Low Cost Lead-Free Soldering Technology to Improve Competitiveness of European SMEs

Project Overview Presentation

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LEADOUT INFODAY
09.09.2005

HORIZONTAL ACTIVITIES INVOLVING SMEs

Background & Motivation

EUROPEAN DIRECTIVE

Harzardous Products - RoHS (2002/95/EC)

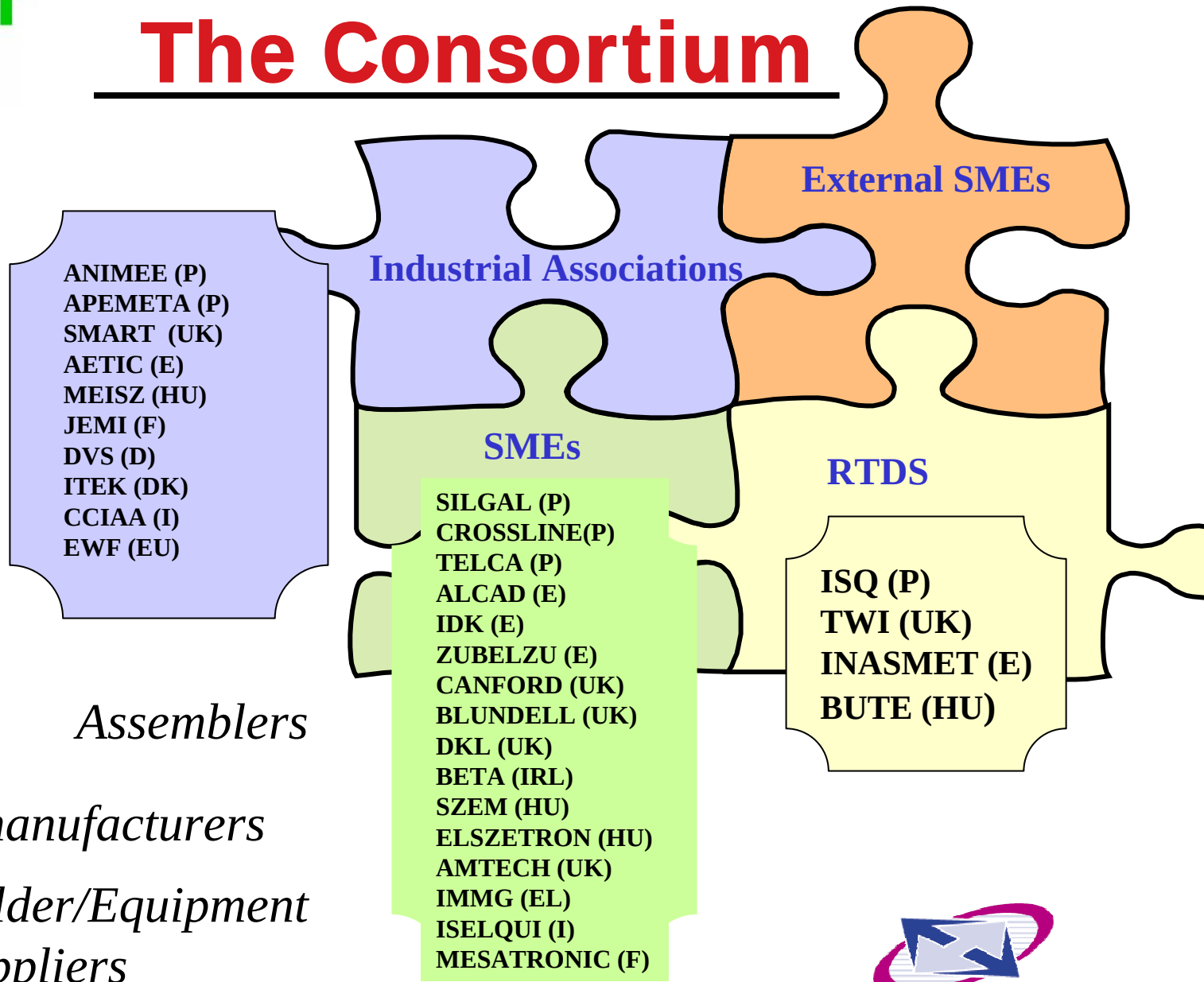
July 2006

- SME LACK OF KNOWLEDGE AND LOW LEVEL OF LFS IMPLEMENTATION
- LACK OF RESEARCH WORK REGARDING LOW VOLUME PRODUCTION, REWORK AND MANUAL SOLDERING
- EUROPEAN BENCHMARKING OF LFS PROCESS

Strategic Objectives

- Development/implementation of low cost lead-free soldering processes to support SMEs in complying with RoHS
- Establishment of process quality standards, reduction of defect rates, improvement of reliability to increase competitiveness of SMEs
- Increasing awareness of health and safety and pollution prevention

