

A New Business Perspective –

Turning Green Manufacturing Into Your Competitive Advantage

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- Business Benchmarks
- Basics of Green Manufacturing
- Regulations
- Green Production Process
- Competitive Advantages
- SMT and Its Experience
- What's Next

BENCHMARKS FOR World Class Companies



QUALITY VALUE SPEED FLEXIBILITY GROWTH

Product, Workplace, People

Cost, Value-Addition

Response, Productivity

Change

Performance, Staff

ENVIRONMENT

Green Manufacturing

WHAT IS GREEN MANUFACTURING?



The true meanings :

- Principle
- Culture
- Commitment
- Duty
- Long term

- fundamental
- for the whole corporation
- by every employee
- to society
- and evolving

GREEN MANUFACTURING



The scope of actions is very wide :

To employ environmentally friendly measures in -

- Factory design and construction
- Daily Operations
- Material and Components
- Production Process
- Products
- End of life issue





ISO 14001 Certification:

- Reduced release of pollutants
- Energy saving
- Resources saving
 - Water saving
 - Paper recycling
- Prevention of potential hazards to the environment

REGULATIONS FOR GREEN PRODUCTION IN THE WORLD



- European Union (EU) WEEE/RoHS/ELV directives, Battery directives, REACH
- Japan Japanese Home Electronics Recycling Law
- USA Some state activities, nothing federal
- China WEEE directives (under preparation)
 - RoHS like law (Information Electronics Production pollution control and management)

WEEE – Waste Electrical & Electronic Equipment RoHS – Restriction of the use of Hazardous Substance ELV – End of Life Vehicle

REGULATIONS FOR GREEN PRODUCTION IN THE WORLD



- The Waste from Electrical and Electronic Equipment (WEEE) Directive:
 - Establishes criteria for collection, recovery and recycling of waste electrical and electronic equipment
- Directive on Restrictions of the Use of Certain Hazardous Substances (RoHS):
 - Ban on a variety of hazardous materials from use in manufacturing process
- End of Life Vehicle (ELV) Directive:
 - Establishes a framework to ensure that vehicles are designed and manufactured in a way that optimizes opportunities for reuse, recycling and recovery

REGULATIONS FOR GREEN PRODUCTION IN THE WORLD

Battery Directives

- Sets permissible limits for mercury, cadmium and lead in batteries
- Registration, Evaluation and Authorisation of Chemicals (REACH)
 - Chemical manufacturers and importers need to register all their substances, and submit the information to a central data base for evaluation, and authorisation if necessary

TIMELINE FOR WEEE & RoHS DIRECTIVES





CHALLENGE IN FULFILLING THESE LEGISLATIONS



- Law and implementation timelines are different in different countries
- Wide range of equipment covered in the list of EEE
- Too many exemptions of each directives
- Identifying hazardous substances and their compound involve huge workload and technical know-how



Before, During & After!



Before

Green concept in design

- Resource saving
- Utilize Green production process
- Selection of proper tools and equipment
- Recyclable constructions
- Minimize the number of components
- Vendor selection



Before

Green concept in the choice of components

- Heavy and toxic metal elimination
- Halogen free PCB
- Recyclable components
- Biodegradable packaging materials



During

RoHS Production Management:

- Component compliance
- Materials control
- Vendor commitment and monitoring
- Process control
- Tools and equipment selection
- Storage management
- Packing materials

RESTRICTION ON SUBSTANCES



Substances restricted by RoHS:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ethers (PBDE)



During (2)

Basic manufacturing process for electronics:

- Lead-Free Soldering
- "No Clean" PCB Assembly
- Reduce Emission of Pollutants
- Use of environment-friendly chemicals

LEAD-FREE SOLDER DEFINITIONS



JEDEC < 0.2wt%Pb

JEIDA < 0.1wt%Pb

EUELVD < 0.1wt%Pb

JEDEC - Joint Electron Device Engineering Council JEIDA - Japanese Electronic Industry Development Association EUELVD - EU End of Life Vehicles Directive

Note: Solders with >85wt%Pb are exempted!

LEAD-FREE PRODUCT DEFINITIONS



(We don't have it yet)

Use the lead-free solders (defined by either JEDEC, JEIDA, or EUELVD) to manufacture the products and don't allow any intentionally added Pb in the products, then the products can be defined as lead-free products!

