Energy storage for load shifting belgrade

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Reference [3] shows that in the future smart grid (SG), both users and power companies could benefit from the economic and environmental advantages of smart pricing methods to more effectively reflect the fluctuations of the wholesale price on the customer side. In addition, smart pricing can be used to reduce the peak demand. A wide and comprehensive literature review on peak load reduction is covered by [4].

Reference [5] studies the effectiveness of customer engagement plans that clearly specify the amount of the grid operator"s intervention in the customer load settings for peak load reduction. An adjustable reference temperature for both constant and proportional deviation plans is defined to limit the output temperature of each thermostat load and to control the number of devices eligible for the DR Program. These possibilities offer significant advantages for the entire power system and rewarding incentives to end-users, for their active participation. In this area, energy services and their future development are both a great challenge and a great opportunity for system operators.

The contemporary electricity market enters a new era, focused on environmental protection, energy savings, and the customer-oriented approach. In this context, active participation of customers and their attitude towards consumption represent a valuable tool for a more efficient energy use, changing the demand so as, to allow peak load reductions and load shifting from peak hours, or to the hours with high power generation from renewable energy sources (RES).

DSM remains a significant segment of modern power systems. Its aim is to apply DSO"s activities designed to induce appropriate changes in the consumers` daily load profile shape [6].

The impact of DSM should be assessed by comparison with non-DSM options (those on the suppliers/operator side: building new power facilities, electric power import or energy storage options). During our research, we have applied a similar approach, contrasting the proposed DSM program effects and costs with those of building new power facilities. Technically, DSM determines the way end-users are going to respond (not the way they might respond, as in DR). Finally, the achieved changes in the load profile shape (peak load reduction) determine the benefit of the DSM measures/programs applied.

An effective DSM program introduces the application of energy efficient devices, standard and additional load control equipment, and a two-way communication option. If there is a dynamic relation between end-users and the utility, a system of dynamic control can be established [6].

Reference [7] presents the impact of DSM strategies in the evolution of the electricity mix of Flores Island in the Azores archipelago. The results show that DSM strategies can postpone investment in new renewable energy resources and improve the operation of the existing system. Our own investigations of the Belgrade consumption area, support this conclusion.

Mathematical optimization models of residential consumers are presented in [8]. They can be readily incorporated into automated decision-making technologies in SGs. The modeling problems can then be solved efficiently in real-time to control optimally all major residential energy loads, storage and production components while considering customer preferences and comfort levels. The developed mathematical models result in mixed integer linear programming (MILP) optimization problems with the objective functions of minimizing energy consumption, total cost of electricity and gas, emissions, peak load, and/or any combination of these objectives, while considering end-user preferences. The simulation results show significant reduction of both energy costs and the peak demand.

Reference [9] presents that in future power grids load control algorithms can be used to automate the control of certain loads (such as electric vehicles and heating devices) targeting peak reduction, valley filling, minimizing CO_2 emissions, load balancing, etc.

Reference [10] investigates the extent to which a home is able to transparently flatten its electricity demand by scheduling their demand for air conditioning (AC) devices, refrigerators, and dehumidifiers with certain flexibility. Results indicate that the average deviation from the mean power is decreased by over 20% across all daily peak periods.

Reference [11] shows that load control applications along with strategically deployed solar photovoltaic (PV) and ice storage systems at the building level can help reduce the building peak demand and energy consumption. The research presents a model for studying coordinated control of building end-use loads, including cooling, lighting and plug loads, together with PV and ice storage integrated with packaged AC units.

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