

Jay Apt

POSITIONS HELD

Carnegie Mellon University

PROFESSOR <i>EMERITUS</i> , TEPPER SCHOOL OF BUSINESS PROFESSOR <i>EMERITUS</i> , ENGINEERING & PUBLIC POLICY	2022 – PRESENT
PROFESSOR, TEPPER SCHOOL OF BUSINESS CO-DIRECTOR, CARNEGIE MELLON ELECTRICITY INDUSTRY CENTER AFFILIATED PROFESSOR IN ENGINEERING & PUBLIC POLICY	2010 – 2022
ASSOCIATE RESEARCH PROFESSOR, TEPPER SCHOOL OF BUSINESS EXECUTIVE DIRECTOR, CARNEGIE MELLON ELECTRICITY INDUSTRY CENTER	2003 — 2010
DISTINGUISHED SERVICE PROFESSOR IN ENGINEERING AND PUBLIC POLICY	2000 — 2010

iNetworks, LLC Venture Capital

MANAGING DIRECTOR AND CHIEF TECHNOLOGY OFFICER	2000 — 2003
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Carnegie Museum of Natural History

DIRECTOR	1997 — 2000
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National Aeronautics and Space Administration

ASTRONAUT FOUR SPACE SHUTTLE MISSIONS. TWO MISSIONS INVOLVED PARTNERSHIPS WITH JAPAN AND RUSSIA; ONE INVOLVED TWO SPACEWALKS.	1985 — 1997
CHIEF OF MISSION SUPPORT BRANCH	1995 — 1996
FLIGHT CONTROLLER, MISSION CONTROL CENTER	1982 — 1985

California Institute of Technology

Jet Propulsion Laboratory, Pasadena, California

SCIENCE MANAGER OF OPTICAL FACILITIES, TABLE MOUNTAIN OBSERVATORY GROUP LEADER, OPTICAL ASTRONOMY GROUP PLANETARY SCIENTIST IN EARTH AND SPACE SCIENCES DIVISION	1980 — 1982
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HARVARD UNIVERSITY

ASSISTANT DIRECTOR, DIVISION OF APPLIED SCIENCES FOUNDING DIRECTOR, PLANETARY IMAGING COMPUTER CENTER	1978 — 1980
STAFF, CENTER FOR EARTH AND PLANETARY PHYSICS	1976 — 1980

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

POST-DOCTORAL FELLOW IN LASER SPECTROSCOPY	1976
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E D U C A T I O N

A.B. IN PHYSICS (MAGNA CUM LAUDE), HARVARD, 1971
PH.D. IN EXPERIMENTAL ATOMIC PHYSICS, MASSACHUSETTS INSTITUTE OF
TECHNOLOGY, 1976. ADVISOR: DAVID PRITCHARD
THESIS TITLE: "VELOCITY DEPENDENCE OF EXCITATION TRANSFER IN
COLLISIONS OF LASER-EXCITED ATOMS"

P R O F E S S I O N A L M E M B E R S H I P S

INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS
SOCIETY FOR RISK ANALYSIS
CIGRE (INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS)
INDUSTRY STUDIES ASSOCIATION
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
AMERICAN GEOPHYSICAL UNION
AMERICAN PHYSICAL SOCIETY
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
ASSOCIATION OF SPACE EXPLORERS

B O A R D S

INDUSTRY STUDIES ASSOCIATION (2012-2014)
ELECTRIC POWER RESEARCH INSTITUTE (EPRI) (2007-2013)
AUDIT COMMITTEE
PHIPPS CONSERVATORY AND BOTANIC GARDENS (1997-2003)
CHAIR, FINANCE COMMITTEE
AUDIT COMMITTEE
NATIONAL ASSOCIATION OF ROCKETRY (1998-2007)

S E L E C T E D H O N O R S A N D A W A R D S

HEINZ HISTORY CENTER HISTORY MAKER'S AWARD FOR INNOVATION (2018)
FELLOW, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (2013)
FELLOW, THE EXPLORERS CLUB (2008)
METCALF AWARD FOR OUTSTANDING ENGINEERING ACHIEVEMENT (2002)
DAVID L. LAWRENCE AWARD OF VECTORS / PITTSBURGH (2000)
NASA DISTINGUISHED SERVICE MEDAL (1997)
NASA EXCEPTIONAL SERVICE MEDAL (1993 AND 1995)
FEDERATION AERONAUTIQUE INTERNATIONALE V.M. KOMAROV DIPLOMA FOR
OUTSTANDING ACHIEVEMENTS IN THE FIELD OF EXPLORATION OF OUTER SPACE
(1991 AND 1992), SERGEI P. KOROLEV DIPLOMA FOR A NON-PLANNED REPAIR OF
A BROKEN DEVICE TO MAKE POSSIBLE THE CONTINUATION OF A MISSION (1991),
AND DE LA VAULX MEDAL FOR ABSOLUTE WORLD RECORD OF ASSEMBLED MASS
OF SPACESHIPS LINKED IN FLIGHT (1998)

