

ERNST WORRELL

CURRICULUM VITAE

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3823 JM Amersfoort
The Netherlands
Date of Birth: 22 February 1964
Citizenship: The Netherlands

Languages: Dutch (mother tongue)
English (excellent)
German (good)
French (fairly)

RESEARCH INTERESTS

Science and technology policy focused on energy, resource and environmental management. Technology, economic and policy development issues particularly related to industrial development, including RD&D, technology and market assessment, policy development and evaluation, as well as planning and modelling. Global environmental change including climate change, energy, water and resource efficiency and waste management. Energy, resource and environmental modelling.

EDUCATION

Ph.D.	Utrecht University, The Netherlands	Chemistry	1994
M.Sc.	Utrecht University, The Netherlands	Chemistry	1988

PROFESSIONAL EXPERIENCE

2010 - Professor 'Energy, Resources & Technological Change', Utrecht University, Utrecht, The Netherlands.

2008 - 2010 Professor 'Energy, Materials & Environment', Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht, The Netherlands

- 2008 - Scientific Director SENSE Research School for Socio-Economic and Natural Sciences of the Environment (collaboration of 9 universities in The Netherlands)
- 2004 - 2010 Manager Energy & Climate Strategies and Director Energy Use & Efficiency, Ecofys, Utrecht, The Netherlands
- 1998 - 2008 Staff Scientist, Energy and Energy Policy Analyst. Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, Berkeley, California, USA
- 1996 Visiting Professor Instituto de Eletrotecnica e Energia, Universidade de Sao Paulo, Brazil
- 1994 - 1995 Visiting researcher Center for Energy and Environmental Studies, Princeton University, Princeton, NJ, USA
- 1989 - 1998 Scientific Researcher, Dept. of Science, Technology & Society, Utrecht University, The Netherlands.
- 1988 - 1989 Scientific Researcher, Energy Science Project, Utrecht University, The Netherlands
- 1986 – 1989 Assistant teacher for students Chemistry. Programme Chemistry & Society, Utrecht University, The Netherlands.

RESEARCH

Author of over 250 publications, including papers in scientific journals, book chapters, conference proceedings and research reports.

Management of international research teams and management of research groups at Ecofys (since 2004), Lawrence Berkeley National Laboratory (since 1998) and Utrecht University (1993 – 1998).

Development, supervision, management and evaluation of inter-disciplinary research projects in energy efficiency and intensity in industry, energy conversion technologies, energy analysis, energy policies, materials intensity and efficiency, evaluation of reduction options of greenhouse gases, climate change policy analysis, life cycle analysis and biomass and waste processing.

Acquisition, management and leadership of research projects commissioned by the Government in the Netherlands, Sweden and U.S. as well as international organisations. Studies were led and conducted for:

- United Nations Environment Programme
- United Nations Division for Sustainable Development
- United Nations Framework Convention on Climate Change Secretariat

- European Commission, Directorate-General Research & Development
- European Commission, Directorate-General Transport & Energy
- European Commission, Directorate-General Environment
- International Energy Agency
- International Energy Agency – Greenhouse Gas R&D Programme
- U.S. Environmental Protection Agency
- U.S. Department of Energy
- U.S. Agency for International Development (US AID)
- U.K. Department for Environment, Food and Rural Affairs
- Ministry of Economic Affairs, The Netherlands
- Ministry of Environment, The Netherlands
- Swedish International Development Agency
- Netherlands National Research Programme on Climate Change and Global Air Pollution (NOP-MLK)
- SenterNovem, Netherlands Agency for Energy and Environment, The Netherlands
- National Institute of Public Health and the Environment (RIVM)
- Environmental and Nature Planning Bureau (PBL)
- California Energy Commission
- New York State Energy Research and Development Authority
- North-West Energy-Efficiency Alliance
- Iowa Energy Center
- ExxonMobil Research & Engineering
- Rio Tinto
- World Business Council for Sustainable Development (WBCSD)
- Energy Conservation Management Board (Connecticut)
- Connecticut Light & Power
- United Illuminating (Connecticut)
- Electric Power Research Institute, USA
- Central Research Institute of the Electric Power Industry, Japan
- Eurelectric, Belgium
- Gasunie, The Netherlands
- Pacific Gas & Electric
- SEP, The Netherlands
- Energiened, The Netherlands
- Climate Works Foundation
- Energy Foundation, USA
- Elsevier Publishers B.V.

COMMITTEES

Scientific Committee *ERTC Energy Efficiency Conference*, Amsterdam, October 19th, 2010

Member Scientific Committee *European Meeting on Chemical Industry and Environment EMChIE VI*, Mechelen, Belgium, May 17-19th, 2010.

Author *Heiligendamm Plan of Action “Bringing Energy Efficiency to Scale”*

prepared for the G8 Summit, Heiligendamm, Germany, 2007, supported by United Nations Foundation, Washington, DC

Lead Author, IPCC Working Group III, *Fourth Assessment Report* (2004 - 2007)

Member *STAP Roster of Experts*, Scientific and Technical Advisory Panel, Global Environmental Facility, World Bank, United Nations Environmental Program (2003 - today).

Member Programme Committee *First European Conference on Energy Management*, Milan, Italy, November 23-24, 2005

Member International Scientific Committee, 7th Conference on *Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction* (PRES'04) Prague, Czech Republic, August 22-26, 2004.

Member International Scientific Committee, 6th Conference on *Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction* (PRES'03), Hamilton, ON, Canada, October 2003.

Panel Leader, *2003 ACEEE Summer Study on Energy Efficiency in Industry*, Rey Brook, NY, July 29th – August 1st, 2003.

Co-Chair of *2001 ACEEE Summer Study on Energy Efficiency in Industry*, Tarrytown, New York, July 24th-27th, 2001.

