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Industry Collaboration Driving Proactive Environmental Improvements

Bob Pfahl

April 13, 2011

Apex

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Agenda

- iNEMI Environmental Vision
- Highlights of Environmental Conscious Electronics Chapter of iNEMI Roadmap
- Key iNEMI Projects
- Environmental Impact of Electronics
  - Products
  - Services
- Concluding Thoughts

The iNEMI Environmental Vision

- To take the initiative to fully leverage the iNEMI roadmap and aggressively drive the key environmental gaps and opportunities in and through the manufacturing electronics supply chain
  - Proactive member led environmental improvement projects that close the technology gaps.
  - Focused collaborative research with universities and key governmental labs working in sync with industry.
- Problems will be attacked with scientific depth and rigor and the solutions implemented will be far reaching and sustainable.

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Sustainability

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Sustainability Requires Balancing Competing Objectives

- **Environmental Regulations do not always lead to sustainability**
  - **Legislating the use of corn based ethanol in automobile fuels without considering environmental, social and economic impacts**
  - **Legislating the use of Compact Fluorescent Lamps without requiring the development of a recycling infrastructure for the mercury in the lamps.**

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iNEMI Roadmap

Environmentally Conscious Electronics Chapter

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Environmental Conscious Electronics (ECE)

The ECE Chapter has 5 Focus Topics

1. Materials
2. Energy
3. Recycling
4. Eco Design
5. Sustainability

It is one of 21 chapters in the iNEMI Roadmap. Each of these also considers the Environmental impact in their specific technical areas.

The 2011 roadmap became available on March 31st 2011

Summary of key issues identified and being worked on

1. Materials

- Un-Harmonized restrictions challenge science based evaluation
- Remaining Lead and halogen free challenges
- Rare earth metals
- Nano Materials

2. Energy

- Efficiency – harmonized requirements and metrics
- Carbon footprint - promote credible, workable methodologies

3. Recycling

- Common approach and infrastructure – closer collaboration
- Harmonize patchwork requirements
- Market incentives for recovered materials

ECE Chapter Continued

4. Eco-Design

- Life cycle impact methodologies and database needs
- Design tools that incorporate LCA analysis real time

5. Sustainability

- ICT technology as an enabler to address climate change
- Water and manufacturing eco-efficiency are emerging areas

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iNEMI Projects

Advancing technical solutions to complex challenges

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iNEMI Actions in Environmental Area

- Roadmap of Environmental Conscious Electronics (since 1996)
- Established the Environmental Leadership Steering Committee to set strategic direction & priorities
- Issued iNEMI Position papers on Product Carbon Foot printing and Definition of Low Halogen
- Issued white paper on Timeline for conversion of Notebook and desktops to HFR-Free and PVC free
- Leading Projects on Pb-free reliability since 1999
- Leading Projects on PVC alternatives since 2009
- Leading Projects on HFR-free reliability since 2008
- Developing LCA tools for ICT products since 2010
- Defining Environmental Research Priorities since 2007
- Rare Earth Metals & Supply Chain Actions Project

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Estimating Life Cycle Eco-impact for ICT Products (Focus on Energy)

Leaders

- *Alcatel-Lucent*
- *Cisco*

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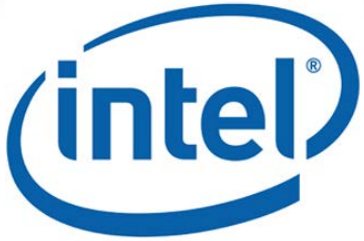
Project Participants



ITRI
Industrial Technology
Research Institute

Celestica™

PURDUE
UNIVERSITY

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iNEMI ICT LCA Project Objectives

✓ **<u>Phase 1</u>**: Develop a methodology for **providing a simplified means of deriving key eco-environmental information for ICT equipment / assets** → *12 months (ended September 2010)*

- Define a set of industry acceptable practices for more easily estimating the eco-impact for different types of ICT equipment
- Provide sufficient accuracy to meet the information's intended use (within ICT industry and its 1st tier suppliers)
- Provide a simplified means for calculating significant eco-impacts of a particular product type over its life cycle stages
- Provide users with a unified format for requesting LCA information from suppliers