ARCHIVAL JOURNAL PAPERS

127. Apt, J., D. Epple, and F. Sowell, *Forest Fires: Why The Large Year-to-Year Variation in Forests Burned?*. In review at Journal of Environmental Economics and Management.
126. Forzieri¹, G., F. Bosello, E. Byers, J. C. J. H. Aerts, S. Alvisi, J. Apt, F. Batista e Silva, A. Bianchi, R. Buizza, C. Carraro, A. Castelletti, F. Castelli, A. Cominola, M. V. Corazza, S. Dasgupta, P. De Girolamo, M. Di Bacco, P. Di Mascio, M. Duca, E. Fisher, C. Gandolfi, S. Gössling, K. Grobe, J. W. Hall, E. Koks, E. Krausmann, H. Ligteringen, G. Loprencipe, P. Mercogliano, A. Montanari, R. Parrado, I. Pecorini, F. R. Feliziani, J. Spinoni, G. Standardi, W. Thiery, M. Tornatore, M. Voudoukas, Y. Wada, E. Zio, and L. Feyen, *Vulnerability of critical infrastructures to climate extremes*, In review at Nature Geosciences.
125. Smillie, S., P. Vaishnav, C. Wade, K. Jordan, A. Venkatesh, A. Sinha, and J. Apt, *Hybrid heat pumps avoid extreme marginal abatement costs of electrifying peak heating loads in cold regions*. Environmental Research Letters, 2024. **19**: 094054.
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122. Smillie, S., M.G. Morgan, and J. Apt, *How vulnerable are US natural gas pipelines to electric outages?*, The Electricity Journal, 2023. **36**: 107251.
121. Lavi, Y. and J. Apt, *Using PV Inverters for Voltage Support at Night Can Lower Grid Costs*. Energy Reports, 2022. **8**: 6347-6354.
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115. Kirchen, K., W. Harbert, J. Apt, and M.G. Morgan, *A Solar-Centric Approach to Improving Estimates of Exposure Processes for Coronal Mass Ejections*. Risk Analysis, 2020. **40**(5): 1020-1039.

114. Murphy, S., L. Lavin, and J. Apt, *Resource adequacy implications of temperature-dependent electric generator availability*. Applied Energy, 2020. **262**: 114424.
113. Keen, J.F. and J. Apt, *How much capacity deferral value can targeted solar deployment create in Pennsylvania?* Energy Policy, 2019. **134**: 110902.
112. Murphy, S, F. Sowell, and J. Apt, *A time-dependent model of generator failures and recoveries captures correlated events and quantifies temperature dependence*. Applied Energy, 2019. **253**: 113513.
111. Fisher, M., J. Apt, and J. Whitacre, *Can flow batteries scale in the behind-the-meter commercial and industrial market? A techno-economic comparison of storage technologies in California*. Journal of Power Sources, 2019. **420**: 1-8.
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109. Freeman, G., J. Apt, and M. Dworkin, *The Natural Gas Grid Needs Better Monitoring*. Issues in Science and Technology, 2018. **34**(4): 79-84.
108. Fisher, M., J. Whitacre, and J. Apt, *A Simple Metric for Predicting Revenue from Electric Peak-Shaving and Optimal Battery Sizing*. Energy Technology, 2018. **6**(4): 649-657.
107. Murphy, S., J. Apt, J. Moura, and F. Sowell, *Resource adequacy risks to the bulk power system in North America*. Applied Energy, 2018. **212**: 1360-1376.
106. Fisher, M.J., F. Sowell, and J. Apt, *The economics of commercial demand response for spinning reserve*. Energy Systems, 2018. **9**(1): 3-23.
105. Kaack, L.H., J. Apt, M.G. Morgan, and P. McSharry, *Empirical Prediction Intervals Improve Energy Forecasting*. Proceedings of the National Academy of Sciences of the United States of America, 2017. **114**(33): 8752-8757.
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102. Fisher, M.J. and J. Apt, *Emissions and Economics of Behind-the Meter Electricity Storage*. Environmental Science & Technology, 2017. **51**(3): 1094-1101.
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86. Rose, S. and J. Apt, *The Cost of Curtailing Wind Turbines for Secondary Frequency Regulation Capacity.* Energy Systems, 2014. **5**(3): 407-422.
85. Rose, S., P. Jaramillo, M. Small, and J. Apt, *Quantifying the Hurricane Catastrophic Risk to Offshore Wind Power.* Risk Analysis, 2013. **33**(12): 2126-2141.
84. Mauch, B., J. Apt, P.M.S. Carvalho and M. Small, *An Effective Method for Modeling Wind Power Forecast Uncertainty.* Energy Systems, 2013. **4**(4): 393-417.
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- National Academy of Sciences of the United States of America, 2013. **110**(29): 11768-11773.
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 79. Victor, D.G., M.G. Morgan, J. Apt, J. Steinbruner, and K. Ricke, *The Truth about Geoen지니어ing*. Foreign Affairs, March 27, 2013.
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58. Peterson, S.B., J. Apt, and J.F. Whitacre, *Lithium-Ion Battery Cell Degradation Resulting from Realistic Vehicle and Vehicle-to-Grid Utilization*. Journal of Power Sources, 2010. **195**(8): 2385-2392.
57. Katzenstein, W., E. Fertig, and J. Apt, *The Variability of Interconnected Wind Plants*. Energy Policy, 2010. **38**(8): 4400-4410.
56. Victor, D.G., M.G. Morgan, J. Apt, J. Steinbruner, and K. Ricke, *The Geoengineering Option: A Last Resort Against Global Warming?* Foreign Affairs, 2009. **88**(2): 64-76.
55. Hines, P., J. Apt, and S. Talukdar, *Large Blackouts in North America: Historical trends and policy implications*. Energy Policy, 2009. **37**(12): 5249-5259.
54. Newcomer, A. and J. Apt, *Near term implications of a ban on new coal-fired power plants in the US*. Environmental Science & Technology, 2009. **43**(11): 3995–4001. *Paper selected as Best Environmental Policy Paper of 2009 by Environmental Science & Technology*
53. Katzenstein, W. and J. Apt, *Response to "Comment on 'Air Emissions Due to Wind and Solar Power' "*. Environmental Science & Technology, 2009. **43**(15): 6108-6109.

