Systems & Advanced Technologies Engineering S.r.l.

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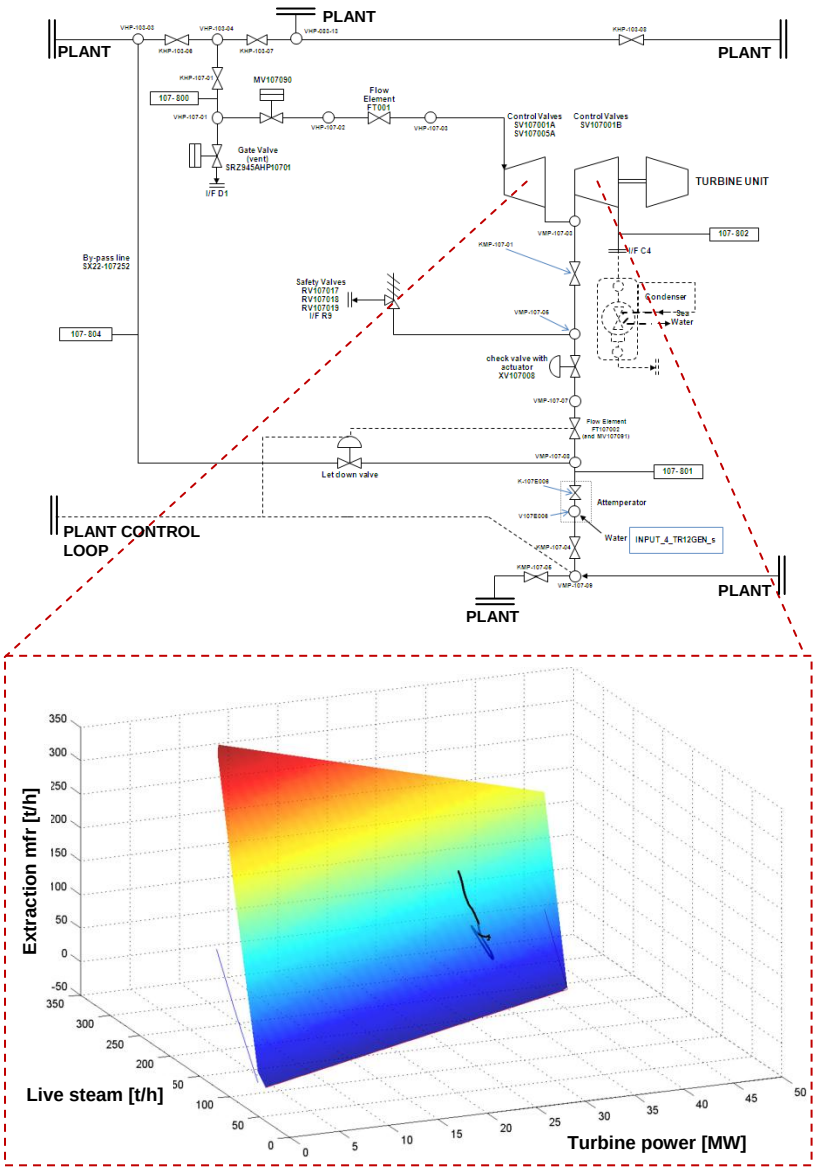
# *COMPSYS MC - DYNAMIC SIMULATION OF STEAM PLANTS*




Turbine unit equivalent scheme and operating point path on a ***COMPSYS MC*** 3D steam consumption diagram (SCD).

## OVERVIEW

Steam systems, typically fossil fuels-burning power plants, nuclear plant or waste process heat recovery system, must be controlled so that an optimum performance of each machine is achieved and safe management of transient conditions are assured.

This objective must be addressed since the system design phase, both to identify the best plant configuration and to specify and verify the control system strategy and components requirements.

## SERVICE DESCRIPTION

Dynamic simulation services provide the analysis of the time history of plant's, steam turbines' and generators' parameters, which affect the design of the system and operations management.

Typically, the actual flow rate response of the whole system, stream characteristics (thermodynamic properties, velocity and flow rate), valves positions, thermal power to the steam generators, machines speed and power are plotted in comprehensible formats as function of time, for sets of pre-defined procedures or events (grid demand changes or back pressure variations, failure of assigned components, etc.).

