

**Nandan U. Ukidwe**

Research Engineer

Solutia Inc.

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**PROFESSIONAL INTERESTS**

Product and process operation and design; Sustainable engineering; Exergy analysis; Statistical and Multiscale analysis

**EDUCATION**

2000 – 2005      Doctor of Philosophy (Advisor: Prof. Bhavik Bakshi)  
Sustainable and Efficient Process Engineering Group  
Department of Chemical & Biomolecular Engineering  
The Ohio State University, Columbus, Ohio  
GPA: 3.96/4.00

1996 – 2000      Bachelor of Chemical Engineering  
University Department of Chemical Technology, Mumbai, India (UDCT)  
Graduated in First Class with Distinction

**AWARDS AND HONORS**

1991              Silver Medal in Annual Science Quiz competition at Nehru Science Center, Mumbai, India

1993              Silver Medal in Dr. Homi Bhabha Junior Scientist Competition, Mumbai, India

1994              Merit Holder in Secondary School Certificate Examination (18<sup>th</sup> in more than 100,000 candidates)

1996              Merit Holder in Higher Secondary School Certificate Examination (13<sup>th</sup> in more than 100,000 candidates)

2000 - 2001      Department of Chemical Engineering Fellow

2003              Election to The Honor Society of Phi Kappa Phi

2005              Presidential Fellow, Ohio State Graduate School

2005              American Institute of Chemists Foundation Outstanding Graduate Student Award

## RESEARCH EXPERIENCE

### **Dissertation Title: Thermodynamic Input-Output Analysis of Economic and Ecological systems for Sustainable Engineering**

- Developed models to analyze integrated industrial-ecological-social systems
- Analyzed environmental performance of electricity generation systems and transportation alternatives
- Studied economic and environmental aspects of supply chains
- Developed multi-scale statistical data fusion framework for life cycle inventory analysis
- Developed indicators of sustainability for practical use
- Implemented multi-objective optimization to design of economically and ecologically conscious industrial systems

## PROFESSIONAL EXPERIENCE

Feb 2004 - **Intern; Solutia Inc., Indian Orchard, Springfield, Massachusetts**  
Apr 2004

Highlight: Participated in Department of Energy sponsored plant-wide utility assessment

- Team identified savings of \$2M
- Developed Software Program to Analyze Power Plant Time Series Data
- Collaborated on Process integration Analysis of solvent Butvar<sup>®</sup> process
- Optimized feed-water preheating for coal and NG-fired boilers
- Applied multiscale analysis to address capacity expansion and debottlenecking
- Analyzed life cycle implications of Indian Orchard operations
- Organized and coordinated various projects and surveys

Jun 1999 - **Intern; Bayer (India) Ltd., Kolshet, India**  
Sep 1999

- Worked in EHS&Q
- Analyzed state-of-the-art effluent treatment plant comprising pH-control, suspended solid separation, biological treatment and tertiary treatment involving polymer dosing
- Studied rotary kiln solid incinerator
- Wrote project report to the coordinator of internship program at UICT

## MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- American Institute of Chemical Engineers
- International Society for Industrial Ecology

## PUBLICATIONS

### Book Chapters

1. Ukidwe N. U., J. L. Hau, and B. R. Bakshi. "Thermodynamic Input-Output Analysis of Economic and Ecological Systems", in *Handbook of Input-Output Analysis*, ed. S. Suh, Edward Elgar, Cheltenham, UK, 2005.

