

## Jun-Ki Choi

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### EXPERTISE

Photovoltaics recycling infrastructure planning  
Energy and environmental systems modeling  
Life cycle assessment and design for environment  
Ecological economics and analysis of economic and social impact to engineering systems  
Multi-criteria decision and uncertainty analysis in system design  
Multiscale optimization of integrated system  
Industrial ecology and sustainability

### 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

### RESEARCH AND WORK EXPERIENCE

- 03/09-present **Goldhaber Distinguished Fellow**, National Photovoltaic Environmental Research Center, Energy Science & Technology Department, Brookhaven National Laboratory, Upton, NY (Supervisor: Dr. Vasilis M. Fthenakis)
  - Developing methodologies for global PV recycling infrastructure planning
  - Creating generic mathematical models for analyzing the economics of PV take back center
- 03/09-present **Research Collaborator**, Center for Life Cycle Analysis, Columbia University, NY
- 12/06-03/09 **Post-Doctoral Research Director**, Center for Resilience, Department of Chemical and Biomolecular Engineering, Ohio State University, Columbus, OH (Mentor: Dr. Bhavik Bakshi)
  - Developed methodologies for multi-scale optimization of biocomplexity of material use
  - Developed Input-Output framework for analyzing the short and long term environmental, economic, and social effect of policy
  - Consulted on the ecological life cycle assessment of the alternative transportation fuel
- 06/06-11/06 **Visiting Scholar**, PRECISE, Purdue University, West Lafayette, IN
  - Co-developed a recycling planning model for automotive shredders' short-term tactical decisions and verify the sensitivity of the decision to reprocess light nonferrous metal to multiple scenarios
  - 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 prioritization of Design for Environment strategies in early concept design stages using Life Cycle Assessment and Multi-Criteria Decision Analysis
  - Performed LCA and case studies for various process and product systems to analyze tradeoff issues between business and environmental strategies
  - Created stochastic modeling to integrate uncertainty in group decision analysis and performed sensitivity analysis with Monte Carlo Simulation

### **Other Research Activities include:**

In addition to performing research on the above dissertation topics, I have been involved with a number of research efforts and projects on product development and different manufacturing processes.

- 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
- Developed eco-efficient vendor selection methodologies with multi decision making process
- 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>
- 09/97-05/99     **Graduate Research Assistant**, University of Michigan, MI, U.S.A
  - 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

### **AWARDS RECEIVED**

Gertrude and Maurice Goldhaber Distinguished Fellowship, Brookhaven National Laboratory (2009 – )  
National Science Foundation Travel Grant Award, LCA IX conference, Boston (2009)  
National Science Foundation Travel Grant Award, Arizona State University (2009)  
Gordon Research Conference Travel Grant, Colby-Sawyer College, New London, NH (2008)  
1<sup>st</sup> 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)

### **PROFESSIONAL ACTIVITIES and SERVICES**

- Member of International Energy Agency (IEA) – PVPS Task 12 on PV EH&S (2009 - )
- Session Chair, Workshop on Land Use in Renewable Energy (Solar Session) – 2009.
- Program Committee of Global Conf. on Sustainable Product Development and Lifecycle Engineering (2008–)
- International Program Committee of Int. Conference on Product Lifecycle Management (2008–)
- Reviewer for the ASME Technical Publication for MSEC 2008 and ICM&P 2008 Conference.
- Reviewer of Journal of Mechanical Design (2008- )
- Reviewer of Technical Publication for PLM 2008.
- Reviewer of Journal of Industrial Ecology (2009 – )
- Reviewer of Energy Policy Journal (2007 – )
- Reviewed NSF Environmental and Energy Proposals (2007 – )
- Reviewer for Journal of Engineering Design (2005 – )
- Member of American Society of Mechanical Engineer (2004 – )
- Member of American Institute of Chemical Engineer (2007 – )
- Member of International Input-Output Association (2007 – )
- Member of International Society of Industrial Ecology (2002 – )

## PUBLICATIONS and PRESENTATIONS

### Refereed Journal Articles and Book Chapters

1. **J.-K. Choi**, J.A. Stuart 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, 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), 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**, and K. Ramani, "A Methodology for Prioritizing DfE Strategies toward Sustainable Product Development", submitted.
9. **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*, accepted.
10. **J.-K. Choi**, and V.M. Fthenakis, "Economic feasibility of recycling photovoltaic modules: Survey and model", *Journal of Industrial Ecology*, accepted.

### 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

1. **J.-K. Choi**, and V.M. Fthenakis "A Model for Optimization of Photovoltaics Recycling Planning," *Proceedings of IEEE – The 34<sup>th</sup> IEEE Photovoltaic Specialists Conference*, Philadelphia, Pennsylvania, June 7-12, 2009.
2. 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.
3. **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.
4. **J.-K. Choi**, B.R. Bakshi, and T. Haab, "A Framework for Assessing the Complex and Networked Sustainable System," *Proceedings – 2008 AIChE annual meeting*, November 16-21, 2008.
5. V. Khanna, **J.-K. Choi**, B.R. Bakshi, "Modeling Technology Transitions and Risks Using Input-Output Framework," *Proceedings – 2008 AIChE annual meeting*, November 16-21, 2008.
6. **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.
7. **J.-K. Choi**, B.R. Bakshi, T. Haab, and P. Goel, "Toward Design for Biocomplexity by Integrated Modeling of Industrial and Economic Systems," *Proceedings – 2007 AIChE annual meeting*, November 4-9, 2007.
8. **J.-K. Choi**, K. Ramani, J. Fiksel, and B.R. Bakshi, "Integrated Decision Analysis for Sustainable Product Design," *Proceedings – 2007 AIChE annual meeting*, November 4-9, 2007.
9. **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*, June 17-21, 2007.
10. 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*, September 12-16, 2006.

