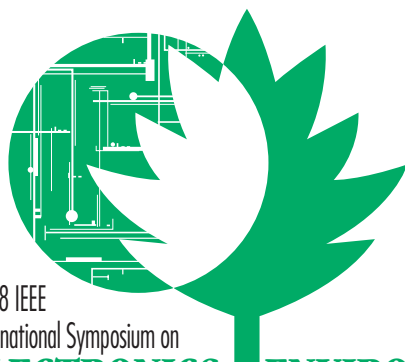
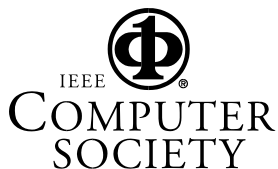


F I N A L P R O G R A M



2008 IEEE
International Symposium on
ELECTRONICS & the ENVIRONMENT

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MAY 19 – 21, 2008
SAN FRANCISCO AIRPORT MARRIOTT
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IEEE International Symposium on Electronics and the Environment

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Scope and Format

The IEEE Computer Society Technical Committee on Electronics and the Environment (TCEE) welcomes you to the 16th International Symposium on Electronics and the Environment (ISEE) to be held May 19-21, 2008, in San Francisco, CA. After two years, we are back again near the Silicon Valley.

ISEE provides an excellent opportunity for environmental and business professionals, design and manufacturing engineers, researchers, and government decision makers interested in advancing practical sustainability solutions in the field to learn about leading edge research and initiatives.

Highlights for the 2008 ISEE Program include:

- 17 technical conference sessions with topics spanning areas from design through energy to end-of-life issues and emerging technologies.
- This year, new sessions on urban systems, transportation, nanotechnology, and education.
- Two tutorials sessions: on industrial ecology and life-cycle assessment, and the Electronic Product Environmental Assessment Tool (EPEAT).
- Keynote and luncheon addresses by leading experts.

This year's event consists of presentations of nearly 80 technical papers on a diverse set of topics authored and presented by an international mix of speakers. A student technical paper contest and poster contest is organized to recognize student contributions to the advancement of knowledge on environmental impacts.

The co-chairs and the entire executive committee are interested in your views of the conference and the environmental aspects of the industry. Please share your views with the organizers and volunteer your time and effort to make the 2009 conference equally successful.



We hope you find this event professionally and personally useful. It represents a unique opportunity to bring together all parties in the field to communicate progress and challenges to improve the sustainability of the electronics industry and emerging fields. We especially extend a warm welcome to our international participants, and wish them a pleasant stay in the San Francisco Bay Area.

Conference Co-Chairs

Valerie Thomas
Arpad Horvath

Program Co-Chairs

Scott Matthews
Eric Masanet
Arpad Horvath
Deanna Matthews



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Student Poster Session Supplies



GREEN ELECTRONICS COUNCIL

Tuesday Luncheon



Speakers

Monday Keynote Presentation

Facilitating the Transition to the Smart Electric Grid

Brad Gammons

Vice President, Global Energy and Utilities Industry, IBM

Brad Gammons is currently serving as Vice President of IBM's Global Energy and Utility Industry. He is responsible for the development and execution of the industry's strategy for sales, solution development and marketing. He is also responsible for the sales and execution of IBM's Intelligent Utility Network growth initiative. Prior to taking his current position, Brad served as the Industry Business Leader for Energy and Utilities in the Americas and as a Segment Executive for ERP and Supply Chain Solutions for IBM's Communications Sector in the Americas. Brad has also acted as a Principle and Project Executive in IBM's Rapid Application Development Practices.

Before joining IBM, Brad served as a Captain in the United States Air Force. There he held positions in Strategy and Planning and as Flight Crew member on the B-52. Brad's formal education includes a BA in Political Science and a MBA in Finance, as well as extensive professional training while serving in the military.

Tuesday Luncheon Presentation

Electricity Use and Efficiency of Data Centers: A Review of Recent Data and Developments

Dr. Jonathan G. Koomey

Project Scientist, Lawrence Berkeley National Laboratory

**Consulting Professor, Department of Civil and Environmental Engineering,
Stanford University**

Dr. Koomey (<http://www.koomey.com>) is one of the leading international experts on electricity used by computers, office equipment, and data centers, and is the author or co-author of eight books and more than one hundred and fifty articles and reports on energy and environmental economics, technology, forecasting, and policy. He has also published extensively on critical thinking skills. He holds M.S. and Ph.D. degrees from



the Energy and Resources Group at the University of California, Berkeley, and an A.B. in History of Science from Harvard University. In 1993 he won the Fred Burgraff Award for Excellence in Transportation Research from the National Research Council's Transportation Research Board. He was named an Aldo Leopold Leadership Fellow in 2004 and an AT&T Industrial Ecology Fellow in January 2005. His latest book is *Turning Numbers into Knowledge: Mastering the Art of Problem Solving* (<http://www.analyticspress.com>), now out in its second edition.

Tutorials

Introduction to Life Cycle Assessment (LCA)

Life Cycle Assessment (LCA) is an increasingly popular framework to assist in decision making about economic and environmental impacts of products and systems. The ISO 14000 environmental management framework outlines LCA and inspires its use in many areas. In short, it involves a “cradle to grave” boundary of the flows and impacts of a product or process, including everything from raw materials extraction to end of life management issues of a product. In this tutorial, we will introduce the framework of LCA, how it can be applied to issues in the electronics industry, and discuss the various tools and methods available to aid in decision making. Implications on carbon footprinting will also be discussed.

Speaker:

H. Scott Matthews, Carnegie Mellon University

H. Scott Matthews is the Research Director of the Green Design Institute and an Associate Professor 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.

Dr. Matthews's experience is in the area of valuing the socio-economic implications of environmental systems and infrastructure. Of particular interest are using the Internet to facilitate environmental LCA of products and processes, supply chain management in the electronics industry, the energy and environmental impacts of computing and the Internet, and the sustainability of infrastructure.



EPEAT Conformance Workshop

Since its launch in July of 2005, EPEAT has become a leading system for identifying greener electronic products, and the “EPEAT Standard” IEEE 1680 has become an important standard for ecodesign of electronics. In EPEAT, manufacturers declare their products’s conformance to the requirements of IEEE 1680 using a web-based database, and EPEAT regularly verifies that the declarations are accurate. There are two primary parties involved in these verifications. Qualified Verifiers (QVs) work with the manufacturers to collect the data to demonstrate conformance, and the Product Verification Committee (PVC) is the final judge and jury that makes the conformance/nonconformance decisions. This workshop will review the requirements of IEEE 1680 in some detail, will explore some of the clarifications and interpretations that have been issued, and will review several verification findings. Much of this workshop is based on the training initially given to the members of the PVC and the QVs.

