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电力系统

面向低碳发展的燃煤机组有序调停模型和算法

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摘要： 节能发电调度是我国实现可持续发展、应对全球气候变化的重要举措。作者研究了通过燃煤机组有序调停实现中短期范围内节能调度、降低碳排放的方法。以燃煤机组占绝大比例的浙江电网为例，提出了面向低碳发展的燃煤机组有序调停模型，建立了具有自适应特性的目标函数，较好地协调了"三公调度"和系统煤耗最小2个目标。为求解这一非凸、非线性并含有分式约束的混合整数规划问题，文章提出了动态调停算法，该算法根据自适应目标函数的识别，动态选择机组进行调停；基于所提出的模型能自适应地使目标函数为最优的特点，还提出了基于外点法的单机组调停方法。该方法首先对机组进行预调停，如果可行，则对于单机组而言达到最优，否则调整机组的启停方式来满足约束条件使其可行。最后通过浙江省实际数据验证了本文方法的有效性，计算了降低煤耗、CO_2和SO_2减排的效益。

关键词： 有序调停燃煤机组；动态调停算法；节能减排；自适应目标 低碳电力

Model and Algorithm of Coal-Fired Unit Cyclic Operation Toward Low-Carbon Development

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Abstract: Energy-conservation based generation dispatching is an important measure to realize sustainable development in China and to cope with global climate change. The authors research an approach to implement medium- and short-term energy-conservation-based generation dispatching and carbon emission reduction by coal-fired unit cyclic operation (CUCO). Taking the Zhejiang power grid, in which coal-fired units hold overwhelming majority, as the research object, a CUCO model oriented to low-carbon development is proposed and an objective function that possesses adaptive feature, by which two objectives, namely the open, just and fair dispatching and least coal consumption, can be well coordinated. To solve such a non-convex and nonliear mixed integer programming with fractional constraints, a dynamic operation algorithm that can dynamically select the unit to be operated according to the identification by adaptive objective function is given. Based on the feature of the proposed model that the objective function can be optimized adaptively, a single unit operation method based on exterior points is put forward, and the operation process is as following: at first the single unit is pre-operated and if the pre-operation is feasible, the optimization for single unit is attained, otherwise the start-shutdown mode of the single unit is adjusted to satisfy the constraints to make the operation feasible. The effectiveness of the proposed approach and algorithm is verified by actual data of Zhejiang power grid, and the benefit from reducing coal consumption and the effects of reducing emission of CO_2 and SO_2 are calculated.

Keywords: coal-fired unit cyclic operation (CUCO)   dynamic operation algorithm   energy-conservation based generation dispatching   adaptive objective function   low carbon electricity

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