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Environmentally Conscious Electronics Roadmap

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Agenda

- **Identified Priorities from 2007 Roadmap**
- **iNEMI Efforts to Address top Priorities**
- **2009 ECE Roadmap Structure and Focus Areas**
- **Current Situation and Future Challenges**

Top Research Priorities from 2007 Gap Analysis of 2007 ECE Roadmap

- **Accepted and sound scientific methods to evaluate environmental impact of materials that are also accepted by regulators, NGOs and industry**
- **New innovative energy sources**
- **R&D to develop a sustainable infrastructure and viable recycled materials market for use in new products and other applications**
- **Greater involvement of industry on policy making for material and energy restrictions to assure better understanding of trade-offs inherent in substitutions**

Top Implementation priorities from 2007 ECE Roadmap

- **A strategy and action plan to convert high-reliability applications to Pb-Free solders.**
- **Proactive programs to convert to bromine free material alternatives.**
- **R&D to develop a sustainable infrastructure and viable recycled materials market for use in new products and other applications**



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iNEMI Efforts to Address Top Priorities

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High Reliability RoHS Task Force Project

Goal: Safeguard the dependability of high reliability RoHS-exempt products as the supply chain converts to Pb-free components and materials.

Strategy:

- Develop recommendations and guidelines that communicate the needs of the High Reliability manufacturers to this segment of the supply chain and relevant standards groups that address these needs.
- Understand and close remaining knowledge gaps that must be closed to allow Pb-free conversion for High Reliability manufacturers.
- Project Lead: Mike Davisson (Agilent Technologies), Thilo Sack (Celestica), Joe Smetana (Alcatel-Lucent)



Tactics

- Phase 1: Publish position statements:
 - "Recommendations to Electronics Industry Component Supply Base".
 - "Pb-Free Manufacturing Requirements for High-Complexity, Thermally Challenging Electronic Assemblies"
 - "RoHS5 & RoHS6 Subassembly Modules"
- Phase 2: Influence supply base for SnPb BGAs
 - Hold workshop and publish results
- Phase 3: Prioritize knowledge gaps and spawn projects as needed.

Milestones & Issues

- Phase 1..... Complete
- Phase 2 On going
- Phase 3..... On going
- ISSUES:

Industry Readiness

- **9 of 11 Telecommunications OEMs Polled took Pb-free Exemption for Solder In Network Infrastructure Equipment**
- **A dual component supply chain has resulted**
 - **Pb-free components for high volume consumer market**
 - **Traditional SnPb components for**
 - **Telecommunications**
 - **Servers**
 - **Military products**
 - **Medical electronics**
- **Reliability of Pb-Free Components with Eutectic Solder has not been fully demonstrated for long life products.**
- **Some Telecom service providers are now demanding that mission critical equipment remain with SnPb solder.**
- **Suppliers are not willing to provide traditional components to small high reliability market.**

Scenarios

- **Long term solution is to reduce reliability risk of Pb-free components and assembly.**
 - The economic incentive is compelling
 - Well worth technology investment
 - Could take several years to complete but this is cumulative, so strides made today are useable.
- **What can we do in the short term to help encourage the availability of SnPb compatible BGAs?**
- **What can we do in the mid term to close remaining knowledge gaps that the High Rel. segments face?**
- **What can be done longer term to better understand and predict reliability of electronics hardware using Pb-free components and assembly?**

Additional Issues

- **Proliferation of Pb-Free metallurgies is significantly complicating the issue of closing knowledge gaps!**
 - Alloys behave differently
 - Can effect form/fit/function
 - supplier A part does not behave like supplier B part in mfg. and/or use.
 - Users are demanding new part numbers from their suppliers
- **Transition in Reliability Concerns**
 - Initial concerns with SAC alloys were thermal cycling
 - Current concern is mechanical failure.