### Refereed Journal Papers

1. Ukidwe N. U. and B. R. Bakshi. "Thermodynamic Accounting of Ecosystem Contribution to Economic Sectors with Application to 1992 U.S. Economy", *Environmental Science and Technology*, 38, 18, 4810-4827, 2004.
2. Yi H.-S., J. L. Hau, N. U. Ukidwe and B. R. Bakshi. "Hierarchical Thermodynamic Metrics for Evaluating the Sustainability of Industrial Processes", *Environmental Progress*, **invited** to special issue on "Sustainable Engineering", 23, 4, 302-314, 2004.
3. Ukidwe N. U. and B. R. Bakshi. "Flow of Natural versus Economic Capital in Industrial Supply Networks and its Implications to Sustainability", *Environmental Science and Technology*, accepted
4. Ukidwe N. U. and B. R. Bakshi. "Thermodynamic Input-Output Analysis of Transportation Alternatives", in preparation
5. Ukidwe N. U. and B. R. Bakshi. "Multiscale Framework for Life Cycle Inventory Analysis", in preparation
6. Hau J. L., N. U. Ukidwe and B. R. Bakshi. "Traditional versus Exergetic Life Cycle Assessment of Electricity Generation", in preparation
7. Ukidwe N. U., M.-L. Wong and B. R. Bakshi. "Comparison of Alternative Electricity Generation Systems using Exergy, ICEC and ECEC Algorithms", in preparation

### Proceedings Publications

1. Ukidwe N. U. and B. R. Bakshi. "Thermodynamic Input-Output Analysis of Economic and Ecological Systems with Application to the U.S. Economy", *Proceedings of Third Biennial Emery Research Conference*, pp 205-214, Center for Environmental Policy, University of Florida, Gainesville, Florida, January 2004.
2. Bakshi B. R. and N. U. Ukidwe. "A Multiscale Bayesian Framework for Environmentally Conscious Process Design", *Proceedings of Foundations of Computer Aided Process Design (FOCAPD) 2004*, Princeton University, Princeton, New Jersey, July 2004.
3. Ukidwe N. U. and B. R. Bakshi. "Emery to Money Ratios for 488 Sectors of the U.S. Economy and their Use for Life Cycle Assessment", *Proceedings of Fourth Biennial Emery Research Conference*, Center for Environmental Policy, University of Florida, Gainesville, Florida, January 2006, submitted.

## Other Publications

1. Ukidwe N. U. and B. R. Bakshi. "Accounting for Ecosystem Contribution to Economic Sectors by Thermodynamic Input-Output Analysis. Approach", *Technical Report*, Department of Chemical and Biomolecular Engineering, The Ohio State University, 2003.
2. Ukidwe, N. U. and G. Parthasarathy. "Industrial Residency Summary Report for Indian Orchard Power Plant and South Butvar: EURECA effort", *Solutia Closing Report*, SR-1752, 2004.
3. Ukidwe N. U. "Thermodynamic Input-Output Analysis of Economic and Ecological Systems for Sustainable Engineering", *Ph.D. Thesis*, The Ohio State University, 2005.

## Additional Paper Presentations

1. Ukidwe N. U. and B. R. Bakshi. "Ecologically Conscious Process System Engineering: A Thermodynamic Framework", *9<sup>th</sup> Annual Graduate Student Symposium*, University of Cincinnati, Cincinnati, Ohio, 2001.
2. Bakshi B. R., J. L. Hau and N. U. Ukidwe. "Exergy, Emergy and Life Cycle Analysis", *International Society for Industrial Ecology, Inaugural Meeting*, Leiden, The Netherlands, 2001.
3. Ukidwe N. U. and B. R. Bakshi. "Input-Output Analysis of ecological and economic systems", *Gordon Research Conference on Industrial Ecology*, Colby Sawyer College, New London, New Hampshire, 2002.
4. Ukidwe N. U. and B. R. Bakshi. "A Thermodynamic Input-Output Approach for analysis of Economic and Ecological Systems", paper 21g, *AIChE Annual Conference*, Indianapolis, Indiana, 2002.
5. Ukidwe N. U. and B. R. Bakshi. "Accounting for Ecosystem Contribution to Economic Sectors by Thermodynamic Input-Output Analysis", *17<sup>th</sup> Annual Edward F. Hayes Graduate Research Forum*, The Ohio State University, Columbus, Ohio, 2003.
6. Ukidwe N. U. and B. R. Bakshi. "Application of Thermodynamic Input-Output Analysis to determine contribution of ecosystems to industry sectors", *2<sup>nd</sup> International Conference on Industrial Ecology*, University of Michigan, Ann Arbor, Michigan, 2003.
7. Ukidwe, N. U. and B. R. Bakshi. "Thermodynamic Input-Output LCA of the 1997 US Economy with Application to Electricity Generation", paper 156b, *AIChE Annual Conference*, San Francisco, California, 2003.
8. Ukidwe N. U., B. R. Bakshi and J. Fiksel. "Thermodynamic Metric for Sustainability", paper 155f, *AIChE Annual Conference*, San Francisco, California, 2003.
9. Parthasarathy G., N. U. Ukidwe and B. R. Bakshi. "Optimal Sustainable Allocation of Water and Energy Flows in an Operational Polymer Process", Paper 109b, *AIChE Spring Meeting*, New Orleans, Louisiana, 2004.
10. Ukidwe N. U. and B. R. Bakshi. "Including Natural Capital in the Life Cycle Assessment of Economic Sectors by Thermodynamic Input-Output Analysis". *inLCA-LCM*, 2004.
11. Ukidwe N. U. and B. R. Bakshi. "Economic versus Natural Capital Flows in Industrial Supply Networks – Implications to Sustainability", paper 5f, *AIChE Annual Conference*, Austin, Texas, 2004.

