PETER CURTISS

Mr. Curtiss has extensive experience in building energy systems, renewable energy technology, neural network modeling, and distributed generation analysis. His undergraduate studies were at Princeton University where he received a Bachelor of Science degree in Engineering from the Architecture and Engineering Program. He subsequently received a Master of Science and a Ph.D. from the Building Systems Program at the University of Colorado.

His undergraduate thesis examined simplified thermal modeling techniques for salt-gradient solar ponds. His masters thesis was a comprehensive comparison of different methods for deriving the constituent solar radiation components from multipyranometer array measurements. His dissertation demonstrated the practical use of neural networks for feedback loop control and energy management in large HVAC systems.

Mr. Curtiss has been a guest researcher at the National Laboratory of Energy and Industrial Technology in Lisbon, Portugal where he designed and implemented a data acquisition system on a salt-gradient solar pond used for heating greenhouses. He has also worked at the Blaustein Desert Research Institute in Sde Boker, Israel performing mass and thermal balances on zero energy housing. His post-doctoral work was at the Ecole des Mines in Paris, France, where he helped design and code a computer program used to estimate the economic externalities from power production.

Mr. Curtiss developed a neural network-based process controller currently used by Honeywell, Inc. In a separate project, he was the project manager for a team that assisted Honeywell in the design of an Internet-based building monitoring, energy management, and systems diagnostic program. Other recent projects include the creation of distributed generation evaluation software that has been used for market penetration by the planning departments of several multinational companies.

In recent years, Mr. Curtiss has worked closely with Toyota investigating numerous aspects of hydrogen-powered automobiles and alternative fuel sources, including fuel cell technology, electric vehicles, maintenance issues, the regulatory environment, and land, water, and energy use for biofuels and exotic fuel resources. He was an active participant in the Fuels of the Future study performed by the National Petroleum Council for the Department of Energy.

He has also been working with the U.S. Army on the development of intelligent control systems for increasing reliability and decreasing fuel consumption in tactical power grids as well as large energy generation facilities. He managed the development team that created the control systems for the SPIDERS microgrid projects at Joint Base Pearl Harbor Hickam and Camp H.M. Smith in Hawaii as well as at Fort Carson in Colorado.

Mr. Curtiss also is actively involved in designing and demonstrating technologies for the SmartGrid and has participated in major demonstration projects for large east and west coast electric utilities.

Mr. Curtiss is an occasional lecturer at the University of Colorado and a licensed mechanical engineer in the state of Colorado.

EDUCATION

1987 - 1992 *University of Colorado, Boulder, CO*
- **Ph.D. in Civil Engineering**: Dissertation demonstrated ability of neural networks to optimize feedback-loop process control and to perform energy management in a commercial-scale HVAC plant.
- **M.S. in Civil Engineering**: Thesis studied methods of analysis of multipyranometer arrays.

1982 - 1986 *Princeton University, Princeton, NJ*
- **B.S. in Civil Engineering**: Thesis examined simplified thermal modeling of salt-gradient solar ponds.

PROFESSIONAL EXPERIENCE

2006 - Present **Intelligent Power and Energy Research Corporation**, *Fort Montgomery, NY*
- **Director of Reasearch and Development**: Manager of hardware and software development teams working on smart control of tactical grids and fixed facilities.

1998 - Present **Curtiss Engineering Inc**, *Boulder, CO*
- **Owner**: Consulting engineer specializing in energy use simulation and analysis, life cycle analyses, process control, and distributed generation technologies.

1996 - 1998 **Architectural Energy Corporation**, *Boulder, CO*
- **Senior Engineer**: Project manager for a wide variety of programming and conceptualization tasks for architects, utilities, control companies, and other major clients.

1994 - 1996 **University of Colorado**, *Boulder, CO*
- **Visiting Assistant Professor** *(post-doctoral position):* Duties included supervision of undergraduate and graduate students in university laboratory, class instructor, and project manager for energy-related projects.

1992 - 1994 **Ecole des Mines de Paris - Centre d'Energetique**, *Paris, France*
- **Research Associate** *(post-doctoral position):* Team member on ECC-funded project which examined the external costs of energy production from a variety of power generation facilities.

1987 - 1992 **University of Colorado**, *Boulder, CO*
- **Research Assistant**: Manager of HVAC laboratory and state-wide weather monitoring network; programming and maintaining computerized control and monitoring system; performing experiments for industrial clients..

