fuel (50Hz)
- 503 - SGE-24HM, gas fuel (50Hz)
- 504 - SGE-36SL, gas fuel (50Hz)

- 505 - SGE-48SL, gas fuel (50Hz)
- 506 - SGE-56SL, gas fuel (50Hz)
- 507 - SGE-42HM, gas fuel (50Hz)
- 508 - SGE-56SM, gas fuel (50Hz)
- 509 - SGE-56HM, gas fuel (50Hz)
- 510 - SGE-56HM+, gas fuel (50Hz)
- 511 - SGE-86EM, gas fuel (50Hz)

**New Cummins Recip Engines**

- 512 - CUM 6CTA8.3-G2, liq fuel (50Hz)
- 513 - CUM 6CTAA8.3-G1, liq fuel (50Hz)
- 514 - CUM 6CTAA8.3-G2, liq fuel (50Hz)
- 515 - CUM 6CTAA8.3-G2, liq fuel (50Hz)
- 516 - CUM QSK23-G3, liq fuel (50Hz)
- 517 - CUM QSL9-G5, liq fuel (50Hz)

**Solar Panel Data Base** - The solar panel database used by THERMOFLEX and NOVO PRO was updated as follows.

Astronergy - added 99 panels from 290 to 550 kW	Longi - added 12 panels from 430 to 550 kW
CanadianSolar - added 75 panels from 330 to 670 kW	REC - added 5 panels from 430 to 450 kW
First Solar - added 18 panels from 425 to 480 kW	Risen - added 40 panels from 360 to 600 kW
GCL - added 40 panels from 365 to 675 kW	Silfab Solar - added 11 panels from 330 to 490 kW
Hanwha - added 15 panels from 380 to 435 kW	Suntech Power - added 39 panels from 360 to 660 kW
JA Solar - added 155 panels from 260 to 550 kW	Talesun - added 60 panels from 280 to 665 kW
Jinko Solar - added 35 panels from 355 to 550 kW	Trina Solar - added 29 panels from 360 to 605 kW
LG - added 4 panels from 400 to 450 kW	Yingli Solar - added 55 panels from 265 to 450 kW

**Wind Turbine Data Base** - The wind turbine database used by THERMOFLEX and NOVO PRO was updated to include the following additional turbines.

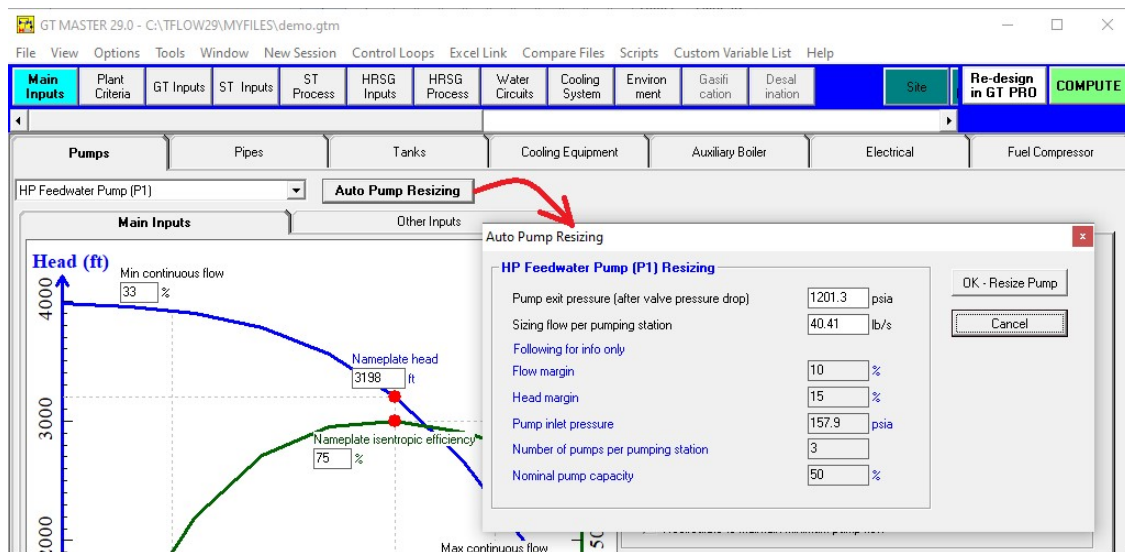
59 Enercon E-103/2350	60 Enercon E-115EP3/2990	61 Enercon E-126EP3/3000
62 Enercon E-126EP3/3500	63 Enercon E-126EP3/4000	64 Enercon E-138EP3/3500
65 Enercon E-138EP3/4200	66 Enercon E-147EP5E2/5000	67 Enercon E-160EP5/4600
68 Enercon E-160EP5E2/5500	69 Enercon E-160EP5E3/5560	
70 Vestas V90-2.0 MW	71 Vestas V100-2.0 MW	72 Vestas V110-2.0 MW
73 Vestas V120-2.2MW	74 Vestas V105-3.45MW	75 Vestas V112-3.45 MW
76 Vestas V117-3.45MW	77 Vestas V117-4.2MW	78 Vestas V126-3.45MW
79 Vestas V136-3.45MW	80 Vestas V136-4.2MW	81 Vestas V150-4.2MW
82 Vestas V155-3.3MW	83 Vestas V150-6.0MW	84 Vestas V162-6.2MW
85 Suzlon S111/2100	86 Suzlon S120/2100	87 Suzlon S128/2700
88 Windey WD107-2000	89 Windey WD131-2000	90 Windey WD131-2100
91 Windey WD147-2500		
92 Unison U120-2.3MW	93 Unison U113-2.3MW	94 Unison U93-2.0MW
95 Unison U88E-2.0MW	96 Unison U151-4.3MW	97 Unison U136-4.2MW

