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## **BIOGRAPHICAL INFORMATION**

H. Scott Matthews is the Research Director of the Green Design Institute and a faculty member in the Departments of Civil and Environmental Engineering and Engineering & Public Policy at Carnegie Mellon University. The Green Design Institute is an interdisciplinary research consortium at Carnegie Mellon focused on identifying and assessing the environmental impacts of systems and helping businesses manage their use of resources and toxic materials.

His research and consulting interests are in the area of valuing the socio-economic implications of environmental systems and infrastructure and industrial ecology. Of particular interest are using the Internet to facilitate environmental life cycle assessment of products and processes, estimating and tracking carbon emissions across the supply chain, and the sustainability of infrastructure. At Carnegie Mellon, he has taught graduate and undergraduate courses in the Departments of Economics, Civil and Environmental Engineering, Engineering and Public Policy, and Computer Science.

## **CURRENT AND PAST POSITIONS**

- July 2006-Present: Assoc. Prof., Civil & Environmental Engineering / Engineering & Public Policy
- Aug 2002-2006: Asst. Professor, Civil & Environmental Engineering / Engineering & Public Policy
- Jan. 2000-Present: Director of Research, Green Design Institute
- July 2000-July 2002: Research Assistant Professor, Carnegie Mellon University, Pittsburgh, PA
- Jan. 1999-June 2000: Assistant Head, Department of Engineering and Public Policy, Carnegie Mellon
- 1996-2001: Environmental Management Consultant, Quantum Corporation, Milpitas, CA
- 1992-1993: Network Manager, Software Engineering Institute, Pittsburgh, PA
- 1990-1992: Consultant, COM-4 Computer Consulting, Inc., Pittsburgh, PA

## **EDUCATION**

- Ph.D., Economics; Graduate School of Industrial Administration, Carnegie Mellon, Jan. 1999  
Title: "The External Costs of Air Pollution and the Environmental Impact of the Consumer in the U.S. Economy", Advisors: Lester Lave (chair), Dennis Epple, Chris Hendrickson
- MS, Economics; Graduate School of Industrial Administration, Carnegie Mellon, 1996
- BS, Computer Engineering and Engineering and Public Policy, Carnegie Mellon, 1992

## **PROFESSIONAL REVIEW ACTIVITIES**

Journal of Industrial Ecology, Environmental Science and Technology, ASCE Journal of Infrastructure Systems, ASCE Journal of Transportation Engineering, IEEE Spectrum, Journal of the Air & Waste Management Association, Resources, Conservation, and Recycling, Greener Management International, Ecological Economics, Energy, ASCE Journal of Architecture Engineering, ASCE Journal of

Professional Practice, Journal of Green Building, Energy Economics, Journal of Environmental Management, International Journal of LCA

## HONORS OR AWARDS

- Laudise Prize (for significant contributions to the community by a young researcher), International Society of Industrial Ecology (ISIE), 2007.
- AT&T Faculty Fellow in Industrial Ecology (w/ E. Williams), "Energy Use of Households," 2005
- AT&T Faculty Fellow in Industrial Ecology, "Energy Impacts of Voice Telecommunications," 2002
- AT&T Faculty Fellow in Industrial Ecology, "Energy Impacts of Wireless Networking," 2001
- AT&T Faculty Fellow in Industrial Ecology, "Environmental Impacts of E-commerce," 2000
- AT&T Faculty Fellow in Industrial Ecology, "Environmental Impacts of E-commerce," 1999
- Carnegie Bosch Institute Applied International Management Faculty Development Award, 2000-2001
- Outstanding Faculty Teacher Award, Department of Economics, 2000.
- Best Student Teacher, Department of Economics, Carnegie Mellon, 1996
- William Larimer Mellon Doctoral Fellowship, 1993-1996.

## PROFESSIONAL AFFILIATIONS AND ACTIVITIES

International Society of Industrial Ecology, Newsletter Contributor (Conference and Activity Reports)  
Journal of Industrial Ecology, Associate Editor (Input-Output Models, LCA)

IEEE, Technical Committee on Electronics and the Environment, Treasurer

IEEE Int'l Symposium on Electronics and the Environment 2002-07, Finance Chair, Program Chair, Conference Co-Chair (various)

2005-2008, IEEE Distinguished Visitor Program Award (traveling lectures on sustainability)

American Society of Civil Engineers (ASCE), Assoc. Member. ASCE Journal of Infrastructure Systems:  
Editorial Board; Co-edited 2 issues on sustainable infrastructure

Association of Environmental Engineering and Science Professors (AEESP), Member

American Center for Life Cycle Assessment - Advisory Council

## BOOKS

1. Chris T. Hendrickson, Lester B. Lave, and H. Scott Matthews, "Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach", RFF Press, April 2006.

## JOURNAL PUBLICATIONS

1. Y. Anny Huang, Christopher L. Weber, and H. Scott Matthews, "Characterization of Scope 3 Greenhouse Gas Emissions for Streamlined Corporate Carbon Footprinting", Environmental Science & Technology, submitted, 2009.
2. Y. Anny Huang, Manfred Lenzen, Christopher L. Weber, Joy Murray, and H. Scott Matthews, "The role of input-output analysis for the screening of sectoral and corporate carbon footprints" Economic Systems Research, submitted, 2009.
3. Matt Kocoloski, W. Michael Griffin, and H. Scott Matthews, "Indirect land-use change and biofuel policy", Environmental Research Letters, submitted.
4. Chris Costello, W. Michael Griffin, Amy Landis, and H. Scott Matthews, "Impact of Biofuel Crop Production on the Formation of Hypoxia in the Gulf of Mexico", Environmental Science & Technology, submitted, 2009.

