Electronics and Sustainability Symposium
University of Illinois
www.sustainelectronics.illinois.edu/symposium/2011
Dear Colleagues,

On behalf of the conference organizing committee, it is my pleasure to cordially welcome you to the second annual Electronics and Sustainability Conference at the University of Illinois. This symposium is one of several important activities launched in the past two years at the Illinois Sustainable Technology Center (ISTC) as part of our Sustainable Electronics Initiative. This initiative is part of our efforts to create a center for sustainable electronics research and education here in at the University of Illinois at Urbana-Champaign. We are developing programs in sustainable electronics research, education, data management, and technical assistance. Through our affiliates program we are developing partnerships with colleagues in industry and education to promote common research and education interests.

We are spearheading Illinois Sustainable Technology Center’s impact by being the first organization in the state of Illinois to accept the State Electronics Challenge, proving that we back up our bluster with sustainable deeds. We have developed what we consider to be the first course in the nation on the topic of electronic waste in collaboration with campus experts in engineering, marketing, and industrial design as well as industry. To draw attention to this growing problem and to illustrate the value still remaining in discarded electronics, we have organized
the second International E-Waste Design Competition to promote team problem-solving among college students worldwide and demonstrate the power of design in creating innovative products to minimize waste and demonstrate the inherent value in older electronics.

Our goal for this symposium is to explore how the advances and applications of sustainable electronics can lead to a healthier and more sustainable future. We want to help forge and strengthen relations between industry, research laboratories, government agencies, the private sector and universities on strategic issues of electronics and sustainability. This symposium, now in its second year, is an important part of building this network of experts from industry and education. With all due respect to the power of modern technology to facilitate virtual networking and relationships, we feel by coming together at symposiums like this, even during challenging economic times, is the best way to get to know one another, our individual strengths, and how we might work together for the common good. With this in mind we challenge you to take these two days to build working relationships and lasting friendships. The sustainable electronic problems we want to solve are simply too complex to go it alone. We need our collective expertise, the best and brightest minds in both education and industry working together to effectively tackle these problems. So we welcome those of you here today, the policy makers, the material scientists, the manufacturers, the designers and engineers, the educators and our future leaders, the students, working together to tackle these complex problems.

William Bullock, Conference Chair

Manohar Kulkarni, Conference Co-Chair
2011 Electronics and Sustainability Symposium

**Schedule**

**Wednesday, Mar. 23**

7:15 - 8:15
REGISTRATION OPENS
Continental Breakfast

8:15 - 8:45
OPENING REMARKS
Sustainable Electronics Initiative
William Bullock University of Illinois at Urbana-Champaign

8:45 - 9:15
END OF LIFE MANAGEMENT
Institutional Disposition and Management
of End-of-Life Electronics: Case Study of U.S. Universities
Callie Babbitt Rochester Institute of Technology

9:15 - 9:30
BREAK

9:30 - 10:00
MATERIAL SELECTION
Electronics on Paper - Will it Succeed
Andrew J. Steckl University of Cincinnati

10:00 - 10:30
PRODUCT DESIGN
ECOMOTO - Motorola Mobility’s Journey to Greener Electronics
Bill Olson Motorola

10:30 - 10:45
BREAK

10:45 - 11:15
PRODUCT USE
Hard Drive Use Analysis
Willie Cade PC Recyclers and Refurbishers

11:15 - 11:45
PRODUCT REPAIR
Repair 2.0: Reinventing the Way We Fix Things
Kyle Wiens iFixit

11:45 - 1:15
LUNCH AND KEYNOTE SPEAKER
“Always Start with the Business Case” - Advice from the Front Lines
John Pflueger Principal Environmental Strategist (Dell)

1:15 - 1:45
ELECTRONICS RE-USE
Technical Challenges in Cell Phone Reuse
Chuck Newman ReCellular

1:45 - 2:15
MATERIAL RECOVERY
End of Life Decision Making for Used Products with
Uncertain Quantity and Quality of Return
Sara Behdad University of Illinois

2:15 - 2:30
BREAK

2:30 - 4:45
PANEL DISCUSSION
Research topics
John Pflueger, Dell
Bill Olson, Motorola
Bill Hoffman, UL Environment
Willie Cade, PC Recyclers and Refurbishers
Jade Lee, Supply Chain Services, Inc
David Walters, IL Environmental Protection Agency
Callie Babbitt, Rochester Institute of Technology
Praveen Gupta, Illinois Institute of Technology

5:00 - 8:00
RECEPTION
Thursday, Mar. 24

7:15 - 8:15  REGISTRATION OPENS
Continental Breakfast

8:15 - 8:45  POLICY
State E-Waste Programs and Their Impacts on the Recycling Industry
*Katie Reilly* Electronic Recyclers International, Inc.