The Consortium



Electronics Associations

Environmental Associations

Assemblers

PCB manufacturers

Solder/Equipment suppliers

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Workprogramme Structure

WORK PACKAGES

WP 1 – SME INFORMATION EXCHANGE

- T1 SME Core Group
- T2 Benchmarking Review
- T3 SME Survey
- T4 Website
- T5 Virtual Institute
- T6- Awareness Promotion Newsletters Information Seminars

WP 2 – TECHNOLOGY DEVELOPMENT

- T1 – Technology Review
- T2 –Process and Reliability Programme
- T3 – Reability Testing
- T4 – Environmental Assessment
- T5 – Environmental Life-Cycle Impact

WP 3 – LEAD FREE TECHNOLOGY, INDUSTRIAL IMPLEMENTATION

- T1 – Evaluation of Equipment and Materials
- T2 – Soldering Trials at Industrial Sites
- T3 – Quality Evaluation of Solder Joints
- T4 – Environmental Health & Safety Assessment
- T5 – Recommendations for SMEs
- T6 – Benchmarking Data Reporting

WP 4 – DISSEMINATION & TRAINING

- T1 – Seminars
- T2- Training Courses

WP 5 – EVALUATION OF THE PROJECT PERFORMANCE

- T1 - Process Improvement
- T2 - Technology Improvement
- T3 - Environmental Improvement

WP 6 - Management

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Key Deliverables

- Benchmarking Summary Report - March 2007
- Report on Soldering Trials - Sept 2005
- Report on Reliability Testing - February 2006
- Photo Library for Joint Inspection - February 2006
- Recommendations for Lead-free Implementation at SMEs - April 2006
- Seminars and Workshops - 5 per country
- Virtual and Conventional Training Courses - 5 to be delivered before July 2006
- Health and Safety Report on Lead-Free Soldering - April 2006
- Environmental Impact Report on the Industrial Use of Lead-Free Solders - Sept 2007

Project Workprogramme

1) BENCHMARKING

2) TECHNOLOGY DEVELOPMENT AND INDUSTRIAL IMPLEMENTATION

3) AWARENESS, DISSEMINATION AND TRAINING

4) ENVIRONMENTAL IMPACTS

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Benchmarking Programme

What is the average defect level in the industry,

Does anyone know?

PPM - Part Per Million Opportunities

$$\frac{\text{Total Defects}}{\text{Baseline}} \times 1{,}000{,}000 = \text{PPM}$$

$$\frac{5}{10{,}000} \times 1{,}000{,}000 = 500 \text{ PPM}$$

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ppm-monitoring.com SMART GROUP

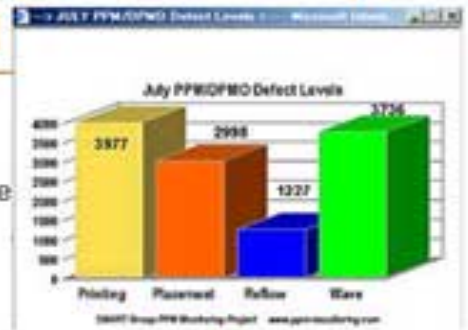
Click Here for

AUGUST PPM AVERAGES

Solder Paste Printing:	1430
Component Placement:	1229
Reflow Soldering:	108
Wave Soldering:	4314

Home | Members Area | About the Project | Monthly Averages | PPM Workshops | Process Defect Guides

smart-e-link | Downloads | Contact Us | Press Cuttings | Link to Us



MONTHLY AVERAGES

Month	Screen Printing	Component Placement	Reflow Soldering	Wave
May	730	15020	448	
June	569	7103	678	
July	3977	2998	1227	3736
August	1430	1229	108	4314

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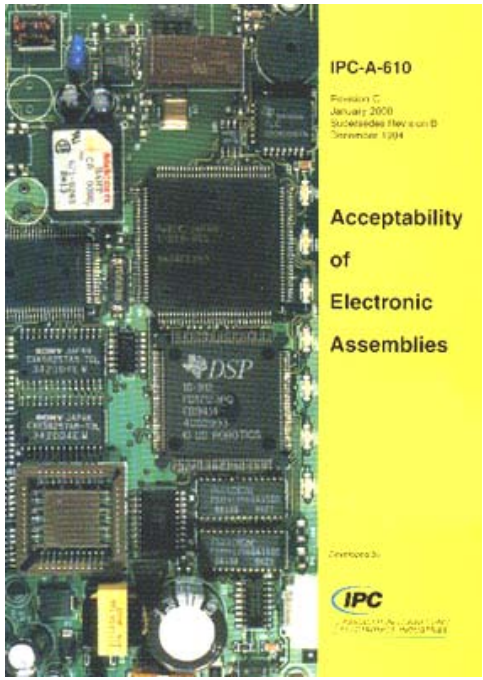
For further information on PPM Monitoring and this SMART Group initiative, contact:
Bob Willis - info@ppm-monitoring.com