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48. Apt, J., L. Lave, and S. Pattanariyankool, *A National Renewable Portfolio Standard? Not Practical*. Issues in Science & Technology, 2008. **25**(1): 53-59.
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43. Walawalkar, R., J. Apt, and R. Mancini, *Economics of electric energy storage for energy arbitrage and regulation in New York*. Energy Policy, 2007. **35**(4): 2558–2568.
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41. Patiño-Echeverri, D., B. Morel, J. Apt, and C. Chen, *Should a Coal-Fired Power Plant be Retrofitted or Replaced?* Environmental Science & Technology, 2007. **41**(23): 7980-7986.
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37. Lave, L.B. and J. Apt, *Planning for Natural Disasters in a Stochastic World*. Journal of Risk and Uncertainty, 2006. **33**: 117-130.
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- Morgan, M.G., S.T. McCoy, J. Apt, M. Dworkin, P. Fischbeck, D. Gerard, K.A. Gregg, R.L. Gresham, C.R. Hagan, D.M. Kreis, R.R. Nordhaus, E.R. Pitlick, M. Pollak, J.L. Reiss, E.S. Rubin, K. Twaite, and E.J. Wilson, Carbon Capture and Sequestration: Removing the Legal and Regulatory Barriers. 2012, New York: RFF Press. 274 pp.
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- Apt, J. and M.G. Morgan, *Making Electric Power More Resilient*, pp. 162-179 in Interdisciplinary Research on Climate and Energy Decision Making, M.G. Morgan, Editor. 2023. Routledge, London and New York.
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- Holliday, C., J. Apt, F. Beinecke, N. Brownell, P. Centolella, D. Garman, C. Gellings, B. Gordon, W. Hogan, R.K. Lester, A. Ritter, J. Rogers, T. Roosevelt, P. Rothstein, G. Roughead, M. Savitz, and M. Williams, *The Power of Change: Innovation for Development and Deployment of Increasingly Clean Electric Power Technologies*. 2016, National Research Council of the National Academies: Washington. 320 pp.
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- Apt, J., G. Morgan, E. Rubin, and H. Zhai, *A brief summary of options for reducing CO2 emissions from existing fossil fuel-fired power plants under Section 111(d) once a new source performance standard has been promulgated*. 2013. 8 pp.
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- Lyles, L.L., R.S. Colladay, L.A. Fisk, J. Apt, J.B. Armor, W.A. Austin, D. Baltimore, R. Bednarek, J.A. Burns, P. Chao, K.S. Flamm, J. Johnson-Freese, P.D. Nielsen, M.S. Turner, and T.H. Vonder Haar, *America's Future in Space: Aligning the Civil Space Program with National Needs*. 2009, National Research Council of the National Academies: Washington. 89 pp.
- Apt, J., L.B. Lave, and S. Pattanariyankool, Generating Electricity from Renewables: Crafting Policies that Achieve Society's Goals. 2008, National Rural Electric Cooperative Association. 40 pp.
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- Spees, K., L.B. Lave, and J. Apt, *Long-Term Investment Decisions for Providing Electric Power in Puerto Rico*. 2008. 66 pp.
- Apt, J., R.L. Gresham, M.G. Morgan, and A. Newcomer, Incentives for Near-Term Carbon Dioxide Geological Sequestration. 2007, The Gasification Carbon Management Work Group: Washington. 68 pp.
- Apt, J., S. Blumsack, and L.B. Lave, Competitive Energy Options for Pennsylvania. 2007, Team Pennsylvania Foundation, Harrisburg, 95 pp.
- Rubin, E. S., S. T. McCoy, and J. Apt. Regulatory and Policy Needs for Geological Sequestration of Carbon Dioxide. 2007, International Risk Governance Council. 14 pp.