<u>Phase 2</u> : Develop an eco-environmental impact assessment estimating tool for ICT equipment / assets → *Timeline ~ 12 months*

iNEMI Project Background

Roots of the project began in September 2008 at the iNEMI Sustainability Summit in Illinois

Discovered an area of Common Concern:

- **ICT equipment LCAs are generally non-competitive** – methods and data are similar for typical classes of products
  - About 90% of parts have common application in ICT product types / classes (we use the same suppliers)
- **Identified an Opportunity –** can we use a "building block" approach in providing LCA-based eco-impact information for ICT product assets /sub-assemblies?
  - Develop an estimator – based possibly on asset / sub-assembly type, weight, size, number of devices by class, energy consumption per LCA stage, etc.
  - Establish consensus within major ICT industry constituents
  - System agnostic, updateable databases via cross-industry information sharing
  - Evaluator can also be used for company-specific products / projects – e.g. get credit for post-consumer content, energy efficiency feature, new material substitute (using primary data)

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Environmental Presentations at Apex

Thursday April 14

South Pacific I

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Thursday April 14 South Pacific I

8:00 - 10:00 am

- **Progress and Results from iNEMI Environmental Projects:**
  - HFR-Free Project Updates — Bob Pfahl, iNEMI
    - High Reliability Project
    - HFR-Free Leadership Project
  - PCB Material Working Group — Jim Arnold, iNEMI
    - Signal Integrity Working Group
    - Eco-Impact LCA Estimator Project Update

10:30 - 12:00 noon

- **Alternative Energy Workshop Results:** Jim McElroy, iNEMI
  - This session will review highlights of the iNEMI Alternative Energy Workshop and discuss proposed collaborative projects that were identified. Participants will have the opportunity to discuss these efforts and to provide input on how the work can provide maximum value to the industry

1:00 – 2:00 pm

- **Environmental Conscious Electronics (ECE) TIG**
  - Gap analysis – Development of 2011 Technical Plan: Scott O'Connell, Cisco

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Environmental Impact of Electronics

Environmentally Preferred Products

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Environmentally Preferred Products

- Are Highly Recyclable
- Use Non-Hazardous Materials
- Minimize Use of Energy
- Minimize Use of Matter

1983
First Portable Cellular Phone
DynaTAC

1996
First Wearable Cellular Phone®
StarTAC

1999

Functional Dematerialization-Smart phones

GPS Receiver

- Telephone
- Windows Mobile 6.1
- Windows Media Player
- QWERTY keyboard
- 320x240 display
- Opera browser
- DataViz Documents to Go
- Messaging
- GPS receiver
- Record and Play multiple audio formats
- Integrated 2.0 megapixel camera
- Video
  - Capture at 15 fps
  - Playback up to 30 fps
  - Multiple video formats supported
- Up to 32GB of storage

Record Reduction: Music (Audio) Portability

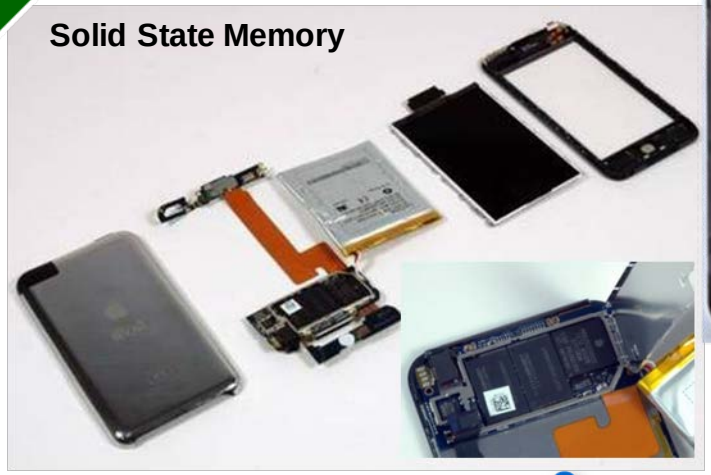

Rissa Studios

Optical Storage
(4.7GB ⇒ >75 Albums)

>500 Albums

~60MB/Album

Solid State Memory



Rissa Studios

iPod Touch
(≤32GB)

