

The Thermoflow Software Suite

Overview

CREATE YOUR POWER PLANT

Thermoflow's Software Suite is an **Expert System** with a vast built-in knowledge base. It **automatically creates** a new power plant optimized both technically and economically for your unique situation and criteria within minutes. The Thermoflow Suite includes **two parallel program approaches**:

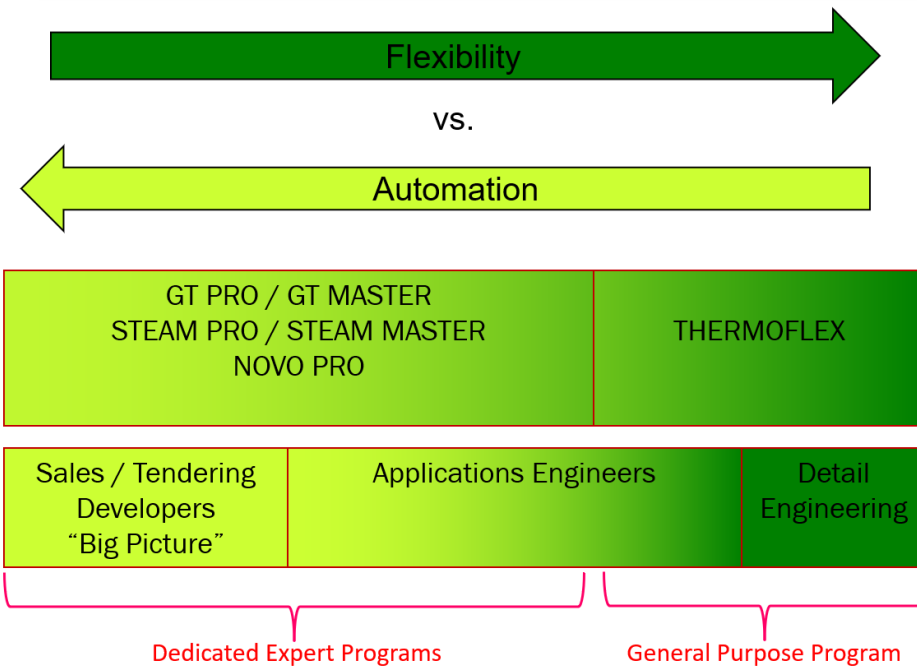
Plant Type	Dedicated Expert Programs	General Purpose Program
Gas Turbine Based Plants	GT PRO GT MASTER	THERMOFLEX
Conventional Steam Plants	STEAM PRO STEAM MASTER	THERMOFLEX
All types of Thermal & Renewable Systems, Hybrid Systems	NOVO PRO	THERMOFLEX

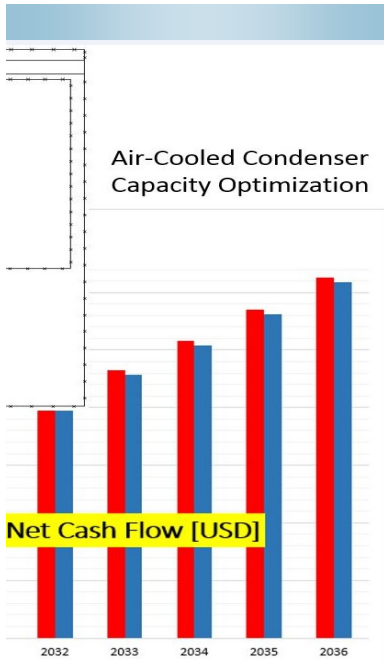
The **Dedicated Expert Programs** and the **General Purpose Program**, to serve all user profiles and markets, from use at the conceptual (big picture) level to the final specification or detail engineering level.



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THE UNIQUE SELLING POINTS

- ✓ Accurately compute thermodynamic performance;
- ✓ creates your plant automatically from scratch in less than 10 minutes and allows you to compare multiple plant configurations
- ✓ automatically designs all significant plant hardware (physical design)
- ✓ creates a complete, detailed itemized cost estimate for the turnkey power plant, incl. Balance-of-Plant, detailed hardware specification and preliminary site layout.
- ✓ models the overall economics of new designs, integrating Cash Flow, ROI/NPV calculations with the changes in performance and capital cost for all design variations (techno-economic optimization)
- ✓ models the economics of the annual operating cycle

“Create your new power plant within 10 minutes, estimate investment costs and optimize NPV.”



DEDICATED EXPERT PROGRAM, OR GENERAL PURPOSE PROGRAM?

The Thermoflow Suite includes two parallel approaches:

the **Dedicated Expert Programs** and the **General Purpose Program**.

The **Dedicated Expert Programs** are **unique** in the industry, and the plant model is built from the **top-down** (see illustration 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 Expert Programs. The structured approach automatically considers all interactions between the subsystems. It also allows many decisions to be managed by the programs. At any level, however, the user is free to alter any or all of the program’s automatic selections.