98 Hyosung HS90-2MW	99 Hyosung HS50	100 Hyosung HS139-5MW
101 Vensys VENSYS70-2.1MW	102 Vensys VENSYS82-1.5MW	103 Vensys VENSYS121-2.5MW
104 Vensys VENSYS126-3.8MW	105 Vensys VENSYS136-3.5MW	106 Vensys VENSYS115-4.1MW
107 Vensys VENSYS155-6.2MW	108 Vensys VENSYS170-5.8MW	
109 Eno Energy Eno 160	110 Eno Energy Eno 152	111 Eno Energy Eno 136-4.5MW
112 Eno Energy Eno 126-4.8MW	113 Eno Energy Eno 126-4.0MW	114 Eno Energy Eno 126-3.5MW
115 Eno Energy Eno 114-3.5MW	116 Eno Energy Eno 100-2.2MW	

## PDE / GT PRO / GT MASTER / PEACE

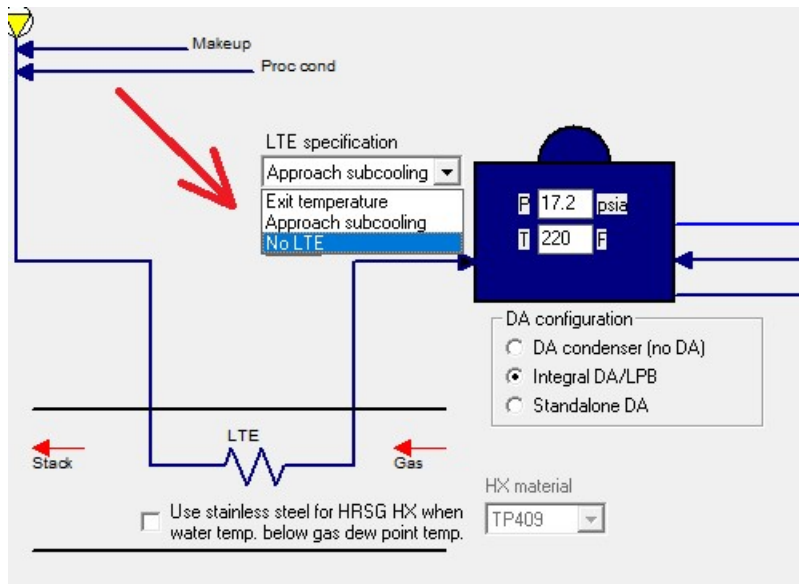
**GTPM** – The interactive process of converting the GT PRO design to a GT MASTER off-design model was revived. This was not included in the original release of Version 29.

