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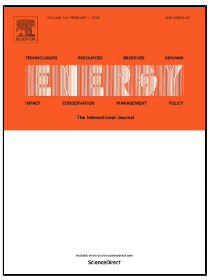

The Impact of the Control Method of Cyclic Operation on the Power Unit Efficiency and Life

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THE IMPACT OF THE CONTROL METHOD OF CYCLIC OPERATION ON THE POWER UNIT EFFICIENCY AND LIFE

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Key words: power unit, cyclic operation, sliding pressure control, efficiency, life

Abstract

The increasing share of renewable energy sources in the overall energy mix forces a change in the character of operation of coal-fired power units. Their task is now to balance the system under variable loads and they have to change from base- to cyclic-load operation. However, cyclic-load conditions involve a decrease in the power unit efficiency and shorten the life of components due to a rise in low cycle fatigue .

The paper investigates the possibilities of reducing own-needs electricity consumption by replacing the power unit constant pressure control with sliding pressure control. The problems arising from such a change in the control method are identified. The minimum value of steam pressure upstream the turbine for the conditions of operation under sliding pressure control is determined that does not produce any negative effects in the turbine performance and that makes it possible to obtain a reduction both in unit heat rate and in the amount of power needed to drive the feed water pumps. The calculation results are verified against measurements of a turbine operating with sliding pressure control.

The analysis also covers changes in the thermal and stress states of the turbine components during the turbine power drop realized by means of constant and sliding pressure control. The life-related effects of the power unit different control methods are assessed.

1. Introduction

The increasing share of electricity generated from renewable energy sources in the power systems of many countries poses new challenges to coal-fired power units, which now have to change the character of their operation and increase their thermal flexibility. This is related to shortening the power unit start-up processes, increasing the rates of changes in the power output and creating the capacity for long-term operation under the minimum load. The requirements are the effect of the random character of electricity generation from renewable energy sources (mainly from wind and solar energy) and of the fact that the function of coal-fired power units is now being reduced to a source balancing the electric power system.