

## Advanced Energy Solutions for Power Plants

Fuel costs, energy conversion efficiencies, and environmental impacts of fossil-fueled plants have become priorities in both developed and developing countries. Advanced Energy Solutions (AES), a product of Honeywell Process Solutions, is an advanced process control product that significantly improves power plant efficiency and reduces plant emissions.

AES provides combustion control in boilers; coordinates multiple boilers, turbines, and heat recovery systems for optimal operation of entire power plants; and provides dynamic balancing of power production to demand.

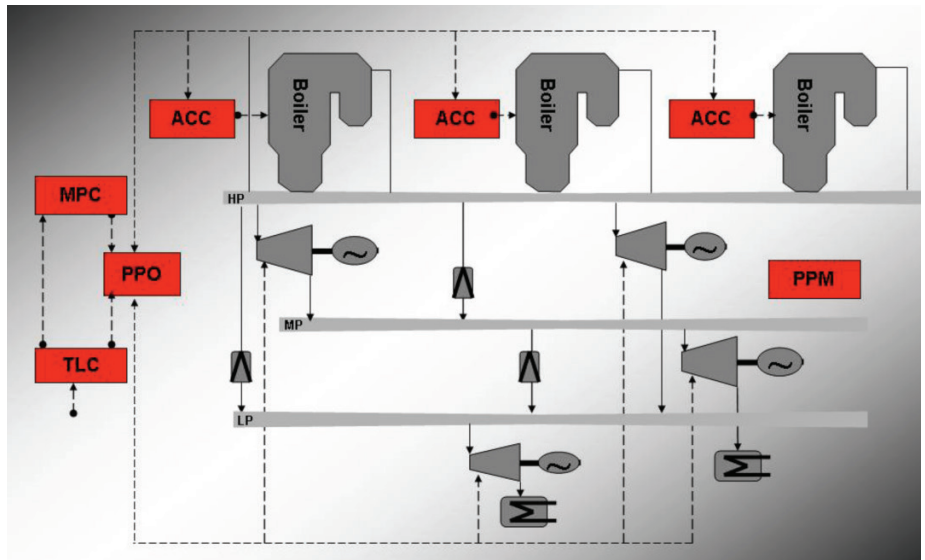
The AES solution is effective for both fossil-fueled power plants and industrial steam plants and has been used for applications covering boilers, steam/gas turbines, and heat recovery steam generators in Europe, Africa, and Asia.

### Successful Applications Worldwide

AES and its component technologies have been implemented in plants worldwide, including the following:

- Co-generation plant Otrokovice, Czech Republic
- ECG Kladno, Czech Republic
- Samsung Fine Chemicals, Korea
- Nam JeJu power plant, Korea
- Sinopec JinShan power plant, China
- SASOL steam plant, Secunda, South Africa
- REPSOL steam plant, La Coruna, Spain

**Contributor: Vladimír Havlena, Honeywell, Czech Republic**



### Solution Overview

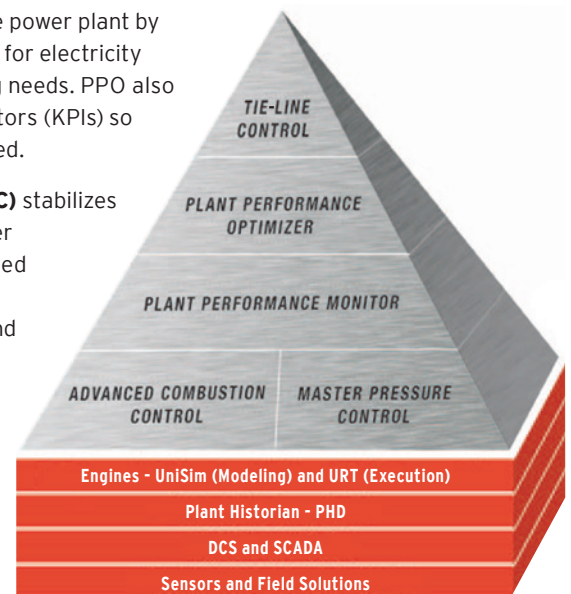
AES is a software-based product that can be implemented as a hierarchical application layer on baseline distributed control systems (DCSs). Several modules are available:

**Advanced Combustion Controller (ACC)** optimizes air distribution and tightly coordinates control of fuel and air ratio for advanced control of the combustion process.

