

Control Group Seminar
Tokyo Institute of Technology

Mechanism Design for Demand Response Programs

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Abstract: Demand Response (DR) programs serve to reduce the consumption of electricity at times when the supply is expensive. Consumers or agents with flexible consumption are recruited by an aggregator who manages the DR program. The aggregator calls on a subset of recruited agents to reduce their electricity use during DR events. Agents are paid for reducing their energy consumption from their baselines. Baselines are counter-factual consumption estimates of the energy an agent would have consumed if they were not participating in the DR program. Baselines are used to determine payments to agents. This creates an incentive for agents to inflate their baselines to increase the payments they receive. There are several newsworthy cases of agents gaming their baseline for economic benefit. We propose a novel self-reported baseline mechanism (SRBM) where each agent reports its baseline and marginal utility. These reports are strategic and need not be truthful. Based on the reported information, the aggregator selects or calls on agents with a certain probability to meet the load reduction target D . Called agents are paid for observed reductions from their self-reported baselines. Agents who are not called face penalties for consumption shortfalls below their baselines. Under SRBM, we show that truthful reporting of baseline consumption and marginal utility is a dominant strategy. Thus, SRBM eliminates the incentive for agents to inflate baselines. SRBM is assured to meet the load reduction target. Finally, we show that SRBM is almost optimal in the metric of average cost of DR provision faced by the aggregator.