8:45 - 9:15  POLICY
State Electronics Challenge and Illinois Electronics Recycling Update
*Mike Mitchell* Illinois Recycling Association

9:15 - 9:30  BREAK

9:30 - 10:00  STANDARDS
Mobile Devices: A New Product Sustainability Standard
*Bill Hoffman* UL Environment

10:00 - 10:30  USE/PRODUCT LIFE CYCLE
A Product Design Guide for Achieving Sustainable LED Lighting Systems
*James Amrine Jr., Dr. Manish Mehta*
National Center for Manufacturing Sciences

10:30 - 10:45  BREAK

10:45 - 11:15  EDUCATION
A Model Transdisciplinary Curriculum for Sustainable Design of Electronics
*Alex Lobos* Rochester Institute of Technology

11:15 - 11:45  ELECTRONICS COLLECTION
E-Scrap Recycling in Champaign County: A Local Government Perspective
*Courtney Rushforth* City of Urbana

11:45 - 1:15  WORKING LUNCH

1:15 - 1:45  ELECTRONIC RECOVERY / EDUCATION
Electronics for Sustainability: Beyond Device Impacts to Enabling Sustainable Lifestyles
*Kyo Suh* University of Minnesota

1:45 - 2:15  ELECTRONICS MANUFACTURING CONSIDERATIONS
Innovation for Sustainability
*Praveen Gupta* Illinois Institute of Technology

2:15 - 2:45  CLOSING REMARKS
*Manohar Kulkarni* Illinois Sustainable Technology Center
Bio
John Pflueger, Ph.D., is Dell’s Principal Environmental Strategist. In this role, John is responsible for driving Dell’s strategy on issues around Environmental Sustainability – including Energy, GHG Emissions, Materials of Concern, Material Use/Recovery/Reuse, and Water. Prior to this role, John was Dell’s subject matter expert on data center energy efficiency and managed initiatives to help customers improve the productivity of their computer systems and facilities. Since graduating from MIT in 1991 with a Ph.D. in Mechanical Engineering, John has spent nineteen years in manufacturing engineering, product development, product marketing and product management roles in the high-tech industry. John currently serves as a director for The Green Grid and as a participant in The Green Grid’s Technical Committee.

"Always Start with the Business Case” – Advice from the Front Lines
John Pflueger

Abstract
As the practice of sustainability matures, the challenges we face as practitioners are maturing as well. While once societal imperative alone could drive efforts, businesses now need a better understanding of the benefits of our initiatives.

In many cases, however, the benefits from our work, while significant, are hard to quantify or spread out over a large number of stakeholders. This is not a sign that sustainability concerns are ebbing, but rather a result of sustainability moving into the mainstream.

For us to sustain our successes, we have to become not only scientists and technologists, but also financial analysts, operations experts, and marketeers. We need to solve not only the technical issues, but also understand and address the economic ones as well. Basic research in our field will continue, but it will have to be supplanted with operations research and other activities that help identify and quantify externalities and enable all stakeholders to recognize the benefits of our efforts.
Callie W. Babbitt, Eric Williams, Ramzy Kahhat

Institutional Disposition and Management of End-of-Life Electronics: Case Study of U.S. Universities

Bio

Callie Babbitt is an Assistant Professor in the Golisano Institute for Sustainability at Rochester Institute of Technology. Her research focuses on environmental implications of emerging technologies and sustainable management of electronic products across their life cycle.

Abstract

Institutions both public and private face a challenge to develop policies to manage the purchase, use and disposal of electronics. Environmental considerations play an increasing role in addition to traditional factors of cost, performance and security. Characterizing current disposition practices for end-of-life electronics is a key step in developing policies that prevent negative environmental and health impacts while maximizing potential for positive social and economic benefits through reuse. To provide a baseline, we develop the first characterization of quantity, value, disposition, and flows of end-of-life electronics at a major U.S. educational institution. Results of the empirical study indicate that most end-of-first-life electronics were resold through public auction to individuals and small companies who either refurbish working equipment for resale or sell unusable products for reclamation of scrap metal. Desktop and laptop computers sold for refurbishing and resale (both within the U.S. and by export) averaged US $20-100 per unit, with computers sold directly to individuals for reuse reaching $250-350 per unit. This detailed assessment was coupled with a benchmarking survey of end-of-life electronics management practices in U.S. higher education. Survey results indicate that while auctions are still commonplace, an increasing number of institutions are responding to environmental concerns by creating partnerships with local recycling and resale entities and mandating domestic recycling. We use the analyses of current disposition practices as input to discuss institutional strategies for managing electronics. One key issue is the tension between benefits of public auctions in terms of income for the institution and increased reuse for society and the environmental risks due to unknown downstream practices. A growing number of institutions seek to mitigate this risk by mandating contracts with certified e-cyclers, procuring only EPEAT computers, or entering into
Sara Behdad is a PhD candidate in the Industrial and Enterprise Systems Engineering Department at the University of Illinois at Urbana-Champaign. She is a member of Decision Systems Laboratory at UIUC. Her research is focused on developing new methods for managing returned used products, particularly electronic waste. Disassembly sequence planning and product end of life management are two areas of her research.