Apt, J., D. Hoffmann, H. Kunreuther, E. Michel-Kerjan, and M.G. Morgan, [The Insurance Industry and Climate Change](#). 2006, Carnegie Mellon University: Pittsburgh. 19 pp.

Committee on Earth Science and Applications from Space, Space Science Board, National Research Council, [Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond](#). 2007, National Academies Press, Washington.

Morgan, M.G., J. Apt, and L.B. Lave, [The U.S. Electric Power Sector and Climate Change Mitigation](#). 2005, Pew Center for Global Climate Change: Washington. 84 pp.

Apt, J. and L.B. Lave, [Electricity Options for Large Industrial Customers in Western Pennsylvania](#). 2005, Allegheny Conference on Community Development: Pittsburgh, Pennsylvania. 28 pp.

Apt, J. and M.G. Morgan, [Critical Electric Power Issues in Pennsylvania: Transmission, Distributed Generation, and Continuing Services when the Grid Fails](#). 2005, Commonwealth of Pennsylvania: Harrisburg, Pennsylvania. 102 pp.

Apt, J., T. Cochran, A. Eng, H.K. Florig, and J. Lyngdal, [Launching Safely in the 21st Century](#). 2005, National Association of Rocketry, Chicago. 118 pp.

SELECTED INVITED TALKS

German-American-Israeli Trilateral Symposium on Energy Solutions, “Characteristics of wind and solar power and their importance for grid integration”, Berlin, October 11, 2023.

Rockefeller University “International Cooperation, Space Policy, and Geoengineering”, March 16, 2023.

Stanford University, “[Electric and Gas Reliability: Insights from Actual Data](#)”, November 14, 2022

University of California at San Diego, “Electricity and Gas Reliability”, March 31, 2021

Danish Technical University (DTU), Lyngby, Denmark, “New Techniques to Analyze Variable Renewable Energy”, May 23, 2018

Byens Lys Copenhagen, Denmark, “[Are low-pollution electricity, markets, and reliability compatible?](#)”, May 22, 2018

National Academy of Sciences Annual Meeting Symposium: The Energy Transition, “The Changing Character of the Electric Power Grid: Variable Renewable Power”, April 30, 2018

National Academy of Engineering-American Association of Engineering Societies Convocation of the Professional Engineering Societies, “The Growing Challenge of Integrating Variable and Intermittent Sources of Power”, April 23, 2018

University of Michigan Joint Seminar Series Electrical and Computer Engineering, Industrial and Operations Engineering, and School for Environment and Sustainability, “Variable Renewable Energy”, March 15, 2018

Rice University, “Variable Solar and Wind Electric Power Production”, May 10, 2016

Danish Technical University (DTU), Risø, Denmark, "Characteristics of Wind and Solar Power", March 9, 2016

Vermont Law School, "Are Renewables a Practical Answer?", July 24, 2015

Columbia University, "Variable Renewable Electricity", February 13, 2015

University of California at San Diego, "Prospects for Low-CO₂ Electric Power", August 29, 2014

Vermont Law School, "Are Renewables a Practical Answer?", June 13, 2014

Harvard University, "New Findings on Variable Renewable Energy and the Electricity Grid", February 5, 2014

University of California at Los Angeles, "Energy – What's Next?", March 1, 2013

Columbia University, "Grid-level electricity storage and markets", May 2, 2012

University of Texas, Austin, "What the Characteristics of Wind and Solar Electric Power Production Mean for Their Future", March 1, 2012

SELECTED CONFERENCE PAPERS

Apt, J., "What has been learned from frequency-domain analysis of wind and solar power", 2019 FISE-IEEE/CIGRE Conference - Living the energy Transition (FISE/CIGRE), Medellin, Colombia, December 5, 2019. Best paper award.
DOI: 10.1109/FISECIGRE48012.2019.8984982

Lavin, L., J. Apt, and S. Murphy, *Resource Adequacy and Scarcity Pricing Implications of Correlated Generator Failures*, United States Association of Energy Economists, Denver, November 3, 2019.

Freeman, G.M., J. Apt, and J. Moura, *Natural gas fuel starvation at large power plants in the U.S. and the effect of gas supply arrangements on reliability and resilience*, International Association of Energy Economists North American Conference, Washington DC September 23, 2018.