12. Parthasarathy G., N. U. Ukidwe and B. R. Bakshi, "Process Integration and Sustainability: Is one from Mars and other from Venus?", paper 1f, *AIChE Annual Conference*, Austin, Texas, 2004.
13. Ukidwe N. U., B. R. Bakshi and G. Parthasarathy. "A Multiscale Bayesian Framework for Designing Efficient and Sustainable Industrial Systems", paper 7c, *AIChE Annual Conference*, Austin, Texas, 2004.
14. Ukidwe N. U. and B. R. Bakshi. "Multiscale statistical framework for hybrid life cycle assessment", *2nd Int'l Conference on Green and Sustainable Chemistry and 9th Annual Green Chemistry and Engineering Conference*, Washington D.C., 2005.
15. Hau J. L., N. U. Ukidwe and B. R. Bakshi. "Entropy, Exergy and Material Flow in Industrial and Ecological Systems", *2nd Int'l Conference on Green and Sustainable Chemistry and 9th Annual Green Chemistry and Engineering Conference*, Washington D.C., 2005.
16. Bakshi B. R. and N. U. Ukidwe "Network Analysis of Industrial and Ecological Systems and its Implications to Sustainable Engineering", *AIChE Annual Conference*, Cincinnati, Ohio, 2005, accepted.
17. Ukidwe N. U., M.-L. Wong, and B. R. Bakshi, "Hybrid Thermodynamic Life Cycle Assessment of Six Alternatives for Generating Electricity", *AIChE Annual Conference*, Cincinnati, Ohio, 2005, accepted.

## TEACHING EXPERIENCE

### **Graduate Teaching Assistant**

Department of Chemical & Biomolecular Engineering  
The Ohio State University, Columbus, Ohio

Sep-Dec 2003; 2004	<u>Chemical Process Dynamics and Control</u> - Used SIMULINK to set up solutions of homework problems for CHE 624 - Worked as a technical consultant for students - Worked as a substitute lecturer
Jan-Mar 2002; 2003	<u>Chemical Engineering Process Design</u> - Used computer simulation package HYSYS for isooctane (WI 2002) and styrene (WI 2003) process design for CHE 764 - Worked as a technical consultant for groups of students and assisted them in design and troubleshooting

## LEADERSHIP & SERVICE EXPERIENCE

Aug 2002 - Jul 2004	<b>Graduate Representative</b> Engineering Region 6 computer facilities at The Ohio State University, Columbus, Ohio
Aug 2002 - Jul 2003	<b>Vice-President and Volunteer</b> Sankalpa (A non profit organization that supports various micro-developmental projects in India)
Mar 1998 - Feb 1999	<b>Member of the Editorial Board</b> Interface (An intercollegiate newsletter reviewing contemporary scientific and technological developments)