1983 - 1987 **Princeton University**, *Princeton, NJ*
- **Research Assistant**: Tasks included monitoring of building energy performance, daylighting estimation experiments, and data acquisition system programming.

Summer 1986 **Blaustein Desert Research Institute**, *Sde Boker, Israel*
- **Research Assistant**: Tasks included monitoring of building energy performance, solar collector testing, and air infiltration studies.

Summer 1985, Fall 1986 **Laboratorio Nacional de Engenharia e Technologia Industrial**, *Lisbon, Portugal*
- **Research Assistant**: Created data acquisition and analysis programs and installed sensors for monitoring system of salt-gradient solar pond.

AWARDS AND REGISTRATIONS

- *Professional Engineer*: State of Colorado, License # 36201
- *Assoc. of Demand-Side Management Professionals*: Graduate Research Paper Competition, 1st Place, 1993
- *New Jersey Department of Energy*: Alternative Energy Competition, 2nd Place, 1985
- *National Merit Scholar*: Princeton University, 1982 – 1986

PATENTS

- *U.S. Patent 8350412*: Dynamically controlling configuration of a power grid comprising one or more stand-alone sub-grids
- *U.S. Patent 8447707*: Automated control of a power network using metadata and automated creation of predictive process models
- *U.S. Patent Pending US-2015-0142197-A1*: Automated identification of components connected in a power grid

BOOKS / BOOK CHAPTERS

- P. Curtiss and N. Breth, **HVAC Instant Answers**, McGraw-Hill, 2002.
- J. F. Kreider, P. Curtiss, and A. Rabl, **Heating and Cooling of Buildings: Design for Efficiency *(2nd Edition)***, McGraw-Hill, 2001.
- Armstrong, P., M. Brambley, P. Curtiss, S. Katipamula, M. Kintner-Meyer, R. Pratt, *Chapter 5 - Controls*, **CRC Handbook of Heating, Ventilation, and Air Conditioning Engineering**, CRC Press, 2001.
- Curtiss, P., J. Haberl, J. Huang, D. Jump, J. Kreider, A. Rabl, T. A. Reddy, and M . Sherman, *Chapter 6 - Heating and Cooling Loads*, **CRC Handbook of Heating, Ventilation, and Air Conditioning Engineering**, CRC Press, 2001.
- Curtiss, P., *Chapter 7 - Principles of Control of Distributed Generation Systems,* **Distributed Generation: The Power Paradigm for the New Millennium**, A. M. Borbely and J. F. Kreider, ed., CRC Press, 2001. (invited submission)
- Curtiss, P., J. Kreider, R. Nelson, and S. Huang, *Chapter 6 - Mechanical System Controls*, Sections 6.2, 6.3, 6.4 and 6.5, pp. 6.15 – 6.41, **CRC Handbook of Mechanical Engineering**, CRC Press, 1998. (invited submission)
- P. Zannetti, R. Cohen, N. Cook, A. Rabl, and P. Curtiss, *Chapter 16 – Environmental Engineering*, Section 16.6, pp. 16.33 – 16.51, **CRC Handbook of Mechanical Engineering**, CRC Press, 1998. (invited submission)
- P. Curtiss and A. Rabl, *Impact Analysis for Air and Water Pollution: Methodology and Software Implementation*, **Environmental Modeling**, Zannetti, P., Ed. Vol. 3, Chap. 13, p. 393-426, 1996.

PEER-REVIEWED PAPERS

- Curtiss, P.S., M. Miller, and G. Gibbons, ***Auto-mapping of Tactical Grid Topology Through the use of Power Beacon***, Proceedings of the 2015 ASME Power and Energy Conference, San Diego, CA, Jul 2015.
- Massie, D.D., P.S. Curtiss, and M. Miller, ***Use of embedded intelligence in tactical grids for energy surety and fuel conservation***, Proceedings of the 2012 IEEE PES General Meeting, San Diego, CA, Aug 2012.
- Curtiss, P.S., D. Massie, and M. Miller, ***A demonstration of intelligent control technology in tactical power grids***, Proceedings of the ASME ES2011 Fuel Cell conference, Washington, DC, Aug 2011.
- Curtiss, P.S. and J. F. Kreider, ***Developments in Light Vehicle Life Cycle Analysis with Application to Electric Vehicles***, Proceedings of the ASME ES2011 Fuel Cell conference, Washington, DC, Aug 2011.