5. Joshua Stolaroff, Christopher Weber, and H. Scott Matthews, "Design Issues in a Mandatory Greenhouse Gas Emissions Registry for the United States", Energy Policy, in press, 2009.
6. Melissa Bilec, Robert Ries, and H. Scott Matthews, "Life Cycle Assessment Modeling of Commercial Building Construction Processes", submitted, ASCE Journal of Infrastructure Systems, 2009.
7. Michael Bigrigg, H. Scott Matthews, and James Garrett, "Analysis of Fault Perturbations in Building Sensor Networked Data Streams", International Journal of Sensor Networks, in press, 2009.
8. Bigrigg, M., Matthews, H. S., Garrett, J., "Imputation of Missing Sensor Data Values Using In-Exact Replicas", Int. J. Intelligent Systems Technologies and Applications, Vol. 7, No. 1, 2009.
9. Cynthia Murphy, David Allen, Braden Allenby, John Crittenden, Cliff Davidson, Chris Hendrickson, Scott Matthews, "Sustainability in Engineering Education and Research at U.S. Universities", in press, Environmental Science & Technology, August 2009.
10. Aweewan Mangmeechai, H.S. Matthews, W. M. Griffin, P. Jaramillo, C. Hendrickson, "Economic and Environmental Life Cycle Assessment of Oil Sands", submitted, Environmental Science & Technology, 2009.
11. Costa Samaras, Scott Matthews, Lester Lave, and Granger Morgan, "Economic Subsidies of Plug-Hybrid Electric Vehicles", submitted, Transportation Research Part D, 2009.
12. Wakeley, Heather, C. T. Hendrickson, W. Michael Griffin, H. S. Matthews, "Economic and Environmental Transportation Effects of Large-Scale Ethanol Production and Distribution in the United States", Environmental Science & Technology, Vol. 43 No. 7, pp. 2228–2233, 2009. DOI: 10.1021/es8015827
13. Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, "Comparative Analysis of the Production Costs and Life-Cycle GHG Emissions of FT-Liquid Fuels from Coal and Natural Gas", Environmental Science and Technology, Vol. 42 No. 20, pp. 7559-7565, 2008.
14. Berges, Mario, Ethan Goldman, H. Scott Matthews, and Lucio Soibelman. "Training Load Monitoring Algorithms on Highly Sub-Metered Home Electricity Consumption Data", Tsinghua Science & Technology, 13 (2008): 406-411.
15. Weber, C.L. and Matthews, H.S. "Food-Miles and the Climate Impacts of Freight Transportation in American Food Consumption", Environmental Science and Technology, Vol. 42, pp. 3508–3513, 2008.
16. Matthews, H.S., Hendrickson, C.T., Weber, C.L. "The Importance of Carbon Footprint Estimation Boundaries" Environmental Science & Technology, Vol, 42 No. 16, pp. 5839-5842.
17. Wakeley, Heather, Scott Matthews, Michael Griffin, Chris Hendrickson, "Comparison of Input-Output and Process-based Life Cycle Inventory Results with an Application to Fischer-Tropsch Coal-to-Diesel Fuels", ASCE Journal of Infrastructure Systems, submitted, 2008.
18. Ping Chen, Corinne Scown, H. Scott Matthews, James H. Garrett, Chris T. Hendrickson, "Managing Critical Infrastructure Interdependence through Economic Input-output Methods", in press, ASCE Journal of Infrastructure Systems, 2008.
19. William R. Morrow, W. Michael Griffin, and H. Scott Matthews, "National-Level Infrastructure And Economic Effects Of Switchgrass Cofiring With Coal In Existing Power-Plants For Carbon Mitigation", Environmental Science & Technology, Vol 42(10), pp. 3501-3507, 2008. DOI: 10.1021/es071893z.
20. Joe Marriott and H. Scott Matthews, "A Disaggregated Electricity Sector Input-Output Model", International Journal of Life Cycle Assessment, submitted, 2007.
21. Aurora L. Sharrard, H. Scott Matthews, and Michael Roth, "Economic and Environmental Implications of Construction Energy Use and Generation under New EPA Emission Standards", Journal of Construction Engineering and Management, Vol, 133, No. 11, November 2007.
22. Melissa Bilec, Robert Ries, H. Scott Matthews, "Sustainable Development and Green Design – Who is Leading the Green Initiative?", ASCE Journal of Professional Issues in Engineering Education and Practice, October 2007.

23. Aurora L. Sharrard, H. Scott Matthews, and Robert Ries, "Estimating Construction Project Environmental Impacts Using an Input-Output-Based Hybrid Life Cycle Assessment Model", ASCE Journal of Infrastructure Systems, December 2008.
24. Chung-Yan Shih, Corinne Scown, H. Scott Matthews, James Garrett, Lucio Soibelman, Keith Dodrill, and Sandy McSurdy, "Data Management for Geospatial Vulnerability Assessment of Interdependencies in US Power Generation", in press, ASCE Journal of Infrastructure Systems, 2008.
25. Heather Wakeley, Michael Griffin, Chris Hendrickson, and H. Scott Matthews, "Alternative Transportation Fuels: Distribution Infrastructure for Hydrogen and Ethanol in Iowa", ASCE Journal of Infrastructure Systems, Vol. 14 No. 3, September, 2008.
26. Christopher Weber and H. Scott Matthews, "Quantifying the Global and Distributional Aspects of American Household Environmental Impact", Ecological Economics, Vol. 66, No. 2-3, 2008, pp. 379-391.
27. Cortney Higgins, H. Scott Matthews, Mitch Small, and Chris Hendrickson, "An Intermediate-Sized Mixed Unit Input-Output Model for Lead in the U.S., 1990-2004", submitted, The Journal of Industrial Ecology, 2007.
28. William R. Morrow, W. Michael Griffin, and H. Scott Matthews, "State-level infrastructure and economic effects of switchgrass co-firing with coal in existing power-plants for carbon mitigation", Environmental Science and Technology, 41(19), pp. 6657-6662, 2007. DOI 10.1021/es070335h
29. Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, "Comparative Life Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation", Environmental Science and Technology, 41, 6290-6296, 2007.
30. Cliff I. Davidson, Chris T. Hendrickson, H. Scott Matthews, Michael Bridges, Braden Allenby, John Crittenden, Yongsheng Chen, Sharon Austin, "Adding sustainability to the engineer's toolbox: a challenge for engineering educators", Environmental Science & Technology, 41 (14), p.4847-4850, Jul 2007.
31. Christopher Weber and H. Scott Matthews, Embodied Emissions in U.S. International Trade: 1997-2004, Vol. 41, No. 14, pp 4875 - 4881; Environmental Science and Technology, 2007. DOI: 10.1021/es0629110.
32. David Gerard, Paul S. Fischbeck, and H. Scott Matthews, "Diesels and Hybrids Don't Mix: Public Perceptions and Actual Driving Behavior of New Diesel and Hybrid Owners", Transportation Research Record No. 2017, 2007.
33. Cortney Higgins, H. Scott Matthews, Chris Hendrickson, and Mitchell Small, "Lead Demand of Future Vehicle Technologies", Transportation Research Part D-Transport and Environment, 12 (2), 103-114, 2007.
34. Troy Hawkins, Chris Hendrickson, Cortney Higgins, H. Scott Matthews and Sangwon Suh, "A Mixed-Unit Input-Output Model for Environmental Life-Cycle Assessment and Material Flow Analysis", Environmental Science and Technology, Vol. 41, No. 3, pp. 1024 - 1031, 2007. DOI [10.1021/es060871u](https://doi.org/10.1021/es060871u).
35. Gyorgyi Cicas, C. T. Hendrickson, Arpad Horvath, and H. S. Matthews, "Development of a Regional Economic and Environmental Input-Output Model of the US Economy", International Journal of Life Cycle Assessment, Vol. 12, No. 6, 2007, pp. 367-374, <http://dx.doi.org/10.1065/lca2007.04.318>.
36. Cliff Davidson, Chris Hendrickson, and H. Scott Matthews, "Sustainable Engineering: A Sequence of Courses at Carnegie Mellon", International Journal of Engineering Education, Vol. 23, No. 2, pp. 287-293, 2007.
37. Melissa Bilec, Robert Ries, H. Scott Matthews, and Aurora Sharrard, "An Example of a Hybrid Life Cycle Assessment of Construction Processes", ASCE Journal of Infrastructure Systems, Vol. 12, No. 4, December 2006, pp. 207-215, (doi 10.1061/(ASCE)1076-0342(2006)12:4(207)).
38. Chris T. Hendrickson, Gyorgyi Cicas, and H. S. Matthews, "Transportation Sector and Supply Chain Performance and Sustainability", Transportation Research Record No. 1983, 2006.

