



**iNEMI**  
International Electronics Manufacturing Initiative

# The iNEMI 2009 ECE Roadmap

**Creating  
A Better World  
Through Electronics**

**Bill Bader  
CEO of iNEMI**

Advancing manufacturing technology

# Environmentally Conscious Electronics (ECE) Roadmap

## Agenda for Today:

- **iNEMI ECE Roadmap Overview** **Bill Bader; iNEMI**
- **Environmentally Friendly Materials** **Grace O'Malley; iNEMI**
- **Recycling & Reuse; Eco Design** **Bill Bader**
- **Energy** **Jos Beekwilder;  
Océ Technologies**
- **Sustainability** **Markus Stutz;  
Dell Computer**
- **Conclusions and Q&A** **Bill Bader**

# Environmentally Conscious Electronics (ECE) Roadmap; The Process and the People

- The 2009 ECE Chapter was the second edition of the environmental roadmap for iNEMI.
- Tremendous momentum and increased depth delivered by the ECE team
- Thirty Two Industry Experts Provided Insight, Data, and Analysis in the following areas:
  - Current Situation Assessment
  - Quantified key industry metrics
  - Critical Issues
  - Business and Technology Needs
  - Gaps and Showstoppers
  - Recommendations

# What has changed from 2007 Roadmap?

- With the original **RoHS implementation date past**, many of the previous gaps have been closed
  - **High reliability product exemption end dates** will drive additional activity
- **Rapidly developing legislation and voluntary environmental stewardship initiatives** are driving additional environmental activity
  - Materials - RoHS revision, REACH & regional requirements (China RoHS, CPSC, etc)
  - Energy - energy efficiency requirements (EuP, Energy Star, etc), certification & labeling requirements (S Korea, ), product carbon footprint
  - Recycling – eco-label design for reuse/recycle criteria (EPEAT, TCO, etc), market interest in recycled content
  - Eco-Design – rapid interest in LCAs globally
- **Industry was reactive in 2007**
- **iNEMI will engage with its members becoming more pro-active with decisions based on sound science and environmentally beneficial practices**

# Trend Analysis; A Simple Summary

- To produce environmentally-conscious electronics the ECE TIG 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!

# Electronics Industry Challenges

- **Be up to date on changing/evolving material restrictions**
- **Ensure full supply chain alignment with end-of-life requirements**
- **Understand customer preferences and legal requirements that drive advancements in energy efficient products**
- **Develop and promote holistic design practices and tools**
- **Drive sustainable business practices**
- **Drive environmentally friendly technology advancements**

**iNEMI Mission:** Forecast and accelerate improvements in the Electronics Manufacturing Industry for a sustainable future.

### **We Accomplish This By:**

- Being the recognized leader at projecting future manufacturing technology needs and closing gaps for the global supply chain.
- Effectively guiding and leveraging the strength of the consortium's industry leading international membership.
- Driving high impact collaborative R&D Results through constantly improving methodologies.
- Becoming “the” recognized forum for addressing environmental gaps and setting the manufacturing electronics industry direction
- Defining and implementing science based sustainable solutions in high impact areas including the environment and health care.
- Proactively leverage and gain impact from key government agencies and labs.

# The iNEMI Environmental Vision

- **We will take the initiative to fully leverage the iNEMI roadmap and aggressively drive the key environmental gaps and opportunities in and through the mfg electronics supply chain**
  - **Focused collaborative research with universities and key governmental labs working in sync with industry.**
  - **Proactive member led environmental improvement projects that close the technology gaps.**
  - **Strengthen ties with policy decision makers. Ensure sustainable solutions are put in place**
- **Problems will be attacked with scientific depth and rigor and the solutions implemented will be far reaching and sustainable.**

# iNEMI Key Deliverables

1. **Technology roadmaps: A comprehensive industry, member, product, and technology forecast of 10-year needs. An unparalleled knowledge and information resource**
2. **Technology deployment projects: Timely, high impact projects to enable results that support members' businesses**
3. **Research priorities and programs that engage members**
4. **Proactive forums across the international landscape on key industry issues**
5. **Position papers to focus industry direction.**

# Environmentally Conscious Electronics – 2009 Roadmap; Example Page

## Gaps

### Materials

- Technical viability and supply chain readiness for Pb-free high reliability products – server, storage and networking equipment
- Technical viability and supply chain readiness for Pb-free high reliability products – medical, aerospace, test equipment
- Assess the technical viability of alternatives to HBCDD (a brominated flame retardant) and DEHP, BBP and DBP (phthalates) in electronic products
- Technical viability of alternatives to HFRs in printed circuit board laminates (iNEMI HFR Free Laminate project)
- Technical viability and environmental life cycle assessment (LCA) of alternatives to cables (iNEMI PVC Alternatives project)
- Development of standard scientific methodologies to assess true life cycle environmental impact of materials and potential trade-offs of alternatives

### Energy

- Promotion of basic principles for effective energy efficiency requirements (TP7)
- Identify and position the supply chain for emerging product carbon footprint requirements, leverage existing activities where appropriate (EICC, GHG Protocol, CDP, etc)