Instructors:

**Wayne Rifer - EPEAT Verification and Standards Manager,
Green Electronics Council**

**Mark Schaffer - Previously the “EPEAT Liaison” at Dell Computer
and member of the EPEAT Board of Advisors**

Topics:

EPEAT Overview

IEEE 1680

EPEAT Verification Process

The Requirements of IEEE 1680

Interpretations, Clarifications, Challenging Issues

Verification Findings to Date

**Mark Schaffer, CarbonView Market Development Manager,
Americas**

As the Supply Chain Consultant’s Americas Market Development Manager for CarbonView, Mark Schaffer oversees all aspects of carbon management and strategies in the America’s region. In this role, Mr. Schaffer monitors and advises on carbon management requirements within legal, marketing and reporting frameworks. He also provides guidance to customers interested in monitoring their carbon emissions and how



knowing your emission levels can assist in making valuable business decisions. He is the senior environmental consultant within Supply Chain Consulting.

In addition to his role with Supply Chain Consulting, Mark is also the president of Schaffer Environmental, an environmental consulting firm that focuses on green procurement in the electronics industry and supply chain. Formerly, Mark was Dell's World Wide Environmental Affairs Environmental Programs Manager where he oversaw the company's green procurement and eco-design initiatives, including the development of EPEAT and the IEEE 1680 standard. He also played an active role in the development of Dell's Desktop and Notebooks product lines. Mr. Schaffer was also one of the primary authors Dell's Annual Sustainability Report and he regularly assisted customers with their questions about Dell's environmental programs.

During his professional career, he has also held positions with Static Control Components, NASA, IBM and Canon Virginia. Mr. Schaffer graduated from North Carolina State University with a degree in Material Science and Engineering.



PROGRAM AT-A-GLANCE

		Track I: Energy and Environmental Analysis	Track II: Electronics and Recycling	Track III: Special Topics in Sustainability	
Time		Sunday, May 18, 2008			
3:00pm-7:00pm		Registration			
Time		Monday, May 19, 2008			
Registration	7:00am-8:00am	Breakfast (Salon E)			
	8:00am-9:30am	Free Tutorial Session (Salons A-D)			
		Introduction to Industrial Ecology and Life Cycle Assessment			
	9:30am-10:00am	Refreshment Break (Foyer)			
	10:00am - 11:30am	Free Tutorial Session (Salons A-D)			
		EPEAT (Electronic Product Environmental Assessment Tool)			
	11:45am-1:00pm	Lunch on your own			
	1:00pm-2:00pm	Keynote Speaker - Brad Gammons, IBM (Salon E)			
	2:00pm-2:15pm	Refreshment Break (Foyer)			
		Technical Session - Power Generation and Distribution (Bayside 1)	Technical Session - ICT (Salons A-D)	Technical Session - Nanotechnology (San Ramon)	
	2:15pm-2:45pm	<i>A Life Cycle Decision Tool for Solar Energy</i>	<i>Design and Assessment of an Intelligent Networked Book Delivery System in the United States</i>	<i>Monte Carlo Multi-Criteria Risk Analysis of Single Wall Carbon Nanotube Production Processes</i>	
	2:45pm-3:15pm	<i>Comparison of Life Cycle Impact Assessment Tools in the Case of Biofuels</i>	<i>Environmental Impacts of the Market Dynamics in Urban E-commerce System: Case Study of Book Retail Market</i>	<i>Environmental Performance Characterization of Atomic Layer Deposition</i>	
	3:15pm-3:45pm	<i>The Impact of Reliability on Wind Turbine Life Cycle Analysis</i>	<i>Creating and Applying a Shared Vision of Sustainable ICT</i>	<i>A framework for risk management and end-of-life (EOL) analysis for nanotechnology products: A case study in lithium-ion batteries</i>	
3:45pm-4:15pm	<i>Sustainable Power Generation</i>	<i>Social Impacts of ICT services - Different impacts in different countries-</i>	<i>Assessment of life-cycle efficiencies for carbon nanotube battery production systems</i>		
4:15pm-5:30pm	Poster Session and Reception (Irvine Room)				