Freeman, G.M. and J. Apt, *Are U.S. Federal Reporting Thresholds Adequate to Address an Interdependent Electricity and Natural Gas Grid?* United States Association of Energy Economists, Houston. December 14, 2017.

Murphy, S. and J. Apt, *Resource adequacy risks to the bulk power system in North America*. Society for Risk Analysis annual meeting, San Diego, California. December 13, 2016.

Kaack, L., J. Apt, and M.G. Morgan, *The Applicability of Empirical Prediction Intervals to Energy Forecasting*. International Association for Energy Economics 39th International Conference, Bergen, Norway. June 20, 2016.

Klima, K. and J. Apt, *Geographic Smoothing of Solar PV: Results from Gujarat*. American Meteorological Society Seventh Conference on Weather, Climate, Water and the New Energy Economy, New Orleans. January 11, 2016.

- Apt, J., *What the characteristics of wind power mean for integration into power grids*. Invited Keynote address at The International Colloquium On Large Wind-Power Plants: Interaction, Control and Integration, Leuven, Belgium. July 9, 2015.
- Rose, S. M. Handschy, and J. Apt, *Modeling Extreme Low-Wind Speed Events for Large-Scale Wind Power*. *Technology, Management, and Policy Consortium*, Lisbon. June 23, 2014.
- Moore, J. and J. Apt, *Energy and Capacity Market Effects of Carbon Policies in Restructured Markets*. *United States Association of Energy Economists*, New York. June 16, 2014.
- Lueken, R., K. Klima, W.M. Griffin, and J. Apt, *The Climate and Health Effects of a USA Switch from Coal to Gas*. *United States Association of Energy Economists*, New York. June 17, 2014.
- Apt, J., S. Rose, P. Jaramillo, M.J. Small, *Quantifying the Hurricane Risk to Offshore Wind Power* (invited) American Geophysical Union Fall Meeting, San Francisco, CA. Dec. 12, 2013.
- Rose, S., M. Handschy, J. Apt, *Estimating the Probability of Extreme Low-Wind Periods in the Central U.S.* Society for Risk Analysis Annual Meeting, Baltimore, MD. Dec. 9, 2013.
- Zhou, Y., A Sheller-Wolf, N. Secomandi, S. Smith, and J. Apt (2013) Combining Operations Management and Engineering Models to Effectively Manage Electricity Storage. *18th Annual INFORMS MSOM Conference*, Fontainebleau, France.
- Zhou, Y., J. Apt, A Sheller-Wolf, N. Secomandi, and S. Smith (2013) Combining Operations Management and Engineering Models to Effectively Manage Electricity Storage. *INFORMS Annual Meeting*, Minneapolis.
- Zhou, Y., A Sheller-Wolf, N. Secomandi, S. Smith, and J. Apt (2013) Combining Operations Management and Engineering Models to Effectively Manage Electricity Storage. *6th International Annual Conference of the Chinese Scholars Association for Management Science and Engineering*, Beijing.
- Rose, S., P. Jaramillo, M. Small, and J. Apt (2012) Quantifying the Hurricane Risk to Regional Offshore Wind Power. *Society for Risk Analysis*, San Francisco.
- Fertig, E. and J. Apt (2012) Optimal investment strategy in low-carbon energy R&D with uncertain payoff. *United States Association of Energy Economists*, Austin, TX.
- Lueken, R. and J. Apt (2012). How Storage Will Transform Power Emissions and Markets. *United States Association of Energy Economists*, Austin, TX.
- Fertig, E., J. Apt, P. Jaramillo, and W. Katzenstein (2012). *The effect of long-distance interconnection on wind power variability*, in *Western Energy Policy Research Conference*. Boise, Idaho.
- Blanco, C.N., P. Jaramillo, and J. Apt (2012). *Generation Valuation Under High Wind Penetration Scenarios*, in *10th Industry Studies Association Conference*, Pittsburgh.
- Hittinger, E., J.F. Whitacre, and J. Apt (2012). *Energy Storage for Grid Applications: Informing Future Development*, in *10th Annual Industry Studies Association Meeting*. Pittsburgh.