39. William R. Morrow, W. Michael Griffin, and H. Scott Matthews, "Modeling Switchgrass Derived Cellulosic Ethanol Distribution in the US", Environmental Science and Technology, Vol. 40, No. 9, 2006, pp. 2877-2886.
40. Troy Hawkins, H. Scott Matthews and Chris Hendrickson, 'Closing the Loop on Cadmium: An Assessment of the Material Cycle of Cadmium in the U.S.,' International Journal of Life Cycle Assessment, 11(1), pp. 38-48, 2006, <http://dx.doi.org/10.1065/lca2006.01.234>.
41. Joe Marriott and H. Scott Matthews, " Environmental Effects of Interstate Power Trading on Electricity Consumption Mixes", Environmental Science and Technology, Vol. 39, No. 22, pp. 8585-8590, 2005. DOI: <http://dx.doi.org/10.1021/es0506859>.
42. Paulina Jaramillo and H. Scott Matthews, "Landfill Gas to Energy Projects: An Analysis of Private and Social Benefits", Environmental Science and Technology, Vol. 39, No. 19, pp. 7365-7373, 2005. <http://dx.doi.org/10.1021/es049325w>
43. H. Scott Matthews and Eric Williams, "Telework Adoption and Energy Use in Building and Transport Sectors in the United States and Japan ", ASCE Journal of Infrastructure Systems, Vol. 11, No. 1, March 2005, pp. 21-30, (doi 10.1061/(ASCE)1076-0342(2005)11:1(21))
44. Shannon M. Lloyd, Lester B. Lave, and H. Scott Matthews, "Life Cycle Benefits of Using Nanotechnology To Stabilize Platinum-Group Metal Particles in Automotive Catalysts", Environmental Science and Technology, 39(5); pp.1384-1392, 2005. DOI: 10.1021/es049325w
45. H. Scott Matthews, Gyorgyi Cicas, and Luis Aguirre, "Evaluation of Residential Fixed Solar Photovoltaic Systems in the US", ASCE Journal of Infrastructure Systems, Vol. 10, No. 3, September 2004, pp. 105-110, (doi 10.1061/(ASCE)1076-0342(2004)10:3(105))
46. H. Scott Matthews, "Thinking Outside 'the Box': Designing a Packaging Take-Back System", California Management Review, Vol. 46, No. 2, Winter 2004.
47. H. Scott Matthews, Chris Hendrickson, Lester Lave, "The Economic and Environmental Implications of Centralized Stock Keeping," Journal of Industrial Ecology, Vol. 6, No. 2, pp. 71-81, 2003.
48. H. Scott Matthews and Lester Lave, " Using Input-Output Analysis for Corporate Benchmarking ", Benchmarking: An International Journal, Vol. 10, No. 2, 2003. (Received "Highly Commended Award" for 2004 by Emerald Publishing).
49. H. Scott Matthews, E. Williams, T. Tagami, and C. T. Hendrickson, "Energy Implications of Online Book Retailing in the United States and Japan", Environmental Impact Assessment Review, Volume 22, Issue 5, 2002, pp. 493-507.
50. Luis Ochoa, Chris T. Hendrickson, and H. Scott Matthews, "An Aggregate, Life Cycle Assessment of Residential Buildings", ASCE Journal of Infrastructure Systems, Vol. 8 No.4, pp. 132-138, 2002.
51. H. Scott Matthews, Lester Lave, and Heather MacLean, "Life Cycle Impact Analysis: A Challenge for Risk Analysis", Risk Analysis, Vol. 22, No.5, pp. 853-860, 2002.
52. H. Scott Matthews, "Use versus Manufacturing Life Cycle Energy and Environmental Impacts for Tape Drives", Resources, Conservation, and Recycling, 36 (2002), pp. 187-196.
53. H. Scott Matthews, Chris T. Hendrickson, and Denise L. Soh, "Environmental and Economic Effects of E-Commerce: A Case Study of Book Publishing and Retail Logistics", Transportation Research Record No. 1763, pp. 6-12, 2001.
54. H. Scott Matthews, Chris T. Hendrickson, and Arpad Horvath, "External Costs of Air Emissions from Transportation," ASCE Journal of Infrastructure Systems, Vol., 7 No.1, March 2001, pp. 111-117.
55. H. Scott Matthews and Mitchell Small, "Extending the Boundaries of Life Cycle Assessment Through Environmental Economic Input-Output Models," Journal of Industrial Ecology, Vol. 4. No. 3, 2000, pp. 7-10.
56. H. Scott Matthews and Lester B. Lave, "Applications of Environmental Valuation for Determining Externality Costs," Environmental Science and Technology, Vol. 34, No.8, pp. 1390-1395, 2000.
57. H. Scott Matthews and Gregory C. Chambers, "Unraveling the Environmental Product Design Paradox", Journal of Sustainable Product Design, Issue 4: January 1998.