11. **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.
12. **J.-K. Choi**, "A Critical Review of Decision Support Tools for Sustainable Product Development," *Abstracts – International Society for Industrial Ecology Conference*, pp162-163, July 1, 2003.
13. **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, June 19-20, 2003.

#### **Presentations** (\* presenter)

1. \* **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.
2. \* **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.
3. \* **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.
4. \* **J.- K. Choi**, and V.M. Fthenakis "A Model for Optimization of Photovoltaics Recycling Planning," *The 34<sup>th</sup> IEEE Photovoltaic Specialists Conference*, Philadelphia, Pennsylvania, June 7-12, 2009.
5. \* **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. – **Won 1<sup>st</sup> place**
6. \* **J.- K. Choi**, B.R. Bakshi, T. Haab, and P. Goel, "Toward Design for Biocomplexity by Integrated Modeling of Industrial and Economic Systems," AIChE annual meeting, Salt Lake City, UT, November 4-9, 2007.
7. \* **J.- K. Choi**, K. Ramani, J. Fiksel, and B.R. Bakshi, "Integrated Decision Analysis for Sustainable Product Design," AIChE annual meeting, Salt Lake City, UT, November 4-9, 2007.
8. \* **J.- K. Choi**, B.R. Bakshi, T. Haab, and P. Goel, "Toward 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.
9. **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
10. \* **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," International Society of Industrial Ecology Conference, Toronto, Canada, June 17-21, 2007.
11. \* **J.- K. Choi**, "A Modeling of Automotive Bulk Recycling Planning, " Potawatomi Industrial Ecology Conference, Potawatomi, IN, Mar.4-6, 2006
12. \* **J.-K Choi**, "Decision Support Tools for Sustainable Supply Chain Management" International Society for Industrial Ecology Conference, Ann Arbor, MI July 1,2003
13. \* **J.-K. Choi**, L. F. Nies, and K. Ramani "Mapping Environmental Impacts along Extended Supply Chain" Environmental Sciences & Engineering Institute Symposium, Lafayette, IN April 11, 2003
14. \* **J.-K. Choi**, L. F. Nies and K. Ramani "Environmental Supply Chain Management" Environmental Review Research Exhibit, West Lafayette, IN the May 8, 2003

#### **TEACHING EXPERIENCE**

##### **Invited Speaker/ Lecturer**, (in past two years)

- Lenfest Center for Sustainable Energy, Earth Institute, Columbia University, NY  
Presentation title: "An Integrated Framework for Analyzing Engineering-Economic-Environmental Systems"
- Dept. of Chemical & Biomolecular Engineering, The Ohio State University, Columbus, OH  
Presentation title: "Process Systems Engineering for the Environment"
- Golisano Institute of Sustainability, Rochester Institute of Technology, Rochester, NY  
Presentation title: "A Framework for Assessing the Biocomplexity of Sustainable Material Use"
- Dept. of Mechanical and Material Engineering, Washington State University, Pullman  
Presentation title: "Toward Design for Biocomplexity by Integrated Modeling of Industrial and Economic Systems"
- College of Engineering and Mathematical Science, University of Vermont, Burlington, VT

Presentation title: “Strategic Engineer: New Paradigm for Engineering Education”

- College of Engineering and Mathematical Science, University of Vermont, Burlington, VT  
Title: “Toward Integrated Assessment of Technology and Policy Alternatives for Materials Use”
- School of Mechanical Engineering, Purdue University, West Lafayette, IN  
Presentation title: “World at Risk: What’s the Role of Sustainable Product and Process Development”
- Dept. of Civil & Environmental Engineering, Purdue University, West Lafayette, IN  
Presentation title: “Design for Environment: beyond DFMA”
- School of Agricultural Engineering, Purdue University, West Lafayette, IN  
Presentation title: “A Systematic Methodology for Implementing LCA to Product Innovation”

**Course Instructor**, School of Mechanical Engineering, Purdue University

Fall 2005            ME 323 (Mechanics of Materials)

- Performed same duties of faculty member for a class of 83
- Created 45 lecture contents, presentation files, and course handouts
- Developed quizzes, exams, course projects, and consulted on design problems
- Achieved course evaluation credit 4.1 out of 5 from all class members
- Nominated for Magoon teaching award

**Teaching Assistant**, School of Mechanical Engineering Purdue University

Spring 2005    ME 553 (Product and Process Design) – Graduate level course  
Fall 2004        ME 323 (Mechanics of Material)  
Spring 2003    ME 270/274 (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)