Abstract

The management of end-of-life electronic waste (e-waste) attracts significant attention in many parts of the world due to environmental concerns, legislative requirements, consumer interests in green products and market image of manufacturers. Effective management of returned used products can result in great profitability for remanufacturers and recyclers.

However, managing e-waste is complicated by factors including the high degree of uncertainty of quantity, timing of arrival and quality of the returned products. Consumers discard their products with no specific pattern, making it difficult for recovery recycling facilities to estimate their arrival rate and quantity. The variability in the stream of returned EOL products makes it hard to plan for their materials, equipment and human resource requirements.

The aim of this research is to tackle the uncertainty associated with the quantity of received used products. A stochastic programming model is introduced which considers the quantity of returned product as an uncertain parameter and determines to what extent the product should be disassembled and what is the best end-of-life option for each subassembly.
Another challenge facing the remanufacturing companies is the variable levels of received product quality. The question is if it is economical to upgrade a product while refurbishing it or not and up to which point it should be upgraded. The purpose of our work is to answer this question.

Bio

William Bullock is Professor of Industrial Design and an Affiliate Faculty with the Illinois Sustainable Technology Center (ISTC). At ISTC he is helping build the Sustainable Electronics Initiative (SEI) a consortium dedicated to the development and implementation of more sustainable systems for designing, producing and remanufacturing and recycling electronic devices. (www.sustainelectronics.illinois.edu). He recently developed the first course at the university on sustainable product design and collaborated with engineering colleagues and industry advisors in creating a new course on the topic of electronic waste (E-waste). He directs the annual International E-waste Design Competition (ewaste.illinois.edu) that challenges students globally to create innovative uses with electronic waste. Bill also directs the Design for Energy and Environment Laboratory at ISTC. DEE Lab links education and design research in the classroom where advanced students from engineering, design and marketing collaborate to conduct product development studies for industry. His career spans three decades as an academician, administrator and practitioner and includes the direction and advancement of industrial design programs at the University of Illinois Urbana-Champaign, Georgia Institute of Technology and Auburn University. He is an active Fellow in the Industrial Designers Society of America and a National Association of Schools of Art and Design accreditation evaluator.

Bio

Willie Cade is President and CEO of PC Rebuilders & Recyclers (PCRR) home of the Computers for Schools program that helps to close the digital divide. PCRR provides refurbished computers for schools, non-profits and at risk students. They were one of the first Microsoft Authorized Refurbisher in the United States. PCRR refurbishes used
computers to meet high quality standards and carry a 3 year warranty. Willie has provided expert testimony to the House Committee on Science and Technology. He is the publisher of www.eWasteCalendar.com a site to promote e-waste collection events in the United States. He was a “Responsible Recycling” or R2 stakeholder. He is the Co-Chair of the Environmentally Sound Refurbishment/Repair of Used Computing Equipment for the Partnership for Action on Computing Equipment of the Secretariat of the Basel Convention of the United Nations Environmental Program. Before founding PCRR, Willie had a management consulting firm whose clients included Booz Allen Hamilton, Toys “R” Us and many other corporations throughout the United States.

Bio

Praveen Gupta teaches the Innovation for Engineers course at University of Illinois, Chicago. Prof. Gupta’s innovation course is taught at multiple institutions around the country. He is the author of many books including Business Innovation in the 21st Century, The Innovation Solution (July 2011), and Six Sigma Performance Handbook.

Prof. Gupta, founding President of Accelper, consults with corporations for sustaining profitable growth through new management tools in knowledge economy. He was the founding Editor-in-Chief of International Journal of Innovation Science. He can be reached at praveeng@uic.edu.

Abstract

Electronics industry has been a fast growing industry causing a significant solid waste. The waste can be end of the life cycle disposal, in-process waste, design waste or designed-in waste. It has been observed that many times waste can be prevented during the design phase of product life cycle.

Praveen Gupta, who has worked at Motorola and AT&T Bell, has pursued science of innovation, and developed a holistic and teachable framework of innovation, called Breakthrough Innovation (Brinnovation™). Prof. Gupta will share his innovation methodology for developing profitable
and environment friendly innovative designs. After his presentation, attendees will have a better understanding of the innovation process, to apply to designing more sustainable products.

Bio

Bill Formerly was the Director of Sustainability Services for the non-for-profit consulting firm, Chicago Manufacturing Center, where he was responsible for strategy and deployment of sustainability services. He also managed the Chicago Waste-to-Profit Network and performed a Product Carbon Footprint assessment of beer for a microbrewery.