## HIGHLY SELECTIVE CONFERENCE PUBLICATIONS

58. J. Schwartz, J. Mankoff, H. Scott Matthews, "Reflections of everyday activity in spending data", Proceedings of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, ACM, New York, NY, 2009.
59. Vipul Singhvi, James Garrett, Carlos Guestrin, and H. Scott Matthews, "Intelligent Light Control Using Sensor Networks", The ACM Conference on Embedded Networked Sensor Systems (SenSys), November 2-4, 2005, San Diego.

## EDITORIALS AND INVITED PUBLICATIONS

- H. Scott Matthews and Reid Lifset, "The Life-Cycle Assessment and Industrial Ecology Communities: Expanding Boundaries Together", Journal of Industrial Ecology, Fall 2007, Vol. 11, No. 4: 1-4.
- Barbara Karn (EPA) and H. Scott Matthews, "Nano Particles Without Macroproblems", IEEE Spectrum, Vol. 44 No. 9, pp. 55-58, 2007.
- Arpad Horvath and H. Scott Matthews, "Sustainability of Transportation and Other Infrastructure Systems", ASCE Journal of Infrastructure Systems, Vol. 11, No. 1, March 2005, p. 1, (doi 10.1061/(ASCE)1076-0342(2005)11:1(1))
- Arpad Horvath and H. Scott Matthews, "Advancing Sustainable Development of Infrastructure Systems", ASCE Journal of Infrastructure Systems, Vol. 10, No. 3, September 2004. pp. 77-78, (doi 10.1061/(ASCE)1076-0342(2004)10:3(77))
- H. Scott Matthews, "Scoping Study on the Environmental Implications of the Growth of the Information and Communications Technology Sector," Organisation for Economic Co-Operation and Development (OECD), Environment Directorate, Paris, 2001.
- H. Scott Matthews, Chris T. Hendrickson, and Lester B. Lave, "Harry Potter and the Hole in the Ozone Layer," IEEE Spectrum, Vol. 37, No. 11, November 2000.
- H. Scott Matthews, "The External Costs of Air Pollution and the Environmental Impact of the Consumer in the U.S. Economy", Ph.D. Thesis, Carnegie Mellon University, 1999.
- H. Scott Matthews, Chris T. Hendrickson, Francis C. McMichael, and Deanna J. Hart, "Disposition and End-of-Life Options for Personal Computers", Green Design Initiative Technical Report #97-10, July 1997.
- Lester B. Lave and H. Scott Matthews, "It's Easier to Say Green than Be Green", Technology Review, Nov/Dec 1996, pp. 70-71. [Reprinted in Technology Review Italian Edition, December 1996, pp.6-7]

## BOOK CHAPTERS

- Cicas, Gyorgyi, Hendrickson, Chris T. and H. Scott Matthews, (2008), 'The Economic and Environmental Consequences of Reduced Air Transport Series in Pennsylvania: A Regional Input-Output Life Cycle Assessment Case Study', The Dynamics of Regions and Networks in Industrial Ecosystems, 2008.
- H. Scott Matthews and Deanna Matthews, "Computers and the Environment", in Computers and the Environment: Understanding and Managing Their Impacts, Eric Williams and Rudiger Kuehr, editors, 2004.
- H. Scott Matthews, "Effects of Virtual Mobility: Environmental Implications of Electronic Commerce Systems", in Auswirkungen der virtuellen Mobilitat (Effects of Virtual Mobility), Springer, Berlin, 2004.
- Hendrickson, Chris, H. Scott Matthews, Jonathan Cagan and Francis C. McMichael, "Design Engineering," Business Aspects of Closed-Loop Supply Chains, Carnegie Mellon University Press, 2003.

- H. Scott Matthews, "The Benefits of the Clean Air Act", in Improving Regulation: Cases in Environment, Health, and Safety, Paul Fischbeck and Scott Farrow, editors, Resources for the Future Press: Washington, 2001.
- H. Scott Matthews, Lester Lave, and Heather MacLean, "Life Cycle Impact Analysis: A Challenge for Risk Analysts", in Human and Ecological Risk Assessment: Theory and Practice, Dennis Paustenbach, Editor, 2002.
- H. Scott Matthews, Francis McMichael, Heather MacLean, and Lester Lave, "Life Cycle Analysis as a Tool for Product Design," in Encyclopedia of Materials Science and Technology, Buschow, Cahn, et al., editors, 2002.
- Lester Lave and H. Scott Matthews, "Its Easier to Say Green than Be Green", in Technology, Humans, and Society: Toward a Sustainable Future, Richard C. Dorf, editor, Academic Press, 2001.

