

**NYU Stern School of Business**  
**Department of Information, Operations & Management Sciences**  
**OPERATIONS MANAGEMENT RESEARCH SEMINAR**

**TOPIC: Price-Responsive Smart Homes with Storable Appliances**

**SPEAKER: Dan Adelman (Chicago)**

**DATE: Wednesday, December 5, 2012**

**TIME: 11:00 AM-12:00PM**

**PLACE: 5-90 KMC**

**ABSTRACT**

We develop a mathematical framework for a smart home's storable appliances to respond optimally to dynamic price signals. Such appliances are characterized by their ability to manage a store of energy, of which air conditioning is our canonical example. Starting with first principles, we develop two mathematical models for smart price-responsive storage appliances: a "price-only" model which is not aware of home occupancy, and an "occupant-aware" model which optimizes its behavior accordingly. We show that under certain conditions it is socially optimal for the electricity utility to pass spot prices down to consumers. We present a methodology to simulate a real-sized city. We present extensive numerical results on ComEd's residential customers' prospective responses to dynamic prices through air conditioners during a hot summer month, both in isolation and in equilibrium. Our results suggest that dynamic prices reduce power bills significantly and even more so with price-responsive appliances. On the other hand, they increase power bills significantly on peak days while price-responsive air conditioners mitigate these bill increases. Overall, the social welfare may increase up to 2.6% for the month and up to 6.8% on a peak day. However, our results indicate that air conditioning alone is not sufficient to account for the peak load reductions observed in many real-world pilot tests, unless consumers are willing to experience substantial thermal discomfort.

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**Bio**

Dan Adelman is a leading expert in Management Analytics, helping companies deploy data and decision analysis to build world-class strategic and tactical management capabilities. By integrating real world data with analytical models, and bringing structure and discipline to decision and control processes, firms can achieve higher profits with lower risk, and attain competitive advantage. Much of Adelman's research is based on interactions with firms from a variety of industries, including internet services, chemical distribution, airlines, third party logistics, fiber-optics manufacturing, semiconductor manufacturing, oil, and others. Recent or current projects include work with Akamai on internet pricing, with GE Global Research Labs on the electricity smart grid, with BP on gasoline supply contract portfolio optimization, with Symantec on software release planning, and others including a project on dynamically managing customer goodwill in a B2B setting. Adelman also conducts research on foundations of the operations research field, including approximate dynamic programming, inventory theory/supply

chain management, and revenue management/pricing optimization. He also studies the linkage between operational performance metrics and the financial performance of the firm.

Adelman has received several awards, including the George B. Dantzig Prize in 1998 for the best dissertation in any area of operations research and the management sciences that is innovative and relevant to practice. He publishes regularly and holds editorial positions in leading academic journals. He has served as Associate Editor for *Management Science*, currently serves as Associate Editor for *Manufacturing and Service Operations Management*, and is the Area Editor for Operations and Supply Chains at *Operations Research*. Adelman also sits on the Marketing Council of the Art Institute of Chicago.

He received a PhD in industrial engineering and operations research in 1997, in addition to a bachelor's degree in industrial engineering and master's degree in operations research from the School of Industrial and Systems Engineering at the Georgia Institute of Technology. Adelman joined the faculty in 1997. He teaches regularly in the school's Executive MBA program.