

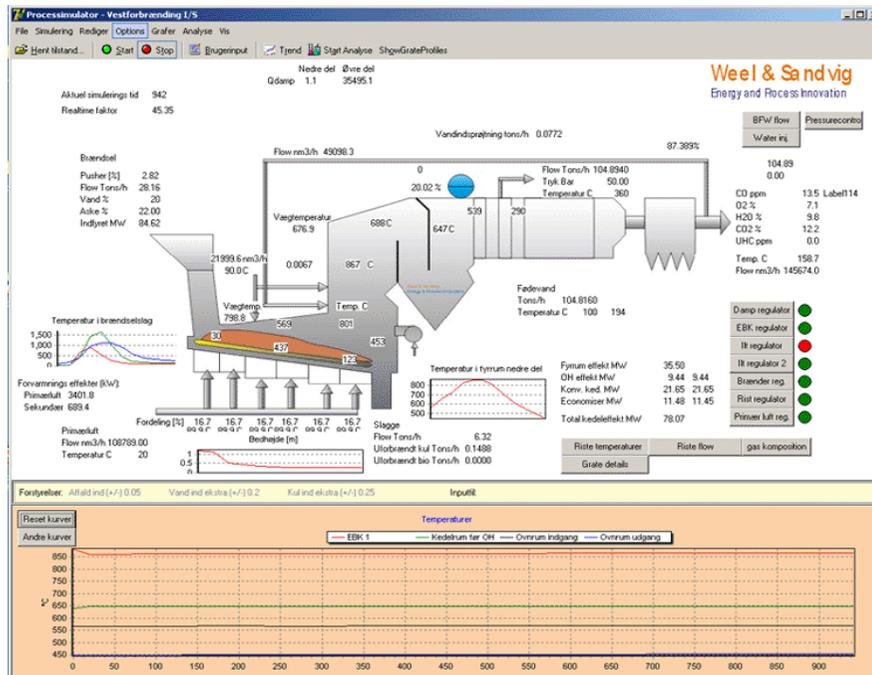
WS.WTE-simulator

Simulators of waste-to-energy plants

- for training of personal, operational analyses and optimisation

Weel & Sandvig has released a simulator for waste-to-energy plants. The new simulator is developed for training of operating personal as well as analysing operating conditions and optimisation of control parameters. So far, the simulator has been sold to the major waste-to-energy plants in Denmark.

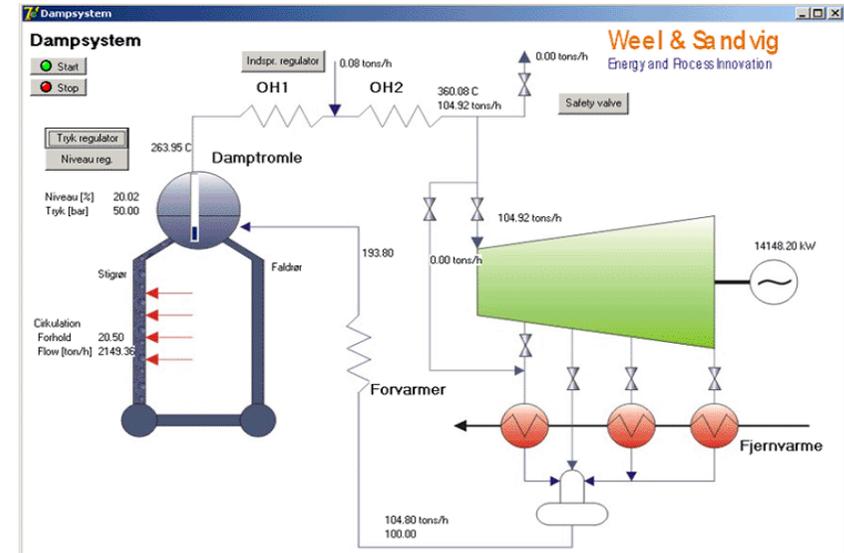
The simulator features a detailed model of the grate combustion processes and the energy conversion process. Detailed modelling of heat transfer from radiation, convection and heat conduction via walls to the water/steam system is included.