### Recycling

- Track evolving country/state legal recycling requirements (TP1)
- Establish a sustainable recycling infrastructure and technical qualification of recycled materials market for use in new products
- Identify product design features that will enable cost-effective, environmentally-responsible reuse/recycling (Basel, R2 guidelines, EPEAT, etc)
- Increased global communication and cooperation within industry regarding recycling challenges – such as use of materials that hinder efficiency or increases hazards of the recycling process (TP4)

2009	2011	2013	2015
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Need



R,O

R

R,O

R

S,R

S

X

X

R

R,O

X

R = Research

O = Optimization

S = Standard

X = No Action/Outsource

Green = No Gap Issues or Resolved

Yellow = Known Gap Mitigation Techniques

Red = No Known Solution – Development Required

# 2009 iNEMI Environmentally Conscious Electronics (ECE) Roadmap

- **ECE Roadmap Focus Areas:**
  - **Materials**
  - **Energy**
  - **Recycling/Reuse**
  - **Eco-Design**
  - **Sustainability**
- **Analysis, Gaps, & Recommendations for each will follow**
- **Large Opportunities Exist within all 5 areas**
- **Maximum TOTAL impact will be realized through a HARMONIUS global approach of industry, legislators, NGO's, and academia**

# Participating in the 2011 Roadmap

- The Environmentally Conscious Electronics (ECE) Technology Working Group (TWG) will begin its task in January 2010
- To Participate in the ECE TWG please Contact:
  - Chuck Richardson, iNEMI Director of Roadmapping  
[chuck.richardson@inemi.org](mailto:chuck.richardson@inemi.org)
  - Jackie Adams, IBM, Chair ECE TWG                      [jackiea@us.ibm.com](mailto:jackiea@us.ibm.com)
  - Ted Reichelt, Intel, Chair ECE TWG                      [ted.reichelt@intel.com](mailto:ted.reichelt@intel.com)
  - Markus Stutz, Dell, Chair ECE, Sustainability sub-group  
[markus\\_stutz@dell.com](mailto:markus_stutz@dell.com)
- Anyone from the Electronics industry is welcomed to participate in defining the industry's future direction



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**Supply Chain  
Readiness on  
Environmentally  
Friendly  
Materials**

*Grace O'Malley  
iNEMI Manager  
of Europe*

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# Materials; 2009 Current Situation Analysis

- **iNEMI membership focus has existed in the materials area of ECE since 1998**
- **Nine projects driven on Pb Free. Work Continues in a thrust to expand the process envelope and improved product reliability as we move forward**
  - **Through 2009 over 100 man years of resources put into iNEMI collaborative Pb Free projects**
  - **Spread across 25 companies**
  - **And in excess of \$1M of materials used for testing and certification**
  - **Membership savings and risk reduction have both been very large**
- **Total supply chain alignment driven through the iNEMI project thrusts**

# iNEMI Materials Areas of Focus

- **Continued projects in Board Assembly – All work done since 2008 is Pb Free. A sample of ongoing projects:**
  - Board Co Planarity in SMT
  - Characterization of Pb-Free Alloy Alternatives Project
  - Pb-Free Component & Board Finish Reliability
  - Solder Paste Deposition
- **Driving Halogen Free Technology Development for PCB's**
- **Brominated flame retardant substitution will have the largest positive environmental impact on computer products.**
- **Study in place for full LCA for PVC alternatives within desktop computer cable and power cords**

# “Low Halogen” (“BFR/CFR/PVC-Free”)

## iNEMI Position Statement

- All printed board and substrate laminates shall meet Br and Cl requirements for low halogen as defined in IEC 61249-2-21 and IPC-4101B
  - The maximum total halogens contained in the resin plus reinforcement matrix is 1500 ppm with maximum chlorine of 900 ppm and maximum bromine being 900 ppm.
- For components other than printed board and substrate laminates:
  - Each plastic within the component contains < 1000 ppm (0.1%) of bromine [if the Br source is from BFRs] and < 1000 ppm (0.1%) of chlorine [if the Cl source is from CFRs or PVC or PVC copolymers].

*Supported by iNEMI*



# Overview of iNEMI HFR-Free Activities



# HFR-Free Project Portfolio

- **Completed projects**
  - **HFR-Free PCB Material Evaluation**
- **Active projects**
  - **HFR-Free High Reliability PCB**
  - **HFR-Free Leadership Program**
    - **HFR-Free PCB Materials**
    - **HFR-Free Signal Integrity**

# HFR-Free PCB Material Evaluation Completed

***Purpose:*** Identify technology readiness, supply capability and standards development opportunities for “halogen-free” alternatives to conventional printed wiring board materials

***Goals of the Project:***

- Identify commercially viable materials
- Benchmark past work and identify critical knowledge gaps
- Design test vehicles and test methodologies
- Leveraging prior investigations, carry out the necessary testing to characterize viable materials
- Analyze results
- Publish recommendations

***Results and Benefits:***

- Determined the critical tests for evaluating halogen-free laminate materials
- Showed industry the general benefits and limitations of non-bromine based flame retardant laminates
- Participants obtained detailed knowledge of each laminate



# HFR-Free PCB Material Evaluation Project Members



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**Vitronics Soltec**

**iNEMI**

# **HFR-Free High Reliability Project: In Process**

**Project Leader:**

**Steve Tisdale**

**Intel Corporation**



# HFR-Free High Reliability Project

***Purpose:*** Identify technology readiness, supply capability and reliability characteristics for “HFR-free” alternatives to conventional printed wiring board materials and printed wiring board assemblies, based on the high-reliability market segment requirements (large, thick boards).