While at Motorola Bill worked on the development of several internal specifications including standards governing the chemical content of products and was heavily involved in external standardization efforts for environmental issues in electronics. Bill also led the semiconductor packaging team for an early Life Cycle Assessment of an electronics product performed by an industry consortium.

Bill spent 2 years at Argonne National Laboratory as a Post Doctoral Appointee. While at Argonne he studied the chemistry and formation of transition metal clusters. The reactions of Nickel and Iron with hydrogen and ammonia were the main topics of the research.

BS Chemistry from Southern Illinois University
Ph.D. Physical Chemistry from Illinois Institute of Technology

Abstract

Sustainability has been an important part of product performance for several years. Electronics in particular have had considerable attention due to the complex mix of substances and the explosive growth in types and numbers of products in the market. UL Environment has worked with the Mobile phone industry to create the first in a series of mobile device sustainability standards to assess the environmental performance of these products. The standards are focused on life cycle thinking and include crite-
Manohar Kulkarni is the Director of Illinois Sustainable Technology Center at the University of Illinois Urbana Champaign where he has the ultimate overseeing responsibility for the center’s staff, research projects, and other scholarly activities. He is also an Adjunct Professor of the Mechanical Science and Engineering at the University of Illinois Urbana Champaign. In addition to academic work as Mechanical Engineering Department Chair/Faculty at Southern Illinois University, University of North Dakota and the University of Wisconsin, he spent seven years in industrial projects-based research and development with Johnson Controls, Inc. in Milwaukee. At SIU Carbondale, he also established an Energy Management Center and directed the Rebuild America partnership for Energy Efficiency. Manohar Kulkarni has presented and published widely. His research interests include thermal system analysis, energy management, energy optimal control of thermal systems, energy efficient technology transfer, thermal analysis of materials and transient thermography. He holds a BS in Mechanical Engineering from the Indian Institute of Technology Madras, Chennai, India; a MS in Mechanical Engineering from the University of Iowa, Iowa City; and a Ph.D. in Mechanical Engineering from the University of Missouri, Columbia. He is licensed Professional Engineer in the states of Illinois and North Dakota. He also serves on a various technical committees, research review panels, advisory commissions, and task forces regionally and nationally. He has been an external examiner for doctoral or promotion & tenure candidates from a number of states within USA, Canada, and India.
Alex Lobos is an Assistant Professor of Industrial Design at Rochester Institute of Technology. His research positions design as a tool for environmental and social innovation. Prof. Lobos is a Fulbright Scholar and holds an M.F.A. from the University of Notre Dame and a B.I.D. from Universidad Rafael Landivar.

Jade Lee is the President of Supply-Chain Services, Inc. (SSI). She received her MBA degree from Northwestern University’s Kellogg Graduate School of Management. Prior to founding SSI, Jade worked over 10 years at the Fortune 100 company Baxter Healthcare International in sales and marketing management whereby she dealt with multi-billion OEM suppliers.

Under Jade’s leadership, SSI has become a corporate customer’s value chain partner capable of delivering integrated solutions in the electronics recycling and reverse supply chain arena. SSI holds 6 key industry certifications, ISO 14001, ISO 9001, OHSAS 18001, R2, RIOS and NAID’s Computer Hard Drive Sanitization and Destruction Certification.

Jade was a Board Director of IAER prior to merging with ISRI. She was also a member of EPA’s multi-stakeholder small group formed to develop the Responsible Recycling (R2) standards for the industry over three-year period. Jade currently serves as the Secretary of ISRI’s Electronics Recycling Division.

It is clear that electronic products must be intentionally designed so their potential environmental and human health impacts do not outweigh their transformative social, economic, and environmental benefits. While “Design for Sustainability” (DfS) approaches are common in the literature, a knowledge gap exists between the practitioners who create these principles [e.g., sustainability experts] and those who apply them [e.g., product designers]. For example, while the environmental sustainability community has increasingly been focused on developing new eco-design tools, product designers tasked with implementing these tools see them only as a ‘rule book,’ without the training to fully implement engineering-based sustainability principles and appreciate
tradeoffs underlying such tools. Further, while eco-design tools focus heavily on materials, manufacturing and end of life, they are not always effective in addressing aspects relevant to product design such as user needs and expectations.

At the root of this problem, there lies a fundamental deficiency in the educational experience of both sustainability and design practitioners, in that current curricula and training in U.S. universities lacks an integrative and holistic perspective on design principles and environmental sustainability goals. Therefore, it was our goal to create a model transdisciplinary curricular experience that applies project-based learning on the topic of sustainable electronics and introduces the tools and perspectives necessary for both designers and sustainability practitioners working in this field. To this end, we report here on the development, implementation, and evaluation of a studio design course structured around sustainable design of electronics. This course, offered fall 2010 at Rochester Institute of Technology, assembled teams of senior-level Industrial Design and graduate-level Sustainability students and tasked them with designing a more sustainable notebook computer and quantifying their results using streamlined life cycle assessment (SLCA). Concurrently, we benchmarked this approach to sustainable design curriculum at peer institutions and assessed student experiences and views on sustainable design using an anonymous, non-parametric survey.