- Apt, J. (2012) Smart Integration of Variable and Intermittent Renewables. *Hawaii International Conference on System Science*, Maui.
- Rose, S., Jaramillo, P., Small, M. J., Grossmann, I., Apt, J. (2011) Quantifying the Hurricane Risk to Offshore Wind Turbines. *Society for Risk Analysis 2011 Annual Meeting*, Charleston, SC.
- Rose, S. and J. Apt, *The Cost of Curtailing Wind Turbines for Frequency Regulation and Ramp-Rate Limitation*, in *29th USAEE/IAEE North American Conference*. 2010: Calgary.
- Katzenstein, W. and J. Apt, *The Cost of Wind Power Variability*, in *29th USAEE/IAEE North American Conference*. 2010: Calgary.
- Hittinger, E., J.F. Whitacre, and J. Apt, *Compensating for Wind Variability Using Co-Located Natural Gas Generation and Energy Storage*, in *29th USAEE/IAEE North American Conference*. 2010: Calgary.
- Apt, J., *Geoengineering: Will an infrastructure for global dimming be desirable or possible?* *Gordon Research Conference on Industrial Ecology*. 2010: New London, New Hampshire.
- Apt, J. *The Character of Electric Power Produced by Wind and Solar Plants (invited talk)*. Indo-US Conference on Climate Change. 2009. Chennai, India.
- Peterson, S., J. Whitacre, and J. Apt. *PHEV Battery Performance in a Vehicle to Grid (V2G) Utilization Scenario: a Technological and Economic Analysis*. 5th Annual Lithium Mobile Power Conference. 2009. Boston.
- Gilmore, E.A., P.J. Adams, J. Apt, and L.B. Lave. *The air quality effects of integrating electrical energy storage into electricity grids*. Society for Risk Analysis 2009 Annual Meeting: Baltimore.
- Apt, J., L. Lave, and M.G. Morgan, *Worst Case Electricity Scenarios: The Benefits & Costs of Prevention (invited talk)*, Society for Risk Analysis 2008 Annual Meeting: Boston.
- Blumsack, S., L. Lave, and J. Apt, *Costs and Prices for Electric Utilities Under Regulation and Restructuring*. Sloan Industry Studies Conference. 2008: Boston.
- Apt, J. and W. Katzenstein. *The Character of Wind Power Variability and its Effects on Fill-In Power*. 7th International Workshop on Large-Scale Integration of Wind Power into Power Systems. 2008. Madrid.
- Walawalkar, R., S. Blumsack, J. Apt, and S. Fernands. *Analyzing PJM's Economic Demand Response Program*. IEEE Power Engineering Society General Meeting. 2008. Pittsburgh.
- Hines, P., J. Apt, and S. Talukdar. *Trends in the History of Large Blackouts in the United States*. IEEE Power Engineering Society General Meeting. 2008. Pittsburgh.
- Newcomer, A., S. Blumsack, J. Apt, L. Lave, and M.G. Morgan. *Electricity Load and Carbon Dioxide Emissions: Effects of a Carbon Price in the Short Term*. 41st Annual Hawaii International Conference on System Sciences. 2008. Waikoloa, Hawaii: Computer Society Press.

- Apt, J., *Controlling Carbon in the US Electricity Sector (Invited talk)*, American Association for the Advancement of Science (AAAS) Annual Meeting, Special Session on Carbon Management. 2007: San Francisco.
- Curtright, A. and J. Apt. *Power Fluctuations from Large Solar Photovoltaic Arrays*. National Solar Energy Conference. 2007. Cleveland, Ohio.
- Rubin, E.S., S.T. McCoy, and J. Apt. *Regulatory and Policy Needs for Geological Sequestration of Carbon Dioxide*. Sixth Annual Conference on Carbon Capture & Sequestration. 2007. Pittsburgh.
- Peters, G., T. DiGioia, C.T. Hendrickson, and J. Apt. *Transmission Line Reliability: Climate Change and Extreme Weather*. American Society of Civil Engineers 2006 Electrical Transmission Conference: Structural Reliability in a Changing World. 2006. Birmingham.
- Apt, J., The risks of integrating wind power into an electric power system. Society for Risk Analysis 2006 Annual Meeting: Risk Analysis in a Dynamic World: Making a Difference. Baltimore.
- Apt, J., J. Bergerson, S. Blumsack, S. Eggers, and L.B. Lave, Managing electricity infrastructure in an era of frequent hurricanes. Society for Risk Analysis 2006 Annual Meeting: Risk Analysis in a Dynamic World: Making a Difference. Baltimore.
- Hines, P., J. Apt, H. Liao, and S. Talukdar, *The Frequency of Large Blackouts in the U.S. Electrical Transmission System*. Monitoring, Sensing, Software and Its Valuation for the Changing Electric Power Industry. 2006. Pittsburgh, PA.
- Talukdar, S., P. Hines, and J. Apt. *Can Cascading Failures be Eliminated?* Monitoring, Sensing, Software and Its Valuation for the Changing Electric Power Industry. 2006. Pittsburgh, PA.
- Florig, H.K., J. Apt, A. Eng, and T. Cochran. *Managing Safety Risks of Amateur Rocketry*. Society For Risk Analysis Annual Meeting 2005. Orlando.
- Lave, L. B., J. Apt, and M.G. Morgan. *Worst Case Electricity Scenarios: The Benefits & Costs of Prevention*. CREATE 2005, University of Southern California, Los Angeles.
- Marriott, J., H. S. Matthews, J. Apt, and L.B. Lave. *Creating an Electricity-Focused Economic Input-Output Tool for Life-Cycle Analysis*. 2005 International Society for Industrial Ecology Conference, Stockholm, Sweden
- Liao, H., J. Apt, and S. Talukdar. *Phase Transitions in the Probability of Cascading Failures Electricity Transmission in Deregulated Markets: Challenges, Opportunities, and Necessary R&D Agenda*. 2004. Pittsburgh, PA.