## ***Goals of the Project:***

- Identify commercially viable materials
- Benchmark past work and identify critical knowledge gaps
- Build on industry knowledge and capability, including the iNEMI BFR-Free PCB Material Evaluation Project
- Design test vehicles and test methodologies
- Leveraging prior investigations, carry out the necessary testing to characterize viable materials
- Analyze results
- Publish recommendations

## ***Status:***

- Currently in the TV build / testing phase
- Completion of Project in Q1 2010



# HFR-Free High Reliability 12 Project Member Firms



# HFR-Free Technology Leadership Project



Stephen Tisdale, Intel – Chair  
HFR-Free Leadership Program

## HFR-Free PCB Materials

(Chair: John Davignon – Intel)

Identify key thermo-mechanical performance characteristics and determine if they are in the critical path for the HFR-free PCB material transition.

## HFR-Free Signal Integrity

(Chair: Stephen Hall - Intel  
Co-Chair: David Senk – Cisco)

Ensure there is no degradation of electrical signals in HFR-free PCB materials, base on investigation of permittivity and loss as well as how they are impacted by moisture absorption in new HFR-free materials.

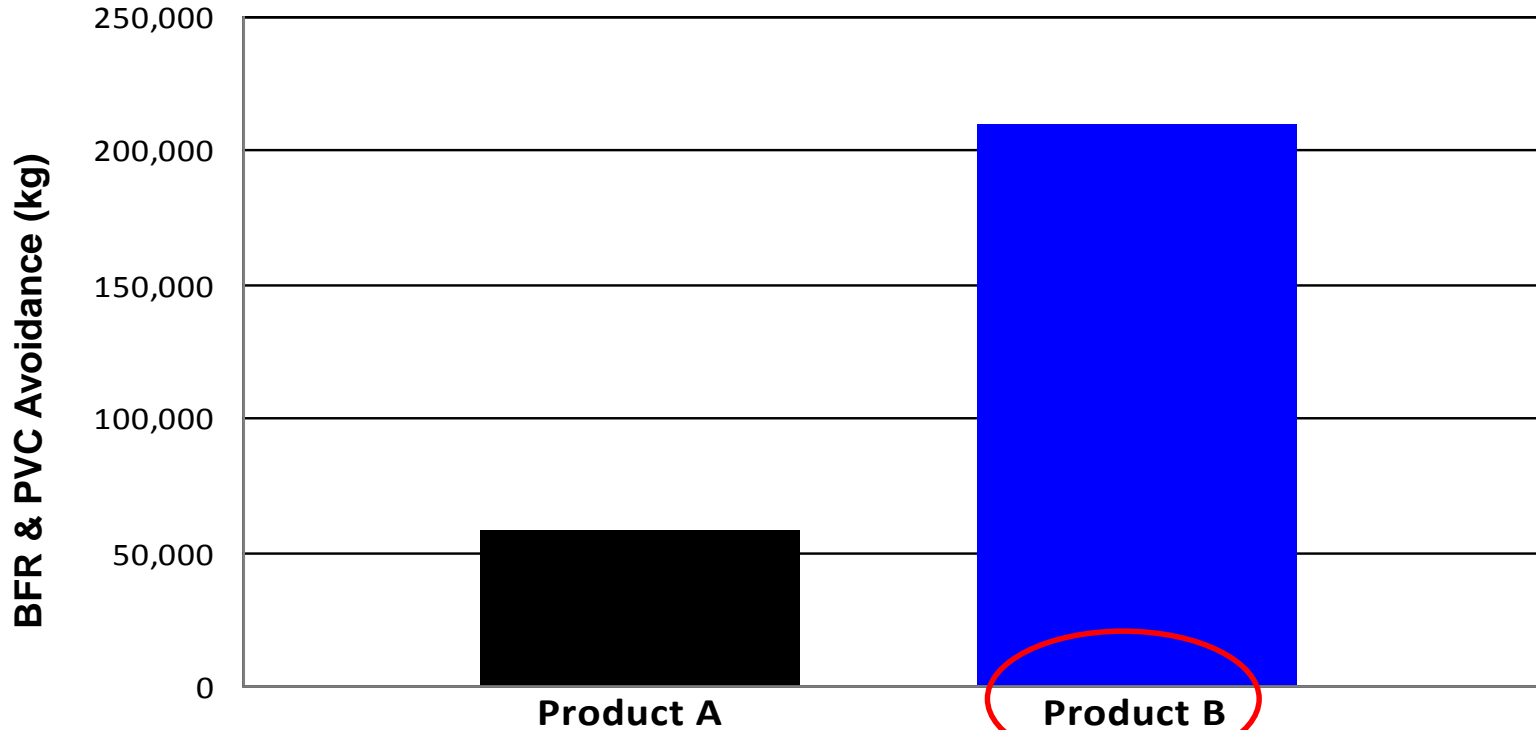


# Technology Challenges of HFR-Free

- **Mechanical Properties**
  - HF materials are ~10% stiffer (8 layer .062” board)
  - Lower mechanical stress limits (higher SJR risk)
    - HF has ~20% worse cold ball pull performance
    - Increased tendency for pad cratering
    - higher rework risk
- **Electrical Properties**
  - HF materials have broader range of Permittivity (Dk) values
    - Reduced margins for high speed busses
    - Especially critical for next generation (e.g. DDR3)

# BFR/PVC Avoidance Scenarios

All Products and Opportunities Are NOT Created EQUAL



Projected BFR and PVC avoidance:

Product A - a single niche BFR/PVC-free product (converting ~1000 parts)

Product B - a mainstream product that has a BFR-free main PCB and BFR-free fan housing and impeller only (converting 3 parts)

# 22 Project Member Firms Participating



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# iNEMI PVC Alternatives Project

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# Background

- 7 of the top 10 global PC manufacturers have set goals to phase-out PVC, where viable alternatives are identified
  - These 7 manufacturers represent over 50% of the worldwide market share for PCs (per IDC WW Quarterly PC Tracker for Q12008)
- PVC alternatives project was proposed at the September 2008 iNEMI Sustainability Summit, approved by the Board
- The project will focus on 2 areas:
  - *Phase 1 - Cradle-to-grave Life cycle assessment (LCA) comparing PVC versus PVC-free cables*
  - *Phase 2 - Technical evaluation of PVC alternatives – electrical, mechanical, safety*

# Incremental iNEMI Materials Impact Work Underway

## Recommendations

- **Need for development and implementation of good scientific methodologies to assess true environmental impacts of materials and potential trade-offs of alternatives (LCA-type approach)**
  - Will be covered in Eco-Design Section.