Steering Committee IEA International Workshop on “Technologies to Reduce Greenhouse Gas Emissions” Engineering-Economic Analyses of Conserved Energy and Carbon,” Washington, DC, May 5th – 7th, 1999.

Lead Author, IPCC Working Group III, *Third Assessment Report* (1998 – 2001).

Coordinating Lead Author, *IPCC Special Report on Methodological and Technological Issues Related to Technology Transfer*, 1997-1999.

Organizational Committee, *International Workshop on Industrial Energy Efficiency Policies: Understanding Success and Failure*, Utrecht, The Netherlands, June 11-12th, 1998.

Scientific Committee, *1998 Seoul Conference on Energy Use in Manufacturing: Energy Savings and CO₂ Mitigation Analysis*, Seoul, Korea, May 19th – 20th, 1998.

Author, IPCC Working Group III, Writing Team of the *Special Report on Emissions Scenarios*, 1996-1998.

Organizational Committee, *Workshop on Methodologies for International Comparisons of Industrial Energy Efficiency*, Vancouver, BC, Canada, April 1st – 2nd, 1996.

Author World Energy Council, Project 3, Working Group A, Preparation for the World Energy Conference, held in Tokyo, 1995.

Organizational Committee, *Workshop on International Comparisons of Energy Efficiency*, Berkeley, CA, March 6th – 9th, 1994

Member Roster of Experts African Energy Policy Research Network (AFREPREN)

Member Industrial Subcommittee International Performance Measurement & Verification Protocol

Reviewer for promotion of Dr. D.R. Carroll to Professor of Basic Engineering, University of Missouri, Rolla, MO, USA

EDITORIAL BOARDS

Editor-in-Chief *Resources, Conservation and Recycling* 1998 - today.

Editorial Board Member *Resources, Conservation and Recycling*, 1995 -1998

Associate editor *Energy, the International Journal* 1995 - today.

Editorial Board *Waste Management*, 2002 – today

Associate Editor *Energy Efficiency*, 2010 - today

Associate Editor *Encyclopedia of Energy*, Academic Press

Editorial Board *Dictionary of Energy*, Elsevier, 2004 – 2005

Editorial Board Global Handbook of Environmental Pollution, Springer, 2006 - today

TEACHING

Teaching of academic courses in energy efficiency at Utrecht University, The Netherlands and University of Sao Paulo, Brazil. Preparation of course material and teaching.

Management and coordination of the track ‘Energy & Resources’ in the Master program “Sustainable Development” at Utrecht University.

Energy & Resources Policies, Masters Program, Utrecht University

Chemistry & Society I, undergraduate and Masters Program, Utrecht University

Chemistry & Society III, Masters Program Utrecht University

Energy & Environment, Section on Energy Efficiency, Masters Program, Utrecht University

Science and Innovation Management, Section on Energy Efficiency, Undergraduate Program, Utrecht University

Industrial Energy Use, Graduate Program, University of Sao Paulo (full graduate course)

POST-DOCTORAL AND DISSERTATION ADVISEES

Lex Roes. Ex-Ante Life Cycle Engineering. Utrecht University, The Netherlands, PhD Thesis (2011).

Wina Graus. Power of Efficiency: International Comparisons of Energy Efficiency and CO₂ Emissions of Fossil-based Power Generation. Utrecht University, The Netherlands, PhD Thesis (2010).

Lonneke Tabak. The synergy between electric mobility and renewable energy
The role of the electric car in future scenarios. Utrecht University, The Netherlands. MSc Thesis (2010).

Spyros Bousios. Increasing the Efficiency in Packaging Material Chains: The Nordic Policy Experience. Utrecht University, The Netherlands. MSc Thesis (2010).

Thodoris Zafeiris. Global CO₂ abatement potential in the pulp and paper industry up to 2030. Utrecht University, The Netherlands. MSc Thesis (2010).

Katerina Kermeli. Global CO₂ and PFCs abatement potential in the aluminium industry up to 2030. Utrecht University, The Netherlands. MSc Thesis (2010).

Gerhard Schoonvelde. Constructing energy efficient dwellings in the Netherlands: The effect of energy efficiency measures through the lifecycle of a dwelling. Utrecht University, The Netherlands. MSc Thesis (2010).

Dirk Haringa. The Potential for Micro-Generation in the Domestic Sector of The Netherlands. Utrecht University, The Netherlands. MSc Thesis (2010).

Nick Dessens, Sectoral Emission Reductions: A South Africa Power Sector Case Study. Utrecht University, The Netherlands. MSc Thesis (2009).

Tijs Langeveld. Exploring Pathways to a Low-Carbon Cement Industry. Utrecht University, The Netherlands. MSc Thesis (2009).

Frank Rietdijk Is Second Hand Best? The Export of Second-Hand Industrial Equipment and the Impact on Energy Efficiency. Utrecht University, The Netherlands. MSc Thesis (2009).

Mariëlle Corsten. Global CO₂ Abatement Potential in the Iron and Steel Industry up to 2030. Utrecht University, The Netherlands. MSc Thesis (2009)

Magda Rouw. Evaluating the Packaging Material Impacts of Packaging Policy in The Netherlands. Utrecht University, The Netherlands. MSc Thesis (2009).

Patrick Defaix. The Potential for Solar Electricity Production in the EU-27. Utrecht University, The Netherlands. MSc Thesis (2009)

Linda Klemisch, Life-Cycle Analysis of the Impact of Paper Recycling on CO₂ Emissions using Black Liquor Gasification. Högskolan Dalarna, Sweden, Bachelor's Thesis (2004).

Cathy Green, San Francisco Energy Efficiency Analysis. California State University at Hayward, California, USA, MSc Thesis (2004).

Sara Farahani, Is CO₂-Free Paper Possible? Högskolan Dalarna, Sweden, Bachelor's Thesis (2003).

