Understanding coal-fired power plant cycles

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Abstract

This report provides a guide to the principles of combustion-based steam cycle plants and combined (gas and steam) cycle plants fuelled by coal. The main types of power generation cycle are introduced, followed by background on the thermodynamics of heat engines and gas and steam cycles. The chapter on steam plant contains sections on PCC boilers, main features of turbines and the cycles themselves. The descriptions cover the influence of appropriate pressures and temperatures, designs of feed heating trains, use of reheat, export of heat, subcritical and supercritical cycles and other aspects, such as materials developments. The chapter on combined cycles concentrates on the two main types (pressurised fluidised bed combustion and integrated gasification combined cycles), describing configurations and steam cycles for these technologies. There are discussions of design aspects and of the influence of parameters including technology type, carbon utilisation, gasification efficiency, gas turbine and gas clean-up. Materials issues for combined cycle plants are discussed. Future power cycles based on coal will probably involve new configurations to accommodate carbon dioxide (CO_2) capture and storage. Examples are given to illustrate how these will impact on the energy flows.