- **Greater involvement of industry on policy making for material restrictions to assure better understanding of trade-offs inherent in substitutions.**
  - Brussels Forum Had that Objective in Mind
  - WebEx ECE Update has the same objective

# Summary of 2009 iNEMI ECE Roadmap and iNEMI Initiatives to Close Gaps

Roadmap Section	Gaps to Be Addressed	iNEMI Projects Addressing Gaps
<b>Materials</b>	<ol style="list-style-type: none"> <li>1. Pb-free conversion</li> <li>2. BFR-free PCBs</li> <li>3. PVC Alternatives for cables</li> </ol>	<ol style="list-style-type: none"> <li>1. 9 Pb-free projects, emphasis on high reliability applications</li> <li>2. 4 BFR-free Laminate projects</li> <li>3. PVC Alternatives Project</li> </ol>
<b>Energy</b>	<ol style="list-style-type: none"> <li>1. Harmonization of energy regulations/standards</li> <li>2. Emerging product carbon footprint initiatives</li> </ol>	<ol style="list-style-type: none"> <li>1. New Product Carbon Footprint project proposed at October 8 Forum</li> <li>2. iNEMI Environmental Leadership Steering Committee</li> </ol>
<b>Recycling</b>	<ol style="list-style-type: none"> <li>1. R&amp;D for increasing recycled content in products</li> <li>2. Product design for reuse/recycling</li> </ol>	<ol style="list-style-type: none"> <li>1. Projects proposed, prioritize in 2010</li> </ol>
<b>Eco-Design</b>	<ol style="list-style-type: none"> <li>1. Building block approach to LCAs</li> </ol>	<ol style="list-style-type: none"> <li>1. Eco-Impact Evaluator Project</li> </ol>

Projects in Green have been presented are currently underway





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# Recycling & Reuse

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# Gaps and Show Stoppers

- **Countries that are not mature enough to effect responsible recycling within their borders**
- **Countries and regions within countries adapting their own programs and guidelines for recycling**
  - **Forces highly fragmented EOL management strategies across a highly segmented market**
- **The need for companies to plan costs and effective strategies to manage EOL recycling on their products**
- **There is a risk that the need to design for recycling could impede product innovation that would otherwise result in “greener” products more quickly.**
  - **DFE efforts must be holistic and deliver the best possible design for the environment attributes**

# Recycling-Reuse Roadmap Needs

- **Develop metrics and infrastructure for effective resource management**
  - Quantify & promote dematerialization efforts underway within industry
  - Increase information sharing between brand owners and electronics recyclers to increase reuse/recycling efficiencies & lower costs
  - Prioritize product & packaging design features that will enable cost-effective, environmentally-responsible reuse/recycling, use data to influence emerging regulations and standards (Basel Convention, R2 guidelines, EPEAT, etc)
- **Identify opportunities for post-industrial & post-consumer recycled content**
  - Quantify use of recycled content metals and plastics in “common” electronic components today, identify opportunities for further R&D

