



## Program Overview

### **Program: GT PRO & GT MASTER**

**Program Type:** Application-Specific Program (see Pages 2 - 4 for further details)

**Power Plant Types:** Gas Turbine Simple Cycle, GT & HRSG, GT and Reciprocating Engine Combined Cycle, Cogeneration (CHP) Systems, Integrated Gasification Combined Cycle (IGCC), Desalination Plants (MSF, MED, RO), CO<sub>2</sub> Capture and Sequestration Plants.

**Program Features:** Automated Design and Off-Design/Simulation. Gas Turbine Database with more than 625 GT and Reciprocating Engine specifications. Cost Estimation and Techno-Economic optimization in conjunction with the PEACE module. Automatic Optimized Cooling System Operation in Off-Design. Multiple Runs to display techno-economical design trends in GT PRO, and produce load profiles in GT MASTER. Bi-Directional Link with MS EXCEL to run plant design and simulation from MS EXCEL. GT PRO and GT MASTER designs can be transferred to the Fully-Flexible Program THERMOFLEX. GT PRO and GT MASTER files can be linked to THERMOFLEX models.

### **Program: STEAM PRO & STEAM MASTER**

**Program Type:** Application-Specific Program (see Pages 2 - 4 for further details)

**Power Plant Types:** Conventional Coal/Oil/Gas Fired Plants, Cogeneration Systems (CHP), Biomass Plants, Waste Incineration Plants, Desalination Plants, Solar (CSP Power Block) and Nuclear Cycles, CO<sub>2</sub> Capture and Sequestration Plants.

**Program Features:** Automated Design and Off-Design/Simulation. Fuel Database with more than 180 pre-defined fuels (coal/gas/biomass/RDF). Cost Estimation and Techno-Economic optimization in conjunction with the PEACE module. Automatic Optimized Cooling System Operation in Off-Design. Multiple Runs to display techno-economical design trends in STEAM PRO, and produce load profiles in STEAM MASTER. Bi-Directional Link with MS EXCEL to run plant design and simulation from MS EXCEL. STEAM PRO designs can be transferred to the Fully-Flexible Program THERMOFLEX. STEAM MASTER files can be linked to THERMOFLEX.

### **Program: PEACE (Plant Engineering And Construction/Cost Estimator)**

**Program Type:** Optional program for use with GT PRO/MASTER, STEAM PRO/MASTER, and THERMOFLEX

**Program Features:** provides additional inputs to automate the preliminary engineering and cost estimation, logical cost functions, balance-of-plant & techno-economic optimization, detailed hardware specifications.

## **Program: THERMOFLEX**

**Program Type:** Fully-Flexible Program (see Pages 2 - 4 for further details)

**Power Plant Types:** Gas Turbine Simple Cycle, GT & HRSG, GT Combined Cycle, Cogeneration (CHP) Systems, Integrated Gasification Combined Cycle (IGCC), Desalination Plants (MSF, MED, RO), Conventional Coal/Oil/Gas Fired Plants, Biomass Plants, Waste Incineration Plants, Concentrated Solar Thermal Power Plants (CSP), CO<sub>2</sub> Capture Plants, Nuclear Cycles, Kalina Cycles, Organic Rankine Cycles (ORC), Wind Power, Photovoltaic (PV) Systems, and others.

**Program Features:** Graphical Interface with more than 185 components. Design and Off-Design/Simulation. Gas Turbine Database with more than 625 GTs. Reciprocating Engine database with more than 380 gas and/or liquid fueled engines. Fuel database with more than 180 pre-defined fuels (coal/gas/LNG/biomass/RDF). US NIST fluid property database. Improved Cost Estimation and Techno-Economic optimization in conjunction with the PEACE module. Multiple Runs to display techno-economical design trends and to produce load profiles. Bi-Directional Link with MS EXCEL to run plant design and simulation from MS EXCEL. Loading of GT PRO, GT MASTER, and STEAM PRO files into THERMOFLEX. Ability to build composite models by links to GT PRO, GT MASTER, and STEAM MASTER.

