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# Demand Response Management in Smart Grid Networks: a Two-Stage Game-Theoretic Learning-Based Approach

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# **Demand Response Management in Smart Grid Networks: a Two-Stage Game-Theoretic Learning-Based Approach**

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**Abstract**— In this paper, the combined problem of power company selection and demand response management (DRM) in a smart grid network consisting of multiple power companies and multiple customers is studied via adopting a reinforcement learning and game-theoretic technique. Each power company is characterized by its reputation and competitiveness. The customers, acting as learning automata select the most appropriate power company to be served, in terms of price and electricity needs' fulfillment, via a reinforcement learning based mechanism. Given customers' power company selection, the DRM problem is formulated as a two-stage game theoretic optimization framework. At the first stage the optimal customers' electricity consumption is determined and at the second stage the optimal power companies' pricing is obtained. The output of the DRM problem feeds the learning system to build knowledge and to conclude to the optimal power company selection. To realize the aforementioned framework a two-stage Power Company learning selection and Demand Response Management (PC-DRM) iterative algorithm is introduced. The performance evaluation of the proposed approach is achieved via modeling and simulation and its superiority against other approaches is illustrated.