Gijs Biermans, Energy Efficiency Policy Modeling for the Steel Industry. Utrecht University, Utrecht, The Netherlands, MSc Thesis (2002).

Sergei Levchenko, Integrated Resource Planning for Economies in Transition. Luikov Heat and Mass Transfer Institute, Belarus Academy of Sciences, Belarus, Post-Doctoral (2002).

Louis Joosten, The Industrial Metabolism of Plastics. Utrecht University, The Netherlands, Ph.D. Thesis (2001).

Yeonbae Kim, Decomposition Analysis of CO₂ Emission Trends Using Physical Indicators. Seoul National University, Korea, Post-Doctoral (2001).

Marko P. Hekkert, Improving Material Management to Reduce Greenhouse Gas Emissions. Utrecht University, The Netherlands, Ph.D. Thesis (2000).

Jack Ihle, Life-Cycle Analysis of Wind and Biomass Energy Systems. University of California at Berkeley, California, USA, MSc Thesis (2000).

Martin Patel, Closing Carbon Cycles. Utrecht University, The Netherlands, Ph.D. Thesis (1999).

Marcio Macedo Costa, Exergy Analysis and Environmental Performance in the Steel Industry. Federal University of Rio de Janeiro, Brazil, Ph.D. Thesis (1999).

Giovani Machado, Greenhouse Gas Emissions and International Trade using I/O

Analysis. Federal University of Rio de Janeiro, Brazil, Ph.D. Thesis (1999).

Leticia Ozawa Meida, Indicators for Energy Efficiency in Industry. Autonomous University of Mexico, Mexico, MSc Thesis (1998).

Jeff S. Chen, The Production of Methanol and Hydrogen Fuels from Municipal Solid Waste. Princeton University, NJ, USA, MSc Thesis (1995).

Dian J.M. Phylipsen, Function Directed Optimisation of Plastics Use (in Dutch). Utrecht University, MSc Thesis (1993).

Berry Meuleman, Energy Savings Through More Efficient Use of Fertilizers (in Dutch). Utrecht University, The Netherlands, MSc Thesis (1993).

REFEREE

Regular referee of manuscripts submitted for publication to:

Ambio

Applied Energy

Atmospheric Environment

Climate Policy

Energy, the International Journal

Energy Efficiency

Energy Journal

Energy Policy

Journal of Environmental Management

Journal of Industrial Ecology

Journal of Policy Analysis & Management

Journal of Energy Technology and Policy

Journal of Wine Research

Mitigation and Adaptation Strategies for Global Change

Proceedings National Academy of Sciences (PNAS)

Resources, Conservation and Recycling

Waste management

World Development

PUBLICATIONS – REFEREED ARTICLES IN JOURNALS AND BOOKS

79. Julian Allwood; Michael F. Ashby; Timothy G. Gutowski; Ernst Worrell. “Material Efficiency: a white paper” *Resources, Conservation & Recycling* **55**: 362–381 (2011).
78. W. Graus and E. Worrell. “Methods to calculate CO₂ intensity of power generation and consumption; a global perspective” *Energy Policy* **39**: 613–627 (2011).
77. W. Graus, M. Roglieri, P. Jaworsky, L. Alberio and E. Worrell. The promise of CCS: evaluating capture-readiness of new EU fossil fuel power plants. *Climate Policy* **11**: 789-812 (2011).
76. Li Shen, Ernst Worrell, Martin K. Patel. “Environmental impact assessment of man-made cellulose fibres” *Resources, Conservation and Recycling* **55**: 260–274 (2010).
75. Li Shen, Ernst Worrell, and Martin K. Patel. “Open-loop recycling: A LCA case study of PET bottle-to-fibre recycling” *Resources, Conservation & Recycling* **55**: 34–52 (2010).
74. Jobien Laurijssen, Frans J. De Gram, Ernst Worrell and Andre Faaij. “Short-term energy efficiency optimization measures in conventional multi-cylinder dryers in the paper industry” *Energy, the International Journal* **35**: 3738-3750 (2010).
73. Luis Munduca, Lena Neij, Ernst Worrell, and Michael McNeil. “Evaluating Energy Efficiency Policies with Energy-Economic Models” *Annual Review of Energy & Resources* **35**: 305–44 (2010)..
72. Jobien Laurijssen, Marc Marsidi, Annita Westenbroek, Ernst Worrell and Andre Faaij. “Paper and Biomass for Energy? The Impact of Paper Recycling on Biomass Availability, Energy and CO₂ Emissions” *Resources, Conservation & Recycling* **54**: 1208–1218 (2010).
71. Jonathan Koomey, Hashem Akbari, Carl Blumstein, Marilyn Brown, Richard Brown, Chris Calwell, Sheryl Carter, Ralph Cavanagh, Audrey Chang, David Claridge, Paul Craig, Rick Diamond, Joseph H Eto, William Fulkerson, Ashok Gadgil, Howard Geller, José Goldemberg, Chuck Goldman, David B Goldstein, Steve Greenberg, David Hafemeister, Jeff Harris, Hal Harvey, Eric Heitz, Eric Hirst, Holmes Hummel, Dan Kammen, Henry Kelly, Skip Laitner, Mark Levine, Amory Lovins, Gil Masters, James E McMahon, Alan Meier, Michael Messenger, John Millhone, Evan Mills, Steve Nadel, Bruce Nordman, Lynn Price, Joe Romm, Marc Ross, Michael Rufo, Jayant Sathaye, Lee Schipper, Stephen H Schneider, James L Sweeney, Malcolm Verdict, Diana Vorsatz, Devra Wang, Carl Weinberg, Richard Wilk, John Wilson and Ernst Worrell. “Defining a standard metric for electricity savings” *Environmental Research Letters* **5** 041017, 10pp (2010).
70. Li Shen, Ernst Worrell and Martin K Patel. “Present and future development in plastics from biomass” *Biofuels, Bioproducts & Biorefining* **4**: 25 – 40 (2010).
69. Ernst Worrell “Energy Without Boundaries?” in: Graedel, T. and E. van der Voet (eds.). 2009. *Linkages of Sustainability*. Strüngmann Forum Report, Vol. 4. Cambridge, MA: MIT Press (pp. 375-388)