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## **Application-Specific or Fully-Flexible Program?**

In **Application-Specific** programs, *the plant model is built from the top down* (see graphic on page 3). Big picture selections are made first, such as plant configuration. The process then continues to lower-level decisions, such as selecting the types of subsystems to be included. Finally, the lowest-level decisions (details) are made. These lowest level decisions are logically and automatically generated by the program. The structured approach automatically considers all interactions between the subsystems. It also allows many decisions to be managed by the program. At any level, however, the user is free to alter any or all of the program's automatic selections.

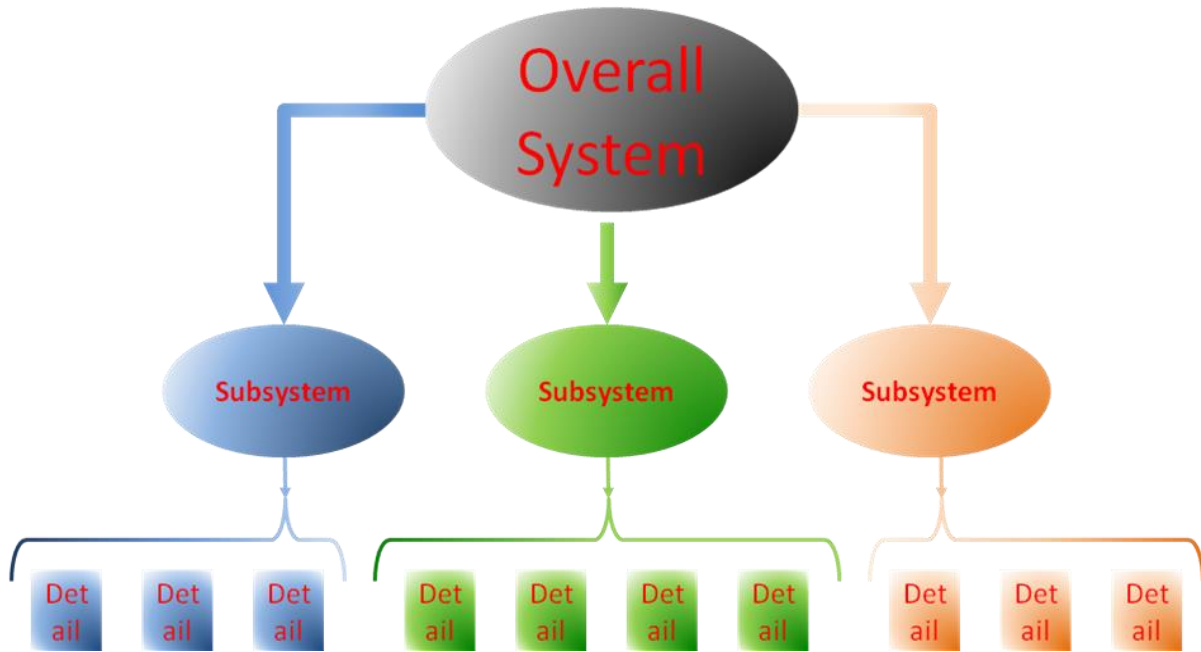
In **Fully-Flexible** programs, *the plant is built from the bottom up* (see graphic on page 3). The user constructs the subsystems from their basic elements, then the overall scheme emerges from the interconnected subsystems. This method allows great latitude and flexibility, but less structured guidance. The **Fully-Flexible** approach places a much greater burden of labor and logic on the user.

### **Combining Application-Specific with Fully-Flexible**

Thermostat's Application-Specific and Fully-Flexible programs are designed to be used on their own, independently of each other. However, their mutual compatibility and connectivity allows the user who has both types to get the best of both modeling approaches. A plant model may be quickly and easily generated in the Application-Specific environment, while one more of its subsystems may be custom built in the Fully-Flexible THERMOFLEX. This "Hybrid Model" then operates seamlessly, as a single system.