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Sustainability

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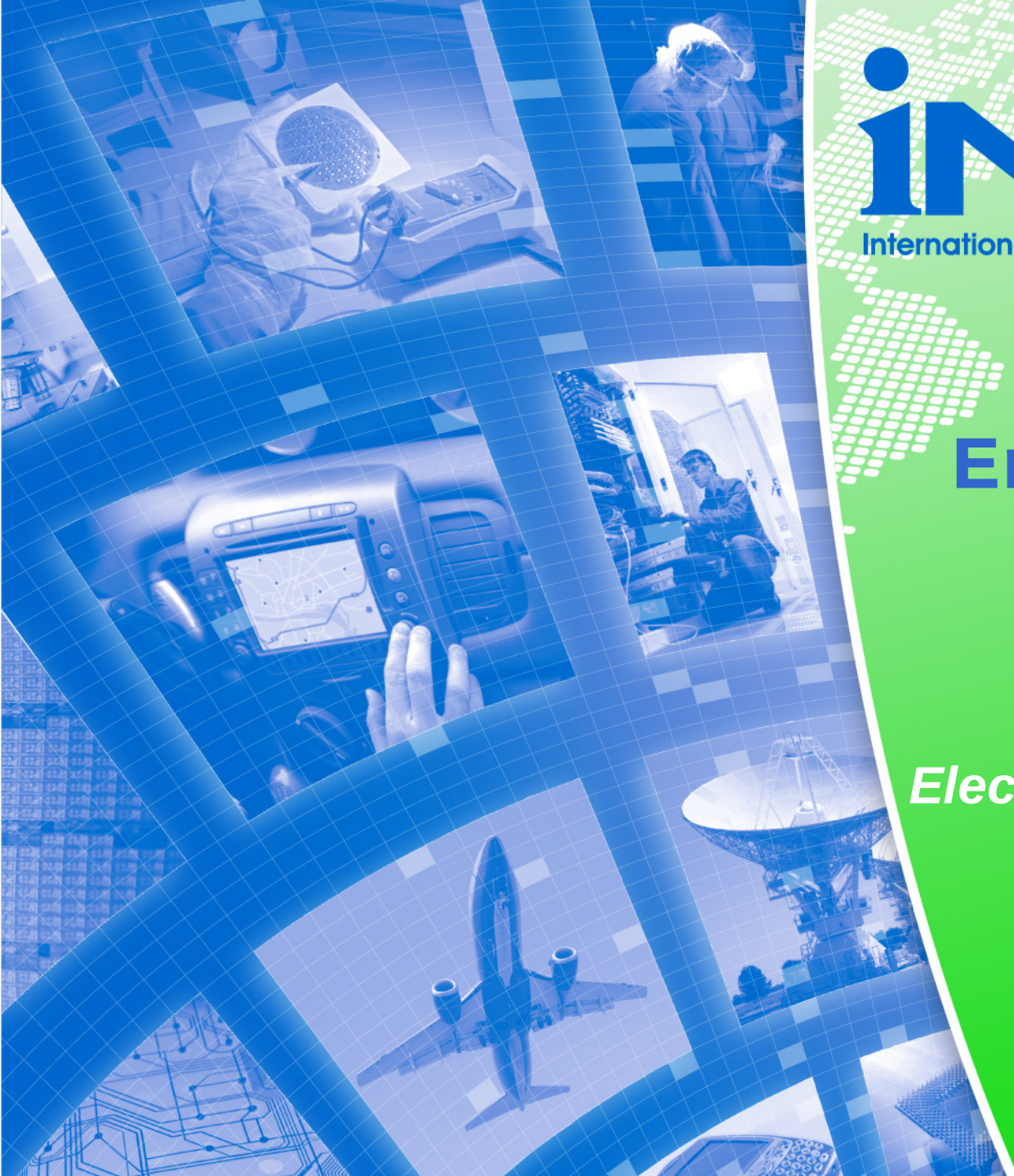

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Environmental Impact of Electronics

Electronics as a solution to Climate Change

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Sustainability

Electronics as *solution* to climate change

- Smart city planning
- Smart buildings
- Smart appliances
- Dematerialization
- Smart industry
- I-optimization
- Smart grid
- Integrated renewables
- Smart work
- Intelligent transport

Potential Impact: Reduction of 1 billion tons of Green House Gas emissions.