68. Andreas Löschel, Mark Delucchi, Trevor N. Demayo, Donald L. Gautier, David Greene, John Johnston, Joan Ogden, Steve Rayner, and Ernst Worrell “Energy: Stocks, Flows, and Prospects” in: Graedel, T. and E. van der Voet (eds.). 2009. Linkages of Sustainability. Strüngmann Forum Report, Vol. 4. Cambridge, MA: MIT Press (pp.398-420).
67. Wina Graus, Ernst Worrell. Trend in efficiency and capacity of fossil power generation in the EU. *Energy Policy* **37**: 2147-2160 (2009).
66. Ernst Worrell, Lenny Bernstein, Joyashree Roy, Lynn Price, Jochen Harnisch. “Industrial Energy Efficiency and Climate Change Mitigation” *Energy Efficiency* **2**: 109-123 (2009).
65. Wina Graus a and Ernst Worrell. “The Principal Agent Problem and Transport Energy Use: Case Study of Company Lease Cars in the Netherlands.” *Energy Policy* **10** **36**: 3745-3753.
64. Vlasis Oikonomou, Martin Patel and Ernst Worrell. “Spillover Impacts of Climate Policy on Energy-Intensive Industry” In: B. Hansjürgens and R. Antes (Eds.) Economics and Management of Climate Change. Springer, New York, NY, pp.65-78.
63. W.H.J. Graus and E. Worrell. Effect SO₂ and NO_x Control on Energy Efficiency Power Generation. *Energy Policy* **7** **35** pp.3898-3908 (2007)
62. W. Graus, M. Voogt and E. Worrell. International Comparison of Energy Efficiency of Power Generation. *Energy Policy* **7** **35** pp.3936-3951 (2007).
61. Vlasis Oikonomou, Martin Patel and Ernst Worrell. Climate Policy: Bucket or Drainer? *Energy Policy* **18** **34** pp.3656-3668 (2006).
60. Lynn Price, Christina Galitsky and Ernst Worrell. “Industry” in Future Electricity Technologies and Systems. T. Jamasb, W.J. Nuttall, and M.G. Pollitt (Eds.). Cambridge University Press, Cambridge, United Kingdom, 2006.
59. Ernst Worrell and Lynn Price. “An Integrated Benchmarking and Energy Savings Tool for the Iron and Steel Industry, *International Journal of Green Energy* **2** **3** pp.117-126 (2006).
58. C.A Ramírez and E. Worrell. “Feeding Fossil Fuels to the Soil. An Analysis of Energy Embedded and Technological Learning in the Fertilizer Industry.” *Resources, Conservation & Recycling* **1** **46** pp.75-93 (2006).
57. Sara Farahani, Ernst Worrell, Göran Bryntse. “CO₂ Free Paper?” *Resources, Conservation & Recycling* **42** pp.317-336 (2004).
56. Ernst Worrell and Gijs Biermans. “Move Over! Stock Turnover, Retrofit and Industrial Energy Efficiency.” *Energy Policy* **7** **33** pp.949-962 (2005).
55. L.Price, E. Worrell, and J. Sinton. “Designing Energy Conservation Voluntary Agreements for the Industrial Sector in China: Experience from a Pilot Project with Two Steel Mills in Shandong Province,” The Handbook of Environmental Voluntary Agreements, E. Croci, ed., Springer, Dordrecht, The Netherlands (2005).

54. Ernst Worrell, Stephan Ramesohl and Gale Boyd. "Advances in Energy Forecasting Models based on Engineering-Economics." *Annual Review of Energy and Resources* **29** pp. 345-381 (2004).
53. Ernst Worrell. Cement and Energy. In: C. Cleveland et al. (Eds). Encyclopedia of Energy – Volume 1, pp.307-315, Elsevier, Amsterdam, 2004.
52. Ernst Worrell. Industrial Energy Use, Status and Trends. In: C. Cleveland et al. (Eds). Encyclopedia of Energy – Volume 3, pp.395-406, Elsevier, Amsterdam, 2004.
51. Ernst Worrell. Recycling of Metals. In: C. Cleveland et al. (Eds). Encyclopedia of Energy – Volume 5, pp.245-252, Elsevier, Amsterdam, 2004.
50. Ernst Worrell, John A. Laitner, Michael Ruth and Hodayah Finman. Productivity Benefits of Industrial Energy Efficiency Measures. *Energy, the International Journal* **11** **28** pp.1081-1098 (2003).
49. Yeonbae Kim and Ernst Worrell. CO₂ Emission Trends in the Cement Industry: An International Comparison. *Mitigation and Adaptation Strategies for Global Change* **2** **7** pp.115-133 (2002).
48. Marko P. Hekkert, Jon van den Reek, Ernst Worrell and Wim C. Turkenburg, "The Impact of Material Efficient End-Use Technologies on Paper Use and Carbon Emissions" *Resources, Conservation & Recycling* **3** **36** pp.241-266 (2002).
47. Yeonbae Kim and Ernst Worrell, "International Comparison of CO₂ Emission Trends in the Iron and Steel Industry" *Energy Policy* **10** **30** pp.827-838 (2002).
46. D. Phylipsen, K. Blok, E. Worrell, J. de Beer, "Benchmarking the Energy Efficiency of Dutch Industry: An Assessment of the Expected Effect on Energy Consumption and CO₂ Emissions" *Energy Policy* **8** **30** pp 663-679 (2002).
45. L. Price, J. Sinton, E. Worrell, D. Phylipsen, H. Xiulian and L. Ji, "Energy use and Carbon Dioxide Emissions from Steel Production in China" *Energy, the International Journal* **5** **27** pp. 429-446 (2002).
44. Ernst Worrell, Nathan Martin, Lynn Price, Michael Ruth, Neal Elliott, Anna Shipley and Jennifer Thorn, "Emerging Energy Efficient Technologies for Industry" *Energy Engineering Journal* **2** **99** pp.36-55 (2002).
43. Leticia Ozawa, Claudia Sheinbaum, Nathan Martin, Ernst Worrell and Lynn Price, "Energy Use and CO₂ Emissions in Mexico's Iron and Steel Industry," *Energy, the International Journal* **3** **27** pp.225-239 (2002).
42. Marko Hekkert, Dolf Gielen, Ernst Worrell, and Wim Turkenburg "Wrapping Up GHG Emissions: An Assessment of Greenhouse Gas Emission Reduction Related to Efficient Packaging Use" *Journal of Industrial Ecology* **1** **5** pp.55-75 (2001).
41. Christina Galitsky, Nathan Martin, and Ernst Worrell, "Energy Efficiency Opportunities for United States Breweries," *MBAA Technical Quarterly* **4** **38** pp.189-198 (2001).