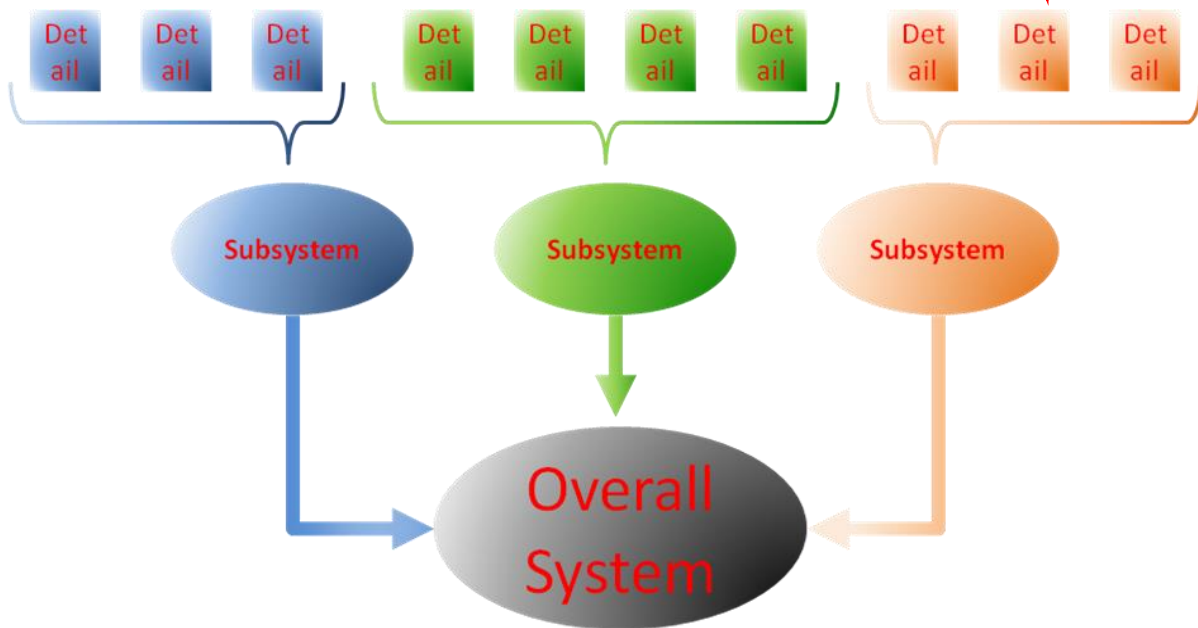
Furthermore, THERMOFLEX can read a plant model built in one of the Application-Specific programs GT PRO, GT MASTER, or STEAM PRO, allowing the user to transition from fast automated design to a Fully-Flexible environment.

**Application Specific:**



A plant model generated in the **Application-Specific** environment (GT PRO or STEAM PRO) can be transferred to THERMOFLEX's **Fully-Flexible** environment.

**Fully-Flexible:**



	Application-Specific Program GT PRO/MASTER, STEAM PRO/MASTER	Fully-Flexible Program THERMOFLEX
Advantages	<p>Many system modeling features and details are already in a logical, ordered manner. All the user needs to do is select which features to include and the numerical values of relevant input parameters. Since many complex plant features are already modeled within the software, the user may invoke them by making a few guided selections rather than needing to synthesize their model from elements. Due to the overall logical structure, hundreds of inputs can be automatically created or user-defined, and can be cross-checked and validated to ensure their consistency, preventing errors and crashes.</p>	<p>The program is more general, and can, in principle, model any system that its user wishes to define. The program provides a library of component models, which the user can connect graphically to construct any configuration. This allows greater variety than can possibly be included in an Application-Specific program.</p>
Disadvantages	<p>The pre-built models are, by their nature, finite. The user is limited to features and details that are within the pre-defined scope of the general model. Thus, in order to have a satisfactory Application-Specific program, the pre-engineered model must be large and mature enough to ensure that all reasonable features and details are included. Therefore, it takes many years to develop a comprehensive family of programs of this type, making them more expensive than a Fully-Flexible program that can cover the same scope.</p>	<p>This type of program normally provides component-logic but leaves system-logic up to its user. The burden placed upon the user is thus, by its nature, far greater than for the Application-Specific type. The burden placed upon the program itself is also much greater, because it must be capable of gracefully handling system configurations and component applications that its developers have never intended, conceived of, or tested. Since the program cannot always “know” what its user is trying to do, it cannot cross-check all inputs, increasing the possibility of inconsistencies, problematic calculations, and crashes, relative to a robust, well –organized Application-Specific program.</p>