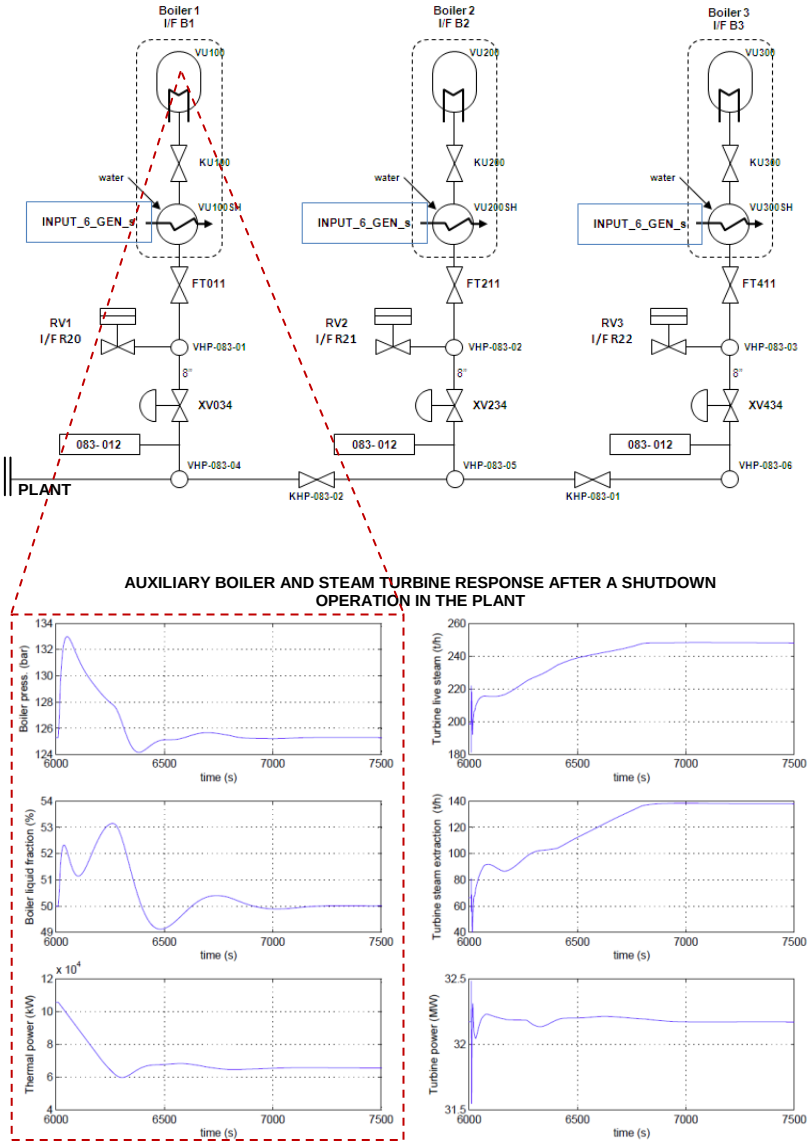
Machines operating conditions are also overlapped to the respective characteristic map to check the achievement of control scheme goals.

A comprehensive summary and commentary is provided to help system's designers to undertake proper corrective actions.

## SCOPE OF THE SIMULATIONS

Power plants, configured in serial and/or parallel turbine units, including steam generators, heat exchangers, piping, manifolds, control and check valves, generators and other machines and controllers are subject to mutual influence during both stationary and transient conditions. Sometimes these interactions are not easy to identify and quantify. For instance the shutdown of a steam turbine or of a steam generator may cause temporary anomalous conditions such as a sudden pressurization of steam distribution lines or the saturation of a controller, even when the analysis of stationary conditions would exclude this occurrence.

Furthermore, when Single Input Single Output controllers are used, each controller may cause a disturbance to the other loops and cause undesired or too long transients. Finally, when a plant is to cope with a wide range of conditions by modules switching and/or recycling, the overall load management strategy and start-up/shut-down procedures must be verified.




Boiler unit equivalent scheme and an example of ***COMPSYS MC*** results plots.

## PROCEDURE OUTLINE

The process system and its control devices are modelled by a set of mathematical equations, including the many physical non linearities, and implemented using pre-defined and tailor made functional blocks in Simulink environment, fully controllable during the numerical process.

The functional blocks performances are tested separately before integration over a wide range of conditions, to assure robustness of the model also under anomalous conditions (e.g. flow reversals or high depresurization).

Testing of the model or its components is performed under assigned stationary or dynamic conditions, derived from experiments or literature data. For poorly documented components, sensitivity analyses are made to assure the overall model performance to conveniently describe the actual system.

During early design phases the controllers are configured and preliminarily tuned, prior to undertake the required set of simulations. Upon necessity, the system or a few parts can be linearized at given operating conditions, to allow frequency response and stability analyses and identify the plants parameters which dominate transients.


***S.A.T.E. Systems and Advanced Technologies Engineering S.r.l.***

Santa Croce 664/A, 30135 VENICE (ITALY)

Tel.: (+39) 041 2757634 fax: (+39) 041 2757633

Email: info@sate-italy.com

www.sate-italy.com