# iNEMI Sustainability Summit

## Recommendations on Recycling

- Work to establish a market for postconsumer plastics as feed stock for “Green” products
- Establish new electronic applications for postconsumer blended plastics
- Increase communication on the proactive efforts of iNEMI membership to deliver materials that reduce the hazards of the (improper) recycling process
- Work cooperatively to develop safe reuse practices for end of life products
- Encourage efficiency, reduced costs, and innovation in recycling systems through competition and other market forces

***We will prioritize iNEMI efforts in 2010***





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**Eco Design**

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# The Eco Design Process; Many Different Drivers

- Regulations such as the EuP directive
- Standards such as The Eco Declaration System; IEC's TC 111 and TC108, or IEEE1680-2006
- Market Initiatives
  - Many ECO Labeling requirements
  - Green procurement Initiatives such as EPEAT
- ECO Design Infrastructure
  - LCA and Life Cycle Thinking – Many different spins on this
  - DFE Tools
  - Environmental Data Bases

**Bottom Line: Another area where harmonization for the sake of simplifying progress is required**

# The Critical Issues; Moving Definitely Forward

- We need to be consistently applying simplified Life Cycle Analysis tools and methods to product design
  - The iNEMI ECO Impact Evaluator of ICT Equipment Project will deliver on this methodology
  - Work conducted will leverage off of prior studies in the area of LCA and LCT
- We are closely following the work underway on Environmental Performance Indicators (EPI) which offer another avenue potentially of simplification and measurement for Eco Design
- EPEAT expansion beyond desktop & laptop products into the balance of ICT
- Desirable harmonization of ECO Labels – At the time of Roadmap Publishing there were 20 different labels across 13 different countries/regions. And....more were in the works

# Key Electronics Industry Eco-Labels – An Opportunity to Harmonize Globally and Across Markets

## A Few Examples



TCO '03 TCO '05  
Swedish environmental/ergonomics label



EPA  
USA Environmental Protection Agency



Der Blaue Engel  
Germany's voluntary environmental label



JEITA  
Japan Electronics and Information  
Technology Industries Association



EPEAT  
Electronic Product Environmental  
Assessment Tool



CEC  
China Environmental Certification



# ECO Impact Evaluator for ICT Equipment Project Details

## Champions:

**Tom Okrasinski, Alcatel-Lucent**

**John Malian, Cisco Systems**

**iNEMI Program Management: Jim Arnold, Ph.D.**

## Project Goals

- Phase 1: Develop a methodology for providing a simplified means of deriving key eco-environmental information for ICT equipment / assets
- Phase 2 : Develop an eco-environmental impact assessment estimating tool for Information and Communications Technology (ICT) products.



# Current Status and Next Steps of Project

The team is researching the following subtasks:

Subtask	Title
1.1	Tools / Methodology
1.2	Databases
1.3	Standards
1.4	Other Investigations
1.5	Publication of White Paper on LCA

The team is preparing to assign resources for the following subtasks:

Subtask	Title
2.1	Define LCA methodology, assessment categories, stages
2.2	Categorize ICT components / assemblies
2.3	Categorize ICT products / assets
2.4	Define LCA estimator tool attributes (e.g. process steps / modules, database associations, inputs / outputs)
2.5	Compile LCA Estimator Tool framework document

# Gaps and Show Stoppers

- **Eco Labels are not taking into account new technologies, life cycle thinking, & actual scientific data**
- **Limited understanding of electronic product design cycles and infrastructure by environmental stakeholders**
- **Wide variety of e-cycling practices make the Design for Recycling guidelines very challenging**
  - **And this COULD be a huge area of E-Benefit if done correctly**

# A Summary of ECE Roadmap ECO Design Recommendations

- **Promote the IEEE 1690-2006 as a Green Procurement standard to give the ICT industry a widely accepted design guideline**
- **Develop non competitive LCA's for ICT products based on a building block approach**
  - **iNEMI project underway**
- **Provide early feedback to Eco label organizations on new technologies, life cycle thinking, and scientific/test data**
- **Work with appropriate organization to initiate a broad industry dialogue on design strategies for reducing waste impact**
- **Develop and publish an iNEMI position statement on product Carbon Foot Print**
  - **Work is now well underway**





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# Energy: Regulatory Factors

*Jos Beekwilder*

*Océ  
Technologies*

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# Energy: policy and perception

## Situation Analysis

- **Public opinion drives ongoing pressure to become more energy efficient**
  - Regulations impacting technology choices
  - Energy labels
  - Green public procurement
- **Energy Costs Impacting End User - perception**
  - Manufacturers held responsible

## Energy Management - Basic popular beliefs

- Equipment should not “waste” energy when not active (i.e. idle, standby, sleeping, off, .....).
- ALL ICT/CE Equipment is sufficiently intelligent to power down when inactive and instantly restart when required.

# Energy Efficiency – Industry echoing public opinion: efficient products

**It pays for businesses to “go green”**

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**Lenovo takes an active role in combating climate change**

Lenovo is committed to providing environmentally responsible, energy-efficient technology choices. In 2007, they joined the Board of Climate Savers Computing to support their efforts in reducing CO<sub>2</sub> emissions related to IT by 50% by 2010.