SELECTED TESTIMONY AND GOVERNMENT FILINGS

- Apt, J. *Testimony on How the Domestic Nuclear Industry Boosts Local Economies, Curbs Emissions, and Strengthens National Security*. U.S. House of Representatives Committee on Science, Space, and Technology, Subcommittee on Energy, May 3, 2019.
- Apt, J. *Testimony on EPA's Clean Power Plan Proposed Rule*, U.S. Environmental Protection Agency Docket No. EPA-HQ-OAR-2013-0602, July 31, 2014.

Oates, D.L., J. Apt and P. Jaramillo, Comments of the Carnegie Mellon Electricity Industry Center on Proposed Energy Information Administration Collection Extensions with Changes, January 22, 2014.

Jaramillo, P., J. Apt and P. Hines, Comments of the RenewElec Project on Integration of Variable Energy Resources Federal Energy Regulatory Commission Notice Of Proposed Rulemaking, Docket No. RM10-11-000, March 2, 2011.

Apt, J., *Testimony on The American Clean Energy Security Act of 2009*, U.S. House of Representatives Committee on Energy and Commerce, Subcommittee on Energy and Environment, April 23, 2009.

SELECTED OUTREACH ARTICLES

Morgan, M.G. and J. Apt, *Stop Arguing and Cut Emissions*, Science **383**, 933 (2024). DOI 10.1126/science.adn9176 <https://www.science.org/doi/reader/10.1126/science.adn9176>

Apt, J. and M.G. Morgan *An urgent plan to decarbonize electricity by 2035* (Opinion), The Hill, September 9, 2021, <https://thehill.com/opinion/energy-environment/571527-an-urgent-plan-to-decarbonize-electricity-by-2035>

Apt, J. and L. Lavin *What is happening in Texas will keep happening until we take action* (Op-Ed), The Washington Post, February 18, 2021, <https://www.washingtonpost.com/opinions/2021/02/18/texas-power-grid-failure-weather/>

Apt, J. *Trump planning unprecedented intervention in electricity markets*. Axios, June 7, 2018, https://www.axios.com/trump-planning-unprecedented-intervention-in-electricity-markets-076cbfb3-2ecf-4d04-a4cf-abe22321ff5.html?utm_source=sidebar

Muller, N., A. Jha, and J. Apt *The deadly 90-day rule* (Op-Ed), The Pittsburgh Post-Gazette, November 2, 2017, p. A9. <http://www.post-gazette.com/opinion/Op-Ed/2017/11/02/The-deadly-90-day-rule-will-help-coal-barons-not-coal-miners-And-kill-people/stories/201711020013>

Apt, J. *Low Pollution at the Lowest Cost*. Federation of American Scientists Op-Eds, February 1, 2016, <http://fas.org/oped/low-pollution-at-the-lowest-cost/>

Apt, J. *Keeping an economic engine running* (Op-Ed), The Pittsburgh Post-Gazette, April 1, 2014, p. B2.

Apt, J. *Voices on the Future: Jay Apt on the Electric Grid*. The Wall Street Journal, November 12, 2013, p. R4.

Apt, J. *Blackouts are a fact of life. Let's deal with them* (Op-Ed), The Wall Street Journal, September 17, 2012, p. R4.

Apt, J., M.G. Morgan and B. Strauss, *This is your captain: Turn off that cell phone!* (Op-Ed), The Pittsburgh Post-Gazette, May 14, 2012.

Apt, J. *The governor should rethink his solar proposal* (Op-Ed), The Pittsburgh Post-Gazette, September 19, 2010.

- Apt, J., *Beyond Cap and Trade and Renewables Portfolio Standards* The EPRI Journal, Summer 2009, p.37.
- Apt, J. and M.G. Morgan, *Carbon Culprits*, (Op-Ed) The Pittsburgh Post-Gazette, February 25, 2007, p.H1.
- Apt, J. and L. Lave, *Electricity Traffic Control*, (Op-Ed) The New York Times, August 13, 2005, p. A27.
- Strauss, B., J. Apt, M.G. Morgan, and D. Stancil, *Are Personal Electronics a Threat to Aircraft?* Aviation Week and Space Technology, April 10, 2006. **164**(15): 58.
- Apt, J. and L. Lave, *Blackouts are Inevitable*, (Op-Ed) The Washington Post, August 10, 2004, p. A19.
- Apt, J. and L. Lave, *Let There Be Light*, (Op-Ed) The Pittsburgh Post-Gazette, August 15, 2004, p. J3.
- Apt, J., *Orbit: The Astronauts' View of Home* (Cover Story). National Geographic Magazine, November 1996. **190**(5): pp. 2-27.
- Apt, J., *La Terre vue de l'espace: Si belle mais si fragile* (Cover Story), Le Figaro Magazine, November 30, 1996: pp.67-97.