40. Giovanni Machado, Roberto Schaeffer, and Ernst Worrell, "Energy and Carbon Embodied in the International Trade of Brazil: An Input-Output Approach, *Ecological Economics* 3 **39** pp.409-424 (2001).
39. Tessa Goverse, Marko P. Hekkert, Peter Groenewegen, Ernst Worrell and Ruud E. H. M. Smits, "Wood Innovation in the Residential Construction Sector; Opportunities and Constraints," *Resources, Conservation and Recycling* 1 **34** pp.53-74 (2001).
38. Ernst Worrell, Lynn Price, Nathan Martin, Chris Hendriks, Leticia Ozawa Meida, "Carbon Dioxide Emissions from the Global Cement Industry," *Annual Review of Energy and the Environment* **26**, pp.203-229 (2001).
37. Ernst Worrell, Lynn Price, and Michael Ruth, "Policy Modeling for Energy Efficiency Improvement in U.S. Industry," *Annual Review of Energy and the Environment* **26**, pp. 117-143 (2001).
36. Ernst Worrell and Lynn Price, "Policy Scenarios for Energy Efficiency Improvement in Industry," *Energy Policy* 14 **29**, pp.1223-1241 (2001).
35. E. Worrell, N. Martin and L. Price, "Energy Efficiency and Carbon Dioxide Emissions Reduction Opportunities in the U.S. Iron and Steel Industry," *Energy, the International Journal* 5 **26** pp.513-536 (2001).
34. M.M. Costa, R. Schaeffer, E. Worrell, "Exergy Accounting of Energy and Materials Flows in Steel Production Systems," *Energy, the International Journal* 4 **26** pp. 363-384 (2001).
33. Ernst Worrell "Manufacturing" in: John Zumerchik (Ed.), "Macmillan Encyclopedia of Energy" MacMillan Reference USA, New York, NY (2001).
32. E. Worrell, N. Martin and L. Price, "Potentials for Energy Efficiency Improvement in the U.S. Cement Industry," *Energy, the International Journal* 12 **25** pp. 1189-1214 (2000).
31. M. Patel, N. von Thienen, E. Jochem, E. Worrell, "Carbon Use for Synthetic Materials in Germany - Current Situation and Saving Potentials for Energy and CO₂," *Resources, Conservation & Recycling* 1 **31** pp. 9-50 (2000).
30. E. Worrell, R. van Berkel, Z. Fengqi, C. Menke, R. Schaeffer, R. O. Williams, "Technology Transfer of Energy Efficient Technologies in Industry: a Review of Trends and Policy Issues," *Energy Policy* 1 **29** pp. 9-43 (2000).
29. L.A.J. Joosten, M.P. Hekkert, E. Worrell, "Assessment of the Plastic Flows in The Netherlands using STREAMS," *Resources, Conservation & Recycling* 2 **30** pp.135-161 (2000).
28. M.P. Hekkert, L.A.J. Joosten, E. Worrell, "Analysis of the Paper and Wood Flow in The Netherlands," *Resources, Conservation & Recycling* 1 **30** pp.29-48 (2000).
27. M.P. Hekkert, L.A.J. Joosten and E. Worrell, "Reduction of CO₂ Emissions by Improved Management of Material and Product Use: The Case of Transport

