

Jun-Ki Choi

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SUMMARY My research background focuses on designing sustainable energy systems with the consideration of economic, environmental, and social performance of complex systems. My analytical skill is multidisciplinary and multi-scale in the sense that I am interested in tackling problems in designing integrated industrial product/process systems and macroeconomic energy/environmental policy with respect to sustainability. Although I have fundamental knowledge about designing mechanical engineering systems, my research projects and consulting activities are also closely related to research areas in industrial systems engineering and business strategic management.

IMMIGRATION STATUS Permanent Resident, USA

CITIZENSHIP South Korea

EXPERTISE Sustainable Systems Design

- *Industry level analysis*
Sustainable manufacturing/ Energy efficiency
Design for environment/ Life cycle assessment
Multi-criteria optimization/ Decision analysis
Photovoltaics /Automotive recycling planning
Design methodology/ Reverse logistics
- *Macroeconomic level analysis*
Energy policy and energy systems modeling
Renewable energy infrastructure planning
Macroeconomic electricity market analysis
Energy economic modeling (MARKAL)
Economic Input/Output Analysis

EDUCATION

- Ph.D. Mechanical Engineering, Purdue University, West Lafayette, IN, May 2006
Dissertation: *A Systematic Methodology for Designing Sustainable Engineering Product Systems*
- M.S.E. Mechanical Engineering, University of Michigan, Ann Arbor, MI, May 1999
- B.S. Mechanical Engineering, Hanyang University, Korea, February 1997

AWARDS RECEIVED

- Laboratory Directed Research and Development program Grant Award, Department of Energy (2010)
- Gertrude and Maurice Goldhaber Distinguished Fellowship, Brookhaven National Laboratory (2009)
- National Science Foundation Travel Grant Award, LCA IX conference, Boston (2009)
- Gordon Research Conference Travel Grant, Colby-Sawyer College, New London, NH (2008)
- 1st place Research Poster Award Prize at the International Input-Output Conference, Seville, Spain (2008)
- National Science Foundation Travel Grant Award, Rochester Institute of Technology (2007)
- ConocoPhillips Summer Research Fellowship, Purdue University (2004, 2005)
- Fredrik Andrews Environmental Dissertation Research Award, Purdue University (2004)
- Engineering Dean's Research Award, Purdue University (2003)
- Department of Mechanical Engineering Fellowship, Purdue University (2002, 2003)
- International Society of Industrial Ecology Student Travel Award, University of Michigan (2002)
- Academic Excellence Tuition Fee Scholarship, Hanyang University (1994, 1995, 1996)

RESEARCH AND WORK EXPERIENCE

- 03/09-present **Goldhaber Distinguished Fellow**, Brookhaven National Laboratory, Upton, NY

- Performed in-depth evaluations of life-cycle energy consumption and associated greenhouse gas emissions for industry's manufacturing processes
 - Developed mathematical models for optimizing the photovoltaics recycling planning and worked with several top PV manufacturers
 - Developed new methodology (MF-LCA) by integrating framework for policy-energy-environment-economy (P3E) with MARKAL and Life Cycle Analysis.
- 12/06-03/09 **Post-Doctoral Research Director**, Center for Resilience, Ohio State University, Columbus, OH
 - Developed methodologies for analyzing the effect of the carbon mitigation policies to the optimized industrial processes (multi-scale analysis)
 - Developed Economic Input-Output framework for analyzing the short and long term environmental, economic, and social effect of policy
 - Consulted on the ecological life cycle assessment
- 06/06-12/06 **Visiting Scholar**, Purdue University, West Lafayette, IN
 - Co-developed a mathematical model for automotive shredders' short-term tactical decisions.
 - Developed a model for the optimization of landfill tipping fees for Automotive Shredder Residue
- 09/00-05/06 **Graduate Research Assistant**, Purdue University, West Lafayette, IN
 - Developed an integrated methodology for eco-design: prioritization of Design for Environment strategies in early concept design stages using Life Cycle Assessment and Multi-Criteria Decision Analysis, and uncertainty analysis.
 - Performed LCA for various product systems to analyze tradeoff issues between business and environmental strategies.
- 09/97-05/99 **Graduate Research Assistant**, University of Michigan, Ann Arbor, MI
 - Environmentally Benign Manufacturing; Researched on the Investigation and optimization of chip formation in Dry-Drilling
 - Studied an analytical stability solution for milling with flexible end mills
- 03/92-08/93 **Military Officer**, Korean ARMY, KOREA

Research Funding and Proposals

I have worked as a main PI in following research projects/proposals.