- Curtiss, P. S., and J. F. Kreider, *Evaluation of cradle-to-grave impacts from potential automotive fuel replacements – an update*, Proceedings of ASME ES2009 Energy Sustainability 2009, July, 2009.
- Curtiss, P. S., and J. F. Kreider, *Life cycle analysis of automotive ethanol produced from municipal solid waste*, Proceedings of ASME ES2009 Energy Sustainability 2009, July, 2009.
- Curtiss, P. S., and J. F. Kreider, *Algaculture as a feedstock source for biodiesel fuel – a life cycle analysis*, Proceedings of ASME ES2009 Energy Sustainability 2009, July, 2009.
- Kreider, J. F., and P. Curtiss, *Comprehensive evaluation of impacts from potential, future automotive fuel replacements*, Proceedings of ES2007, Energy Sustainability 2007, June 2007.
- Massie, D., P. Curtiss, and J. F. Kreider, *Neural Network Optimal Controller for Commercial Ice Thermal Storage Systems*, ASHRAE Transactions, Vol. 110, Pt. 2, pp. 361-369.
- Curtiss, P.S., and J. F. Kreider, *Recent Developments in the Control of Distributed Electrical Generation Systems,* Journal of Solar Energy Engineering, Vol. 125, pp. 352-358.
- Bailey, M., P.S. Curtiss, P. Blanton, T. B. McBrayer. *Thermodynamic and externality analyses of a cogeneration plant*, Proceedings of ISEC 2003: International Solar EnergyConference, Kohala Coast, Hawaii, March 2003.
- Yewdall, Z., P. S. Curtiss, and J. F. Kreider, *Photovoltaic and Solar Thermal Market Penetration Analysis*, Proceedings of the ASME Solar 2002 Conference, Reno, NV.
- Massie, D. and P. S. Curtiss, *Neural Network Basics for Use in Building Mechanical Systems*, Proceedings from 2001 International Conference of Chartered Institution of Building Services Engineers and American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc., London, England, October 18, 2001.
- Massie, D., P. Curtiss, and J. F. Kreider, *Neural Networks for Control and Fault Detection in State-of-the-Art Buildings*, ASHRAE Transactions, Vol. 107, 2000.
- Bailey, M. B., J. F. Kreider, and P. Curtiss, *Results of a Probabilistic Fault Detection and Diagnosis Method for Vapor Compression Cycle Equipment*, ASHRAE Transactions, Vol. 107, 2000.
- Kreider, J. F., and P. Curtiss, *Distributed Electrical Generation Technologies and Methods for Their Economic Assessment*, ASHRAE Transactions, Vol. 106, Pt. 1, 2000.
- Curtiss, P., *Control of Distributed Electrical Generation Systems*, ASHRAE Transactions, Vol. 106, Pt. 1, 2000.
- Kreider, J. F., P. Curtiss, D. Massie, and E. Jeannette, *A Commercial-Scale University HVAC Laboratory*, ASHRAE Transactions, Vol. 105, Pt. 1, 1999.
- Curtiss, P., D. Cohen, and J. F. Kreider**, *A Methodology for Technical and Financial Assessment of Distributed Generation in the US*, Proceedings of the ASME ISEC April 1999 Conference.
- Dodier, R., P. Curtiss, and J. F. Kreider, *Small Scale On-Line Diagnostics for an HVAC System*, ASHRAE Transactions, Vol. 104, Pt. 1, 1998.
- Massie, D., P. Curtiss, and J. F. Kreider, *Predicting Central Plant HVAC Equipment Performance Using Neural Networks – Laboratory System Test Results*, ASHRAE Transactions, Vol. 104, Pt. 2, 1998
- Jeannette, E., K. Assawamartbunlue, P. Curtiss, and J. F. Kreider**, *Experimental Results from a Predictive Neural Network HVAC Controller*, ASHRAE Transactions, Vol. 104, Pt. 2., 1998
- Jeannette, E., J. F. Kreider, and P. Curtiss, *Neural Network-based Multi-Photocell Array Developments*, ASME Solar Energy, 1998
- Kreider, J.F., Curtiss, P.S., and Massie D.D. *Use of Neural Networks to Predict Next-Day Electrical Loads*, Chapter 2, Proceedings of the West Coast Energy Management Congress, Association of Energy Engineers, April 8-9, 1998, 24 pp. (invited)
- Cohen, D., M Krarti, J. Kreider, and P. Curtiss, *Prediction of Energy Savings for Building Retrofits Using Neural Networks*, ASME Transactions, Journal of Solar Energy Engineering, 1998
- Kreider, J. F., C. Gould, P. Curtiss, and P. Tabb, *Community Energy and Analysis Decision Support (CEADS)*, Transactions of the ASME ISEC, June 1998

- Kreider, J. F., C. Gould, P. Curtiss, and P. Tabb, *Sustainable Community Energy Analysis*, Proceedings of WREC 1998, Elsevier Science, Ltd., pp. 2652 – 2655.