**Plant Performance Optimizer (PPO)** increases the efficiency and reliability of the power plant by optimizing the utilization of steam for electricity generation and process or heating needs. PPO also analyzes key performance indicators (KPIs) so business objectives can be achieved.

**Master Pressure Controller (MPC)** stabilizes steam pressure and prevents boiler and turbine outages using advanced predictive control algorithms. It continuously balances produced and consumed steam and increases asset life by minimizing wear.

**Tie-Line Controller (TLC)** is a power quota planning and real-time execution toolkit for management of energy supply and demand.



“As the first company in the world to apply advanced control application technology to CFB units, Sinopec significantly enhanced the effectiveness and control performance of the distributed control system at the CFB boiler level and for the entire plant. Even more impressive, all improvements were achieved by implementing software rather than executing a major hardware refurbishment at the plant. We have also to date achieved an estimated \$1 million of savings on the supply of energy to our refinery.”

— Zhao Weijie, Chief

Engineer, Sinopec Shanghai Petrochemical Company (2008)

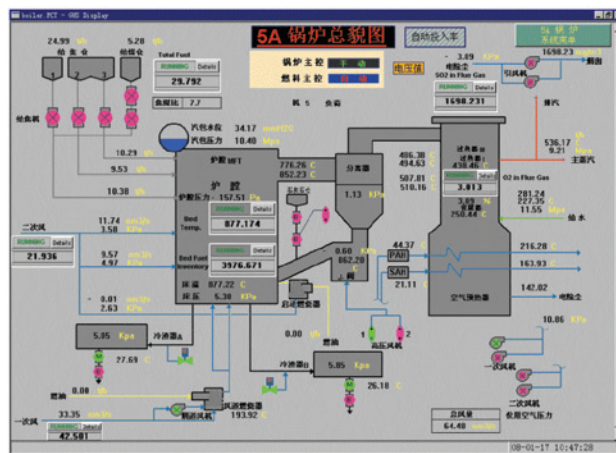
## Inventions and Innovations

Advanced Energy Solutions incorporates innovative concepts to improve energy efficiency, reduce emissions, and improve the economic operation of industrial and utility fossil-fueled power plants:

- Dynamic coordination of the air-fuel ratio (AFR) in the boiler reduces the AFR variation and enables combustion optimization. An extension of linear model predictive control technology for ratio control was developed.
- Turbulence during combustion results in emissions being highly stochastic. Deterministic optimization methods were unable to provide satisfactory performance. AES’s “cautious optimization” strategy takes uncertainty into account.
- One of the key challenges for coal-fired power plants is the variability in the BTU content of the coal. With advanced estimation and inferential sensing technology, leaking air variation and coal quality variation are identified and combustion parameters are optimized online.
- The solution has been extended for circulating fluidized bed (CFB) boilers. CFB boiler dynamics depend significantly on the accumulated char in the bed. An inferential bed fuel inventory (BFI) sensor was developed to estimate the accumulated char level and adapt the model used for predictive control accordingly.
- Another innovation is the plantwide optimization of boilers, turbines, and heat recovery systems to improve the end-to-end efficiency of a power plant.



## Most Innovative Power Technology of the Year Award from Asian Power magazine, 2008



For the application of AES to Sinopec’s Shanghai Petrochemical Company Principal Power Plant in Shanghai, Honeywell received the 2008 Most Innovative Power Technology of the Year Award from Asian Power, the leading publication for energy professionals in Asia.

For more information: V. Havlena and J. Findejs, Application of model predictive control to advanced combustion control, *Control Engineering Practice*, vol. 13, pp. 671-680, 2005.