PROGRAM AT-A-GLANCE

		Track I: Energy and Environmental Analysis	Track II: Electronics and Recycling	Track III: Special Topics in Sustainability
Time Tuesday May 20, 2008				
Registration	7:00am-8:00am	Breakfast (Salon E)		
		Technical Session - Energy Use (Bayside 1)	Technical Session - EOL Design and Policy for an International Market (Salons A-D)	Technical Session - Green Manufacturing (San Ramon)
	8:00am-8:30am	<i>Life Cycle Assessment (LCA) in electrical and electronic sector in Malaysia - a case study of ballast</i>	<i>DfE for the products distributed across the borders</i>	<i>Environmental and Health Risk Assessment for California Printed Circuit Board Manufacturing: Guidance for Pollution Prevention Opportunities</i>
	8:30am-9:00am	<i>Using Feedback to Enhance Use Phase Efficiency in PC Systems</i>	<i>Rethinking of recycling and reuse options of obsolete Personal Computers in China</i>	<i>Measures and trends in energy use of semiconductor manufacturing</i>
	9:00am-9:30am	<i>Lifetime Exergy Consumption of an Enterprise Server</i>	<i>Understanding population dynamics of WEEE recycling system in the developing countries: A SIR model</i>	<i>Improvement of home appliances design based on energy-saving concept: case studies on hair dryer and coffee maker</i>
	9:30am-10:00am	<i>Energy Efficiency Meets Ecodesign Technology Impacts of the European EuP Directive</i>	<i>Trade of Secondhand EEE from Japan to Developing Asia - the Need for Policy Development Based on Actor Analysis</i>	<i>Environmental Sustainability in the Semiconductor Industry</i>
	10:00am-10:30am	Refreshment Break (Foyer)		
		Technical Session - Thermodynamics as a Tool (Bayside 1)	Technical Session - End of Life Management (Salons A-D)	Technical Session - Transportation (San Ramon)
	10:30am-11:00am	<i>Thermodynamics: The guidepost of effective use of energy</i>	<i>The Role and Value of Information for Supply Loop Management, Framework & Applications for the End-Of-Life Cell Phone Industry</i>	<i>Use of Industrial By-Products in Urban Transportation Infrastructure: argument for increased industrial symbiosis</i>
	11:00am-11:30am	<i>A Thermodynamic Framework for Analyzing and Improving Manufacturing Processes</i>	<i>Proposal and feasibility assessment of tele-inverse manufacturing</i>	<i>Predictive Life Cycle Comparison of Compact Sized Lightweight Vehicles with Aluminum & High Strength Steel</i>
	11:30am-12:00pm	<i>Estimating exergy renewability for sustainability assessment of corn ethanol</i>	<i>Remanufacturing Process Planning for IT-Equipment</i>	<i>Engineering Students Game to Green the Automobile Supply Chain</i>
	12:00pm-12:30pm	<i>Environmental and Energy Impacts of Transportation under Extended Producer Responsibility (EPR) Policy</i>	<i>Modeling the Economic and Environmental Performance of Recycling Systems</i>	<i>Environmental and Energy Impacts of Transportation under Extended Producer Responsibility (EPR) Policy</i>
	12:30pm-2:00pm	Luncheon Speaker - Jonathan Koomey (Lunch Provided) (Salon E)		
		Technical Session - Systems and Analysis (Bayside 1)	Technical Session - End of Life Flows (Salons A-D)	Panel Session - Plastics (San Ramon)
	2:15pm-2:45pm	<i>Environmental Life Style Analysis</i>	<i>Original Equipment Manufacturer End-of-Life Equipment Collection Metrics</i>	Panel Topics: <i>Sustainable Use of Flame Retardants in Electronics</i>
	2:45pm-3:15pm	<i>Product Design for Remanufacturing - rethinking design to facilitate integrated product service offerings</i>	<i>Forecasting sales and generation of end-of-life computers in the U.S.</i>	<i>Analysis of different biodegradable material and its technique to produce dishware</i>
	3:15pm-3:45pm	<i>A Case Study of Platinum Group Metals Availability for Electronics Manufacturers</i>	<i>Application of WEEE/waste inventORIZATION methodology using tracer tracking along material flow in a developing country</i>	<i>Recycling Plastics from Electronic Scrap: A Case Study</i>
3:45pm-4:15pm	<i>Assessing Life Cycle Environmental Implications of Polymer Nanocomposites</i>	<i>Characterizing Architectural Options for Electronic Waste Recycling Systems</i>	<i>Sustainability of Plastics Used in the Electrical, Electronics and Appliances Market</i>	
4:15pm-4:45pm	<i>What goes around comes around, - high level of cadmium in low cost jewelry.</i>	<i>Estimating Regional Material Flows for LCDs</i>		



PROGRAM AT-A-GLANCE

		Track I: Energy and Environmental Analysis	Track II: Electronics and Recycling	Track III: Special Topics in Sustainability
		Wednesday, May 21, 2008		
Registration	7:00am-8:00am	Breakfast (Salon E)		
		Technical Session - Thermodynamic Evaluations (Bayside 1)	Technical Session - Informatics and RFID (Salons A-D)	Technical Session - Urban Systems (San Ramon)
	8:00am-8:30am	<i>Thermodynamics and Recycling, A Review</i>	<i>Environmental Applications of RFID</i>	<i>Complexity in Urban Systems: ICT and Transportation</i>
	8:30am-9:00am	<i>Case Studies in Energy Use to Realize Ultra- High Purities in Semiconductor Manufacturing</i>	<i>E-market for e-waste: an environmental management system for the United States</i>	<i>The Energy and Greenhouse Gas Emissions Impact of Telecommuting</i>
	9:00am-9:30am	<i>Energetic and Environmental Evaluation of Titanium Dioxide Nanoparticles</i>	<i>Improving Environmental Information Handling and Data Exchange Within the Electronics Industry</i>	<i>Does Standardized High-Tech Park Development Fit Diverse Environmental Conditions: A Taiwan Case Study</i>
	9:30am-10:00am	<i>A Thermodynamic Metric for Quality Assessments in Manufacturing, Lead vs. Lead-Free Solders Case Study</i>	<i>The New Process in Integrated E-waste Management in China</i>	<i>The potential for domestic energy savings through assessing user behaviour and changes in design.</i>
	10:00am-10:15am	Refreshment Break (Foyer)		
		Technical Session - DfE and Materials (Bayside 1)	Technical Session - EOL International Markets and Supply Chains (Salons A-D)	Technical Session - Education (San Ramon)
	10:15am-10:45am	<i>An integrated impact assessment and weighting methodology: evaluation of the environmental consequences of lead-free solder alternatives</i>	<i>The recycling of excess and obsolete electronic systems. Current and future demands, requirements, and concerns.</i>	<i>Educating Engineers in the Anthropocene</i>
	10:45am-11:15am	<i>Comparison of simplified LCA variations for three LCA cases of electronic products from the ecodesign point of view</i>	<i>Sustainability perspective on the international reverse chain for reuse and recycling of computers</i>	<i>A Problem Based Learning (PBL) Module on Electronics & the Environment</i>
	11:15am-11:45am	<i>Moisture Absorption Phenomena in Green Composite Printed Wiring Board Prototypes</i>	<i>Estimation of Secondhand Personal Computer Import and Export in Asian Region</i>	<i>Assessing Impacts of Personal Electricity Consumption</i>
	11:45-12:15pm	<i>Microchip Reuse: Environmental Rationale and Design Implications</i>	<i>The application of the International Resource Recycling System (IRRS) to encourage e-waste recycling in the Asia-Pacific region</i>	<i>Sustainability: Educating Informally</i>
	12:30pm-1:30pm	Lunch (Provided), Student Awards, and Recognition of ISEE Committee (Salon E)		
		Panel Session - Environmental Management (Salons A-D)		
	1:45pm-2:15pm	<i>o Brominated Flame Retardants - Voluntary Emissions Control Action Program</i>		
	2:15pm-2:45pm	<i>o Green Standards for Electronics - EPEAT Expansion and Beyond</i>		
	2:45pm-3:15pm	<i>o EPEAT Uncloaked: A Critical Examination of EPEAT</i>		
	3:15pm-3:45pm	<i>o Key Carbon Emissions Reduction Strategies of Climate Leader Companies</i>		
	3:45pm-4:00pm	Refreshment Break (Foyer)		
4:00pm-5:30pm	Final Plenary Panel: Sustainable Systems, Carbon Footprints, and the Path Forward (Salon A-D)			



MONDAY, MAY 19, 2008

7:00am-8:00am

Continental Breakfast

Salon E

FREE TUTORIALS

8:00am – 9:30am

I. Introduction to Industrial Ecology and Life Cycle Assessment

Salons A-D

Introduction to Life Cycle Assessments (LCAs) Life Cycle Assessment (LCA) is an increasingly popular framework to assist in decision making about economic and environmental impacts of products and systems. The ISO 14000 environmental management framework outlines LCA and inspires its use in many areas. In short, it involves a “cradle to grave” boundary of the flows and impacts of a product or process, including everything from raw materials extraction to end of life management issues of a product. In this tutorial, we will introduce the framework of LCA, how it can be applied to issues in the electronics industry, and discuss the various tools and methods available to aid in decision making. Implications of LCA modeling on carbon footprints will also be discussed.