- Curtiss, P., *Examples of Neural Networks Used for Building System Control and Energy Management*, ASHRAE Transactions, Vol. 103, Pt. 2, 1997.

- Kreider, J., S. Blanc, R. Kammerud, and P. Curtiss, *Operational Data as the Basis for Neural Network Prediction of Hourly Electrical Demand*, ASHRAE Transactions, Vol. 103, Pt. 2, 1997.

- Curtiss, P., M. Dreicer and A. Rabl, *Environmental impact and costs of nuclear and fossil fuel cycles*, Proceedings of the World Renewable Energy Congress - IV, June 1996.

- Curtiss, P. and A. Rabl, *Impacts of air pollution: general relationships and site dependence*, Atmospheric Science, Vol 30, No. 19, pp. 3331-3347, 1996.

- Curtiss, P., G. Shavit, and J. F. Kreider, *Neural networks applied to buildings - a tutorial and case studies in prediction and adaptive control*, ASHRAE Transactions, V. 102, Pt. 1, 1996.

- Kreider, J., P. Curtiss and R. Andelman, *Knowledge-based tool for Diagnosing HVAC operations and maintenance problems in small office buildings*, Seminar presentation, ASHRAE Winter Annual Meeting, Atlanta, February 1996.

- Curtiss, P., *Experimental results from a network-assisted PID controller*, ASHRAE Transactions, Vol. 102, Pt. 1, 1996, pp. 1157-1168.

- Curtiss, P., J. F. Kreider, and G. Goble, *The use of neural networks to predict pile loads as a function of the deflection*, Proceedings of ETCE Annual Conference, January, 1996

- Curtiss, P. and A. Rabl, *A software system for the analysis of environmental impacts and costs based on the impact pathways methodology*, Solar Engineering, March 1995, pp. 317-324.

- Kreider, J. F., D. E. Claridge, P. Curtiss, R. Dodier, J. Haberl, and M. Krarti, *Building energy use prediction using recurrent neural networks*, ASHRAE Transactions, Vol. 117, 1995.

- Goble, G., J. F. Kreider, P. Curtiss, and J. Berger, *Neural network predictions of load-deflection curves for concrete piles in Florida*, Proceedings of the International Conference on Design and Construction of Deep Foundations, Orlando, FL, pp. 738-758, December 1994.

- Curtiss, P., S. Starkweather, and J. F. Kreider, *Application of neural networks to multipyranometer array data*, Proceedings of the 1994 ASME International Solar Energy Conference.

- Curtiss, P., *Development of an educational software package for use in building systems and HVAC classes*. ASHRAE Transactions, 1994, Vol. 100, Pt 1.

- Curtiss, P., J. F. Kreider, and M. J. Brandemuehl, *Energy management in central HVAC plants using neural networks*. ASHRAE Transactions, 1994, Vol 100, Pt 1.

- Curtiss, P., M. J. Brandemuehl, and J. F. Kreider, *Adaptive control of HVAC processes using predictive neural networks*. ASHRAE Transactions, 1993, Vol. 99, Pt 1, pp. 496-504., 1993.

- Curtiss, P., J. F. Kreider, and M. J. Brandemuehl, *Artificial neural networks proof of concept for local and global control of commercial building HVAC systems*. Solar Engineering - 1993, pp. 429-443, ASME, New York, 1993.

- Curtiss, P., *An analysis of methods for deriving the constituent insolation component from multipyranometer array measurements*, Proceedings of the 1992 ASME International Solar Energy Conference.

- Curtiss, P. and J. F. Kreider, *Laboratory tests of the nonlinearity of outside air percentage as a function of damper position and induced inlet pressure*. ASHRAE Transactions, pp. 196-202, Vol. 98, Pt 1, 1992.