Exploring Environmental Applications and Benefits of Information and Communications (ICT) Technology

An Overview of a Special Issue of the Journal of Industrial Ecology

Eric Masanet, Ph.D.

Environmental Energy Technologies Division

Lawrence Berkeley National Laboratory

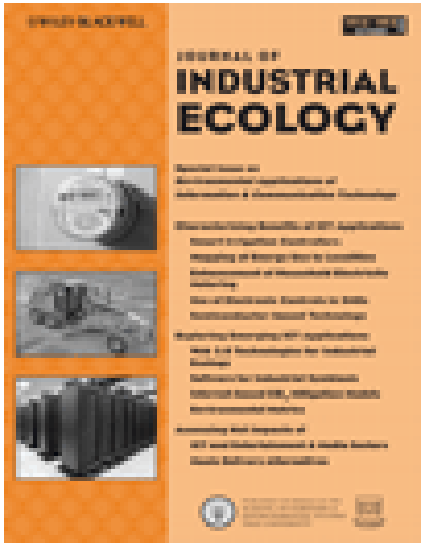
2011 iNEMI Environmental Leaders Conference

Intel, Chandler, Arizona

February 23rd, 2011

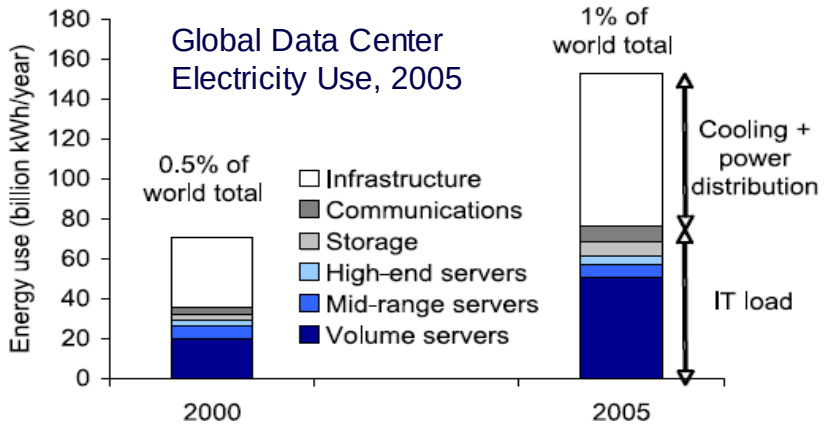
Journal of Industrial Ecology

- Premier journal in the areas of analysis, trends, and critical assessments of innovations and technologies related to sustainability
- Deep historical ties to the research community on ICT and environment
  - "*E-Commerce, the Internet, and the Environment," Volume 6, Number 2*
- Ranked in top 1/3 of environmental science journals
- Special issue sponsor: Computer Sciences Corporation's Leading Edge Forum



Historical Attention on Impacts

Source: Silicon Valley Toxics Coalition



Source: Koomey (2008)