## PEER-REVIEWED PROCEEDINGS

1. Sharrard, Aurora L., Nikithser, Ashley Corrine Scown, and H. Scott Matthews. "The Challenge of Correlating Local Air Monitor Data with Construction Site Activity: A Pittsburgh Case Study." Construction Research Congress: A Global Community. Grand Bahama Island, Bahamas. May 2007. American Society of Civil Engineers, Construction Institute.
2. Sharrard, Aurora L., Melissa Bilec, H. Scott Matthews, and Robert Ries. "Two Construction Hybrid Life Cycle Assessments." Construction Research Congress: A Global Community. Grand Bahama Island, Bahamas. May 2007. American Society of Civil Engineers, Construction Institute.
3. Sharrard, Aurora L., H. Scott Matthews, and Robert Ries. "Building Consensus on the Environmental Impacts of Construction Using An Input-Output-Based Hybrid Life Cycle Assessment Model." Construction Research Congress: A Global Community. Grand Bahama Island, Bahamas. May 2007. American Society of Civil Engineers, Construction Institute.
4. Matthews, H. S., J. H. Garrett, Jr., M. W. Bigrigg. "Information and Communication Technology for Intelligent, Sustainable Infrastructure Systems," Proceedings of the International Association of Bridge and Structural Engineers (IABSE) Symposium: Responding to Tomorrow's Challenges in Structural Engineering, Budapest, Hungary, September 13-15, 2006.
5. Breton, M., T. Brady, E. Williams, and H. S. Matthews, "Monitoring and Control Systems to Manage Energy Use in US Homes", Proceedings of 4th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL), London, June 21-23, 2006.
6. Singhvi, V., J. H. Garrett, Jr., H. S. Matthews, C. Guestrin, K. P. Lam "Utility-based Decision Making in Building Infrastructure", Proceedings of the Joint International Conference on Computing and Decision Making in Civil and Building Engineering, Montreal, Canada, June 14-16, 2006.
7. E. Williams, H. S. Matthews, M. Breton, and T. Brady, "Use of a Computer-Based System to Measure and Manage Energy Consumption in the Home", Proceedings of 2006 International Symposium on Electronics and the Environment, San Francisco, May 2006.
8. H. Scott Matthews, Michael Roth, Aurora Sharrard, and Melissa Bilec, "Economic and Environmental Implications of Construction Energy Use and Generation Under New EPA Emission Standards", Proceedings of 2005 ASCE Construction Research Conference, San Diego, 2005. (doi 10.1061/40754(183)20)
9. Ochoa, Luis, Chris Hendrickson, Scott Matthews and Robert Ries, "Life Cycle Assessment of Residential Buildings," Proceedings of 2005 ASCE Construction Research Conference, San Diego, 2005. (doi 10.1061/40754(183)18)
10. Singhvi., V., Bigrigg, M., Matthews, H., Garrett, J., 2005, "Continuous Commissioning using Embedded Sensors", International Conference on Computing in Civil Engineering, Cancun, Mexico, July 2005. (doi 10.1061/40794(179)47).
11. Hui Min Chong and H. Scott Matthews, "Comparative Analysis of Traditional Telephone and Voice-over-Internet Protocol (VoIP) Systems", Proceedings of the 2004 Institute of Electrical and

- Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 10-13, 2004, Scottsdale, AZ, USA.
12. Junbeum Kim, Yongwoo Hwang, H. Scott Matthews, and Kwangho Park, "Methodology for Recycling Potential Evaluation Criterion of Waste Home Appliances Considering Environmental and Economic Factor", Proceedings of the 2004 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 10-13, 2004, Scottsdale, AZ, USA.
  13. Akinci, Burcu, Mikhail Chester, Chris Hendrickson, H. Scott Matthews, and Kevin McCloskey, "Automated Photologging and Retrieval for a Digital Photograph Library," Proc. Of the Transportation Research Board Annual Meeting, 2004.
  14. "Electricity Use of Wired and Wireless Telecommunications Networks in the United States ", H. Scott Matthews, SETAC/ISIE Symposium, Geneva Switzerland, December 3-5, 2003.
  15. H. Scott Matthews, "Information and Communications Technologies and Sustainability", Proceedings of 2003 IEEE Conference on Systems, Man, and Cybernetics, Washington, DC, USA, Oct. 5-8, 2003.
  16. H. Scott Matthews, Woon Sien Loh, and Hui Min Chong, "Electricity Use of Wired and Wireless Telecommunications Networks in the United States", Proceedings of the 2003 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 19-22, 2003, Boston, MA, USA.
  17. H. Scott Matthews, Chris T. Hendrickson, Hui Min Chong, and Woon Sien Loh, "Energy Impacts of Wired and Wireless Networks", Proceedings of the 2002 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 6-8, 2002, San Francisco, CA, USA.
  18. H. Scott Matthews and Chris T. Hendrickson, "Economic and Environmental Implications of Online Retailing in the United States", Proceedings of the 15th International Symposium Informatics for Environmental Protection, October 10-12, 2001, Zurich, Switzerland.
  19. H. Scott Matthews, Chris T. Hendrickson, and Denise Soh, "The Net Effect: Environmental Implications of E-Commerce and Logistics," Proceedings of the 2001 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 5-9, 2001, Denver, CO, USA.
  20. Elizabeth Jimison, Ed Pennington, and H. Scott Matthews, "Assessing the Results of a Worldwide Packaging Takeback System," Proceedings of the 2000 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 8-10, 2000, San Francisco, California.
  21. H. Scott Matthews and Gregory Chambers, "Use versus Manufacture Life Cycle Energy and Environmental Impacts for Tape Drives," Proceedings of the 2000 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 8-10, 2000, San Francisco, California.
  22. Chris Hendrickson, N. Conway-Schempf, H. Scott Matthews and Francis McMichael, "Green Design Educational Modules and Case Studies," Proceedings of the 2000 ASEE Conference, St. Louis, 2000.
  23. H. Scott Matthews and Gregory C. Chambers, "Unraveling the Environmental Product Design Paradox", Proceedings of the 1997 Institute of Electrical and Electronics Engineers (IEEE) International Symposium on Electronics and the Environment, May 3-5, 1997, San Francisco.
  24. Lester B. Lave and H. Scott Matthews, "Price Setting for Green Design", Proceedings of the 1995 IEEE International Symposium on Electronics and the Environment, May 1-3, 1995, Orlando.

#### **OTHER WORKING PAPERS OR UNPUBLISHED MANUSCRIPTS**

1. Aurora L. Sharrard and H. Scott Matthews, "A Civil Engineering Perspective of Green Building Standards", submitted, Journal of Green Buildings, 2005.