- Packaging,” *Resources, Conservation & Recycling* 1 **30** pp.1-27 (2000).
26. M. Patel, N. von Thienen, E. Jochem, E. Worrell, “Recycling of plastics in Germany” *Resources, Conservation & Recycling* 1-2 **29** pp.65 – 90 (2000).
 25. M.P. Hekkert, L.A.J. Joosten, E. Worrell, W.C. Turkenburg, “Reduction of CO₂ Emissions by Improved Management of Material and Product Use: the Case of Primary Packaging” *Resources, Conservation & Recycling* 1-2 **29** pp.33-64 (2000).
 24. J-W. Velthuijsen and E. Worrell, “The Economics of Energy,” in: J.C.J.M. van den Bergh (Ed.), Handbook of Environmental and Resource Economics, Edward Elgar Publishers, Cheltenham, UK, 1999.
 23. M. Patel, E. Jochem, F. Marscheider, and E. Worrell, “CO₂ Emissions from Nonenergy Use – Methodological Aspects and a Case Study for Germany,” *AMBIO* 2 **28** pp.175-181 (1999).
 22. M.K. Patel, A. Thiess and E. Worrell, “Surfactant Production and Use in Germany: Resource Requirements and CO₂ Emissions,” *Resources, Conservation and Recycling* 1 **25** pp.61-78 (1999).
 21. C.A. Hendriks, J-W. Velthuijsen, E. Worrell, and K. Blok, “The Case of Combined Heat and Power in the European Union” in: F. Convery (ed.) “A Guide to Policies for Energy Conservation: The European Experience” Edgar Elgar Publishing Ltd., Cheltenham, Glos, UK, 1998.
 20. Lynn Price, Laurie Michaelis, Ernst Worrell and Marta Khrushch “Sectoral Trends and Driving Forces of Global Energy Use and Greenhouse Gas Emissions” *Mitigation and Adaptation Strategies for Global Change* **3** pp.263-319 (1998).
 19. Jeroen de Beer, Ernst Worrell, Kornelis Blok, “Future Technologies for Energy Efficient Iron and Steelmaking” *Annual Review of Energy and the Environment* **23** pp.123-205 (1998).
 18. M.K. Patel, E. Jochem, P. Radgen, and E. Worrell, “Plastic Streams in Germany – An Analysis of Production, Consumption and Waste Generation,” *Resources, Conservation and Recycling* 3-4 **24** pp.191-215 (1998).
 17. A.P.C. Faaij, M.P. Hekkert, E. Worrell, A.J. van Wijk “Optimization of the Final Waste Treatment System in The Netherlands” *Resources, Conservation & Recycling* **22** pp.47-82 (1998).
 16. J.G. de Beer, E. Worrell and K. Blok, “Long-Term Energy-Efficiency Improvements in the Paper and Board Industry”, *Energy, the International Journal* 1 **23** pp.21-42 (1998).
 15. E. Worrell, L. Price, N. Martin, J. Farla, and R. Schaeffer, “Energy Intensity in the Iron and Steel Industry: A Comparison of Physical and Economic Indicators”, *Energy Policy* 7-8 **25** pp.727-744 (1997).
 14. G.J.M. Phylipsen, K. Blok and E. Worrell “International Comparisons of Energy Efficiency: Methodologies for the Manufacturing Industry”, *Energy Policy* 7-8 **25** pp.715-725 (1997).

13. E.D. Larson, E. Worrell and J.S. Chen, "Clean Fuels from Municipal Solid Waste for Fuel Cell Buses in Metropolitan Areas", *Resources, Conservation & Recycling* 4 **17** pp.273-298 (1996).
12. J.G. de Beer, E. Worrell, K. Blok, "Sectoral Potentials for Energy Efficiency Improvements in The Netherlands", *International Journal of Global Energy Issues* 5/6 **8** pp.476-491 (1996).
11. Jeroen de Beer, Ernst Worrell, Kornelis Blok "Long Term Energy Efficiency Improvement" *Studies in Environmental Science* **65** pp.1081-1086 (1995).
10. E. Worrell, "Advanced Technologies and Energy Efficiency in the Iron and Steel Industry in China", *Energy for Sustainable Development* 4 **2** pp.27-40 (1995).
9. E. Worrell, B. Meuleman and K. Blok, "Energy Savings by Efficient Application of Fertilizer", *Resources, Conservation & Recycling* 3/4 **13** pp.233-250 (1995).
8. E. Worrell, A.P.C. Faaij, G.J.M. Phylipsen and K. Blok, "An Approach for Analysing the Potential for Material Efficiency Improvement", *Resources, Conservation & Recycling* 3/4 **13** pp.215-232 (1995).
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PRESENTATIONS (SELECTED)

70. Een Systeembenadering voor Efficiënte Motoren in Industrie. *Agentschap NL*, Utrecht, April 28th, 2010 (invited).
69. The Next Frontier in Energy Efficiency, *P3-Conference*, Dortmund, Germany, April 12-13th, 2010 (keynote speaker).
68. Afval: Grondstof of Brandstof? De Bijdrage van de Afvalsector aan Emissiereducties van Broeikasgassen – Een Verkennende Studie. *Themadag NVRD*, March, 31st, 2010 (invited).
67. Setting your mind to Energy Efficiency. *Climate Neutral Utrecht 2040*, Utrecht, February 4-6th, 2010 (invited).
66. Unleashing the Yellow Giant: The Central Role of Industrial Energy Efficiency in China. “China: Leading the Global Energy Transition?” Clingendael Institute, The Hague, November 18th, 2009 (invited).
65. Energy Efficiency Opportunities in the U.S. Iron and Steel Industry. *2009 World Energy Engineering Congress*, Washington, DC, November 4-6th, 2009.
64. Strategic Energy Management in Petroleum Refining at a Challenging Time. *Strategic Refinery Management, Maintenance and Optimisation*, Prague, September 17-18th, 2009 (keynote speaker).
63. Climate Change: The Key Role of Energy Efficiency. *9th International Vacuum Insulation Symposium, London*, September 17-18th, 2009 (keynote speaker).
62. Het Juiste Klimaat voor Ketenbeheer. *Roadmap Workshop MJA-3 Overige Industrie*, NedCar, Born, June 25th, 2009 (invited).
61. Obesitas en Energie: Naar een Efficiënt Gebruik van Grondstoffen. Oratie, Universiteit Utrecht, 29 april 2009
60. Industry and Climate Change: The Role of Energy Efficiency. *5th European Conference Economics and Management of Energy in Industry*, Vilamoura, Portugal, April 14-17th, 2009 (keynote lecture).
59. European Energy Efficiency Standards & Trends. *World Energy Engineering Congress*, Washington, DC, October 1-4th, 2008 (invited)..
58. Benchmarking bij Allocatie van Emissierechten: Een goede Optie voor Fase 3 van de Emissiehandel. *Het Nationale CO₂ Platform*, Ridderkerk, The Netherlands, September 17-18th, 2008 (invited).
57. Setting Your Mind to Energy Efficiency. *Improving Energy Efficiency in Papermaking*, Hoofddorp, The Netherlands, June 9-11th, 2008 (invited).
56. Benchmarking and Best Practices. *Cement Energy Efficiency Workshop*, International Energy Agency/World Business Council for Sustainable Development, Paris, September 4-5th, 2006 (invited).