The two most notable outcomes of this novel curricular approach, which will be highlighted in this presentation, are 1) high quality conceptual designs of innovative solutions for sustainable computers, including design for disassembling a notebook in one minute, design for eliminating packaging, and design of kiosks to facilitate consumer participation in e-cycling; and 2) a response rate of over 75% of students indicating that they would be more likely to incorporate sustainability into their design practices after completing this course. However, challenges also emerged, particularly related to the integration of PhD and undergraduate students from disparate backgrounds, difficulty in redesigning a product so entrenched in current form, and varied levels of sustainability knowledge held by students entering the course. These challenges will be addressed through continuous improvement for subsequent course offerings for designers and other sustainability practitioners. The trans-
Manish Mehta, Ph.D.

Bio

Dr. Manish Mehta is Executive Director of Industry Forums & Sustainability at the National Center for Manufacturing Sciences, a cross-industry R&D consortium based in Ann Arbor, Michigan. His responsibilities include identifying new manufacturing technology needs, conducting emerging technology assessments, and organizing collaborative research and development projects in areas such as lightweight materials, net shape manufacturing, nanomanufacturing, sustainability, and alternative energy.

Manish obtained his B.S. degree in Mechanical Engineering from Bangalore University, India (1984), followed by M.S. and Ph.D. degrees in Industrial Engineering from the University of Cincinnati, OH (1993). He graduated from the University of Michigan Stephen M. Ross Business School’s Executive Program (2001) specializing in technology strategy. He has over 60 publications, including invited talks, authorship of three successive studies of nanotechnology commercialization trends in the US (2003, 2006, 2008), and a chapter in the Nanomanufacturing Handbook (Taylor & Francis, 2006). He was a two-term member of the National Academy of Sciences Board on Manufacturing and Engineering Design (2002-2007). He was Peer Review Director of Michigan’s 21st Century Jobs Fund 2008 Business Plan Competition. He is a member of the 2009-2010 ASM International Detroit Chapter Executive Committee, a Fellow of the Engineering Society of Detroit (ESD) and also active in the Society of Manufacturing Engineers [SME Nanotech Forum], and Society of Automotive Engineers.

James M. Amrine, Jr.

James M. Amrine, Jr., of Altair ProductDesign, is a graduate of the Sibley School of Mechanical and Aerospace Engineering at Cornell University. After earning a degree in Mechanical Engineering with a concentration in Automotive Design, he began work as a design engineer at Altair Engineering, Inc. in the fall of 1998. He has done work for automotive OEMs and Tier One suppliers in the design and release of suspension,

disciplinary curriculum empowers future designers with necessary sustainability tools to be competitive in the emerging interdisciplinary work environment, while providing graduate sustainability students an understanding of consumers’ needs, wants and the design process.
body, and drivetrain systems. He has also worked on defense programs such as the Army FAST Semi-trailer. He was involved with the design of the Altair BUSolutions program to develop a low cost of ownership transit bus which would increase fuel efficiency while also reducing maintenance costs over the lifetime of the vehicle. He now serves as the Lead Design Engineer for Sustainability Programs for Altair and is working for Altair subsidiary ilumisys in conjunction with the National Center for Manufacturing Sciences to develop a guide for the sustainable design of LED lighting products.

Solid State Lighting, using light emitting diodes (LEDs), has great energy saving potential over conventional incandescent and fluorescent currently in use. However, although there are great energy savings in the use phase of the lamps, the remainder of the product lifecycle is not so cut-and-dried. LED products rely upon on-board or sometimes off-board power supplies and other electronic circuits. Aluminum heat sinks may be required for heat management to maintain long lifetimes. Adhesives or fasteners are necessary to hold all the constituent components together. All of this added complexity has an environmental footprint, especially when considered against the relative simplicity of fluorescent tubes and screw-in incandescent bulbs. Only by evaluating the entire product lifecycle, from raw material extraction to manufacturing to use through end-of-life, can the overall ecological impacts of the lamps be determined.

ilumisys and NCMS have partnered, through a grant from the US Department of Energy, to review and quantify the impacts of LED lamps and incandescent and fluorescent benchmark lamps over a product lifecycle. Based upon the knowledge gained, an interactive design guide/tool is under development to aid lighting designers and engineers to make design decisions that consider environmental impacts in all phases of the life of a product.