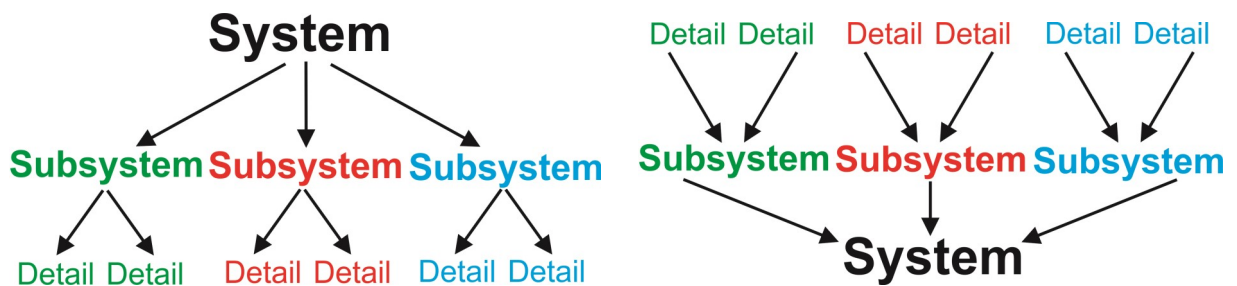
The **General Purpose Program** (THERMOFLEX) is using a **bottom-up** approach to create new systems (see illustration on page 3). The user constructs the subsystems from their basic elements, then the overall scheme emerges from the interconnected subsystems. This method allows great latitude and flexibility, but less structured guidance. The General Purpose Program’s approach places a much greater burden of labor and logic on the user.

Combining Dedicated Expert Programs with the General Purpose Program

Thermoflow's Dedicated Expert and General Purpose 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 Dedicated Expert Program's environment, while one more of its subsystems may be custom built in the General Purpose environment of THERMOFLEX. This "Hybrid Model" then operates seamlessly, as a single system.

Furthermore, THERMOFLEX can read a plant model built in one of the Dedicated Expert Programs GT PRO, GT MASTER, or STEAM PRO, allowing the user to transition from fast automated design to the flexible environment of the General Purpose Program THERMOFLEX.

THERMOFLOW'S TWO PARALLEL DESIGN APPROACHES: TOP-DOWN AND BOTTOM-UP



"Is the Thermoflow Suite just a heat balance program"?

No! Don't confuse the Thermflow Suite with heat balance programs!

The Thermoflow Suite is a comprehensive plant design and simulation Expert System and goes far beyond the intended scope and capability of heat balance software.

Commonly available "heat balance programs" are network solvers into which the user inputs network configuration and component characteristics. They require the user to know, a priori, the network configuration, its logic, and how to impose and debug it. They require the user to know initial values of key mass flows and pressures, and where to impose them without under- or over-specifying the network. They require the user, a priori, to know either the physical design details (hardware) of a component, or its performance characteristics, but are unable to create the physical hardware or performance characteristics! Thus, these heat balance programs are not practically useful to create new designs, because it is unrealistic with them to design many plant configurations, different permutations and combinations of technical parameters, consider the effect of design variations on performance, cost and economics, and find the optimal solution, all within a reasonable time frame.

The Bottom Line is: The Thermoflow Suite should not be confused with commonly available "heat balance programs"! Thermoflow's Expert System is unique in the industry, and does its specialized job far more effectively than any other program, especially when developing a new project starting from scratch.

THE MODULES - IN BRIEF

GT PRO & GT MASTER: Dedicated Expert Program (see Pages 2 - 3 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), CO₂ Capture and Sequestration Plants.

Program Features: Automated Design and Off-Design/Simulation. Gas Turbine Database with more than 750 GT and Gas/Diesel Engine specifications. Cost Estimation and Techno-Economic optimization in conjunction with the PEACE module. Automated 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. Scripting Feature. Bi-Directional Link with MS EXCEL to run plant design and simulation from EXCEL. GT PRO & GT MASTER designs can be transferred to the General Purpose Program THERMOFLEX. GT PRO/GT MASTER files can be linked to THERMOFLEX models.

STEAM PRO & STEAM MASTER, Dedicated Expert Program

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, CO₂ 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. Automated 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 EXCEL. STEAM PRO designs can be transferred to the General Purpose Program THERMOFLEX. STEAM MASTER files can be linked to THERMOFLEX.

NOVO PRO, Dedicated Expert Program

Power Plant Types: All types of Thermal and Renewable Power Plants, Storages, Hydrogen Production Plants

Program Features: Automated Design & **Hourly Off-Design Grid Simulation** of PV Plants and/or Wind Farms including Storages (Battery, Pumped Hydro,...) and/or **Hydrogen Production Plants**. Grid Simulation of Combined Thermal & Renewable Systems by importing (customized) GT MASTER & THERMOFLEX plant models.

Design & Simulation of Hydrogen Production Plants.

THERMOFLEX, General Purpose Program (see Pages 2 - 3 for further details)

Power Plant Types: GT Simple Cycle, GT Combined Cycle, Cogeneration (CHP) Systems, Integrated Gasification Combined Cycle (IGCC), Desal. Plants (MSF, MED, RO), Conv. Coal/Oil/Gas Fired Plants, Biomass Plants, Waste Incineration Plants, Concentrated Solar Thermal Power Plants (CSP), CO₂ Capture Plants, Nuclear Cycles, Kalina Cycles, Organic Rankine Cycles (ORC), Wind Power, PV Systems, Storage/Battery, and others.

Program Features: Graphical Interface with more than 190 components. Design & Off-Design/Simulation. GT and Recip. Engine database with more than 750 specifications. Fuel database incl. LNG, biomass, RDF, coals. US NIST fluid property database. Scripting Feature. 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 EXCEL. Import of GT PRO, GT MASTER, and STEAM PRO files for automated plant model setup.

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