Main screen of the simulator.

The water/steam system is modelled as a natural circulating system including dynamics of the boiler drum and steam water circulating system. The simulation model also features an almost complete control system. The user can even add or remove controllers or change specification on existing ones for investigation of new and perhaps better control strategies.

As standard, the simulator comes with a rather simple steam turbine model. Optionally, an advanced steam turbine model can be implemented.



Window of the steam system open.

Among others the simulator is suitable for:

- Training of operating personal.
- Investigations on critical situations (e.g. steam pipe explosion).
- Analyses and test of control strategies.
- Identification and investigation of bottlenecks for increased capacity.

The simulator provides full graphical presentation ([Trend curves](#)) of a long list of parameters which can be selected and composed freely by the user. Momentarily [Grate profiles](#) of a number of parameters such as temperatures of solids or gasses, gas composition etc. can be presented graphically (color scale) as well.

Serious errors or break downs often arise from minor errors, not being eliminated in the right way or right time. Investigations on how to eliminate faults to further develop or minimize the damage when larger accidents suddenly take place are important in generating the "right" procedures for controlling the situation. The simulator is most suitable for such investigations and, perhaps even more important, the simulator is also most suitable for training the operating people in the procedures until knowing them by heart.

The capacity of a plant can be limited for instance due to the control strategy or values of control parameters selected. Some control parameters might be set to fixed values not taking into consideration what influence they have on the overall system regarding capacity or performance.

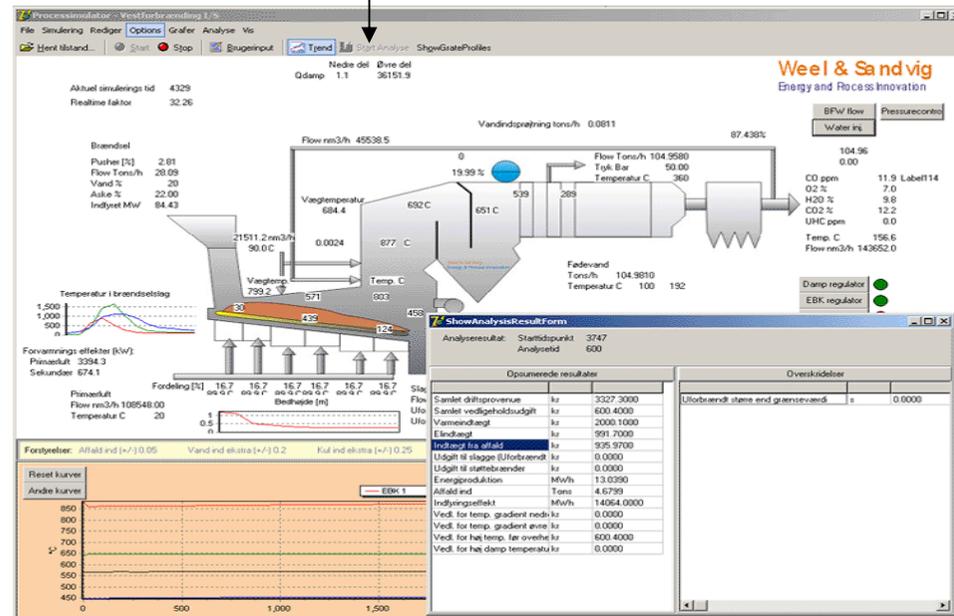
As the simulator provides splendid opportunities for investigation consequences of different control strategies or optimization of control parameters, the simulator is a powerful tool for elimination of bottlenecks and developing better control strategies.

Analyzing the economics

As a special feature, the simulator includes a tool for analyzing the economics of the plant operation. The analysis quantifies and summarizes the benefits and penalties resulting from the actual operation of the plant for a given time of operation. Both short term economics (capacity in destruction of waste, production of heat and power and long term costs (like consumption of lifetime of critical components) are included.

