Power Plant Simulator & Designer

Advanced Software for Boiler and Power Plant Simulation

Power Plant Simulator & Designer (PPS&D) provides state-of-the-art capabilities for modeling and simulating the operation of nearly any type of thermal power plant. Originally developed by KED GmbH in Germany for use by boiler OEMs in their detailed design work, **PPS&D** has since been used by numerous clients worldwide for simulating the operation of many types of boilers and thermal power plants.

- Natural & forced circulation boilers, both sub- and super-critical
- Pulverized coal boilers
- Combined cycle power plants, heat recovery steam generators including once-through and Benson designs
- Municipal waste incinerators
- Fire tube boilers
- Fluidized-bed combustion boilers

Model Steady-State *and* Dynamic Boiler Operation

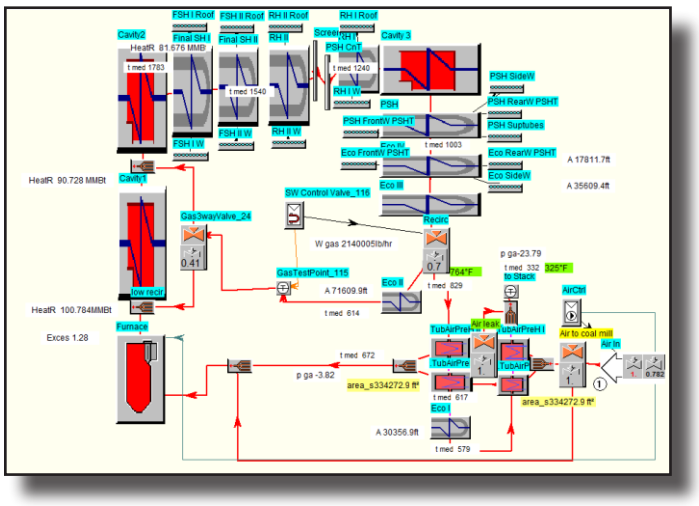
PPS&D is available in a basic version for performing steady-state simulations of plant operation. The enhanced version adds dynamic simulation, allowing testing and integration of key steam cycle control functions, and evaluation of system transient (startup, shutdown, process upset) response.

Easy-to-use yet powerful

The user friendly GUI and mature library of power plant components allow the user to quickly build plant models by dragging and clicking. Component connection is provided within the GUI based on connectivity rules defined for each component. For any component the user can obtain context-sensitive data including module variable values and stream connection information. Default data values are provided for nearly all parameters to facilitate rapid prototyping.

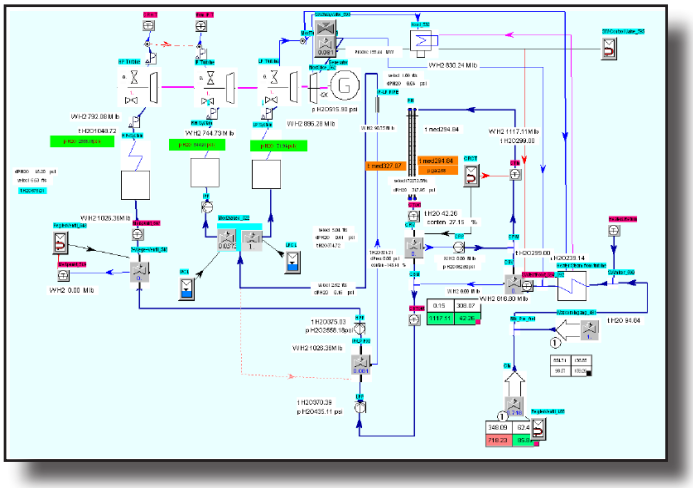
Groups of components can be assigned to a group, thus facilitating the building of large plant models containing many subsystems. The groups are extremely flexible, permitting nearly unlimited hierarchical layers with simple control of the hierarchical views and easy external connection between components in different views.

The current **PPS&D** version reflects over 15 years of development using feedback from clients throughout the world, including many from boiler manufacturers and designers. The robust numerical engine gives fast convergence even for complex plant models and has been benchmarked using a number of test loops.