R E C E N T C O U R S E S T A U G H T

- 45-966 Catastrophic Risk Analysis and Management (MBA); formerly numbered 45-858
 45-875 Government and Business (MBA)
 45-995 Energy Business Project (MBA) with Prof. Chris Telmer
 47-881 Seminar on Electric Power Restructuring (MBA and PhD students)
 47-882 Seminar on Low-Carbon Electric Power (MBA and PhD students)
 70-376 Energy Systems (Undergraduate Business Majors)
 46-851 Problem Design and Verification (Undergraduate CIT optimization methods)
 39-405 Engineering Design: The Creation of Products and Processes (Undergraduate CIT)

P h D S T U D E N T S S U P E R V I S E D

Sole Advisor

- Adam Newcomer, 2008 (now at NiSource)
 Rahul Walawalkar, 2008 (now at Customized Energy Solutions)
 Warren Katzenstein, 2010 (now at Facebook)
 Shira Horowitz, 2012 (now at National Grid)
 Brandon Mauch, 2012 (now at Ascend Analytics)
 Colleen Horin Lueken, 2012 (now at Fluence)
 Emily Fertig, 2013 (now at Google)
 Steven Rose, 2013 (now at NextEra Analytics)
 Jared Moore, 2014 (now at Meridian Energy and Policy Consulting)
 Roger Lueken, 2014 (now at The Brattle Group)
 Daniel Schnitzer, 2014 (now at EarthSpark International)
 Michael Fisher, 2017 (now at Centrica plc)
 Jeremy Keen, 2019 (now at the National Renewable Energy Laboratory)

Sinnott Murphy, 2019 (now at the National Renewable Energy Laboratory)
Gerad Freeman, 2019 (now at the Pacific Northwest National Laboratories)
Luke Lavin, 2021 (now at the National Renewable Energy Laboratory)
Yamit Lavi, 2023 (now at the US Department of Energy)
Sean Smillie, 2023 (now at Energy+Environmental Economics, E3)

Co-Advisor

Paul Hines, 2007 (now at EnerNoc)
Graham William Strauss, 2005 (now at the Naval Air Warfare Center)
Robert Lee Gresham, 2010 (now at National Grid)
Scott Peterson, 2012 (now at Shady Side Academy)
Eric Hittinger, 2012 (now at Rochester Institute of Technology)

PhD Committee (at Carnegie Mellon University except as noted)

Elisabeth Gilmore, 2009 (now at Carleton University)
Inês Margarida Lima de Azevedo, 2009 (now at Stanford University)
Hari Chandan Mantripragada, 2009 (now at the University of Pittsburgh)
Kathleen Spees, 2008 (now at The Brattle Group)
Melissa Chan, 2008 (now at the Kennedy School of Government, Harvard)
Seth Adam Blumsack, 2006 (now at the Pennsylvania State University)
Dalia Patiño-Echeverri, 2006 (now at Duke University)
Joseph Frank DeCarolis, 2005 (now Director, US Energy Information Administration)
Chao Chen, 2005 (now at Worley-Parsons)
Dmitri Perekhodtsev, 2004 (now at LECG Paris)
Sompop Pattanariyankool, 2010 (now at the Energy Ministry, Government of Thailand)
Sharon Wagner, 2011 (now at The University of Maine)
Vanessa Schweitzer, 2011 (now at the National Center for Atmospheric Research)
Kyle Meisterling, 2011 (now at UC Santa Barbara)
Yangfang (Helen) Zhou, 2012 (now at Singapore Management University)
Kyle Siler-Evans, 2012 (now at RAND)
Nicholas Siefert, 2013 (now at the US Department of Energy)
Hossein Safaei, 2014 (Harvard University; now at IHS Energy)
Tuhfe Göcmen Bozkurt, 2016 (Danish Technical University; now at DTU Risø)
Lynn Kaack, 2019 (now at ETH Zurich)
Siddharth Singh, 2019 (now at University College, London)
Cristiana Lopes Lara, 2019 (now at Amazon)
Adam F. Abdin, 2019 (Université Paris-Saclay; now at CentraleSupélec)
Marko Jereminov, 2019 (now at Pearl Street Technologies)
Naeem Turner Bandeale, 2023 (now attending business school)