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Electricity demand and storage dispatch modeling for buildings and implications for the smartgrid[1] MENGLIAN ZHENG, CHRISTOPH MEINRENKEN, Columbia University — As an enabler for demand response (DR), electricity storage in buildings has the potential to lower costs and carbon footprint of grid electricity while simultaneously mitigating grid strain and increasing its flexibility to integrate renewables (central or distributed). We present a stochastic model to simulate minute-by-minute electricity demand of buildings and analyze the resulting electricity costs under actual, currently available DR-enabling tariffs in New York State, namely a peak/offpeak tariff charging by consumed energy (monthly total kWh) and a time of use tariff charging by power demand (monthly peak kW). We then introduce a variety of electrical storage options (from flow batteries to flywheels) and determine how DR via temporary storage may increase the overall net present value (NPV) for consumers (comparing the reduced cost of electricity to capital and maintenance costs of the storage). We find that, under the total-energy tariff, only medium-term storage options such as batteries offer positive NPV, and only at the low end of storage costs (optimistic scenario). Under the peak-demand tariff, however, even short-term storage such as flywheels and superconducting magnetic energy offer positive NPV. Therefore, these offer significant economic incentive to enable DR without affecting the consumption habits of buildings' residents. We discuss implications for smartgrid communication and our future work on real-time price tariffs.

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