2. Chris T. Hendrickson and H. Scott Matthews, "Use of Green Design Educational Modules," submitted to Journal of Engineering Education, February 2002.
3. H. Scott Matthews, Benoit Morel, and Tim Shimeall, "Unsafe at Any Speed: Why Software Should be Treated Like Automobiles", submitted to Issues in Science and Technology.
4. H. Scott Matthews, Chris T. Hendrickson, and Lester B. Lave, "Correcting Consumer and Producer Prices for Air Pollution Emissions," submitted to Journal of Environmental Economics and Management, 2000.
5. H. Scott Matthews and Lester B. Lave, "External Costs of Air Pollution from U.S. Industrial Sectors: Life Cycle Effluent Fees," submitted to American Economic Review, 2000.
6. H. Scott Matthews, "A Case Study of Hazardous Material Substitution", Working Paper, Aug 1998.
7. H. Scott Matthews and Lester B. Lave, "Accounting for Environmentally Conscious Design and Manufacturing", Working Paper, January 1996.

### CONFERENCE PAPERS AND INVITED PRESENTATIONS

1. "Carbon Management for Companies", ASCE Pittsburgh Section, March 27, 2008.
2. "Introduction to Input-Output Models for Transportation Modeling", UC Berkeley (Workshop on Biofuels LCA), July 1, 2008.
3. Seattle Public Utilities – "Infrastructure Implications of Alternative Fuels", July 2007.
4. Wash. State Dept of Ecology, "Development of the Consumer Environmental Index", July 2007.
5. University of New Hampshire, "Infrastructure Implications of Alternative Fuels", April 2007.
6. "A Cause Of Data Perturbations in Building Sensors", Michael Bigrigg and H. Scott Matthews, Int'l Conf. on Computing in Civil Engineering, Montreal, Canada, 2006.
7. "Motivating Environmental Systems and Life Cycle Thinking for High School Students", H. Scott Matthews, Chris Hendrickson, Troy Hawkins, Joseph Marriott, and Aurora Sharrard, 2005 Association of Environmental Engineering and Science Professors Research and Education Conference, July 26, 2005, Potsdam, NY.
8. "Sustainability Engineering at Carnegie Mellon: A New Sequence of Graduate Courses", Cliff I. Davidson, H. Scott Matthews, and Chris T. Hendrickson, 2005 Association of Environmental Engineering and Science Professors Research and Education Conference, July 26, 2005, Potsdam, NY.
9. "Life Cycle Assessment Using Input-Output Models", 9<sup>th</sup> Annual Green Chemistry and Engineering Conference, Washington, DC, June 23, 2005.
10. "Environmental Cost Accounting", National Association of Environmental Management, Chicago, December 2004.
11. Hawkins, Troy, H.S. Matthews, 'IO MFA Analysis of the Relationship between Cadmium Recycling and Zinc Production.' Fourth SETAC World Congress / 25th Annual Meeting in North America, Portland, Oregon, 14-18 November 2004.
12. "Computers and the Environment", United Nations, March 8, 2004.
13. "Electricity Use of US Telecom Networks", International Conference on Life Cycle Assessment (InLCA), Seattle, September 2003.
14. " Implications of New Economic Classification Systems on Input-Output Based LCA Models", International Conference on Life Cycle Assessment (InLCA), Seattle, September 2003.
15. " Using Life Cycle Assessment for Corporate Benchmarking ", National Association of Environmental Management, Baltimore, October 2003.
16. "Overview and Preview of NAEM/Carnegie Mellon Executive Education Course", NAEM Atlanta Chapter, December 8, 2003.
17. "Assessing Knowledge Needs for Critical Infrastructure Protection", ICES Knowledge Management Forum, October 30, 2003.

18. H. Scott Matthews, Woon Sien Loh, and Hui Min Chong, "Energy Consumption of Wired and Wireless Communications Networks", International Society for Industrial Ecology Second International Conference, Ann Arbor, Michigan, June 29-July 2, 2003.
19. H. Scott Matthews and Joseph Marriott, "A Source Generation Comparison of Electricity Consumption in US Production Sectors", International Society for Industrial Ecology Second International Conference, Ann Arbor, Michigan, June 29-July 2, 2003.
20. "Input-Output based Life Cycle Analysis for New Economy Models", with Chris T. Hendrickson, 14th International Conference on Input-Output Techniques, Montreal, Canada, Oct 11-15, 2002.
21. "Pollution Prevention via Life Cycle Analysis", Keynote, Ohio EPA Hazardous Waste Management Conference, July 2002.
22. "What is the Information Technology Sector, and how does it affect Economic Growth?", with Thomas Grahame (U.S. Department of Energy), Electric Utilities Environmental Conference, Tucson, AZ, January 22-25, 2002.
23. "Economic and Environmental Implications of Online Retailing in the United States and Japan", International Society for Industrial Ecology Conference, Amsterdam, Nov. 2001.
24. "Environmental Implications of the Growth of the Information and Communications Technology Sector", OECD Environmental Policy Directorate, Paris, November 7, 2001
25. "Environmental Life Cycle Assessment: Theory and Examples", Alfred University Center for Environmental and Energy Research, Keynote Speaker, October 24, 2001.
26. "Economic and Environmental Implications of the New Economy," Organisation for Economic Co-Operation and Development World Forum, Plenary Speaker, May 14-16, 2001, Paris.
27. Economic and Environmental Implications of E-commerce," Silicon Valley Conference on Solutions for Sustainability: Evaluating Our Global Performance, Feb. 28-Mar. 1, 2001, Foster City, CA, USA.
28. H. Scott Matthews, Chris T. Hendrickson, and Lester B. Lave, "Economic Input-Output Based Life Cycle Assessment for Sustainability," Society of Environmental Toxicology and Chemistry (SETAC) 21st Annual Meeting, Nashville, TN, November 12-16, 2000.
29. "Environmental Implications of E-Commerce: Book Publishing Case Study," Industrial Ecology 2000 (IE2000) Conference, Berkeley, CA, October 5-7, 2000.
30. "External Costs and Externalities of Production", NATO Advanced Research Workshop on Green Engineering and Management, Budapest, Hungary, May 26-28, 2000.
31. "Estimating The External Costs of Air Pollution using Input-Output Models," Pollution Abatement and Control Expenditures (PACE) Workshop on Survey Design, Resources for the Future, March 9-10, 2000, Washington, DC.
32. "The Carnegie Mellon Life Cycle Analysis of Alternative Fuel Options," Silicon Valley Conference on Solutions for Sustainability: Evaluating Our Global Performance, February 23-24, 2000, Foster City, CA.
33. H. Scott Matthews, Chris T. Hendrickson, Arpad Horvath, and Lester Lave, "Life Cycle Assessment with Economic Input-Output Models: eiolca.net," Society of Environmental Toxicology and Chemistry, November 14-18, 1999, Philadelphia, PA.
34. H. Scott Matthews, "Environmental Management of Electronic Products," How Green is Silicon Valley Conference, Center for Environmental Journalism, Berkeley, Oct. 9, 1999, Berkeley, CA.
35. "Life Cycle Analysis: A Practical Tool for Pollution Prevention," SAE Southern Automotive Manufacturing Conference and Exposition, September 28-30, 1999, Birmingham, AL.
36. "Life Cycle Analysis of Alternative Automobile Fuels and Technologies (2000-2010)," SAE Southern Automotive Manufacturing Conference and Exposition, September 28-30, 1999, Birmingham, AL.
37. "An Introduction to eiolca.net", Silicon Valley Conference on Environment, Health, and Safety in Tomorrow's Marketplace, February 24-25, 1999, Foster City, CA.