55. Energy Efficiency, CO₂ Emissions, and the Potential for Reduction for the Cement Industry, *Cement Energy Efficiency Workshop*, International Energy Agency/World Business Council for Sustainable Development, Paris, September 4-5th, 2006 (invited).
54. Vraagvermindering door Energie Efficiency. *Bijeenkomst VerkenningCommissie Energie Onderzoek*, NWO, Amsterdam, July 16th, 2006 (invited).
53. Motor Systems in U.S. Industry, *Industrial Electric Motor Systems Workshop*, International Energy Agency, Paris, May 15-16th, 2006 (invited).
52. Energy Efficiency – An Overview. *Workshop Enhancing Papermaking through Better Energy Usage*. Vienna, February 22nd-24th, 2006 (invited).
51. Energy Management. *Workshop Enhancing Papermaking through Better Energy Usage*. Vienna, February 22nd-24th, 2006 (invited).
50. Geschakeld Geheel: Een Oefening in Ketenefficiency. *Conference Energie in Beweging*, Utrecht, November 28th, 2005 (invited).
49. Material Flows and Carbon Cycles. *American Geophysical Union Fall Meeting*, San Francisco, December 8th – 12th, 2003 (invited).
48. “Energy Star Guides: Making Use of the Energy Guide for Corn Wet Milling Plants.” *Annual Energy Star Corn Wet Milling Focus Meeting*, Washington, DC, December 2nd, 2003 (invited).
47. “Energy Star Guides: Making Use of the Energy Guide for Auto Assembly Plants.” *Annual Energy Star Auto Assembly Focus Meeting*, General Motors World Headquarters, Detroit, MI, September 26th, 2003 (invited).
46. “Towards Increased Policy Relevance in Energy Modeling.” *2003 ACEEE Summer Study on Energy Efficiency in Industry*, Rye Brook, NY, July 29th – August 1st, 2003.
45. “Emerging Energy-Efficient Industrial Technologies.” *Summer Committee Meetings National Association of regulatory Utility Commissioners (NARUC)*, Denver, CO, July 27-30, 2003 (invited).
44. “Evaluating Energy-Efficiency Policy: Lessons Learned.” *2003 Annual Conference Asia-Pacific Energy Research Center*, Tokyo, February 26-27, 2003 (invited).
43. “Modeling Policies in the Clean Energy Futures Study” *INEDIS/EETA International Workshop on Policy Modeling for Industrial Energy Use*, Seoul, Republic of Korea, November 7-8, 2002.
42. “Towards Improved Policy Relevance in Engineering-Economic Analysis” *INEDIS/EETA International Workshop on Policy Modeling for Industrial Energy Use*, Seoul, Republic of Korea, November 7-8, 2002.
41. “Energy Efficiency Opportunities for the Wet Corn Milling Industry” *Meeting Corn Refiners Association*, Chicago O’Hare (Rosemont), September 26th, 2002

40. "Energy Efficiency Opportunities for Vehicle Assembly Plants" *Energy Star Focus Meeting*, Washington, DC, June 20th, 2002,
39. "Energy Efficiency Opportunities for Breweries" *Energy Star Focus Meeting*, Washington, DC, June 18th, 2002
38. "Energy Efficiency Opportunities in the Brewery Industry" *24th National Industrial Energy Technologies Conference*, Houston, TX, April 16-19, 2002.
37. "The New California Climate Action Registry: Development of Methodologies for Calculating Electricity Related Greenhouse Gas Emissions" *Earth Technologies Forum*, Washington DC, March 24 – 27, 2002.
36. "Reaching Beyond Obvious Investments" *Earth Technologies Forum*, Washington DC, March 24 – 27, 2002 (invited).
35. "Emerging Energy-Efficient Industrial Technologies", *California Energy Commission*, Sacramento, CA, February 20th, 2002 (invited).
34. "Evaluating GHG Emission Reduction Projects in Industry Using a Multi-Project Baseline" *Workshop on Baseline Quantification Methodologies for Climate Change Mitigation Projects*, Berkeley, CA, September 10-12, 2001 (invited).
33. "Technology Directions in Industry: A Brief Survey" *3rd Energy Scenarios Workshop*, Energy Research Institute, Beijing, China, August 22nd-24th, 2001 (invited).
32. "Emerging Energy-Efficient Technologies for Industry," *2001 ACEEE Summer Study on Energy Efficiency in Industry*, Tarrytown, NY, July 24-27th, 2001.
31. "Steam Systems in Industry: Energy Use and Energy Efficiency Improvement Potentials," *2001 ACEEE Summer Study on Energy Efficiency in Industry*, Tarrytown, NY, July 24-27th, 2001.
30. "Incorporating the Productivity Benefits into the Assessment of Cost Effective Energy Savings Potential Using Conservation Supply Curves," *2001 ACEEE Summer Study on Energy Efficiency in Industry*, Tarrytown, NY, July 24-27th, 2001.
29. "Potential Impacts of Energy Efficiency Policies in the U.S. Industry: Results from the Clean Energy Futures Study," *2001 ACEEE Summer Study on Energy Efficiency in Industry*, Tarrytown, NY, July 24-27th, 2001 (invited).
28. "Barriers and Opportunities: A Review of Selected Successful Energy-Efficiency Programs," *2001 Industrial Energy Technology Conference*, Houston, TX, May 1-4, 2001 (invited).
27. "Emerging Energy-Efficient Technologies for Industry," *Proceedings 2001 Industrial Energy Technology Conference*, Houston, TX, May 1-4, 2001.
26. "Opportunities to Improve Energy Efficiency in the U.S. Pulp and Paper Industry," *Paper Machine Technology 2001*, February 7-8, 2001, Lanaken, Belgium (invited).
25. "Emerging Energy-Efficient Technologies in Industry" *Earth Technologies Forum*,

Washington, DC, October 30th – November 1st, 2000 (invited).