Application of the analysis results in calculation of income from destruction (treatment) of the amount of waste, production of useful heat and generated electricity. The total revenue is calculated by subtracting operating cost from the total income. Operating costs are: penalties associated with too high amount of unburned in cinders, cost for additional fuel and costs associated with increased need for maintenance or lifetime consumption when the plant is passing through transients with high temperature gradients or too high local temperature levels.

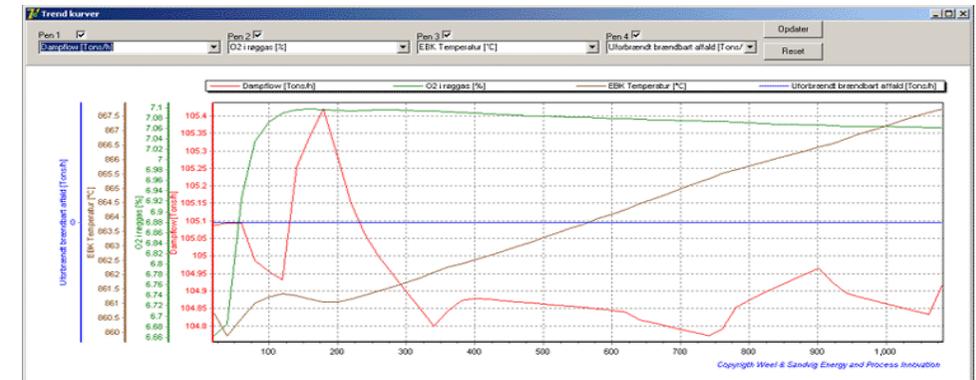
The analysis is started from the tool bar.



When the analysis period is over the results are presented in a window as illustrated. The total revenue is presented as well as a list of the individual costs and incomes. One goal with the analysis tool is to train the operating personal to operate the plant efficiently and carefully for improving the long term economics. Our experience is that costs associated with transient temperature strains in the plant are not focused in the daily operation. The most obvious explanation probably is that, so far, the immediate damage from such operation is not seen and so far the costs associated have never been attempted quantified and presented.

Trend curves

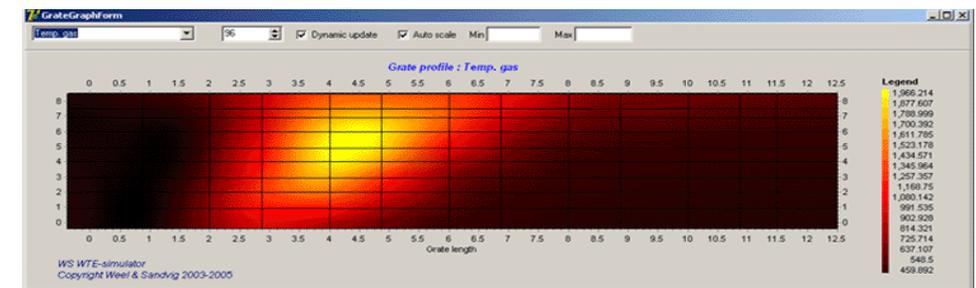
The WS waste-to-energy plant simulator provides trend curves for a long list of parameters. Up to four parameters of free choice can be plotted in one graph. In addition, on the main screen of the simulator for all parameters presented if you double-click the values a trend curve for the actual parameter will pop up. The feature enables you to get a fast overview of how a certain change will influence the operation and develop in the plant.



Trends of the steam flow (tons per hour), oxygen content in flue gas (%), temperature in after burning chamber (ABC) and amount of unburned in cinders (tons per hour) are shown.

Grate profiles

The simulator provides a splendid view of the grate performance by featuring a snap-shot of the grate profile for a number of parameters.



Snap-shot of the temperature profile of gas in the grate. The grate profile is shown as a vertical longitudinal section.

Contact

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