

The energy consumption optimization based on energy storage.

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The article presents the issues related to saving electricity costs for energy users who exploit the two-stage tariff with the using of electricity storage. We assume that the power object consumes only active power; consumption schedule depends on day of the week and has a maximum during of each day. We divide the total power consumption into two parts: the first one is completely fixed, and the second – can be changed in the optimization. Typical set of users as mentioned above are one or more homes, an apartment building, an office center, a farm, and not a large industrial enterprise with a mainly active power consumption.

The problem of determining the lowest energy costs is formulated and solved for various ratios between the network power, the load power, the capacity of converter and the electricity storage capacity. The task was reduced to a linear programming problem with a total number of variables of 2520. The optimal mode maintenance was performed for an optimization interval of 1 week and a discretization step of 12 minutes. It is shown that the use of electricity storage reduces the cost of consumed energy by 5–25%. However, investments in additional equipment (storage and converter) are estimated as significant. Economic efficiency is significant (10% or more) only when the converter power is about 10% or more of the power that user consume from the network. The general conclusion is that investing in the energy storage systems and its operating costs even with optimal mode maintenance in the economic sense, does not give a profit in compare with, than the buying electricity from the grid. Because the difference of two-stage tariff does not cover of the investment cost of the necessary additional equipment.

Keywords: linear programming, electricity storage, energy saving, reduction of electricity consumption, optimal mode maintenance, simplex method, two-state tariff, voltage stability.