Critical information in the lifecycle analysis is the useful life of the product as well as its performance. For example, there are products on the market making claims such as “60 watt replacement,” when the light output is nowhere near that of a conventional 60 watt incandescent lamp. Testing
Charles Newman is the founder and Chairman of the Board of ReCellular Inc., the world’s largest collector and processor of used cellular handsets. Prior to founding ReCellular, he was a principal of the Newman Computer Group, the largest used Digital Equipment Corporation computer.

Bio

Mike Mitchell has served as executive director for the Illinois Recycling Association since 2001. Prior to that he has worked for regional and national environmental advocacy organizations Greenpeace and Citizens for a Better Environment since 1991. BA, Hunter College; MA, St. Joseph’s University.

In addition to Illinois Recycling Association’s extensive involvement in the state-wide electronics recycling legislation, Mr. Mitchell serves on the advisory committee for the national State Electronics Challenge program.

Abstract

I. Introduction to the State Electronics Challenge. Learn how to decrease the environmental footprint of your computer equipment through participation in the State Electronics Challenge. The Challenge is a free program that provides support to state, tribal, regional, and local governments for lifecycle stewardship of computer equipment.

II. Electronics Recycling in Illinois: The Electronic Products Reuse and Recycling Act is one year old. Its most important provision, a landfill ban for covered electronic devices, takes effect January 1, 2012. I will provide an overview of the current status on implementation of the legislation as well as proposed amendments both short term and long term, that the recycling community is advocating. An overview of existing electronics recycling collection and processing in Illinois will also be provided.

Bio

Charles Newman is the founder and Chairman of the Board of ReCellular Inc., the world’s largest collector and processor of used cellular handsets. Prior to founding ReCellular, he was a principal of the Newman Computer Group, the largest used Digital Equipment Corporation computer.
Bill Olson is Director of the Office of Sustainability and Stewardship for Motorola Mobile Devices, leading a key corporate initiative named ECOMOTO. In his role, Bill drives go-to-market strategy for green mobile device products and technologies, and has championed the adoption of ECOMOTO principles across several Motorola business units. ECOMOTO focuses on the realization of environmentally sound, seamless Motorola mobile products and seeks to deliver sustained business impact through green materials and innovative ecodesign practices as can be found in the world’s first carbon free phones built with post consumer recycled plastic: W233 RENEW and MOTOCUBO A4S ECO and the world’s first “green” android phones introduced in 2010 - CITRUS and SPICE.

Bill started the ECOMOTO initiative during his previous role in Motorola Corporate Research, where he headed labs dedicated to International and Environmental Research. Bill’s team in Europe conducted testing on hundreds of Motorola products to ensure they met environmental regulatory requirements of the EU (WEEE/RoHS), American and Asian markets. His lab in China worked closely with manufacturing engineering and the supply chain to achieve improvements in factory productivity, yield and product reliability.

Abstract

The presentation will explore the technical and processing issues associated with cell phone reuse. Approximately 200,000,000 cell phones are retired each year in the United States. Only a small fraction of these are reused. The difficulty of removing personal and brand information from phones and reusing phones on different networks adds considerable time and expense when processing for reuse. Existing and potential solutions to these challenges will be reviewed.

Bio

Bill Olson is Director of the Office of Sustainability and Stewardship for Motorola Mobile Devices, leading a key corporate initiative named ECOMOTO. In his role, Bill drives go-to-market strategy for green mobile device products and technologies, and has championed the adoption of ECOMOTO principles across several Motorola business units. ECOMOTO focuses on the realization of environmentally sound, seamless Motorola mobile products and seeks to deliver sustained business impact through green materials and innovative ecodesign practices as can be found in the world’s first carbon free phones built with post consumer recycled plastic: W233 RENEW and MOTOCUBO A4S ECO and the world’s first “green” android phones introduced in 2010 - CITRUS and SPICE.
Katie Reilly serves as the Program Manager of E-Waste Legislation for Electronic Recyclers International, Inc. (ERI). Katie is in charge of tracking and monitoring all e-waste legislation in the US. She works to ensure that ERI’s network of

In 2010, Motorola launched its latest green phone, Motorola CITRUS™. Powered by Android™ 2.1, Motorola CITRUS is an affordable, entry-level, customizable smartphone in a compact design that is environmentally conscious. CITRUS features a housing made from 25 per cent post-consumer recycled plastic. The material saves 20 per cent of the energy needed to make the phone compared with standard plastic. It also means less landfill waste and encourages more recycling by creating a market for used materials.

The phone is also certified CarbonFree® through an alliance with Carbonfund.org™. Motorola offsets the carbon dioxide generated to manufacture, distribute and operate the phone during its lifetime through investments in energy efficiency and reforestation. Additionally, the phone is BFR- and PVC-free, is made of 99% recyclable housing, and comes with an energy-efficient charger. Further, CITRUS comes standard with Treehugger - a green android SW application that offers consumers the latest environmental news and developments.