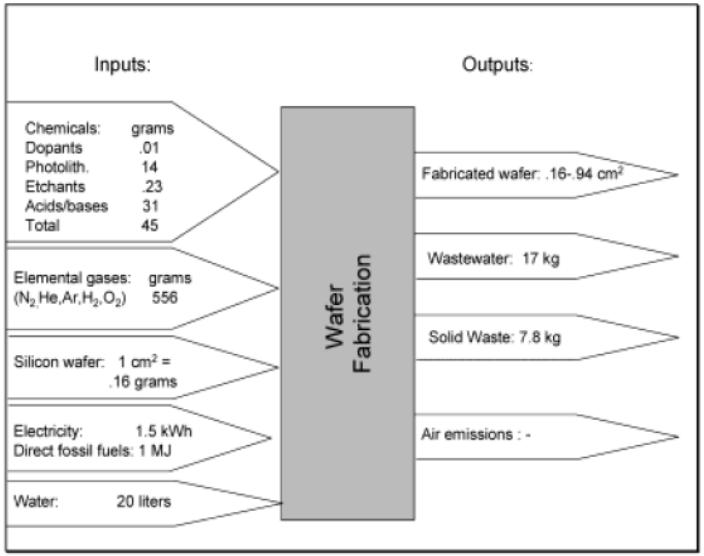
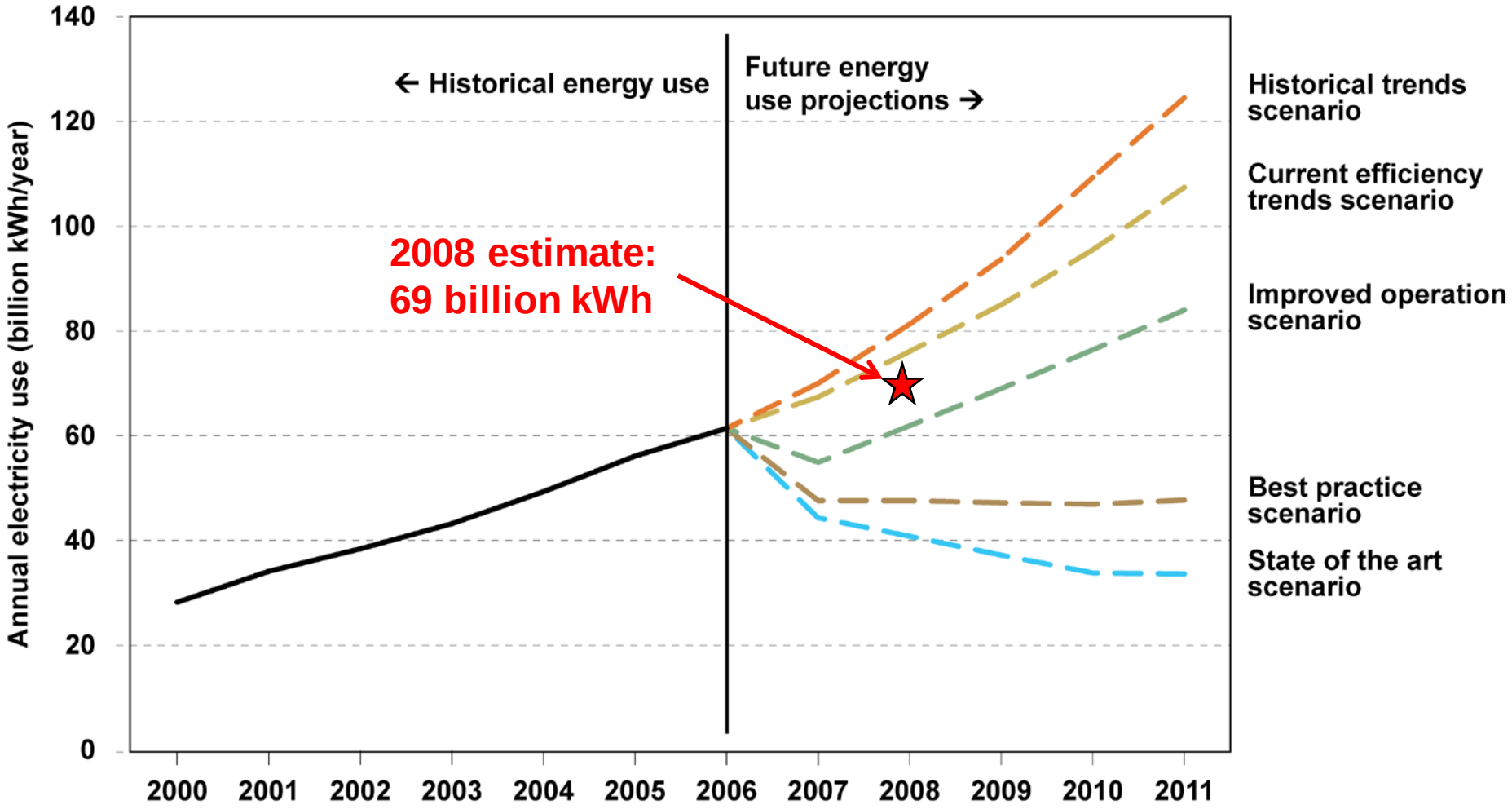


FIGURE 2. Summary input/output table for wafer fabrication

"The 1.7kg Microchip"
Williams et al. (2002)

