ARS-AMEG
Simulator – training system

VIEW T/POWER DCS system and
thermal power plant process simulator

The simulator as a modern training approach

The ARS-AMEG simulator – training system represents a model of a thermal power plant unit along with the distributed control system of the unit in question. It is used for staff training, DCS testing, automation and control logic testing, process analysis etc. The main benefit of such a system consists in the preservation of all manipulative operations of the DCS with the one crucial difference – the operations are performed on a virtual plant instead of the physical one; therefore there is no danger whatsoever to the plant equipment. The usage of simulators for staff training significantly increases the stability level during plant operation.

VIEW® T-POWER control system

VIEW® T-POWER is a modern control system, developed at the Institute "Mihajlo Pupin". The VIEW® T-POWER DCS is realized by integration of the industrial process controllers (the ATLAS® MAX and ATLAS® RTL type PLCs), the SCADA VIEW6000® software package as well as a steam boiler and turbine control system. So far, it has been implemented in a great number of thermal power plant (TPP) units in various plants: TPP „Nikola Tesla A", TPP „Kostolac B", TPP „Morava", TPP „Kolubara", TPP/Heating plant „Novi Sad".

The thermal power plant unit model

The TPP unit model is based on physical laws that define the functioning of the real plant in question; above all the laws of mass and energy conservation in thermodynamic calculations. All the processes in the plant are modeled: the fuel transport, processing and combustion, the transport of fresh air and flue gas, water heating, evaporation and superheating and condensation, the turbine unit, the heat transfer through the entire system. All the actuators are modeled as well: valves, pumps, dampers, fans, mills, conveyors etc. The model
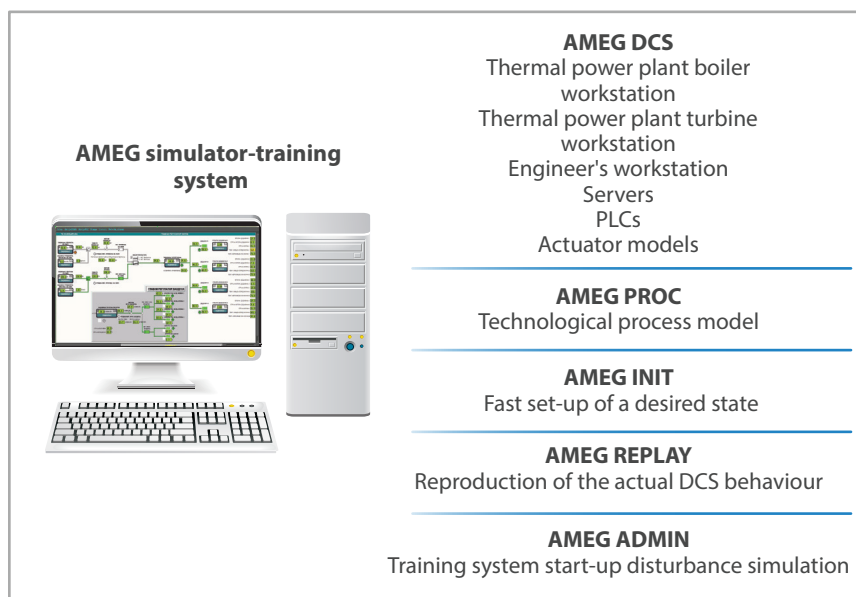
generates all the measurements that exist on the actual plant – pressures, flows, temperatures, feedback information from the actuators etc. It is even possible to calculate values that are not measured on the plant, thus enabling a more detailed insight in the plant behavior.

ARS-AMEG hardware configuration

The entire hardware of this system consists of a high-end personal computer (PC), configured in such a manner that it is able to support the demanding program packages of the simulator system. This PC runs all the components of the DCS system as well as several virtual ATLAS® RTL machines. The virtual servers and PLCs are used to run the ARS-AMEG simulator and the VIEW® T-POWER DCS. All these components together form the simulation of the DCS system and the plant technological processes. The entire simulator is modular, allowing the user to expand the basic training system hardware with as much operator stations as needed to meet the user's demands for training capacity.

Advantages and justifiability

The thermal power plant and DCS simulator represents an application of modern computer power in energetics, which can be found in only a few companies in the world. It reflects the physical system behavior in all working regimes. The ARS-AMEG system is adjustable and configurable; it can be extended or modified in accordance to the changes made on the plant equipment. The use of the simulator significantly simplifies the analysis of the technological processes. Finally, it is important to point out that the simulator is a highly profitable investment – the insurance fees are lower if the plant's employees are trained on a certified simulator/training system. It is possible to design and implement training centers in other industry areas as well.

AMEG simulator-training system

AMEG DCS
Thermal power plant boiler workstation
Thermal power plant turbine workstation
Engineer's workstation
Servers
PLCs
Actuator models

AMEG PROC
Technological process model

AMEG INIT
Fast set-up of a desired state

AMEG REPLAY
Reproduction of the actual DCS behaviour

AMEG ADMIN
Training system start-up disturbance simulation

VIEW T-POWER DCS Simplified block-diagrams

TPP boiler
unit workstation

TPP turbine
unit workstation

Switch

Switch

Engineer workstation

Servers

Switch

Switch

Industrial
controllers
ATLAS MAX
ATLAS RTL

Technological process
of a TPP unit with its
sensors and actuators

ARS-AMEG system components

The ARS-AMEG simulator is a modular system; it enables different configurations and functional possibilities depending on the complexity of the observed system but also on the user demands.

AMEG_DCS is the basic component and it includes the model of all plant actuators along with the corresponding control logic. It is used for start-up training and basic actions on the VIEW® T-POWER system, DCS maintenance and exploitation, automation and control algorithms testing.

AMEG_PROC represents the model of the technological process. With this application activated, all the measurements and signals are simulated. The model expresses the same dynamic characteristics as the reference plant, so the time needed to achieve a desired state on the simulator is the same as the time needed on the process.

AMEG_INIT is an option which enables the supervisor to bring, within seconds, the simulator to a predefined state (plant warm-up, shutdown, steady state etc.). This option is particularly of interest for exercising certain actions that need to be taken in critical situations.

AMEG_REPLAY is a subsystem that is not designed as a simulator, but as a system which is able to reproduce, at desired speed, the behavior of the real DCS based on the signals and measurements that have been archived on the VIEW® T-POWER servers during plant operation.

AMEG_ADMIN is a strictly administrative application intended for plant supervisors that are in charge of the staff training and testing. This option allows the start-up of different unit simulators on the same hardware platform as well as the simulation of various critical scenarios using a special graphical interface.