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**Lenovo's green strategies include:**

- All Lenovo ThinkPad notebooks, ThinkVision monitors and many ThinkCentre products launched from 2008 are ENERGY STAR® 4.0 compliant and deliver up to 70% energy efficiency improvements
- Lenovo systems with EPEAT Gold ratings contain up to 90% reusable and recyclable materials and ship in packaging that is 90% recyclable
- Lenovo Power Manager and BatteryStretch technologies offer adjustable power management

All Lenovo LCDs launched from 2008 are ENERGY STAR 4.0 and EPEAT Gold certified.

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The Target EcoSmart™ family of products is PVC-free and features recyclable plastic accents and nickel-free metals that help reduce the amount of toxins released into our environment.

			
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# EuP Directive

- **Enacted in 2005 targets to push energy efficiency of products within the EU**
- **Has resulted in energy efficiency regulations for products that include the ICT/CE industry**
- **Driving important standards on horizontal items such as standby, off-mode, network-standby**
- **For the moment: emphasis on energy efficiency minimum requirements**
- **Imminent: Product Carbon Footprint labelling**

# ENERGY STAR

- **Global Energy Efficiency Standard for Public and Corporate Green procurement**
- **Trend: a qualifier for market access**
  - **Almost every manufacturer has qualified products**
- **New developments:**
  - **More strict verification requirements (barrier for SME's)**
  - **More frequent updates of specs (growing push)**
  - **More strict specs (more focus on 25% most efficient)**
  - **ENERGY TOP STAR: intended to outline the winners**
- **EPA effectively organized an Energy-efficiency rat-race**

# The Big Picture; Carbon Footprint



Global CO<sub>2</sub> Emissions

~ 40 Billion tonnes

~2%

ICT Sector  
~ 850 Mil tonnes

PC Sector

~ 320 Mil tonnes

How do we get the facts and data?



Sources: Smart 2020 Report 2008; IDC; Gartner



# From the big picture to a label?

- **Product Carbon Footprint label**
  - Governments across Europe are striving for this.
  - Some companies publish PCF-figures
  - Personal position: can not be regulated horizontally
    - for “big” products: Energy during use phase dominant (servers, PC,s Laserprinters, TV’s, home entertainment, CPE, ....)
    - for “small” products: manufacturing dominant (cell-phones, hand-held devices, inkjet-desktopprinters)
    - too inaccurate or too complicated to be useful for labelling.
    - who needs another label ?

# iNEMI Energy Efficiency Improvement Opportunities

- **Technology & Development Needs**
  - **More efficient power supply technology**
    - reduce losses at low load percentages
  - **Intelligent power management:**
    - e.g. network proxy, smart servers, cloud computing: meet the popular belief of intelligence.
    - Ecma International has developed a definition standard for Network Proxying.
  - **Low energy technologies (e.g. like the step from CRT to TFT, or glass-fiber based instead of Cu-based communications)**
  - **New innovative energy sources**
    - solar and wind energy is fluctuating by nature, but there is more than enough if we can harvest it intelligently

# iNEMI Outreach Needs

- **Academia:**
  - Enlist university/lab cooperative research with industry on improved power supply efficiency.
- **Standardisation bodies:**
  - Harmonize energy management standards (Energy Star, EuP, Ecma, etc)
    - “Every governments/legislative solution creates potentially massive Overhead requirements”
    - Harmonizing promotes more rapid new product development and more efficient energy use.
  - Define and drive common test and measurement methodologies.
  - Resolve the Product Carbon Footprint dilemma
- **Industry associations:**
  - Drive harmonization of Energy management directives (Digital Europe, JEITA, ITI, CEA, Swico, ITAC, .....).
- **Drive coordination of government (€) support for corporate voluntary initiatives.**
  - Awards for scope or programs
  - Awards for innovation and initiative

# Energy Summary

- **There is a gigantic worldwide energy reduction opportunity that can be realized through advancements in ICT products**
- **There's a big public push to deliver on energy Efficiency**
- **We don't need more legislation, we need harmonized legislation that thus frees up resources to innovate:**
  - **With energy efficiency improvements in product design and in product usage models**
  - **With comprehensive voluntary initiatives that have big positive impact in the field of Green Energy**
- **Opportunities for iNEMI and its membership are large**
  - **but the risk of backfire (overregulation) remains**