The combination of green hardware with green software in the CITRUS design represents an important development for green-minded consumers and engineers. My presentation will review the materials engineering research that culminated in the market introduction of the first green android platform product and a description of green android apps such as Tree-Hugger and Light Bulb Finder that were specifically developed for this exciting product.

Bill first joined Motorola’s automotive group in 1992, where he implemented the first VOC-free conformal coating for engine controls. He also drove a variety of cost reduction teams for the engine auto body/control businesses.

Bill graduated from the University of Wisconsin-Madison with a Ph.D. in Inorganic Chemistry. Bill has 23 US patents and more than 40 technical publications.

Abstract

In 2010, Motorola launched its latest green phone, Motorola CITRUS™. Powered by Android™ 2.1, Motorola CITRUS is an affordable, entry-level, customizable smartphone in a compact design that is environmentally conscious. CITRUS features a housing made from 25 per cent post-consumer recycled plastic. The material saves 20 per cent of the energy needed to make the phone compared with standard plastic. It also means less landfill waste and encourages more recycling by creating a market for used materials.

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Bio

Katie Reilly serves as the Program Manager of E-Waste Legislation for Electronic Recyclers International, Inc. (ERI). Katie is in charge of tracking and monitoring all e-waste legislation in the US. She works to ensure that ERI’s network of
Electronic devices are one of the fastest growing portions of the waste stream in the US. The global technological revolution is fueling the rapidly increasing electronic waste (e-waste) problem. As a result, 24 states have passed some type of electronic waste legislation in an effort to manage the e-waste that is being generated in their state in an environmentally safe and proper manner. Most of these programs place responsibility directly on the manufacturers of the electronic devices. This patchwork of state programs, no two the same, is directly impacting the way e-waste is managed in the US. Electronic Recyclers International, Inc. (ERI) is the largest electronics recycler in the US and works with numerous collectors, retailers, and manufacturers under the various state programs. From the perspective of an electronics recycler, the complexity of these programs presents new opportunities as well as new challenges for the electronics recycling industry. Recyclers operating in multiple state programs must keep track of the various electronic devices that can be recycled and the entities from which those devices can be collected under each program. Funding for the collection and recycling of e-waste by manufacturers is changing the way in which e-waste collection programs are being operated and allowing local programs to provide low cost or no cost services to their communities. The high standards manufacturers require in order to work as part of their takeback programs are encouraging all recyclers to increase their

Abstract

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environmental, health, and safety standards. Recyclers, such as ERI, are constantly striving to meet higher standards and, in doing so, are helping to push the electronics recycling industry forward with state-of-the-art shredding and glass cleaning technology so that e-waste can be properly managed here in the US. What is obvious is that these state e-waste programs are directly impacting the electronics recycling infrastructure. The issue of environmentally safe and cost-effective management of e-waste will continue to be a topic of concern in the US as new state programs are implemented, the success of current programs is evaluated and the EPA explores e-waste as a top priority under the current administration.

**Bio**

Courtney Rushforth is the recycling coordinator for the City of Urbana’s U-CYCLE program. Ms. Rushforth has served in this position for the past eight years. She educates local residents on waste reduction and recycling, coordinates the day-to-day operations of the U-CYCLE program, and organizes large scale recycling events. During the past five years, Ms. Rushforth has coordinated electronic recycling events with other local municipalities and Champaign County, where she has witnessed local consumer trends in the collection of e-scrap. Ms. Rushforth is currently an At-Large Representative for the Illinois Counties Solid Waste Management (ILCSWMA) Board, and is the East Central Illinois Regional Coordinator for the Illinois Recycling Association. She received her Master’s degree in Journalism and Mass Communication from Arizona State University, and a Bachelor of Science degree in Environmental Communications and Education from the University of Illinois.

**Abstract**

In 2010 Champaign County residents recycled 291 tons of electronic scrap during a series of quarterly recycling events. The community response at these events indicated a high need for e-scrap management in the local community. This presentation will focus on the local government perspective on e-scrap recycling and consumer response in Champaign County, and an analysis of electronic recycling trends and impacts in the local community.
Increasingly, people are managing their social networks on mobile information and communication technology (ICT) platforms. These ubiquitous electronic devices materialize virtual relationships by leveraging spatially-specific and networked informational flows for reducing environmental impacts associated with vehicle dependent, sparsely populated urban sprawl communities. In this study, we show how participation through the mobile ICT devices could reduce greenhouse gas (GHG) emissions as people become virtually close together via their social network. A package delivery system (individual door to door delivery from online purchases) was selected to illustrate this idea. Specifically, three systems are compared through simulation to estimate total system delivery distance and GHG emissions: the cur-
In many ways, paper is a very attractive substrate material for many electronic device applications: very low cost, available in almost any size (from pre-cut to roll-to-roll), versatile (surface finishes which can greatly alter its properties), portable (light weight and flexible). From an environmental point of view, paper is a renewable resource and is readily disposable (incineration, biodegradable).