LEAD-FREE SOLDERING



 Eventual legislation aims to eliminate lead from the soldering alloy by 2010:

Ja <mark>pan</mark>	2005
EU	July 2006
JSA	possible 2008
	(no implementation date yet)

TECHNICAL ISSUES IN LEAD-FREE SOLDERING

- Higher melting point
- Completely new discipline in production management
- Difficult in wetting
- Reliability issues
 - Solder joint integrity
 - Whisker growth
- Choice of equipment



After

(Products in the Field)

- Packaging Materials Disposal and Environment-friendly
- No release of toxic substances in product life
- End of Life Treatment Recycling of Components
- Collection of equipment
- Use of Biodegradable materials

CHALLENGES ON GREEN MANUFACTURING



Long term effort

Investment

- Determination
- Education
- Training
- Water treatment
- Waste treatment
- Emission control
- Testing
- Capital equipment
- Certification of international standards

CHALLENGES ON GREEN MANUFACTURING



Increase in product cost

Awareness

- Higher material cost
- Higher sub-material cost
- Less choice
- Less supplier
- Monitoring and Compliance of new regulations



If you can master "green manufacturing" and your competitors cannot ...

COMPETITIVE ADVANTAGES THROUGH GREEN MANUFACTURING

External Benefits:

- To be qualified by world class customers
 - Most have "Green" Program
 - Will only work with "green" suppliers
 - Extension to entire supply chain
- Ahead of competitors
- Enhance company image
 - Good corporate citizen

COMPETITIVE ADVANTAGES THROUGH GREEN MANUFACTURING

- **External Benefits:**
- Barrier of entry:
 - Investment
 - Knowledge
 - Approvals
 - Management
 - Customer loyalty
 - Gain market share

COMPETITIVE ADVANTAGES THROUGH GREEN MANUFACTURING

Internal Benefits:

- Enrich company culture
- Happy and healthy employees
- Long term cost reduction through
 - Better process control
 - Energy efficient
 - Less wastage
- Higher quality and reliability
- Promote R&D activities



SMT Experience

SURFACE MOUNT TECHNOLOGY LIMITED (SMT)

- Established in 1986, listed in Singapore
- Total employees > 10,000
- **Produ**ction area > 620,000 sq.ft.
- 94 SMT lines
- Manufacturing over 20% of floppy disk drives (FDD) and 10% of CD-ROMs of the world market
- One of the largest and leading Hong Kong based Electronics Manufacturing Services (EMS) Providers in Southern China
- World ranking 28th in Top 100 Contract Manufacturers*

*Source: "Top 100 Contract Manufacturers", Electronic Business, Sept 2004

MANUFACTURING LOCATIONS





SMT EXPERIENCE



- Lead-free soldering
 - Started production since Oct 2001
 - Supplying lead-free products to all Japanese customers
 - All new SMT lines are lead free
- ISO 14001 approval in Jan 2003
- Qualified as Sony's "OEM Green Partner" in Feb 2003 – the first one in China!
- OHSAS 18001 Certification in Feb 2004

SONY "OEM GREEN PARTNER" Program



 Since then Sony established the "OEM Green Partner" program and requested all tier-one suppliers must comply. Then tier-two suppliers must also follow

SONY "OEM GREEN PARTNER" PROGRAM (Cont'd)

- Sony's standard is called SS-00259 specifications similar to RoHS
- Became the forerunner of RoHS production methodology
- In 2004, the concept of "OEM Green Partner" spread to other Japanese companies
- Now there are worldwide adoptions



The Rewards!

SMT BENEFITS FROM PRACTICING GREEN PRODUCTION

Synergy effect with other Management **Progra**ms

Six Sigma

Zero Inventory

Just in Time

To Create the Best in Class Company!

SMT BENEFITS FROM PRACTICING GREEN PRODUCTION

Market	t Share	Increased
More F	Profit	Charge higher price
Gain N	lew Customers	Car Industry
Quality		28 ррт
First P	ass Yield	> 99.45 %
Scrap		< 0.16 %

FINANCIAL HIGHLIGHTS





FINANCIAL HIGHLIGHTS



Group Net Profit



WHAT'S NEXT FOR SMT



- The Green Supply Chain
- Promote "OEM Green Partner" Program to other industries
- Start RoHS production line in end 2004 and plan for company-wide implementation





Start Green Manufacturing Now!