Thomas Lee

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EDUCATION

University of Pennsylvania, Philadelphia, PA
School of Engineering and Applied Sciences
2016-2017 M.S.E. Electrical Engineering
2013-2017 B.A.S. Computer Science

The Wharton School
2013-2017 B.S. Economics (Concentrations: Statistics, Finance)
Honors: *Summa cum laude* (for B.A.S. and B.S.), IEEE-Eta Kappa Nu

Relevant Coursework
Physical Systems: Electrical Circuits and Systems, Battery Systems, Ocean-Atmosphere Dynamics
Decision Science: Optimization Theory, Modern Convex Optimization, Control of Systems
Data Science: Probability, Stochastic Processes, Micro-Econometrics, Machine Learning
Energy Economics: Environmental & Energy Economics, Energy Finance

RESEARCH

(*Work in Progress*, April 2019-) **"A Dynamic Programming Approximation for Energy Storage Arbitrage's Market Scalability with Price Impact and Renewables Growth"**
Energy arbitrage at a large scale faces diminishing wholesale market returns, rendering historical price based studies inadequate for long-term assessments. Developed an efficient and flexible dynamic programming method incorporating realistic non-convex supply stacks to quantify energy arbitrage profit scalability as a function of storage and renewables deployment (applied to CAISO numerical study). Derived analytic solutions for social planner and Cournot-Nash equilibrium cases of storage ownership.

(*Senior Thesis*, December 2017) "**Optimizing Electricity Generation Portfolios with Intermittency: Does Delayed Externality Pricing Cause Lock-in Regret?**"
Derived closed-form conditions for carbon lock-in to exist in the presence of renewable energy. Built an hourly-resolution capacity expansion model to quantify the extent that ongoing natural gas combined cycle buildout in the PJM system may contribute to carbon lock-in. Presented findings during session of *Energy Economics & Finance Seminar* (May 2018) organized by Professor Arthur van Benthem.

"**Energy Storage in PJM: Exploring Frequency Regulation Market Transformation**."
Kleinman Center for Energy Policy. Research Paper. July 2017.
Quantified system reliability and economic impacts of PJM's "Regulation D" market design and subsequent revisions, and reviewed the power engineering and regulatory background of frequency regulation. Assessed implications for energy storage projects. Currently cited 12 times, including in *IEEE Transactions on Smart Grid*, *Energy Policy*, and *Applied Sciences*. Presented findings as part of 2017 Carnot Prize ceremony, to an audience including former EPA Administrator Gina McCarthy.

"**A Market for Primary Frequency Response? The Role of Renewables, Storage, and Demand.**"
Kleinman Center for Energy Policy. Working Paper. June 2018.
Distinguished between capability and provision for primary frequency response (an essential reliability service), quantified impact of renewables on headroom provision based on a simplified economic dispatch model, and discussed potential market design considerations in light of new FERC interconnection rules.

PROFESSIONAL EXPERIENCE

Boston Energy Trading and Marketing (Mitsubishi Corp.), Boston, MA
2020-   *Senior Trading Analyst, Congestion Trading*
2018-2020   *Senior Trading Analyst, Energy Trading*
Used power flow analysis and graph clustering to manage proprietary FTR portfolio with ~100TWh notional volume. Built fundamental supply-demand and probabilistic valuation models for power and gas futures; executed CAISO strategy achieving 4+ Sharpe ratio. Developed the core LP formulation for company's energy storage optimization and valuation framework. Conceived and researched a copula-based stochastic weather generator (SWG) with novel correlation linkages, now used in Monte Carlo valuations.

AQR Capital Management, Greenwich, CT
2017-2018   *Quantitative Research Analyst, Global Asset Allocation*
(Worked part-time concurrently during final Fall 2017 semester.)
2016   *Quantitative Research Intern*
Researched option-implied correlations and forecast accuracy for currencies risk modeling. Implemented quantitative global macro signals with international commodity trade data. Used linear algebra to derive new closed-form portfolio optimization solution, and conducted empirical investment research leading to a published journal paper:

(As RA) "**Optimal Currency Hedging for International Equity Portfolios**"
Jacob Boudoukh, Matthew Richardson, Ashwin Thapar, Franklin Wang.
Financial Analysts Journal. Aug 2019.

Kleinman Center for Energy Policy, University of Pennsylvania
2017-2018   *Research Fellow*
2016-2017   *Research Assistant, Energy Storage Research*
Investigated electricity market design related to energy storage investment and grid reliability price signals. Published research articles and presented findings.

Computer and Information Science Department, University of Pennsylvania
2016   *Teaching Assistant*, Introduction to Machine Learning (CIS 419/519)
Formulated exam questions, graded, and conducted weekly office hours. Python-based course covering supervised learning, neural networks, and reinforcement learning.

Opower (Oracle), San Francisco, CA
2015   *KPCB Engineering Fellow (Summer)*
Contributed to AMI data platform for demand response. Helped build R demonstration of diurnal load curve clustering using k-means for residential electric demand.

LEADERSHIP

2019-2020   **Young Professionals in Energy – Boston Chapter**
Programming Committee Member
Initiated and organized panel on offshore wind in the US Northeast, including speakers from Orsted and MHI Vestas. Organized ISO New England control room site visit.

2016-2017   **Trustees Social Responsibility Advisory Committee**, University of Pennsylvania
Voting Student Representative
One of 12 voting members advising Trustees on endowment proxy voting. Successfully negotiated adoption of 1st GHG Emissions guideline (2017). Led 8-student research team on fossil fuels report (2015) resulting in Trustees mandate to consider climate factors in endowment investments (2017) and de facto coal and tar sands divestment (2020).