Speakers:

H. Scott Matthews, Carnegie Mellon University
Braden R. Allenby, Arizona State University

9:00am-10:00am

Refreshment Break

Foyer

10:00am – 11:30am

II. Electronic Product Environmental Assessment Tool (EPEAT)

Salons A-D

Since its launch in July of 2005 EPEAT has become a leading system for identifying greener electronic products, and the “EPEAT Standard” IEEE 1680 has become an important standard for eco design of electronics. In EPEAT, manufacturers declare their products’ conformance to the requirements of IEEE 1680 using a web-based database, and EPEAT regularly verifies that the declarations are accurate. There are two primary parties involved in these verifications. Qualified Verifiers (QVs) work with the manufacturers to collect the data to demonstrate conformance, and the Product Verification Committee (PVC) is the final judge and jury that makes the conformance/nonconformance deci-

sions. This workshop will review the requirements of IEEE 1680 in some detail, will explore some of the clarifications and interpretations that have been issued, and will review several verification findings. Much of this workshop is based on the training initially given to the members of the PVC and the QVs.

1:00pm – 2:00pm

KEYNOTE ADDRESS

Facilitating the Transition to the Smart Electric Grid

Brad Gammons, IBM

Salon E

2:00pm-2:15pm

Refreshment Break

Foyer

TECHNICAL SESSIONS

2:15pm-4:15pm

ENERGY AND ENVIRONMENTAL ANALYSIS: SESSION I

Power Generation and Distribution

Bayside 1

A Life Cycle Decision Tool for Solar Energy

Corinne Reich-Weiser, David Dornfeld, Tristan Fletcher,
University of California, Berkeley
Steve Horne, *SolFocus Inc.*

Comparison of Life Cycle Impact Assessment Tools in the Case of Biofuels

Amy Landis, *University of Pittsburgh*

The Impact of Reliability on Wind Turbine Life Cycle Analysis

Joseph Foley, Timothy Gutowski, *Massachusetts Institute of Technology*

Sustainable Power Generation

Preethi Prakash Rao, Srikanth Pingali, Anna University



2:15pm-4:15pm

**ELECTRONICS AND
RECYCLING:
SESSION I
Information and Communication
Technology (ICT)**

Salons A-D

**Design and Assessment of an
Intelligent Networked Book Delivery
System in the United States**

Junbeum Kim, Ming Xu, Ramzy Kahhat, Braden Allenby,
Eric Williams, *Arizona State University*

**Environmental Impacts of the Market
Dynamics in Urban E-commerce
System: Case Study of Book Retail
Market**

Ming Xu, Junbeum Kim, Ramzy Kahhat, Braden Allenby,
Arizona State University

**Creating and Applying a Shared
Vision of Sustainable ICT**

Jeff Omelchuck, *Green Electronics Council*

**Social Impacts of ICT Services -
Different Impacts in Different
Countries**

Kazue Takahashi, Masayuki Tsuda, Jiro Nakamura, *NTT
Energy and Environment Systems Laboratories*
Yasunari Matsuno, Yoshihiro Adachi, *University of Tokyo*

2:15pm-4:15pm

**SPECIAL TOPICS IN
SUSTAINABILITY:
SESSION I
Nanotechnology**

San Ramon

**Monte Carlo Multi-Criteria Risk
Analysis of Single Wall Carbon
Nanotube Production Processes
Under Uncertain Manufacturing
Costs, Occupational Health Risks,
and Regulatory Standards**

Zeynep D. Ok, James C. Benneyan, Jacqueline A.
Isaacs, *Northeastern University*

**Environmental Performance
Characterization of Atomic Layer
Deposition**

Chris Yuan, David Dornfeld, *University of California,
Berkeley*

**A Framework for Risk Management
and End-of-Life (EOL) Analysis for
Nanotechnology Products: A Case
Study in Lithium-Ion Batteries**

Sun Olapiriyakul, Reggie Caudill, *New Jersey Institute
of Technology*

**Assessment of Life-Cycle
Efficiencies for Carbon Nanotube
Battery Production Systems**

Thomas Seager, Brian Landi, Ryne Raffaele, *Rochester
Institute of Technology*

4:15pm-5:30pm

**POSTER SESSION
AND RECEPTION
Irvine Room**

**A Case Study of Platinum Group
Metals Availability for Electronics
Manufacturers**

Elisa Alonso, Frank Field, Randolph Kirchain,
Massachusetts Institute of Technology

**A Novel Control Scheme to Maximize
Efficiency for Active Mode Efficiency
Regulation**

Young-Bae Park, *Fairchild Semiconductor*

Advanced Battery Recycling

Steve Sloop, *On To Technology*

**An LCIA Weighting System Based on
China Environmental Policy and
Local Manufacturing Industry
Situation**

Fangyi Li, *Shandong University*

**Assessing the Sustainability of the
Material Recovery System for CRT
Glass**

Marie-Claude Nadeau, Jeremy Gregory, Randolph
Kirchain, *Massachusetts Institute of Technology*



Can Renewable Energy Meet Africa's Development Needs?