**GT MASTER: Auto Pump Resizing** – A method to automatically resize a pump and its driver is now available from the [Pumps] tab of the [Pipes, Pumps, Etc.] topic in GT MASTER. As shown below, the sizing inputs are overall pressure rise and sizing flow.

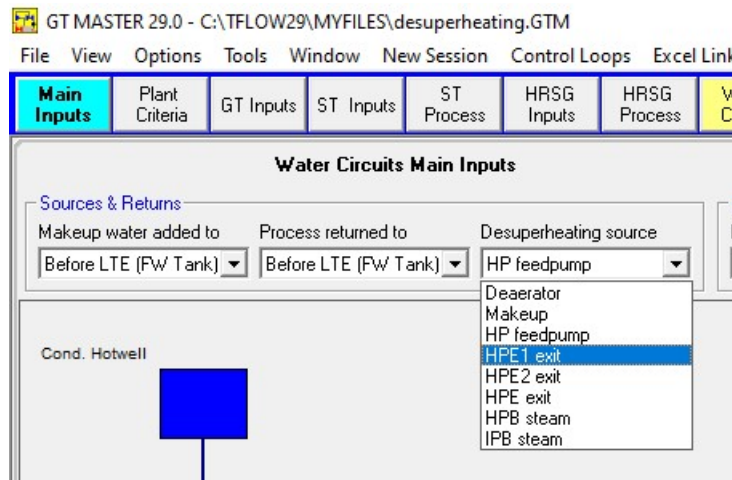


**Reciprocating Engine Graphic Output** – A new graphic output showing engine details for reciprocating engine cases is available.

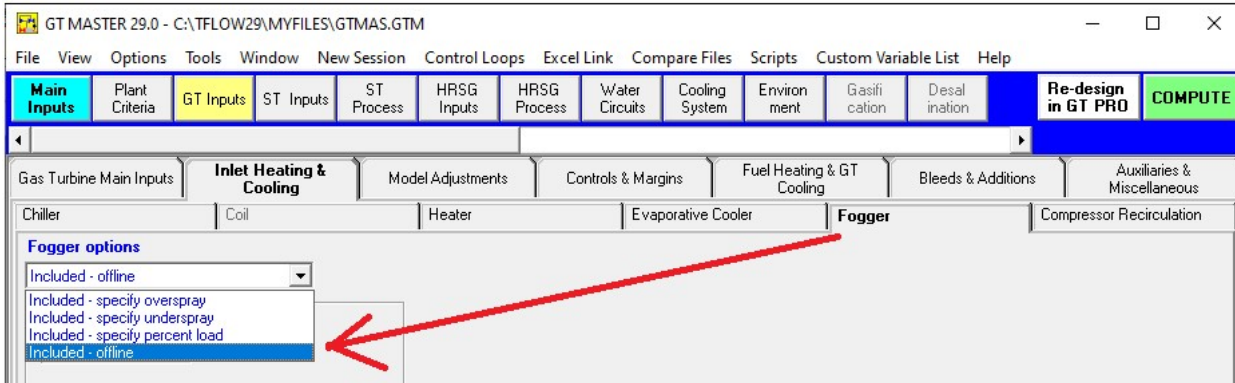
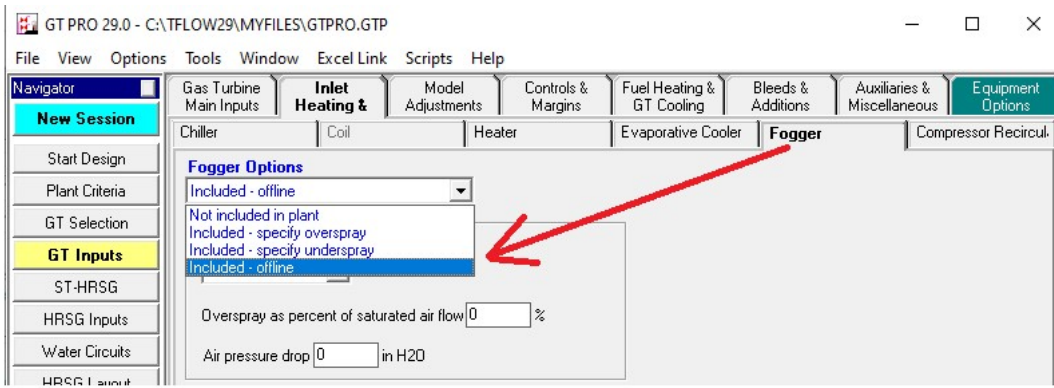
**GT PRO** – a new 'No LTE' choice was added to the LTE Specification list on the [Water Circuit] topic. This can be used in lieu of the historical method of setting desired DA operating temperature to a value lower than the feedwater supply temperature.