**INEMI**  
International Electronics Manufacturing Initiative

# Electronics as a Solution for Sustainability

*Markus Stutz,  
Dell*

*15 December  
2009*

Advancing manufacturing technology

# Introduction

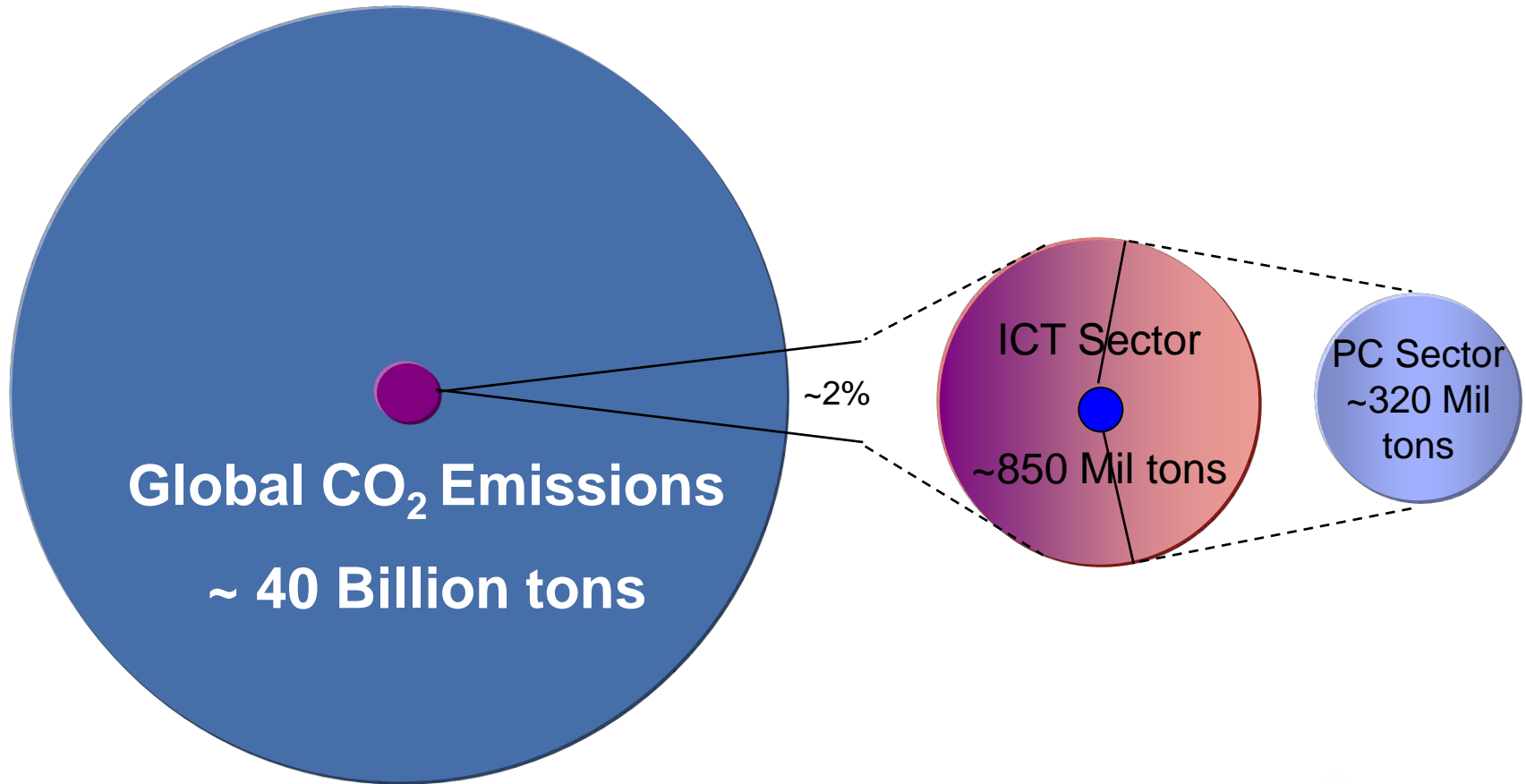
- **Sustainability has evolved into a business imperative**
- **To date initiatives focusing on minimizing our industry's environmental impact, mainly driven by legislative requirements**
- **However another – more significant – aspect:**

**Electronics as solution for sustainability**

**Empowering people to live a sustainable lifestyle**



# The Big Picture – CO<sub>2</sub> Emissions



Sources: Smart 2020 Report 2008; IDC; Gartner

# Electronics as a Solution –Statements

- **“The savings made possible by computing’s ‘enabling effects’ could amount to five times computing’s own footprint.” (GeSI)**
- **“Electronics-enabled solutions could cut annual CO<sub>2</sub> emissions in the U.S. by 13% to 22% from business-as-usual projections for 2020.” (SMART 2020)**
- **“Between 1990 and 2007, the economic output of the European Union grew almost 40%, and its per capita incomes by more than a third. Yet, its energy requirements and power consumption, while rising, did so by only 11%.” (AeA Europe)**
- **The electronics industry is in a unique position to demonstrate leadership in reducing its own footprint by creating energy efficient solutions for other sectors through structural change and innovation**

# Demonstrating Leadership through Structural Change and Innovation

- **Structural change: Re-engineer the way organizations operate**
  - Replacing products with online services (e.g. newsletters),
  - moving business to the Internet (e.g. customer support)
  - adopting technology-enabled ways of working (e.g. telecommuting, videoconferencing)
- **Innovation**
  - Efficiency gains of displays: Replacing CRTs (cathode-ray tubes) with LCDs (liquid crystal displays)

# Influencing Other Sectors

- **Electronics as solution to climate change**
- **Smart grids**
- **Smart buildings**
- **Smart lighting**
- **Smart city planning**
- **Smart appliances**
- **Smart industry**
- **Smart work**
- **Intelligent transport**
- **Dematerialization**