Adaora Okwo, *Georgia Institute of Technology*

Characterizing Architectural Options for Electronic Waste Recycling Systems

Susan Fredholm, Jeremy Gregory, Randolph Kirchain, Massachusetts Institute of Technology

Design and Assessment of an Intelligent Networked Book Delivery System in the United States

Junbeum Kim, Ming Xu, Ramzy Kahhat, Braden Allenby, Eric Williams, *Arizona State University*

Design of the Full Biodegradable and Single-Use Dishware Mold Based on Automatic Ejection Technology

Guo An-fu, Li Jian-feng, Li Fang-yi, Yang Yong, Wang Wen-yuan, Wei Bao-kun, *Shandong University*

E-Market for E-Waste: An E-Waste Management System for the United States

Ramzy Kahhat, Junbeum Kim, Ming Xu, Braden Allenby, Eric Williams, *Arizona State University*

End-of-Life Management of Cell Phones in the United States

Vered Doctori-Blass, Mihoyo Fuji, Joaquin Neira, Leigh Favret, Sarvy Mahdavi, Robert Miller, Roland Geyer, *University of California, Santa Barbara*

Environmental and Economic Assessment of Nano-Fabrication Processes of Memory Devices

Lindsay J. Dahlben, Jacqueline A. Isaacs, *Northeastern University*

Environmental Impacts of Labor in Manufacturing

Teresa W. Zhang, David A. Dornfeld, *University of California, Berkeley*

Forecasting Sales and Generation of End-of-Life Computers in the United States

Yan Yang, Eric Williams, *Arizona State University*

Halogen-Free FR Systems for Advanced Printed Circuit Boards

Nikolas Kaprinidis, Sabine Fuchs, *Ciba*

Improve Electricity Distribution Efficiency - Save Environment

Aditya Pyasi, Valerie Thomas, *Georgia Institute of Technology*

Increased Efficiency of Wind Generated Electricity using Demand Side Management

Paddy Finn, Colin Fitzpatrick, Martin Leahy, Edin Omerdic, *University of Limerick*

Life Cycle Assessment of Semiconductor Manufacturing

Sarah Boyd, Nikhil Krishnan, David Dornfeld, *University of California, Berkeley*

Manufacturability and Sustainability Analysis of Nanoscale Manufacturing

Chris Yuan, David Dornfeld, *University of California, Berkeley*

Opportunity for Landfill Gas-to-Energy Projects in the United States

Dexin Luo and Valerie Thomas, *Georgia Institute of Technology*

RFID Signaling to Stimulate Reuse of Personal Computers

Eanna Cronin, Stewart Hickey, Colin Fitzpatrick, *University of Limerick*

Simultaneous Disassembly of PCBs Based on Components Reusability Assessment

Yang Jiping, Xiang Dong, Gao Peng, Zhong Ming, Cheng Yang, Wang Jingsong, Duan Guanghong, *Tsinghua University*

Sustainable Power Generation

Preethi Prakash Rao, Srikanth Pingali, *Anna University*

The Technical and Broader Societal Impact of Organic Electronic Devices

Roderick Jackson, Diogenes Placencia, *Georgia Institute of Technology*

Understanding Population Dynamics of WEEE Recycling System in the Developing Countries: A SIR Model

Tienhua Wu, Yenming J. Chen, *National Kaohsiung First University of Science and Technology*



TUESDAY, MAY 20, 2008

7:00am-8:00am

Continental Breakfast

Salon E

7:00am-8:00am

TCEE COMMITTEE MEETING

Room location here.

TECHNICAL SESSIONS

8:00am-10:00am

ENERGY AND ENVIRONMENTAL ANALYSIS: SESSION II

Energy Use

Bayside 1

Life Cycle Assessment (LCA) in Electrical and Electronic Sector in Malaysia — A Case Study of a Ballast

Sitty Nur Syafa Bakri, Salmijah Surif, *Universiti Kebangsaan Malaysia*

Rajeswari K.Ramasamy, *SIRIM Berhad*

Using Feedback to Enhance Use Phase Efficiency in PC Systems

Stewart Hickey, Colin Fitzpatrick, *University of Limerick*

Lifetime Exergy Consumption of an Enterprise Server

Christopher Hannemann, Van Carey, *University of California, Berkeley*

Ampip Shah, Chandrakant Patel, *Hewlett Packard Laboratories*

Energy Efficiency Meets Ecodesign – Technology Impacts of the European EuP Directive

Karsten Schischke, Nils F. Nissen, Lutz Stobbe, *Fraunhofer IZM*

Herbert Reichl, *Technical University of Berlin*

8:00am-10:00am

ELECTRONICS AND RECYCLING: SESSION II

End-of-Life Design and Policy for an International Market

Salons A-D

DfE for Products Distributed Across Borders

Keiji Masui, *National Institute of Advanced Industrial Science and Technology*

Rethinking of Recycling and Reuse Options of Obsolete Personal Computers in China

Jianxin Yang, Bin Lu, *Chinese Academy of Sciences*

Understanding Population Dynamics of WEEE Recycling Systems in Developing Countries: A SIR Model

Tienhua Wu, Yenming J. Chen, *National Kaohsiung First of Science and Technology*

Trade of Secondhand EEE from Japan to Developing Asia – The Need for Policy Development Based on Actor Analysis

Chika Aoki Suzuki, Yasuhiko Hotta, Magnus Bengtsson, Akira Ogihara, *Institute of Global Environmental Strategies*

8:00am-10:00am

SPECIAL TOPICS IN SUSTAINABILITY: SESSION II

Green Manufacturing

San Ramon

Environmental and Health Risk Assessment for California Printed Circuit Board Manufacturing: Providing Guidance for Pollution Prevention Opportunities

Carl Lam, Xiaoying Zhou, Thomas Green, Julie Schoenung, *University of California, Davis*

Pauline Batarseh, Kim Wilhelm, *California Department of Toxic Substances Control*



Measures and Trends in Energy Use of Semiconductor Manufacturing

Liqiu Deng, Eric Williams, *Arizona State University*

Improvement of Home Appliances Design Based on Energy-Saving Concept: Case Studies on Hair Dryer and Coffee Maker

Hua Li, Hong-chao Zhang, Derrick Tate, John Carrell, *Texas Tech University*

Environmental Sustainability in the Semiconductor Industry

John Harland, Ted Reichelt, Marissa Yao, *Intel Corporation*

10:00am-10:30am
Refreshment Break
Foyer

TECHNICAL SESSIONS

10:30am-12:30pm
ENERGY AND ENVIRONMENTAL ANALYSIS: SESSION III
Energy Analysis
Bayside 1

Thermodynamics: The Guidepost of Effective Use of Energy

Elias Gyftopoulos, *Massachusetts Institute of Technology*

A Thermodynamic Framework for Analyzing and Improving Manufacturing Processes

Matthew Branham, Timothy Gutowski, *Massachusetts Institute of Technology*
Dusan Sekulic, *University of Kentucky*