Key Features

- Accurate modeling of single and two-phase flow regions in both natural and forced circulation regimes. For single-phase regions this follows a conventional computational path. For two-phase regions **PPS&D** accurately assesses heat transfer, pressure drop and void fraction according to the local heat transfer regime.
- Large database of physical medium properties that is easily extended by user. Heat transfer media include over 20 gases with real properties (Joule-Thomson effect), water with two phase flow, numerous other fluids (including user defined), dust and slag with radiant component.
- Divide any heat exchanger into zones to better calculate temperature and mass flow distributions. Full fidelity estimation of tube and fin metal temperatures in all heat transfer regimes.
- Model input and simulation run output data are easily linked to Excel worksheets. Create user-definable fields for input and output.
- Extensive component library contains over 60 different boiler and balance-of-plant elements (heat exchanger, attemperator condenser, pump...)
- Gas turbine exhaust gas can be introduced into the boiler combustion chamber for waste heat boiler simulation. Differing fuel types can be mixed prior to combustion.
- Heat transfer algorithms include the effect of thermal radiation from gases and dust/ash in boilers and gasifiers on boiler components. Tube thermal conductivity is material and temperature dependent.



• PID control elements allow automated control of boiler processes (valves, attemperator sprays, etc.). Control fuel flow by setting target steam production, independent of steam temperature. Flue gas and steam/water flows can be divided and recombined.

• Calculate efficiency using both input-output and heat loss methods.

Applications

The complexity of a **PPS&D** plant model is driven by the level of detail and type of analysis required, i.e. steady-state or transient. For any simulation, a complete thermal balance and efficiency calculation is performed and pressure drops and fluid velocities are calculated at the component level. Beyond this, a broad range of plant characteristics and operational scenarios can be treated as required by the project.

Existing Plants

• Estimate levels of fouling, high and low temperature corrosion and identify gas flow anomalies.

• Calculate potential for steaming in economizer.

• Check impact of modifications, repairs or changes to operating procedures on transient performance.

• Use as a desktop simulator to train operations staff.

• Calculate steam cycle efficiency (heat balance) according to ASME PTC or other codes to resolve commissioning issues.

• Check HRSG duct burner operation (e.g. calculate fin temperatures, efficiency increase, etc.)

Feasibility, Design and Design Validation

• Design prototyping or parameter scoping for both static and transient modes of operation.

• Analyze different operating conditions (load levels, fuel inputs, fouling, feed water temperature) and design features.

• Assess and select materials for minimizing potential damage (creep, oxidation, etc.)

• Calculate natural circulation ratio in drum boiler, find minimum load for circulation.

IGCC and Advanced Combined Cycle Designs

• Detailed modeling of all sub-critical evaporation regimes.

• Modeling of multiple external heat exchangers, gasifiers and complex linked process plant heat, gas and fluid streams.

• Dynamic analysis to address startup, shutdown, load change and system upsets.

Fluidized Bed Boilers

• Heat transfer for fluidized bed boilers and heat exchangers.

• Monitor ash flow at nearly any point in the boiler.

• Assess combustion levels and desulphurization with limestone.

Service & Support

PPS&D is delivered with 3 days of introductory training at the client site and one year of technical support with software maintenance. The technical support can be renewed yearly. Technical support is provided via e-mail or telephone by Tetra Engineering Group with additional level-2 support available if required from KED GmbH. Tetra provides training at regular intervals at their US home office (Connecticut) and European office (Nice, France). On-site training is also available.

Applications engineering support for full development or fine-tuning of client plant models is also available from Tetra.

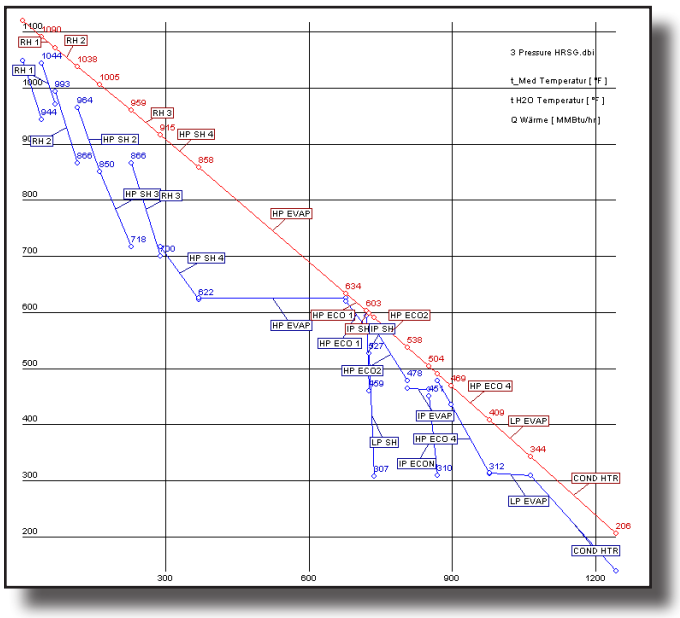
Hardware Requirements

• MS Windows 95/98/NT/ME/XP/2000/VISTA

• 1GHz Pentium (or compatible) processor or above

• 300 MB of free disk space, 4x CD Drive, 128 MB RAM

• 1024x768 SVGA Monitor



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