Halogen-Free, Phase II Project

Goal: Promote standards development for halogen-free printed wiring boards by establishing materials, manufacturing, assembly, and test guidelines

Strategy:

- Extend results of the Halogen Free PCB Phase I Project
- Create a proactive stance in the electronics industry for other non-regulated halogenated organic substances
- Project Leads: Steve Tisdale, Intel; Co-Chair; Roger Krabbenhoft, IBM



Tactics

- Phase 1: Measure broadband frequency dependent dielectric constant and loss tangent (10KHz - 20GHz)
- Phase 2: Determine compatibility of candidate laminate materials with higher temperature assembly

Milestones & Issues

- Project start.....July 12, 2007
- Phase 1.....Q208
- Phase 2 Q408
- ISSUES:

Proactive Programs

“Industry should take a proactive approach, work with stakeholders, and direct our activities where there is technical/ecological evidence we could and should be doing a better job to protect the environment. We should involve stakeholders in the process of evaluating alternative technologies to determine trade-offs between product functionality, environmental impact, reliability, safety, and cost.”

iNEMI Halogen-free Project

Project Objectives:

- **Build on industry knowledge and capability,**
- **Consider unique market segment requirements,**
- **Identify technology readiness and gaps,**
- **Stimulate supply capability, and**
- **Recommend standards development opportunities**

Conclusions from Current Efforts

- **All Materials will continue to be modified**
 - **Reliability verification of these changes is crucial**
- **Consumer Electronics drive the cost and the market**
 - **The high rel. market must develop a viable scenario to take advantage of consumer components and meet their reliability requirements.**
- **Firms are expected to be Socially Responsible**
 - **Industry must establish proactive science based programs to addresses potential environmental risks.**
 - **Stakeholders must be involved in the process from the beginning.**



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2009 ECE Roadmap Structure and Focus Areas

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2009 ECE Roadmap Teams

Chair: Frank Rossman, Jabil

- **Materials Team**
- **Energy Team**
- **Recycling Team**
- **Design Team**

ECE Themes/Teams Matrix for 2009

Themes & Topic Teams	Key Legal and voluntary requirements	Trends/emerging issues	R&D and process needs	Risks / show-stoppers	Enabling technologies and processes
Materials (RoHS, etc)					
Energy (E-star, etc)					
Recycling (WEEE, etc)					
Design (EuP, etc)					
Cross-Cutting Coordination	Component Manufacturing Core Manufacturing Technology Crosscutting TWGs Product Emulator Groups				

Cross-cutting ECE TWG Issues with Component Manufacturing TWGS

Key Component TWG	Environmental Needs	Time Frame
Interconnect Substrates-Organic	•Alternatives to Brominated Flame Retardant	
Interconnect Substrates-Ceramic	•Alternatives to Beryllia substrates	
Displays	•Alternatives to Hg in Lamps •Improve Energy Efficiency	
Mass Data Storage	•Increase recycled content	
Optoelectronics	•High Temperature Soldering Compatibility	
Digital Silicon Technology	•Reduce energy and water use, decrease emissions •Improve device power management	
Energy Storage Systems	•Improve Energy Efficiency	
RF Components	•High Temperature Soldering Compatibility	
Passive Components	•High Temperature Soldering Compatibility	
Connectors	•Alternative Flame Retardants	

2009 ECE Roadmap Focus Areas

To remain competitive, the electronics industry must continue to keep pace with emerging:

- **material restrictions,**
- **customer preferences for energy efficient products,**
- **end-of life requirements,**
- **holistic design requirements,**
- **Societal expectations on Corporate Social Responsibility (CSR)**

Roadmap 2009 discussion topics

- **Energy Management has become a major technical problem: How to reduce energy use while increasing performance**
- **Sustainability metrics**
- **RoHS / WEEE / EUP aftermath & updates**
- **Solving the remaining technical challenges of RoHS**
- **Voluntary agreements**
- **Multi Stakeholder R&D Programs**
- **Steps to legislative harmonization**
- **Continuous improvement in companies**
- **Strategic vision of sustainable electronics**
- **Closer cross-linkage to technology roadmaps**



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Current Situation and Future Challenges

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Changing Situational Analysis

- **New Regulations are appearing around the world**
- **Market expects products to be bromine free: It is time for the industry to work together to eliminate it.**
- **Increased Emphasis on Energy Efficiency and Energy Sources**
- **Increased Emphasis on Recycling Technology and Creating a Market for Recycled Materials**
- **Increased Important of Corporate Social Responsibility**

Challenges to the Industry

- **Closer environmental linkage to technology roadmaps**
 - Evaluating the technology iNEMI Technology Roadmaps to chart environmental effects of technological trends
- **Implementing continuous improvement (CIP) in companies – learning from experiences**
- **The electronics industry must develop a strategic vision of sustainable electronics**
- **The industry must convey this vision to its stakeholders**



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