U.S. Data Center Energy Use



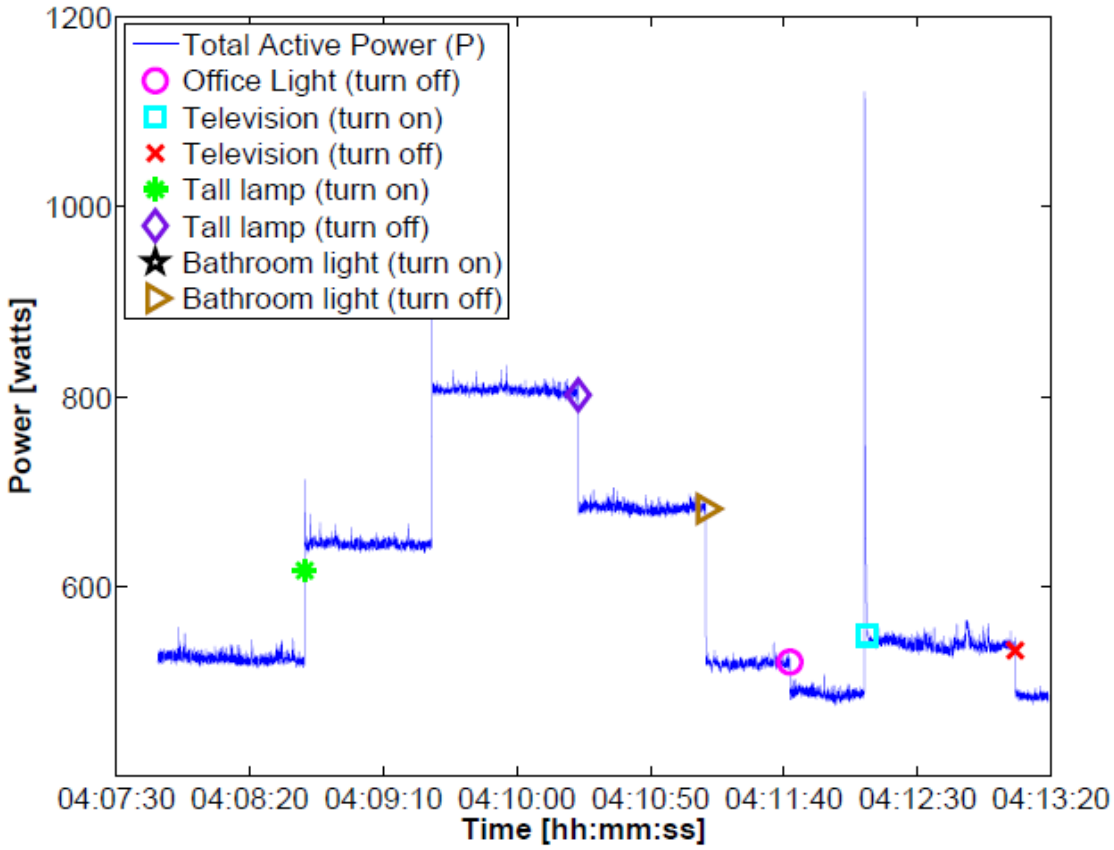
Source: Brown et al. (2007) "Report to Congress"

Goals and Objectives

- To take a pulse on state of the art in applications and research related to the environmental benefits of ICT
  - The call for papers cast a wide net to solicit contributions from a range of sectors and interests (buildings, data, industry, applications, models, etc.)
- To provide a useful compendium to highlight:
  - real-world benefits;
  - cutting-edge research efforts to quantify and understand such benefits; and
  - trends and opportunities.
- To contribute to the state of knowledge and serve as a useful reference point for future work

Applications: Example 1

"Enhancing Electricity Audits in Residential Buildings with Non-Intrusive Load Monitoring"
Mario E. Berges, Ethan Goldman, H. Scott Matthews, and Lucio Soibelman, Carnegie Mellon