**Desuperheating source** – may now be HPE0, HPE1, or HPE2 in addition to HPE exit which denotes the economizer feeding water to the HP evaporator. These choices are included on the **Desuperheating source** pulldown list when the HX exists in the HRSG.



**Fogger Offline** – the fogger may now be explicitly switched to offline in both GT PRO and GT MASTER. While it has always been possible to achieve this operating state, this new switch provides a direct and easy-to-interpret program input. The switch is available in each program as shown below.



**New Inputs for Wartsila Gas Engines (#468-471)** - If one of the Wartsila engines is selected, the panel shown below containing two additional inputs will appear at the upper right-hand corner of the **GT Inputs** screen:

Engine Design Ambient Temperature Range	
Minimum temperature	41 F
Maximum temperature	107.6 F

**Minimum temperature** and **Maximum temperature** represent the expected ambient temperature limits for the engine. These inputs will dictate the engine’s performance: **Minimum temperature**, whose default value is 41°F/5°C, impacts the cooling system design. A lower value requires a higher concentration of anti-freezing agent in the coolant, resulting in lessened heat transfer performance of the cooling system. As a consequence of this modification to the coolant, the efficiency and power output of the engine will be reduced at a higher ambient temperature; **Maximum temperature**, whose default value is 107.6°F/42°C, influences the turbocharger design. A higher value necessitates booster fans with higher capacity, such that the power output can be maintained at a higher ambient temperature. This results in a booster fan design that will lead to more auxiliary power consumption and lower overall efficiency at normal conditions.

**CO2 Emissions** - Annual Estimates done in GT PRO, GT MASTER, and TIME for GT MASTER now include CO2 emissions during startup and shutdown. Previously, CO2 emissions were only included for hours in normal operation. This can be important for plants that have multiple SUSDs per day.

## THERMOFLEX / PEACE

**Major Internal Restructuring** – As described at the beginning of this letter.

**Plate HX** – The design, off-design, size, weight, and cost models were revised and improved.

**Electrolyzer Output** – now includes electrolyzer module dimensions, weight, building area, and estimated plot plan.

**New Inputs for Wartsila Gas Engines (#468-471) in GT library:** This is described in the GT PRO section, above.

**REFPROP Version 10** – The software now uses REFPROP Version 10. If you need NIST REFPROP material properties, you'll be prompted to download and install this particular software feature from our online Center. See [Help] – [Download TF REFPROP] for instructions.

## **STEAM PRO / STEAM MASTER / PEACE**

**Steam Turbine Tuning** – The Steam Turbine Tuning feature that was previously only available in GT MASTER and THERMOFLEX is now included in STEAM MASTER. This feature is accessed using buttons on the [ST Controls] tab on the [Steam Turbine] topic.

**Flue Gas Cooler** – A new ability to bypass HP FWHS is now available to supplement the ability to bypass LP heaters.

**Evaporator Drum Steam** - Steam from the boiler drum may now be selected to provide process steam, heat feedwater, and/or to run the steam air heater.

**Steam Air Heaters** – Models without flue gas air heaters may now have two steam air heaters on each of the primary and secondary air streams. Each heater may be fed by its own steam source from an appropriate location in the cycle. Previously, the model supported only one SAH on each of the primary and secondary streams.

## **PEACE**

Cost multipliers were revised, mostly upwards, relative to Version 29. Notable exceptions are solar panel prices and prices for solar thermal plant which were revised downwards. The EPC price for a typical 2x1 RHT GTCC is 8% higher in Version 30 compared with Version 29. However, this will vary with plant details.

Reference currency exchange rates, relative to the USD, and regional cost multipliers were revised.