Applications of paper-based electronics currently being considered or investigated include biochips, sensors, communication circuits, batteries, smart packaging, displays. The potential advantages of paper-based devices are in many cases very compelling. For example, biochips fabricated on paper can use the capillary properties of paper to operate without the need of external power sources, greatly simplifying the design and reducing the cost. Furthermore, if the biochip is

Bio

Prof. Andrew Steckl is an Ohio Eminent Scholar & Gieringer Professor of Solid State Electronics at the University of Cincinnati. He was educated at Princeton and the University of Rochester.

Prof. Steckl is a Fellow of IEEE and AAAS, and a winner of the Rieveschl Award. Current research activities in his lab are focused on: rare earth doped nitride semiconductors for light emitting applications, organic and biopolymeric materials for photonic and electronic devices; electrofluidic materials and devices for nano/bio applications. Prof. Steckl’s research has resulted in more than 320 journal publications and over 400 conference presentations. His publications have garnered in nearly 4,000 citations in the technical literature, with 300-400 citations/year in the last few years, yielding a citation h-index of 36. His research has been funded by the ARO, ARL, AFOSR, AFRL, DARPA, NSF, etc.

Abstract

In many ways, paper is a very attractive substrate material for many electronic device applications: very low cost, available in almost any size (from pre-cut to roll-to-roll), versatile (surface finishes which can greatly alter its properties), portable (light weight and flexible). From an environmental point of view, paper is a renewable resource and is readily disposable (incineration, biodegradable).

Results indicate that SPLS can reduce distance mileage by up to 91% in high housing unit density area (urban area) compared to CDS. PLS can also reduce distance mileage by 21% in urban areas but only 1% in suburban areas. However, these tremendous reductions are highly dependent on assumptions of network participation. A simple 5% social network participation rate shows significant carbon reducing affects.
used for diagnostic purposes it can be disposed of by incineration thus preventing potential contamination. For e-reader devices, in addition to flexibility, the ideal solution for providing the look-and-feel of ink on paper is to have e-paper on paper.

The presentation will cover the following:
- Introduction to paper electronics – what is paper, why paper, how is paper used;
- Brief review of current paper devices – biochips, transistors, displays, batteries;
- Can paper electronics succeed in the marketplace?

Bio

Bio
Kyle Wiens is the CEO of iFixit, a collaborative repair community and Apple parts retailer. iFixit is dedicated to helping people everywhere keep their hardware running longer. He co-authored the first free repair manuals for Apple hardware while studying Computer Science at Cal Poly, San Luis Obispo. Kyle is a board member of Softec and the IEEE CE Society. He has spoken widely on cloud computing, technical writing, repair, making service documentation accessible to a global audience, and sustainable consumer electronics device design. In his spare time, Kyle kayaks and tinkers with robots.

Repair 2.0: Reinventing the Way We Fix Things
Kyle Wiens

Abstract
The US has a long-standing culture of repairing cars: there is a massive parts, documentation, and resale infrastructure built around using cars as long as possible. This is more challenging with electronics due to increases in complexity and variety of models. The inaccessibility of repair and cost involved in recycling in the developed world means that our devices are migrating elsewhere.
While following the trail of e-waste to Africa, I learned about Jua Kali, a group of tinkerers in Kenya who make their living as modern-day McGyvers. They hack, dissect, repair, and make an astonishing variety of things with stunningly primitive tools. Their creativity is manifested in car body work, scrap metal sculpture, board-level cell phone repair, and domain-specific engineering to solve hyper-local problems that I had no idea existed. These people aren’t inventing new technology. Instead, they’re mashing up things that we’ve already made, modifying them to suit their needs, and providing solutions to a group of people that are completely off the radar of our product engineers.

This inspiration led me to wonder what it would take to spread a Jua Kali-style revolution of reuse elsewhere in the world. What if everyone had free access to a repair manual for everything they owned? How much longer would our things last? I started iFixit with the goal of providing people the knowledge and encouragement they need to make their things work as long as possible. Making repair accessible to everyone is the best shot we’ve got at reducing e-waste and starting to make our high-tech lives sustainable. We can’t keep throwing away cell phones every 18 months! We need to get every last bit of functionality from the things we own before we safely recycle them.

Repair is stuck in the 20th century. Service manuals are almost never available online, and the few troubleshooting forums that exist are rife with spam and ad-baiting. iFixit.com is bringing repair into the digital age, allowing anyone with minimal computer experience and a camera to share their knowledge and create high quality repair manuals.