- 10/10-09/12 **PI**, Multicomplexity of Energy and Material Use: Integrated Assessment of Technology and Policy Alternatives, funded by U.S. Department of Energy: Laboratory Directed Research and Development (LDRD) Program : \$280,000
- 03/09-03/12 **PI**, Global Photovoltaic Recycling Infrastructure Planning, funded by Brookhaven National Laboratory, Gertrude and Maurice Goldhaber Distinguished Fellowship Program: \$126,000
- Pending **Co-PI**, System Modeling and Real-Time Energy Efficiency Control in Manufacturing Facility with "Micro-Grid, (PI- Cindy Chang) submitted to SBU-BNL Seed Grant: budget - \$100,000
- 06/04-06/05 **PI**, A Systematic Methodology for Designing Sustainable Engineering Product Systems, funded by Andrew Fredrik Environmental Dissertation Grant: funded by Purdue University: \$10,000
- 05/03-06/04 **PI**, Creating the Purdue Product Lifecycle Management Portal, funded by Purdue University, Engineering Dean Office: \$10,000

I have assisted in preparing a number of research proposals to NSF as a postdoctoral associate or a graduate assistant.

- Assisted as postdoctoral researcher, Toward Integration of Industrial Ecology and Ecological Engineering funded by the U.S. National Science Foundation, Environmental Sustainability Program.
- Assisted as postdoctoral researcher, A Multiscale Statistical Framework for Assessing the Biocomplexity of Material Use – The Case of Transportation Fuels, funded by the U.S. National Science Foundation, BE/Material Use: Science Engineering and Society Program.

Other Research Activities include:

In addition to performing research on the above topics, I have been involved with a number of research efforts and projects.

- Performed research on guiding energy efficient technologies in a semiconductor manufacturing processes.
- Contributed to study on identifying the effect of the BNL's solar farm renewable energy integration to the grid.
- Provided technical assistant and meet cost reduction and environmental regulation for small and medium enterprise in the state of Indiana through Technical Assistant Program (TAP) projects
- Co-developed in implementing Tooling Advisory System consist of material selection advisor, metal-casting selection advisor, and engineering cost advisor
- Participated in creating product node architecture for efficient management of distributed project environment - Funded by National Science Foundation
- Developed eco-efficient vendor selection methodologies with multi decision making process - Funded by Phillips Petroleum
- Performed case studies of mold design for injection molding process
- Trained for the Certification in Charmilles Wire EDM and Esprit for mold design process
- Created and managed Purdue official product lifecycle management (PLM) portal <https://engineering.purdue.edu/PLM> - Funded by Engineering Dean's Office

TEACHING EXPERIENCE

Course Instructor as a sole Lecturer, School of Mechanical Engineering, Purdue University

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|-----------|------------------------------|
| Fall 2005 | ME 323 Mechanics of Material |
|-----------|------------------------------|
- Performed same duties of faculty member for a class of 83
 - Achieved course evaluation credit 4.1 out of 5 from all class members
 - Nominated for Magoon teaching award

Teaching Assistant Experiences, School of Mechanical Engineering, Purdue University

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|-----------------------|---|
| Spring 2003/2005 | ME 553 (Product and Process Design) – Graduate level course |
| Spring 2002/Fall 2004 | ME 323 (Mechanics of Material) |
| Spring 2001/2004 | ME 270/ME 274 (Statics and Dynamics) |
| Fall 2002 | ME 444 (Computer Aided Design and Manufacturing) |
| Fall 2001 | ME 597R (Intellect Property) – Graduate level course |
| Fall 2000 | ME 363 (Principle of Manufacturing Process) |

Invited Speaker/ Lecturer

Energy and Environmental Consulting Group, *Samsung SDS*, Seoul, Korea
Sustainable Construction Management Laboratory, *Yonsei University*, Seoul, Korea
Energy Policy Analysis Group, *Korean Institute of Energy Research*, Daejeon, Korea
Department of Mechanical Engineering, *SUNY Buffalo*, NY
Renewable and Clean Energy Center, *University of Dayton*, OH
Sustainability Study Program, *University of New Haven*, CT
Ira A. Fulton School of Engineering, *Arizona State University*, Tempe, AZ
Lenfest Center for Sustainable Energy, Earth Institute, *Columbia University*, NY
Dept. of Chemical & Biomolecular Engineering, *The Ohio State University*, Columbus, OH
Golisano Institute of Sustainability, *Rochester Institute of Technology*, Rochester, NY
Dept. of Mechanical and Material Engineering, *Washington State University*, Pullman, WA
College of Engineering and Mathematical Science, *University of Vermont*, Burlington, VT
School of Mechanical Engineering, *Purdue University*, West Lafayette, IN
Dept. of Civil & Environmental Engineering, *Purdue University*, West Lafayette, IN
School of Agricultural Engineering, *Purdue University*, West Lafayette, IN