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



# Smart Grid Opportunity

## U.S. reduction potential in 2020

MMT of CO<sub>2</sub>

230-480<sup>1</sup>

56%

25%

19%

Breakdown of ICT-enabled CO<sub>2</sub> reduction potential

Integrating renewable energy

Reduce T&D losses

Consumer awareness

## Description

- Balance unpredictable supply from renewable sources with demand

- Remotely monitor grid performance and balance utilization of resources

- Provide information on prices and usage to customers

## Example

- Software algorithms
- Remote monitoring of production
- Pool distributed sources into "virtual power plant"

- Automatic detection and pre-emption of faults
- Adaptive voltage control
- Extended granularity of information for the grid's remote control systems

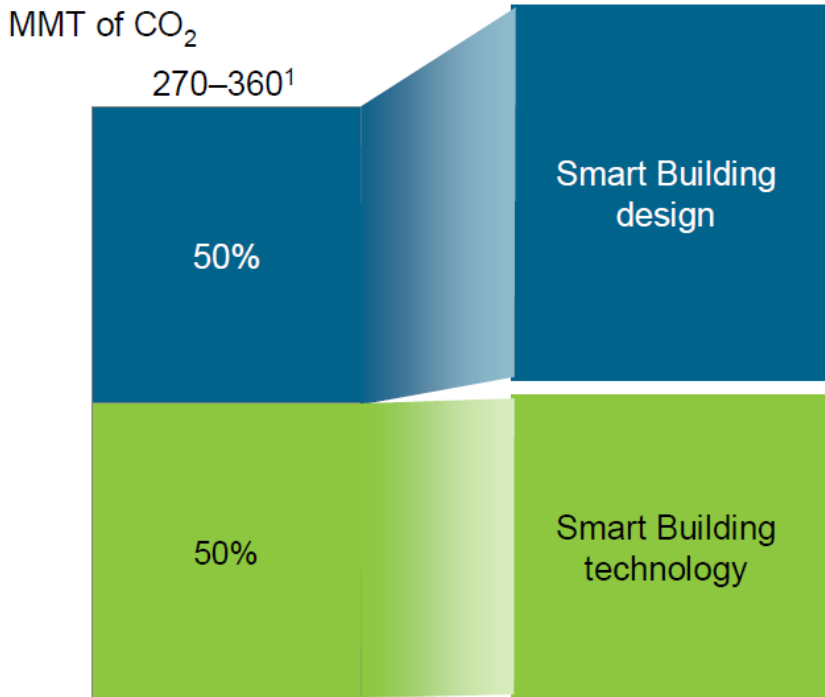
- Smart meters with time of use prices
- Intelligent thermostats and appliances that adjust usage based on prices
- Web-based interface to control and analyze usage

Source: Smart 2020 Report 2008



# Smart Building Summary

## U.S. reduction potential in 2020



Breakdown of ICT-enabled CO<sub>2</sub> reduction potential

## Description

- Design buildings that have minimal, or even negative, energy consumption

- Optimize energy consumption of an entire building in real-time based on inputs from occupants, local utilities and outdoor weather

## Example

- Simulation and modeling design software: building size, lighting, choice of material, air flows and HVAC sizing
- Building Information Modeling (BIM)

- Smart appliances
- Smart sensors and controls
- Building Management Systems (BMS)
- Smart meters
- Decision-making software

Source: Smart 2020 Report 2008



# Electronics as a Solution

- **While there is the responsibility to minimize the electronics industry's environmental impact from operations, products, and services, the compelling news is that the electronics industry has a particular opportunity to make society function more efficiently and easily and thereby mitigate our impact on the environment.**
- **Several potential synergies exist between different electronics applications, which provide opportunities to create virtual cycles, or low carbon feedback, and achieve transformative change.**



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# Conclusions & Thank You

*Bill Bader*

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# 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 will 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**
  - **Requires Industry Commitment and Continuity of R&D Leading to Results**
- **We are ALL in this together – Harmonization will lead to better results and a “Better World Through Electronics”**

# Effective And Lasting Progress Requires Global Teamwork and Alignment



# Participating in the 2011 Roadmap

- The Environmentally Conscious Electronics (ECE) Technology Working Group (TWG) will begin its task in January 2010
- To Participate in the ECE TWG please Contact:
  - Chuck Richardson, iNEMI Director of Roadmapping  
[chuck.richardson@inemi.org](mailto:chuck.richardson@inemi.org)
  - Jackie Adams, IBM, Chair ECE TWG                      [jackiea@us.ibm.com](mailto:jackiea@us.ibm.com)
  - Ted Reichelt, Intel, Chair ECE TWG                      [ted.reichelt@intel.com](mailto:ted.reichelt@intel.com)
  - Markus Stutz, Dell, Chair ECE, Sustainability sub-group  
[markus\\_stutz@dell.com](mailto:markus_stutz@dell.com)
- Anyone from the Electronics industry is welcomed to participate in defining the industry's future direction

**Thanks to the  
Presenters**

**Thanks For  
Attending**

**Expect an iNEMI  
Update in 90-120  
Days**

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