Estimating Exergy Renewability for Sustainability Assessment of Corn Ethanol

Thomas Seager, *Rochester Institute of Technology*
Christopher Cummings, *Purdue University*

Environmental and Energy Impacts of Transportation under Extended Producer Responsibility (EPR) Policy

Y. Anny Huang, H. Scott Matthews, *Carnegie Mellon University*

10:30am-12:30pm
ELECTRONICS AND RECYCLING: SESSION III
End-of-Life Management
Salons A-D

The Role and Value of Information for Supply Loop Management: Framework and Applications for the End-Of-Life Cell Phone Industry

Vered Doctori-Blass, Roland Geyer, *University of California, Santa Barbara*

Proposal and Feasibility Assessment of “Tele-Inverse Manufacturing”

Mitsutaka Matsumoto, Nozomu Mishima, Keijiro Masui, Shinsuke Kondoh, *National Institute of Advanced Industrial Science and Technology*

Remanufacturing Process Planning for IT-Equipment

Stylianos Chiotellis, Sebastian Kernbaum, Günther Seliger, *Technical University of Berlin*

Modeling the Economic and Environmental Performance of Recycling Systems

Jeffrey Dahmus, Susan Fredholm, Elsa Olivetti, Jeremy Gregory, Randolph Kirchain, *Massachusetts Institute of Technology*



10:30am-12:30pm

SPECIAL TOPICS IN SUSTAINABILITY: SESSION III

Transportation

San Ramon

Use of Industrial By-Products in Urban Transportation Infrastructure: Argument for Increased Industrial Symbiosis

Alberta Carpenter, *University of New Hampshire*

Predictive Life Cycle Comparison of Compact Sized Lightweight Vehicles with Aluminum & High Strength Steel

Hyung-Ju Kim, Colin McMillan, Greg Keoleian, Steven Skerlos, *University of Michigan*

Engineering Students Game to Green the Automobile Supply Chain

Jacqueline A Isaacs, Jay Laird, *Northeastern University*
Thomas Seager, *Rochester Institute of Technology*

Reconsidering Food Miles: Implications of Transport on Life Cycle Carbon Emissions of Food Products

Chris Weber, H. Scott Matthews, *Carnegie Mellon University*

12:30pm – 2:00pm

LUNCHEON SPEAKER

Jonathan Koomey, Ph.D., Lawrence Berkeley National Laboratory and Stanford University

Salon E

TECHNICAL SESSIONS

2:15pm-4:45pm

ENERGY AND ENVIRONMENTAL ANALYSIS: SESSION IV **Systems and Analysis**

Bayside 1

Environmental Lifestyle Analysis

Timothy G. Gutowski, Amanda Taplett, Anna N. Allen, Amy Banzaert, Rob Cirinciore, Stacy Figueredo, Susan Fredholm, Alissa Jones, Barry Kudrowitz, Robert J. Scaringe, Sittha Sukkasi, Mika Tomczak, Jessica Vechakul, Malima Isabella Wolf, *Massachusetts Institute of Technology*

Product Design for Remanufacturing - Rethinking Eesign to Facilitate Integrated Product Service Offerings

Erik Sundin, Mattias Lindahl, *Linköping University*

A Case Study of Platinum Group Metals Availability for Electronics Manufacturers

Elisa Alonso, Frank Field, Randolph Kirchain, *Massachusetts Institute of Technology*

Assessing Life Cycle Environmental Implications of Polymer Nanocomposites

Vikas Khanna, Bhavik Bakshii, L. Lee, *The Ohio State University*

What Goes Around Comes Around — High Level of Cadmium in Low Cost Jewelry

Martin Streicher-Porte, Susanne Pfenninger, Alexandra Buckenmayer, *Kantonales Labor Zürich*

2:15pm-4:45pm

ELECTRONICS AND RECYCLING: SESSION IV

End-of-Life Flows

Salons A-D



Original Equipment Manufacturer End-of-Life Equipment Collection Metrics

Elsa Olivetti, Jeremy Gregory, Randolph Kirchain,
Massachusetts Institute of Technology

Forecasting Sales and Generation of End-of-Life Computers in the U.S.

Yan Yang, Eric Williams, *Arizona State University*

Application of WEEE/E-Waste Inventorization Methodology Using Tracer Tracking Along Material Flow in EEE Lifecycle in Developing Country

Amit Jain, *IRG Systems South Asia Pvt. Ltd.*

Characterizing Architectural Options for Electronic Waste Recycling Systems

Susan Fredholm, Jeremy Gregory, Randolph Kirchain,
Massachusetts Institute of Technology

Estimating Regional Material Flows for LCDs

Seung-Jin Lee, Joyce Cooper, *University of Washington*

2:15pm-4:45pm

SPECIAL TOPICS IN SUSTAINABILITY: SESSION IV

Panel Session on Plastics

San Ramon

The Sustainable Use of Flame Retardants in the Electronics Industry

Susan Landry, Ray Dawson, *Albemarle Corporation*

Analysis of Different Biodegradable Material and its Technique to Produce Dishware

Jia Xiujie, Li Jianfeng, Li Fangyi, *Shandong University*
Wei Baokun, *Shandong Jiufa Group Company*

Recycling Plastics from Electronic Scrap: A Case Study

Puneet Shrivastava, *Texas Tech University*

Sustainability of Plastics Used in the Electrical, Electronics and Appliances Market

D'Lane Wisner, *D'Lane Wisner and Associates*

Patrick Meyer, *BASF Corporation*

Carlos Gonzales, *Bayer Material Sciences*

Anne Kaplan, *DuPont*

Jon Pyper, *The Dow Chemical Company*

Ivo Mersiowsky, Gesa Koeberle, *Five Winds
International*



**WEDNESDAY, MAY 21,
2008**

7:00am-8:00am
Continental Breakfast
Salon E

TECHNICAL SESSIONS

8:00am-10:00am
**ENERGY AND
ENVIRONMENTAL
ANALYSIS: SESSION V**
Thermodynamic Evaluations
Bayside 1

**Thermodynamics and Recycling: A
Review**
Timothy Gutowski, *Massachusetts Institute of
Technology*

**Case Studies in Energy Use to
Realize Ultra- High Purities in
Semiconductor Manufacturing**
Eric Williams, *Arizona State University*
Nikhil Krishnan, *Columbia University*
Sarah Boyd, *University of California, Berkeley*