PUBLICATIONS and PRESENTATIONS

Refereed Journal Articles and Book Chapters

1. **J.-K. Choi** and K. Ramani, "Modeling of Automotive Recycling Planning in the United States", *International Journal of Automotive Technology*, 6 (4): 413-41, 2005.
2. C.W. Chung, **J.-K. Choi**, K. Ramani and H. Patwardhan, "Product Node Architecture: A Systematic Approach to Provide Structured Flexibility in Distributed Product Development", *Concurrent Engineering Research & Application*, 13 (3), pp. 219-232, 2005.
3. J.A.S. Williams, S. Wongweragiat, X. Qu, W. Bonwaitan, **J.-K. Choi**, and J. Schiff, "An Automotive Bulk Recycling Planning Model", *European Journal of Operational Research*, 177, pp969-981, 2007.
4. **J.-K. Choi**, L.F. Nies, and K. Ramani, "A Framework for the Integration of Environmental and Business Aspects toward Sustainable Product Development", *Journal of Engineering Design*, 19 (6), pp436-446, 2008.
5. **J.-K. Choi**, and B.R. Bakshi, "Attribution of Global Warming," *Encyclopedia of Global Warming and Climate Change*, Ed. S.G. Philander and G.J. Golson, Sage Publication, pp. 95-99, 2008.
6. **J.-K. Choi**, and B.R. Bakshi, "Economic Repercussion of Carbon Permit," *Encyclopedia of Global Warming and Climate Change*, Ed. S.G. Philander and G.J. Golson, Sage Publication, pp. 167-169, 2008.
7. **J.-K. Choi**, and B.R. Bakshi, "American Electric Power," *Encyclopedia of Global Warming and Climate Change*, Ed. S.G. Philander and G.J. Golson, Sage Publication, pp. 45-46, 2008.
8. **J. -K. Choi**, B.R. Bakshi, and Tim Haab "Effects of a carbon price in the U.S. on economic sectors, resource use, and emissions: An input-output approach," *Energy Policy*, 38 (7), pp 3527-3536, 2010.
9. **J. -K. Choi**, and V.M. Fthenakis, "Economic feasibility of recycling photovoltaic modules: Survey and model", *Journal of Industrial Ecology*, 14(6), pp 947-964, 2010.
10. **J. -K. Choi**, and V.M. Fthenakis, "Design and Optimization of Photovoltaics Recycling Infrastructure", *Environmental Science and Technology*, 44(22), pp 8678-8683, 2010.
11. K. Ramani, F. Zhao, **J.-K. Choi**, D. Ramanujan, W. Berstein, J. Sutherland, C. Handwerker, H.M. Kim, D. Thurston, "Integrated Sustainable Life Cycle Design: A Review", *Journal of Mechanical Design*, 132(9), 2010
12. H.C.Kim, V. Fthenakis, **J.-K. Choi**, D. Turney, "Harmonization of LCA studies: Greenhouse-gas Emission from Thin-film Photovoltaic Life Cycle" in print, *Journal of Industrial Ecology*, 2012, DOI:10.1111/j.1530-9290.2011.00423.x
13. D. Hsu, P. O' Donoughue, G. Heath, V. Fthenakis, H.C. Kim, **J.-K. Choi**, D.Turney "Life Cycle GHG Emissions of Crystalline Silicon Photovoltaic Electricity Generation: Systematic Review and Harmonization", *Journal of Industrial Ecology*, 2012, DOI: 10.1111/j.1530-9290.2011.00439.x.
14. F.Zhao, **J. -K. Choi**, J. Sutherland, C. Handwerker, K.Ramani, "A Primary Overview of Sustainable Product Realization for the Life Cycle" *Designing Sustainable Products, Services and Manufacturing Systems*, Ed. A. Chakrabarti, S. Rachuri, P. Sakar., and S. Kota, Research Publishing, pp120-135, 2011.
15. D. Ramanujan, W. Berstein, **J. -K. Choi**, F. Zhao, K. Ramani, "Prioritizing Design for Environment strategies using a stochastic Multi Criteria Decision Analysis", in review *Journal of Mechanical Design*.
16. **J.-K. Choi**, P. Friley, and T. Alfstad, "The Implication of the Energy Policy to the Dynamic Life Cycle Environmental Impact of an Industrial Product System: Survey and model", accepted for publication in *Renewable and Sustainable Energy Review* 2012.