38. H. Scott Matthews, Chris T. Hendrickson, and Arpad Horvath, "The External Costs of Transportation Goods and Services", Transportation Research Board Annual Conference, January 10-14, 1999, Washington, DC.
39. H. Scott Matthews, "Air Pollution Costs of Industrial Production", Informs: Partnering for Global Technology Management Conference, Seattle, October 25-28, 1998.

### **COURSES TAUGHT AT CARNEGIE MELLON**

<b>Course / Level</b>	<b>Year</b>	<b>Dept. <sup>1</sup></b>	<b>Teacher Rating <sup>2</sup></b>	<b>Course Rating <sup>2</sup></b>
Infrastructure Management	Spring 2003	CEE/EPP	4.7	4.8
Benefit-Cost Analysis	Fall 1995	ECON	4.6	4.5
Civil Systems Pricing / Benefit-Cost Analysis	Fall 1997	CEE/ECON	4.5	4.3
Civil Systems Pricing / Benefit-Cost Analysis	Fall 1998	CEE/ECON	4.3	4.0
Civil Systems Pricing / Benefit-Cost Analysis	Fall 1999	CEE/ECON	4.3	4.0
Civil Systems Pricing / Benefit-Cost Analysis	Fall 2000	CEE/ECON	4.8	4.8
Civil Systems Pricing / Benefit-Cost Analysis	Fall 2001	CEE/ECON	4.9	4.8
Civil Systems Pricing / Benefit-Cost Analysis	Fall 2002	CEE/ECON	4.8	4.8
Civil Systems Pricing / Benefit-Cost Analysis	Fall 2003	CEE/ECON	4.6	4.5
Case Studies in Engineering and Public Policy	Fall 1999	EPP	4.7	4.4
Information Warfare and Security	Spring 2000	EPP	4.6	4.6
Information Warfare and Security	Spring 2001	EPP/SCS	4.2	4.1

**Legend:**

<sup>1</sup>ECON = Undergraduate Economics Department, EPP=Department of Engineering and Public Policy, CEE/ECON= Jointly Offered and Listed in Undergraduate Economics and Graduate Civil and Environmental Engineering Department, EPP/SCS=Joint Between EPP and Computer Science

<sup>2</sup> - Teacher and Overall Course Ratings on 5-point scale, as surveyed from students by University

### **EXECUTIVE EDUCATION / TUTORIAL COURSES**

- “Economic Input-Output Life Cycle Assessment: Using it to Teach Systems and Life Cycle Concepts“, 2005 Association of Environmental Engineering and Science Professors Research and Education Conference, July 24, 2005, Potsdam, NY.
- “Applied EH&S Topics – Full Cost Accounting, Valuation, and Corporate Sustainability”, National Association of Environmental Managers ‘Foundations for Management Excellence’, June 2003-05.
- Arpad Horvath, H. Scott Matthews, and Harald Florin, " Using Life Cycle Assessment Tools and Models", University of California Extension Campus, January 12-13, 2001, Berkeley, CA.
- Arpad Horvath, H. Scott Matthews, and Harald Florin, "An Introduction to Life Cycle Assessment Tools and Models", National Fuel Cell Research Center, 1999, 2000, Irvine, CA.

### **SPONSORED RESEARCH AND PROJECTS**

- H. Scott Matthews and Granger Morgan, “Assessing Future Supply Curves for Coal in Light of Economic, Technological and Environmental Uncertainties”, NETL, \$180,000, 2006-08.
- H. Scott Matthews, Cliff Davidson, Eric Williams, Mike DeKay, “Sustainable Consumption, Globalization and Information: Impacts and Opportunities”, NSF CTS-0628232, \$100,000, 2006.