**Energetic and Environmental
Evaluation of Titanium Dioxide
Nanoparticles**
Geoffrey Grubb, Bhavik Bakshi, *The Ohio State
University*

**A Thermodynamic Metric for Quality
Assessments in Manufacturing: Lead
vs. Lead-Free Solders Case Study**
Dusan Sekulic, Hui Zhao, *University of Kentucky*

8:00am-10:00am
**ELECTRONICS AND
RECYCLING:
SESSION V**
**Informatics and Radio Frequency
Identification (RFID)**
Salons A-D

Environmental Applications of RFID
Valerie Thomas, *Georgia Institute of Technology*

**E-Market for E-waste: An E-waste
Management System for the United
States**
Ramzy Kahhat, Junbeum Kim, Ming Xu, Braden Allenby,
Eric Williams, *Arizona State University*

**Improving Environmental
Information Handling and Data
Exchange Within the Electronics
Industry**
Eric Simmon, John Messina, *National Institute of
Standards and Technology*

**The New Process in Integrated E-
waste Management in China**
Xuefeng Wen, Hualong Hu, State Environmental
Protection Administration, Beijing
Xiaohua Zhou, *University of Kentucky*

8:00am-10:00am
**SPECIAL TOPICS IN
SUSTAINABILITY:
SESSION V**
Urban Systems
San Ramon

**Complexity in Urban Systems: ICT
and Transportation**
Braden Allenby, *Arizona State University*

**The Energy and Greenhouse Gas
Emissions Impact of Telecommuting**
Kurt Roth, Todd Rhodes, Ratcharit Ponoum, *TIAX LLC*



Does Standardized High-Tech Park Development Fit Diverse Environmental Conditions: Environmental Challenges in Building Taiwan's Central Science-based Industrial Park

Wenling Tu, *Shih-Hsin University*
Yujung Lee, *Oxford University Centre for the Environment*

The Potential for Domestic Energy Savings through Assessing User Behaviour and Changes in Design

Edward Elias, Steve Culley, Elies Dekoninck, *University of Bath*

10:00am-10:15am
Refreshment Break
Foyer

TECHNICAL SESSIONS

10:15am-12:15pm
ENERGY AND ENVIRONMENTAL ANALYSIS: SESSION VI
Design for Environment (DfE) and Materials
Bayside 1

An Integrated Impact Assessment and Weighting Methodology: Evaluation of the Environmental Consequences of Lead-Free Solder Alternatives

Xiaoying Zhou, Julie Schoenung, *University of California, Davis*

Comparison of Simplified LCA Variations for Three LCA Cases of Electronic Products from the Ecodesign Point of View

Jani Valkama, Marika Keskinen, *Tampere University of Technology*

Moisture Absorption Phenomena in Green Composite Printed Wiring Board Prototypes

John Lincoln, Oladele Ogunseitan, Jean-Daniel Saphores, *University of California, Irvine*
Andrew Shapiro, *Jet Propulsion Laboratory*

Microchip Reuse: Environmental Rationale and Design Implications

Roland Geyer, Frederic Chong, *University of California, Santa Barbara*
John Oliver, *California Polytechnic State University, San Luis Obispo*
Raj Amirtharajah, Venkatesh Akella, *University of California, Davis*

10:15am-12:15pm
ELECTRONICS AND RECYCLING: SESSION VI
End-of-Life International Markets and Supply Chains
Salons A-D

The Recycling of Excess and Obsolete Electronic Systems: Current and Future Demands, Requirements, and Concerns

Chris Ryan, Peter Bennison, *Metech International*

Sustainability Perspective on the International Reverse Chain for Reuse and Recycling of Computers

Eric Williams, Ramzy Kahhat, Braden Allenby, Edward Kavazanjian, Junbeum Kim, Ming Xu, *Arizona State University*

Estimation of Secondhand Personal Computer Import and Export in Asian Region

Aya Yoshida, *National Institute for Environmental Studies*

Application of the International Resource Recycling System (IRRS) to Encourage Electronic Waste Recycling in the Asia-Pacific Region

Masachika Suzuki, *International University of Japan*



10:15am-12:15pm

SPECIAL TOPICS IN SUSTAINABILITY: SESSION VI
Education

San Ramon

Educating Engineers in the Anthropocene

Brad Allenby, *Arizona State University*

A Problem Based Learning (PBL) Module on Electronics & the Environment

Colin Fitzpatrick, *University of Limerick*

Assessing Impacts of Personal Electricity Consumption

Deanna Matthews, Paulina Jaramillo, Joe Marriott, *Carnegie Mellon University*

Sustainability: Educating Informally

Cynthia Orndoff, *Florida Gulf Coast University*

12:15pm – 1:30pm

LUNCH, STUDENT AWARDS, AND COMMITTEE RECOGNITION

Salon E

1:45pm-3:45pm

PLENARY PANEL SESSION

Environmental Management

Salons A-D

Brominated Flame Retardants - Voluntary Emissions Control Action Program

Glade Squires, *Bromine Science and Environmental Forum*

Green Standards for Electronics - EPEAT Expansion and Beyond

John Katz, *United States Environmental Protection Agency*

EPEAT Uncloaked: A Critical Examination of EPEAT

Wayne Rifer, *Green Electronics Council*
Vicky Salazar, *United States Environmental Protection Agency*

Key Carbon Emissions Reduction Strategies of Climate Leader Companies

Ronald Meissen, *Baxter International Inc.*
Patrick Eagan, *University of Wisconsin-Madison*

Using FMEA and FAHP to Risk Evaluation of Green Components

Chia-Wei Hsu, Allen Hu, Wei-Cheng Wu, *National Taipei University of Technology*

3:45pm-4:00pm

Refreshment Break
Foyer

4:00pm-5:30pm

PLENARY PANEL SESSION

Sustainable Systems, Carbon Footprints, and the Path Forward.