24. “Emerging Energy-Efficient Technologies in Industry” *Fall Meeting Association of State Energy Research and Technology Transfer Institutions* Bolton Landing, NY, October 18-20, 2000 (invited).
23. “New Energy Efficient Technologies in Industry” *Air Pollution Prevention Forum*, Western Regional Air Partnership, San Francisco, May 31st – June 1st, 2000 (invited).
22. “Cooling Companies: Potentials and Policies for Energy Efficiency in Industry,” *Energy Colloquium, Energy and Resources Group, University of California Berkeley*, Berkeley, CA, September 8, 1999 (invited).
21. “Energy Efficiency Research at Lawrence Berkeley National Laboratory,” *Financing Technology: The Bottom Line on Manufacturing Efficiency*, Oakland, CA, June 28, 1999 (invited).
20. “Scenarios of Carbon Emissions Reductions for the U.S. Industrial Sector,” *1999 ACEEE Summer Study on Energy Efficiency in Industry*, Saratoga Springs, NY, June 15-18, 1999.
19. “Energy Use in the Chemical Process Industry” *Workshop on Carbon Reduction Technology Opportunities for the Chemical Process Industry*, Baltimore, MD, 3-4 March 1999 (invited).
18. “Energy Efficiency Technologies and Measures for the U.S. Iron and Steel Industry,” *Technology Review Workshop for the Iron and Steel Industry*, Washington, DC, 11 February 1999 (invited).
17. “Energy Efficiency Opportunities in Electric Arc Steelmaking” *56th Electric Furnace Conference*, New Orleans, LA, November 15 – 18, 1998 (invited).
16. “Industrial Energy Use” *1998 Director’s Review of the Environmental Energy Technologies Division*, Ernest Orlando Lawrence Berkeley National Laboratory, October 7, 1998, Berkeley, CA (invited).
15. “Energy Intensity Indicators for Industry and Energy Efficiency Improvement Options” *APERC Workshop on Energy Efficiency Indicators in Industry*, September 21-22, 1998, Tokyo, Japan (invited).
14. “Establishment of APEC Network on Energy Efficiency Indicators for Industry” *APERC Workshop on Energy Efficiency Indicators in Industry*, September 21-22, 1998, Tokyo, Japan (invited).
13. “Beyond Indicators” *International Workshop on Industrial Energy Efficiency Policies: Understanding Success and Failure*, INEDIS, International Network of Energy Demand Analysis in the Industrial Sector, Utrecht, The Netherlands, 11-12 June 1998.
12. “Evaluating Potentials for Energy Efficiency Improvement: Experiences with Bottom Up Modelling in The Netherlands” *1998 Seoul Conference on Energy Use in Manufacturing: Energy Savings and CO₂ Mitigation Policy Analysis*, Korea Energy Economics Institute/Korea Resource Economics Association, Seoul, Korea, 19-20 may 1998 (invited).

11. “Energy Efficient Technologies in the Cement and Steel Industry - Experiences in Developing Countries” *Workshop on Technology Transfer and Innovation in the Energy Sector*, STAP, GEF, UNEP, 19-20 January 1998, Amsterdam, The Netherlands (invited).
10. “Monitoring of Energy Efficiency Improvements in The Netherlands 1980 –1994” *18th Annual North American Conference, United States Association of Energy Economics*, San Francisco, CA, September 7 –10, 1997.
9. “Energy Efficiency and Advanced Technologies in the Iron and Steel Industry” *1997 ACEEE Summer Study on Energy Efficiency in Industry*, Saratoga Springs, NY, July 8 – 11, 1997.
8. “International Energy Efficiency Comparisons and Policy Implications in the Iron and Steel Industry” 1997 ECEEE Summer Study “The Energy Efficiency Challenge” Spindleruv Mlyn, Czech Republic, June 9 –14, 1997
7. “Potentials and Policies to Improve Energy Efficiency” *Europhysics Study Conference on Economy – Energy – Entropy*, Geneva, May 10 –13, 1996 (invited).
6. “Potentials and Policy Implications of Energy and Material Efficiency Improvement” United Nations Division for Sustainable Development, United Nations Headquarters, New York, NY, February 1996 (invited).
5. “International Comparison of Energy Efficiency Improvement in the Cement Industry” *1995 ACEEE Summer Study on Energy Efficiency in Industry*, Grand Island, NY, August 1- 4, 1995.
4. “Advanced Technologies and Energy Efficiency in the Iron and Steel Industry in China” *China Council on International Cooperation and Economic Development Workshop on Demonstration Projects*, Beijing, China, May 1995.
3. “Changes in Energy Intensity and Energy Efficiency: Manufacturing, Other Industry and the Transformation Sector” *International Workshop on International Comparisons of Energy Efficiency*, Berkeley, CA, March 6-9, 1994.
2. “Energy Conservation in the Iron and Steel Industry” *International Conference on Energy Efficiency and Process Technology*, Athens, Greece, October 19 –22, 1992.
1. “A Tool for the Assessment of Industrial Energy Conservation Policy” *UN-ECE Symposium on Energy Efficiency Measures in Industry*, Bled, Slovenia, September 30 – October 4, 1991.