

Jay Apt

POSITIONS HELD

Carnegie Mellon University

PROFESSOR *EMERITUS*, TEPPER SCHOOL OF BUSINESS 2022 – PRESENT

PROFESSOR, TEPPER SCHOOL OF BUSINESS 2010 – 2022
CO-DIRECTOR, CARNEGIE MELLON ELECTRICITY INDUSTRY CENTER
AFFILIATED PROFESSOR IN ENGINEERING & PUBLIC POLICY

ASSOCIATE RESEARCH PROFESSOR, TEPPER SCHOOL OF BUSINESS 2003 — 2010
EXECUTIVE DIRECTOR, CARNEGIE MELLON ELECTRICITY INDUSTRY CENTER
DISTINGUISHED SERVICE PROFESSOR IN ENGINEERING AND PUBLIC POLICY 2000 — 2010

iNetworks, LLC Venture Capital

MANAGING DIRECTOR AND CHIEF TECHNOLOGY OFFICER 2000 — 2003

Carnegie Museum of Natural History

DIRECTOR 1997 — 2000

National Aeronautics and Space Administration

ASTRONAUT 1985 — 1997
FOUR SPACE SHUTTLE MISSIONS. TWO MISSIONS INVOLVED PARTNERSHIPS WITH JAPAN AND RUSSIA; ONE INVOLVED TWO SPACEWALKS.

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
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PLANETARY SCIENTIST IN EARTH AND SPACE SCIENCES DIVISION

HARVARD UNIVERSITY

ASSISTANT DIRECTOR, DIVISION OF APPLIED SCIENCES 1978 — 1980
FOUNDING DIRECTOR, PLANETARY IMAGING COMPUTER CENTER

STAFF, CENTER FOR EARTH AND PLANETARY PHYSICS 1976 — 1980

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

POST-DOCTORAL FELLOW IN LASER SPECTROSCOPY 1976

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
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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)
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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 (1998)

ARCHIVAL JOURNAL PAPERS

123. Apt, J. and D. Epple, *Forest fires: Why the large year-to-year variation in forests burned?*, in review at Proceedings of the National Academy of Sciences of the United States of America, 2022.
122. Smillie, S., M.G. Morgan, and J. Apt, *How vulnerable are US natural gas pipelines to electric outages?*, in review at Nature Communications, 2022.
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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116. Freeman, G., J. Apt, and J. Moura, *What causes natural gas fuel shortages at U.S. power plants?* Energy Policy, 2020. **147**: 111805.
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.
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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.
101. Handschy, M.A., S. Rose and J. Apt, *Is It Always Windy Somewhere? Occurrence of Low-Wind-Power Events over Large Areas*. Renewable Energy, 2017. **101**: 1124-1130.
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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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47. Wilson, E.J., M.G. Morgan, J. Apt, M. Bonner, C. Bunting, M. de Figueiredo, J. Gode, C. Jaeger, D.W. Keith, S.T. McCoy, R.S. Haszeldine, M. Pollak, D.M. Reiner, E.S. Rubin, A. Torvanger, C. Ulardic, S. Vajjhala, D. Victor, and I. Wright, *Regulating the Geological Sequestration of Carbon Dioxide*. Environmental Science & Technology, 2008. **42**(8): 2718-2722.

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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

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 RECENT 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.
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- 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.
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- 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.
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- 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.
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- 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.
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- Apt, J. and M.G. Morgan, *Carbon Culprits*, (Op-Ed) The Pittsburgh Post-Gazette, February 25, 2007, p.H1.
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- 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.
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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)
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Warren Katzenstein, 2010 (now at Facebook)
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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 the Midcontinent ISO)
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)
Gerard Freeman, 2019 (now at the Pacific Northwest National Laboratories)
Luke Lavin, 2021 (now at the National Renewable Energy Laboratory)
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Paul Hines, 2007 (now at EnerNoc)
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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 Clark University)
Inês Margarida Lima de Azevedo, 2009 (now at Stanford University)
Hari Chandan Mantripragada, 2009 (now at Carnegie Mellon University)
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 at North Carolina State University)
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 Bandele