Salon A-D



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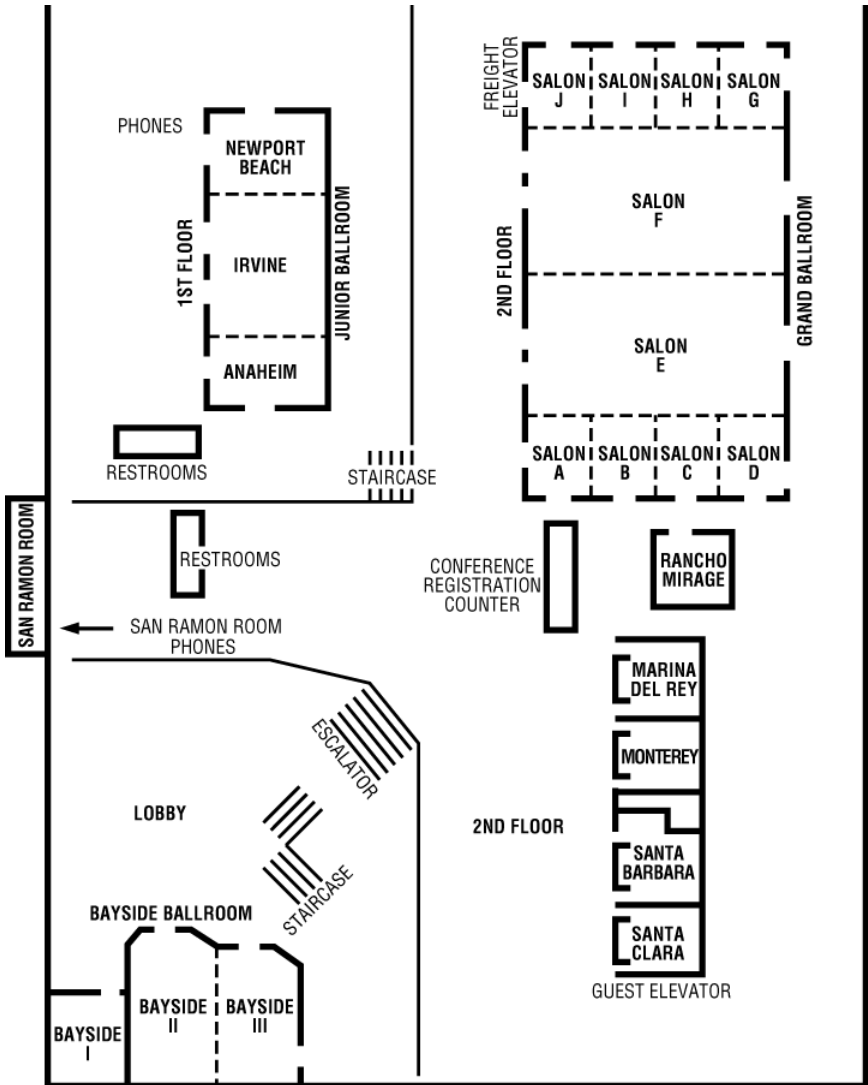


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San Francisco Airport Marriott Floorplan





TCEE Executive Committee Structure

Executive Committee:

Chair:	Braden Allenby
Immediate Past Chair:	Reggie Caudill
Treasurer:	H. Scott Matthews
Vice Chairs:	
Technical Activities:	Mark Newton
International Activities:	Pat Eagan
Conferences:	Cynthia Murphy
Publications:	Hong-Chao Zhang
Academic Activities	Julie Ann Stuart Williams



Electronics and the Environment 2008 Committee Report

Our Mission

To ensure that environmental and social considerations are integrated and imbedded into electronics products and processes from design and manufacturing to end-of-life management, and to explore the environmental and social implications of emerging technologies.

Scope

The focus of the IEEE Technical Committee on Electronics & the Environment (TCEE) encompasses all aspects of sustainable science and technology as it applies to information and communication technologies (ICT), including environmental health and safety subjects, social implications of ICT technologies, and emerging technologies, with a focus on the integration of this knowledge into sound scientific and engineering principles applied across the entire lifecycle of electrical and electronics products and processes, and the services built on these technologies. The implementation of our mission includes a wide variety of activities including conferences and publications, educational efforts, standards development, research recommendations, and advocacy coordination.

Committee History

The Committee started work in 1992, and was elected a formal committee of the IEEE Technical Activities Board in 1994. Today, the Committee is a Technical Committee of the IEEE Computer Society. The TCEE has helped to formulate the IEEE Environment, Health and Safety Policy Statement (Policy 9.21) which articulates IEEE's commitment to integrating environmental objectives and considerations into all electrical and electronics engineering activities, worldwide. TCEE sponsored a research and development workshop which focused on current research on environmentally conscious products and materials for electronics. Individual members of the TCEE participated in the working group to develop IEEE Standard 1680, called the Electronic Product Environmental Assessment Tool (EPEAT) standard. IEEE 1680 is the first environmental standard in the US for electronic products.

Current Initiatives and Activities

The primary activity of the committee remains the sponsorship of the IEEE International Symposium on Electronics and the Environment; and the TCEE is committed to assur-



ing that the ISEE is, and continues to be, one of the premier technical conferences and international forums to address issues associated with electronics, technology, society and the environment. Towards that end, the TCEE has expanded its activities this year in the following areas:

Strategically positioning the conference to accomplish the following:

To strengthen the technical depth and scope of the ISEE conference to be more responsive to the needs of the electronics industry and its stakeholder communities, both today and in the future.

To reenergize the conference by engaging actively key segments of the OEM, information and communication technologies, and service provider communities and expanding participation of others from industry, academia, government, and other organizations.

To streamline and improve the conference organizational committee structure and operational support services.

To explore the implications for ICT professionals of emerging technologies across the frontiers of nanotech, biotech, robotics, and cognitive science, as well as ICT itself.

Represent IEEE in a new initiative of the American Society of Civil Engineers (ASCE), in collaboration with other professional societies and federal agencies, on Practice, Education and Research for Sustainable Infrastructure (PERSI).

Initiate effort to establish closer relationships with the IEEE Society on Social Implications of Technology and the International Society of Industrial Ecology (ISIE), as well as other organizations such as the Materials Society and the Air and Waste Management Association

The IEEE TCEE is proud to recognize the participation and contribution of our international partners in designating this year's ISEE as the 2008 Electronics Goes Green conference, and intends to build on this strength by ensuring that the ISEE remains the premier event for presenting and learning about the latest in social and environmental dimensions of ICT technologies and services, including environmentally and socially appropriate design, manufacturing, emerging technologies, recycling, and policy from world leaders in industry, academia, government and other organizations.





SAVE THE DATE

**2009 IEEE International
Symposium on Electronics
and the Environment
will take place in the
week of May 18, 2009
in Phoenix, Arizona**