Applications: Example 2

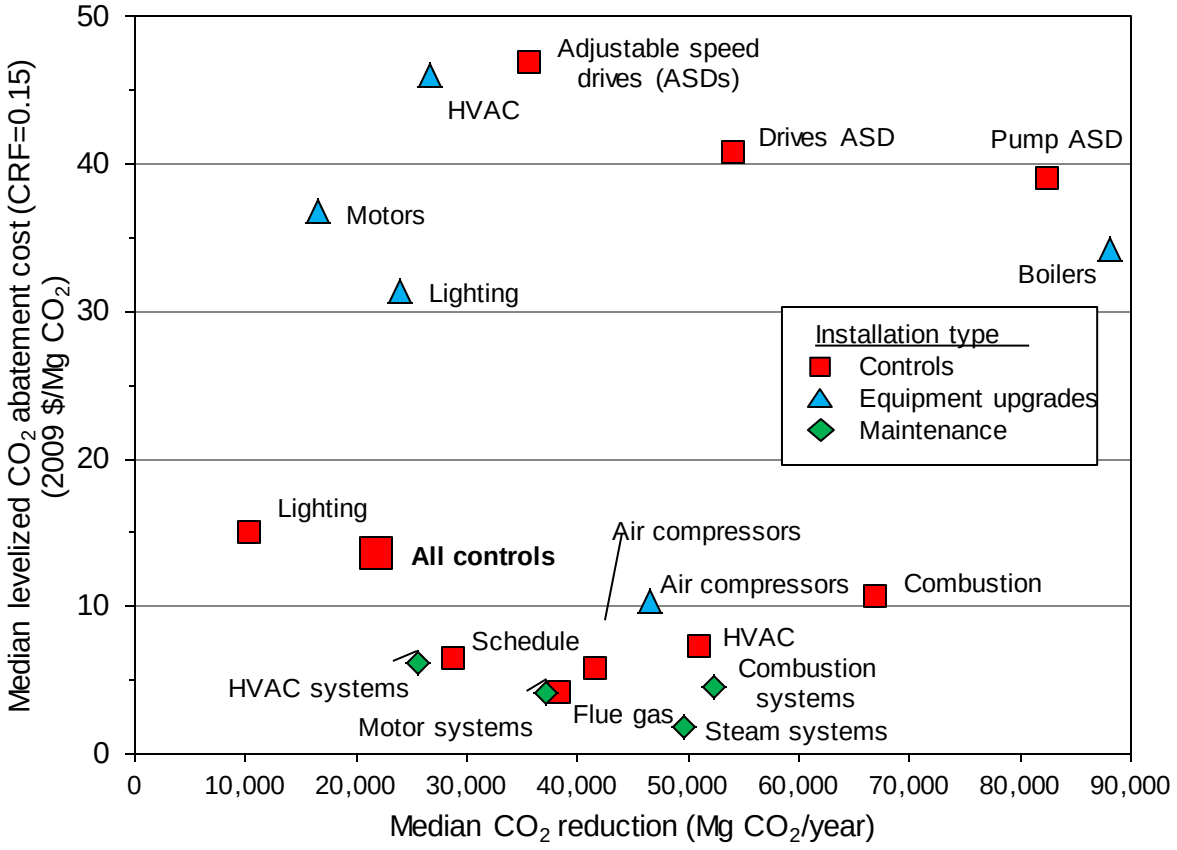
"Energy Benefits of Electronic Controls at Small and Medium Sized U.S. Manufacturers"
Eric Masanet, Lawrence Berkeley National Laboratory