Books

1. **J.-K. Choi** and K. Ramani, "The Quest for Sustainable Product Design: A Systematic Methodology for Integrated Assessment of Environmentally Benign and Economically Feasible Product Design", 2009, VDM Publishing.

Conference Proceedings and Abstracts (* presenter)

1. ***J.-K. Choi** "Sustainability of Photovoltaic: Recycling and Dynamic LCA" *International Symposium on Sustainable Systems and Technology*, Boston, MA, May 16, 2012.
2. ***J.-K. Choi**, and P. Friley "The Implication of the Energy Policy to the Dynamic Life Cycle Environmental Impact of a Product System" *15th Energy, Utility, Environment Conference*, Phoenix, AZ, Jan. 31, 2012.
3. ***J.-K. Choi**, and V.M. Fthenakis "Mathematical Modeling of PV Recycling Process," *First International Conference on PV Module Recycling*, Berlin, Germany, Jan. 26, 2010.
4. ***J.-K. Choi**, and *V.M. Fthenakis "Mathematical Modeling for Cost Optimization of PV Recycling Infrastructure," *Proceedings of EUPVSEC – The 25th European Photovoltaics Solar Energy Conference and Exhibition*, Valencia,

Spain. Sep 6-9, 2010.

5. V.Fthenakis, **J.-K. Choi**, *H.C. Kim, D.Turney, G. Heath, P. Saywer, D. Hsu, P. O'Donoghue "Environmental Profiles of Photovoltaics: Critical Review and Harmonization of Thin-film Life-cycle Assessments", Portland, OR, November 2-4,2010
6. ***J.- K. Choi**, and V.M. Fthenakis "Double Greening Photovoltaic: Recycling Planning," *Workshop on Land Use of Renewable Energy, Life Cycle Assessment IX conference*, Boston, MA, Sep. 27-30, 2009.
7. ***J.- K. Choi**, "Summary of Solar Session: Market, Land Use, and Recycling," *Workshop on Land Use of Renewable Energy, Life Cycle Assessment IX conference*, Boston, MA, Sep. 27-30, 2009.
8. ***J.- K. Choi**, and V.M. Fthenakis "A Model for Optimization of Photovoltaics Recycling Planning," *Proceedings of IEEE – The 34th IEEE Photovoltaic Specialists Conference*, Philadelphia, Pennsylvania, June 7-12, 2009.
9. *V. Khanna, **J.-K. Choi**, B. R. Bakshi, T. C. Haab, "Assessing the risks to complex industrial networks due to loss of natural capital and its implications to process design," International Conference on Foundations of Computer-aided Process Design, Breckenridge, Colorado, June 7-12, 2009.
10. ***J.- K. Choi**, B.R. Bakshi, and T. Haab "A Framework for Assessing the Biocomplexity of Material Use," International Input-Output Conference, Seville, Spain, July 9-11, 2008. poster presentation – **Won 1st place**
11. ***J.- K. Choi** and K. Ramani, "An Integrated Decision Analysis for the Sustainable Product Design," *Proceedings of ASME–International Conf. on Manufacturing Science and Engineering*, October 7-10, 2008.
12. ***J.- K. Choi**, B.R. Bakshi, and T. Haab, "A Framework for Assessing the Complex and Networked Sustainable System," *Proceedings – 2008 AIChE annual meeting*, Philadelphia, November 16-21, 2008.
13. *V. Khanna, **J.-K. Choi**, B.R. Bakshi, "Modeling Technology Transitions and Risks Using Input-Output Framework," *Proceedings – 2008 AIChE annual meeting*, Philadelphia, November 16-21, 2008.
14. **J.- K. Choi**, *B.R. Bakshi, T. Haab, and P. Goel, "A Multiscale Modeling Framework for Assessing the Impact of Environmental Policies on Industrial Activity," *Proceedings – The First International Symposium on Sustainable Chemical Product and Process Engineering*, September 25-28, 2007.
15. ***J.- K. Choi**, B.R. Bakshi, T. Haab, and P. Goel, "Toward Design for Biocomplexity by Integrated Modeling of Industrial and Economic Systems," –*2007 AIChE annual meeting*, Salt Lake City, November 4-9, 2007.
16. ***J.- K. Choi**, J. Fiksel, and B.R. Bakshi, "Integrated Decision Analysis for Sustainable Product Design," *2007 AIChE annual meeting*, Salt Lake City, November 4-9, 2007.