- Lester Lave, Chris Hendrickson, Scott Matthews, Jeremy Michalek, and Michael Griffin, “Material Use, Infrastructure Change, and Environmental Impacts for Alternative Fuels and Vehicles”, NSF CTS-0628084, \$1,500,000, 2006-11.
- H. Scott Matthews, “Life Cycle Analysis Of Alternative Pathways For Production And Delivery Of Hydrogen For Vehicles”, \$40,000, Subcontract to NETL, 2006.
- Lucio Soibelman, H. Scott Matthews, and James P. Garrett, “Knowledge Management and Visualization in Support of Vulnerability Assessment of Electricity Production”, National Energy Technology Laboratory (NETL), 2005-2007, \$230,000.
- W. Michael Griffin and H. Scott Matthews, “Infrastructure Effects of Expanded Liquefied Natural Gas Use”, PITA, \$60,000, 2005-06.
- Cliff Davidson, Chris Hendrickson, and Scott Matthews (with co-PIs Allen (UTexas), Crittenden and Allenby (ASU), “Sustainability Science and Engineering Education”, NSF/EPA, \$2,000,000, 2004-07.
- James Garrett, Burcu Akinci, David Greve, H. Scott Matthews, Irving Oppenheim, Hoon Sohn, and Lucio Soibelman, "Funds for Establishment of an AIS Sensors Lab", Pennsylvania Infrastructure Technology Alliance, 2005, \$100,000.
- H. S. Matthews and C. Hendrickson, "Economic Assessment of US-VISIT Program", Department of Homeland Security (via US Army Corps of Engineers), 2005, \$100,000.
- H. S. Matthews and Chris T. Hendrickson, " Visualization & Management of Interdependencies for Critical Infrastructure Protection”, Pennsylvania Infrastructure Technology Alliance, 2005, \$50,000.
- H. S. Matthews and James H. Garrett, "Integration of Pervasive Sensor Networks for Embedded Building Commissioning”, Pennsylvania Infrastructure Technology Alliance, 2005, \$22,000.
- H. S. Matthews and Eric Williams, " Effects of computer usage patterns on the life cycle energy consumption of IT infrastructure", AT&T Foundation Faculty Fellow in Industrial Ecology, 2003, \$25,000.
- M. Bigrigg and H. S. Matthews, “Continuing Research into Sensor Deployment and Networking for Building and Facility Management”, Pennsylvania Infrastructure Technology Alliance, October 2003-September 2004, \$50,000.
- R. Lifset (Yale), D. Rejeski (Smithsonian Institution), and H. S. Matthews, “Workshop on Information Technology and the Environment”, National Science Foundation, Fall 2003, \$45,000.
- L. B. Lave, H. S. Matthews, C. T. Hendrickson, and M. Small, “Tracking Heavy Metal Life Cycle Pathways with Input-Output Methods”, National Science Foundation, 2003-2007, \$1,200,000. NSF CTS-0328870, REU Supplement \$12,500 and Other Supplement \$15,000 in 2004.
- C. T. Hendrickson and H. S. Matthews, “Assessment Tool and Visualization for Regional Supply Chain Impacts”, National Science Foundation, August 2003-July 2006, \$375,000. NSF REU Supplement \$12,000 in 2004.
- H. S. Matthews and R. Ries (University of Pittsburgh), “Assessment and Re-design of Processes for Green Construction”, National Science Foundation, October 2003-September 2006, \$375,000. NSF REU Supplement \$5,000 in 2004.
- C. T. Hendrickson, H. S. Matthews, and Jim Garrett, “Analyzing Critical Infrastructure Interdependencies: Security and Survivability Effects in the Service Sector”, NSF, October 2002-September 2004, \$150,000. NSF REU Supplements \$7,500 in 2003, 2004.
- B. Akinci, C. Hendrickson, and H. S. Matthews, “Exploring the use of automatic, real-time photographic data acquisition and archival for construction project documentation”, Pennsylvania Infrastructure Technology Alliance, September 2002-August 2003, \$40,000.
- M. Bigrigg and H. S. Matthews, “Exploratory Research into Sensor Deployment and Networking for Building and Facility Management”, Pennsylvania Infrastructure Technology Alliance, September 2002-August 2003, \$30,000.

- H. S. Matthews, “Enhancements to Internet-based Input-Output Modeling”, Department of Commerce, January – September 2003, \$20,000.
- H. S. Matthews and Z. Istvan, Advanced Research Workshop, “Life Cycle Energy and Environmental Implications of Information Technology”, North Atlantic Treaty Organization (NATO) Science Programme, Budapest, Hungary, Sept 1-3, 2003, \$40,000 (co-funding from Carnegie Bosch Institute).
- H. S. Matthews, "Energy Impacts of Voice Telecommunications," AT&T Foundation Faculty Fellow in Industrial Ecology, 2002, \$25,000.
- A. Horvath (UC Berkeley), "Computer-Aided Hybrid Models for Environmental and Economic Life Cycle Assessment", U.S. Environmental Protection Agency, September 2002-August 2005, \$275,000 (Faculty Associate, CMU portion \$125,000)
- H. S. Matthews, "Electricity Use of Data Centers", AT&T Corporation, May–July 2001, \$15,000.
- H. S. Matthews and C. Hendrickson, "Energy Impacts of Wireless Networks," AT&T Foundation Faculty Fellow in Industrial Ecology, 2001, \$25,000.
- E. Williams (UN Univ.), H. S. Matthews, S. Mori (Sci. Univ. of Tokyo), Y. Baba (Univ. of Tokyo), and M. Fujimoto (Sumitomo Marine Research Institute, Tokyo), "The Digital Economy and Energy Efficiency: Comparative Studies of Production, Distribution and ICT Infrastructure," The Japan Foundation Center for Global Partnership, April 2001- March 2003, \$200,000.
- C. Hendrickson and B. Akinci, “Multi-Disciplinary Exploratory Research to Exploit Motor Vehicle Information and Communications Technology”, National Science Foundation, August 2001-July 2002, \$100,000.
- H. S. Matthews, C. T. Hendrickson and L. B. Lave, AT&T Foundation Faculty Fellow in Industrial Ecology, "Environmental Impacts of E-commerce," 2000, \$25,000.
- H. S. Matthews, C. T. Hendrickson and L. B. Lave, AT&T Corporation, "Environmental Impacts of E-commerce", 2000, \$10,000.
- H. S. Matthews, C. T. Hendrickson and L. B. Lave, AT&T Foundation Faculty Fellowships in Industrial Ecology, "Environmental Impacts of E-commerce," 1999, \$25,000.
- H. S. Matthews, C. T. Hendrickson and L. B. Lave, "Environmental Impacts of E-commerce", AT&T Corporation, 1999, \$25,000
- C. Hendrickson and H. S. Matthews, "Life Cycle Product Information Systems for Scalable and Sustainable Enterprises", National Science Foundation, August 2000- July 2001, \$95,000.

#### **EXAMPLE CONSULTING / EXTERNAL PROJECTS**

- Aliah, Inc. (Analytic Hierarchy Process Decision Making Tool Support)
- Organization for Economic Cooperation and Development (OECD)
- Quantum Corporation (Environmental Management)
- Chipcenter.com / echips.com (biweekly online column on "Information Warfare")
- CH2M Hill (Assessment of Erie Runway Expansion Project)
- Palm, Inc. (Sustainable Management of Products)
- Washington State Department of Ecology
- US DOE National Energy Technology Laboratory (Peer review of Energy LCA studies)
- US EPA Office of Solid Waste, subcontract via Industrial Economics, Inc. (Assessment of Waste LCA models)