Energy savings from one SME control system installation =

-1,400 efficient refrigerators, or

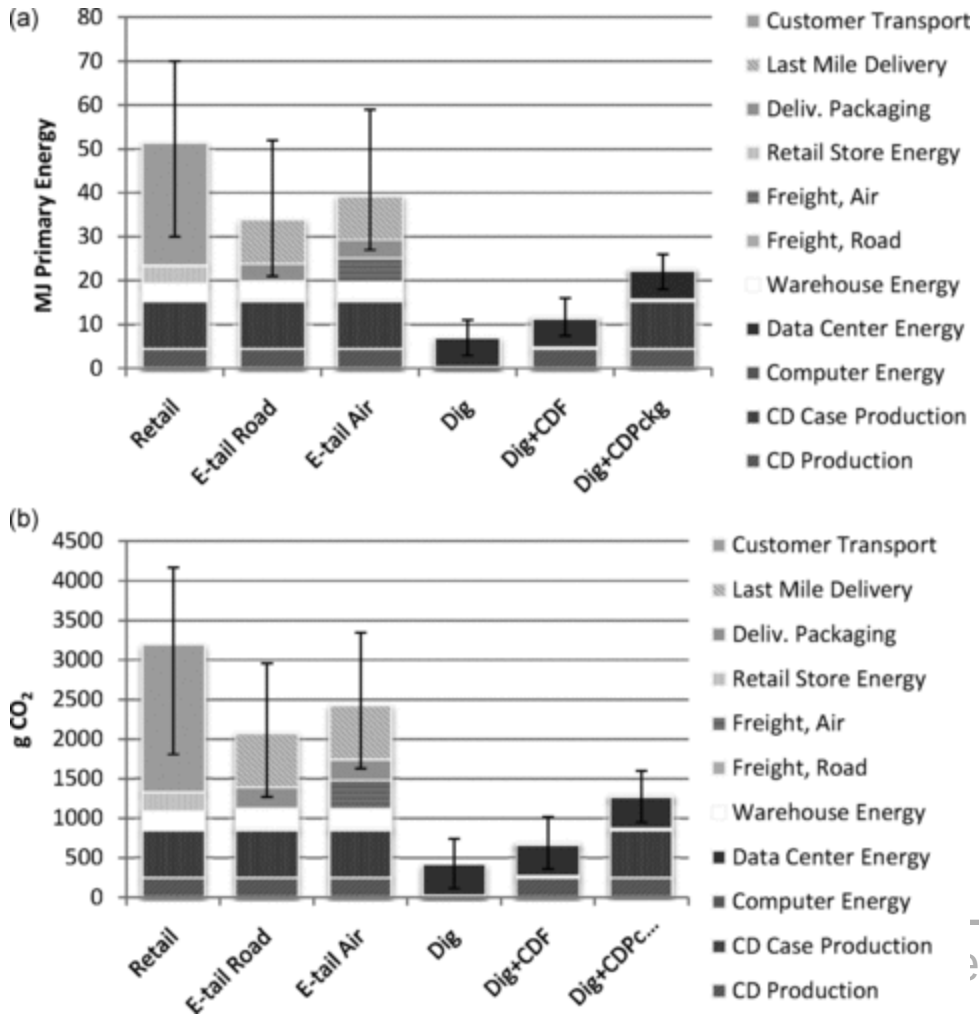
- 2,150 CFLs, or

- 20 upgrades to a Prius.



Net benefits: Example1

"The Energy and Climate Change Implications of Different Music Delivery Methods"



Error bars represent 90% credible intervals from Monte Carlo analysis.

Dig = digital download;

Dig+CDF = digital download with the file burned to a CD;

Dig+CDFPckg = digital download with the file burned to a CD and stored in individual CD packaging.

Summary

- Provided a snapshot of the cutting edge in research and thought in the research domain, and captures the multi-faced nature of ICT's benefits.
- Highlighted future directions for ICT applications and their potential positive implications, as well as research to better understand and communicate these issues
- Reinforced the importance of future research work that will allow us to maximize the positive and minimize the negative impacts of ICT moving forward.
- Contacts:
  - Eric Masanet, LBNL ermasanet@lbl.gov
  - Scott Matthews, CMU, hsm@cmu.edu

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Future Thrusts

Becoming more proactive in our environmental collaboration

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Summary of Future Thrusts

- **To produce environmentally-conscious electronics the industry must continue to keep pace with:**
  - **Continuing emergence of material restrictions**
  - **Energy efficiency requirements and renewable energy**
  - **End-of life requirements**
  - **Holistic Eco-design requirements**
  - **Sustainable business practices**

- **As many of these issues are shared by industry, it's best to work together!**

Concluding Thoughts

- New global environmental requirements continue to multiply – faster than industry can effectively respond
- Industry needs to be more proactive in developing solutions that:
  - Are based on science and engineering, delivering value to customers
  - Are available in advance of new regulations
  - Can influence future regulations and stakeholder groups for more sustainable results
- iNEMI and its members plan to play a significant role in preparing industry for these future needs.
- Sustainability will be a major undertaking for industry as well as society.
- Electronic solutions can help to empower people to live a more sustainable lifestyle

www.inemi.org

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