- Curtiss, P. and J. F. Kreider, *Determination of beam, diffuse and reflected insolation components through the use of a multi-pyranometer array*. Proceedings of the ASES Annual Meeting, pp. 351-353, June 1988.

COURSES TAUGHT

- **AREN3130**: Undergraduate Energy Laboratory, University of Colorado
- **CVEN5010**: Energy Control Systems, University of Colorado
- **CVEN5050**: Solar Design, University of Colorado
- **CVEN5830**: Renewable Energy Systems, University of Colorado

SELECTED INVITED SEMINARS AND TALKS

- ***Application of Bi-Directional Electric Vehicle Aggregation in a Cyber Secure Microgrid Controller,*** Aug 2013, GVSETS Vehicle Electronics and Architecture conference, Troy, MI.
- ***Evaluation of Potential Automotive Fuel Replacements***, Sep 2006, Clean Air Conference, Keystone, CO.
- ***Environmental Burdens of Energy and Calculation of Damages***, Feb 2006, Lecture for visiting French engineers, University of Colorado.
- ***Energy Prices and Economic Decisions with DG Systems***, Oct 2003, University of Colorado Building Systems Program seminar series.
- ***Utility pricing strategies,*** May 2001, TriGen Conference on Distributed Generation in CO, Westminster, CO.
- ***Controls for Today and Tomorrow***, June 2000, Advanced Building Systems Technology conference and exposition, Washington, D.C.
- ***Optimal Control and Financial Analysis of Distributed Generation***, Feb 2000, Lecture for visiting French engineers, University of Colorado.
- ***An Introduction to Distributed Generation,*** Dec 1999, University of Colorado Building Systems Programs seminar Series.
- ***Technical Analysis of Microturbines***, Feb 1999, Lecture for visiting French engineers, University of Colorado.
- ***HVAC Process Control and Plant Optimization Using Neural Networks***, April 1992, October 1994, April 1996, and November 1998, University of Colorado Building Systems Seminar Series.
- ***Estimation des Couts Externes de la Production Nucleaire de l'Electricité*** (*Estimating the External Costs of Nuclear Electricity Production*), June 1994, Centre d'Etude sur L'Evaluation de la Protection dans le Domaine Nucleaire, France.
- ***Méthodes de Contrôle avec des Réseaux Neuronaux*** (*Methods of Control using Neural Networks*), July 1993 Ecole des Mines de Paris; also presented May 1994, at Bucharest Polytechnic University, Bucharest, Romania (through TEMPUS exchange program).
- ***The Impact Pathways Method for Determining the External Costs of Electricity Production***, May 1994, Bucharest Polytechnic University, Bucharest, Romania (through TEMPUS exchange program).

COMMERCIAL SOFTWARE

- **Intelligent Power Controller:** Automated control program for power surety and fuel efficiency for fixed and tactical power grids*. Available from IPERC, Fort Montgomery, NY*
- **GridSim***: Configurable grid simulation program. Available from IPERC, Fort Montgomery, NY*
- **NetFIT***: A Windows-based neural network training and prediction tool. Available from Kreider & Associates, LLC, Boulder, CO.*
- **D-Gen Pro**: A GRI-funded software tool used to perform annual simulation and economic feasibility studies of microturbines in commercial applications *Available from Architectural Energy Corporation, Boulder, CO.*
- **CEADS**: A GUI-based design program used to design and analyze distributed generation technologies at the community scale. *Available from the Joint Center for Energy Management at the University of Colorado.*

- **TRAINNET / TESTNET**: A package of computer programs used to train and test neural networks. *Available from the Joint Center for Energy Management at the University of Colorado.*
- **HCB**: A package of education computer programs used for modeling building energy consumption, performing part load ratio calculations, displaying psychrometric and refrigerant properties, explaining engineering economics, and demonstrating lighting and process control principles. *Software included with the textbook Heating and Cooling in Buildings: Design for Efficiency, by Jan Kreider, Peter Curtiss, and Ari Rabl, McGraw Hill, 2001.*
- **PATHWAYS**: Software package used to perform atmospheric distribution modeling, dose-response function calculation, and determination of the external cost of electricity production from a variety of source and emission types. *Registered at the Bibliothéque Nationale in France.*

COMMERCIAL MUSIC

- Keyboards and synthesizer for "Heart In a Jar" music CD, ASIN: B0042KZYI2