

**Li Sun\***, Liuchang, Reliable and flexible steam and power system design, **Applied Thermal Engineering**, 2015,79:184-191

Steam and power systems should be designed with high reliability and flexibility to satisfy process energy and power demands and reduce penalty costs due to equipment failures and steam and power demand variations. Uncertainties of equipment failure and flexible process steam and power demands have different impacts on system reliability, steam and power generation, individual equipment operation performance, and process production loss due to utility deficits. Measures adopted to respond to uncertainties implementation include compensation options of equipment operating load sharing, equipment startup, and equipment (in failure) repair, and penalties both of electricity import from the grid and production loss. This paper has proposed a procedure of the system design based on simultaneously modelling and optimizing of the structure and operation with system reliability analysis, and a mixed-integer linear programming (MILP) model is formulated associated with compensation costs and penalty costs to obtain both system configuration with spare equipment (in hot or cold standby) and spare capacities, and operating scheduling specification to account for equipment failures and process steam and power demand fluctuations. In this optimization, the effect of equipment failures on system operation performance and costs is analyzed by system reliability, and uncertain steam and power demands are formulated by a multi-period stochastic programming. A case study shows the application and effectiveness of the proposed methodology.

High lights:

- Steam power system design including reliability analysis under uncertain demands.
- Equipment failure and mode transfer affect both system reliability and operating cost.
- Effect of uncertainty on optimization model by compensation items and penalty costs.
- System configuration and operation scheduling specified to uncertainties in the design.
- Five equipment modes in system configuration design and operating scheduling.