17. ***J.- K. Choi**, H.S. Yi, B.R. Bakshi, T. Haab, and P. Goel, "Toward Integrated Assessment of Technology and Policy Alternatives for Materials Use," *Proceedings – International Society of Industrial Ecology Conference*, Toronto, Canada, June 17-21, 2007.
18. * **J.- K. Choi**, B.R. Bakshi, T. Haab, and P. Goel, "Tward Integrated Assessment of Technology and Policy Alternatives for Materials Use," Global Symposium on Sustainable Product Development and Life Cycle Engineering, Rochester, NY, September 18-22, 2007.
19. **J.- K. Choi**, * B.R. Bakshi, T. Haab, and P. Goel, "A Multiscale Modeling Framework for Assessing the Impact of Environmental Policies on Industrial Activity," The First International Symposium on Sustainable Chemical Product and Process Engineering, Guangzhou, China, September 25-28, 2007
20. H.S. Yi, **J.-K. Choi**, and *B.R.Bakshi, "Toward Integrated Assessment of Technology and Policy Alternatives for Materials Use," *Proceedings – Biennial International Workshop in Advances in Energy Studies*, Porto Venere, Italy, September 12-16, 2006.
21. * **J.- K. Choi**, "A Modeling of Automotive Bulk Recycling Planning, " Potawatomi Industrial Ecology Conference, Potawatomi, IN, Mar.4-6, 2006
22. **J.-K. Choi**, and *K. Ramani, "Decision Support Tools for Environmental Product and Process Management: Survey and Needs," *Proceedings – International Society for Environmental Information Sciences Conference Archives*, pp24-37, June 2-4, 2004.
23. ***J.-K. Choi**, "A Critical Review of Decision Support Tools for Sustainable Product Development," *Abstracts – International Society for Industrial Ecology Conference*, pp162-163, Ann Arbor, MI. July 1, 2003.
24. * **J.-K. Choi**, L. F. Nies, and K. Ramani "Mapping Environmental Impacts along Extended Supply Chain" Environmental Sciences & Engineering Institute Symposium, poster presentation. Lafayette, IN April 11, 2003
25. **J.-K. Choi**, and *K. Ramani, "A Gap analysis of Decision Support Tools for Sustainable Product Development," *Proceeding – S&E Information Technology and Environmental Conference*, pp56-58, France, June 19-20, 2003.
26. * **J.-K. Choi**, L. F. Nies and K. Ramani "Environmental Supply Chain Management" Environmental Review Research Exhibit, poster presentation. West Lafayette, IN the May 8, 2003

Media

1. Green Machine: Where do solar cells go when they die? 13-Oct-2010 by Helen Knight, New Scientist.
2. Making Solar Panels Greener 2-Feb-2011 by Sarah Everts, Chemical & Engineering News

PROFESSIONAL ACTIVITIES and SERVICES

- Member of International Energy Agency (IEA) – PVPS Task 12 on PV EH&S (2009 -)
- Expert Fellow, New York Energy Policy Institute (NYEPI) – (2009 -)
- Session Chair, International Symposium on Sustainable Systems and Technology (Systems Session) - 2012
- Session Chair, Workshop on Land Use in Renewable Energy (Solar Session) – 2009.
- Program Committee Global Conf. on Sustainable Product Development and Lifecycle Engineering (2008–)
- International Program Committee of Int. Conference on Product Lifecycle Management (2008–)
- Reviewer for Conference: ASME Technical Publication for MSEC and ICM&P 2008 Conference, Reviewer of Technical Publication for PLM 2008.
- Reviewer: Journal of Mechanical Design (2008-), Journal of Industrial Ecology (2009 –), Energy Policy Journal (2007 –), Renewable and Sustainable Energy Reviews (2011-), Journal of Engineering Design (2005 –)
- Reviewed NSF Environmental and Energy Proposals (2007 -2009)
- Member of Professional Society: American Society of Mechanical Engineer, International Input-Output Association (2007 –), International Society of Industrial Ecology (2002 –)