ISQ

HORIZONTAL ACTIVITIES INVOLVING SMEs

Inspection Criteria



Printing: Number of apertures

Placement: Number of components

Reflow: Number of joints

Wave: Number of joints

Monitoring occurs through the lead-free implementation period

- To compare leaded and lead-free processes
- Assessment of equipment suitability

Technology Development

- Aim is to qualify specific assembly processes at core group SMEs using actual product
  - based on inspection and reliability testing, with assistance from RTD partners
  - less controlled, more realistic than pure test board development
  - reflow, wave, hand, mixed and rework
  - materials:
    - tin/lead for baseline
    - tin/silver/copper all processes
    - ‘tin/copper’ for wave and hand
  - boards and components as supplied, not all components may be lead-free, but automatically get a range of finishes and lead types

Technology Development

- Recording procedure for all assemblies
  - pcb finish, materials, process details
  - rework method, location, materials
  - temperature, solderability issues, defects?
- Inspection according to IPC-A-610D
- All assembled product function tested at SME
  - joints inspected and digitally recorded for quality standards report
- Reliability regimes agreed with assemblers
  - to best match in-house and standard tests for each assembly
  - ageing, temperature cycling, vibration, impact
  - parallel testing to compare tin/lead and lead-free assemblies

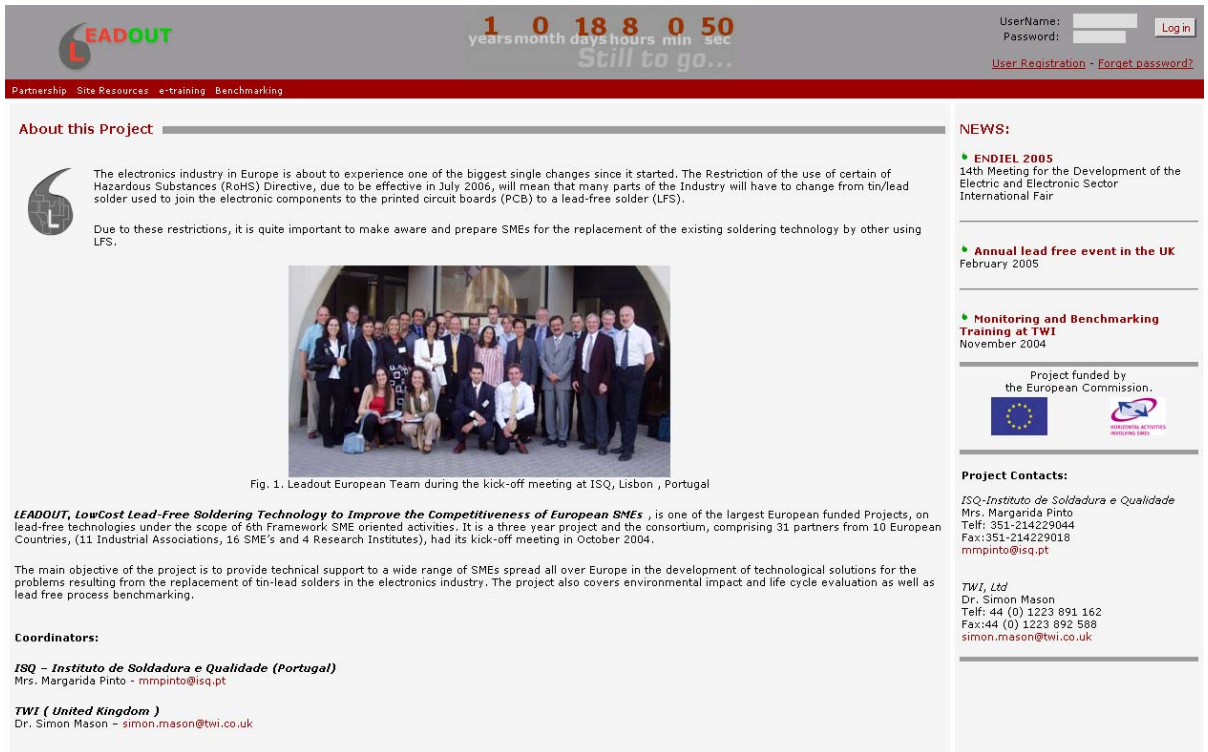
AWARENESS

INFODAYS

NEWSLETTERS

WEB SITE

WWW.LEADOUTPROJECT



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Training - Sept 2005 - Sept 2007

Appropriate material, style and level for SMEs

* Standard courses
* Practical workshops
* e-learning/virtual institute

Dissemination - May 2005 - Sept 2007

Information and best practice

* LEADOUT Newsletters, papers
* LEADOUT Web Site (Information & Help Desk)
* LEADOUT Seminars
* Industrial Trade Association Events

Environmental Impacts

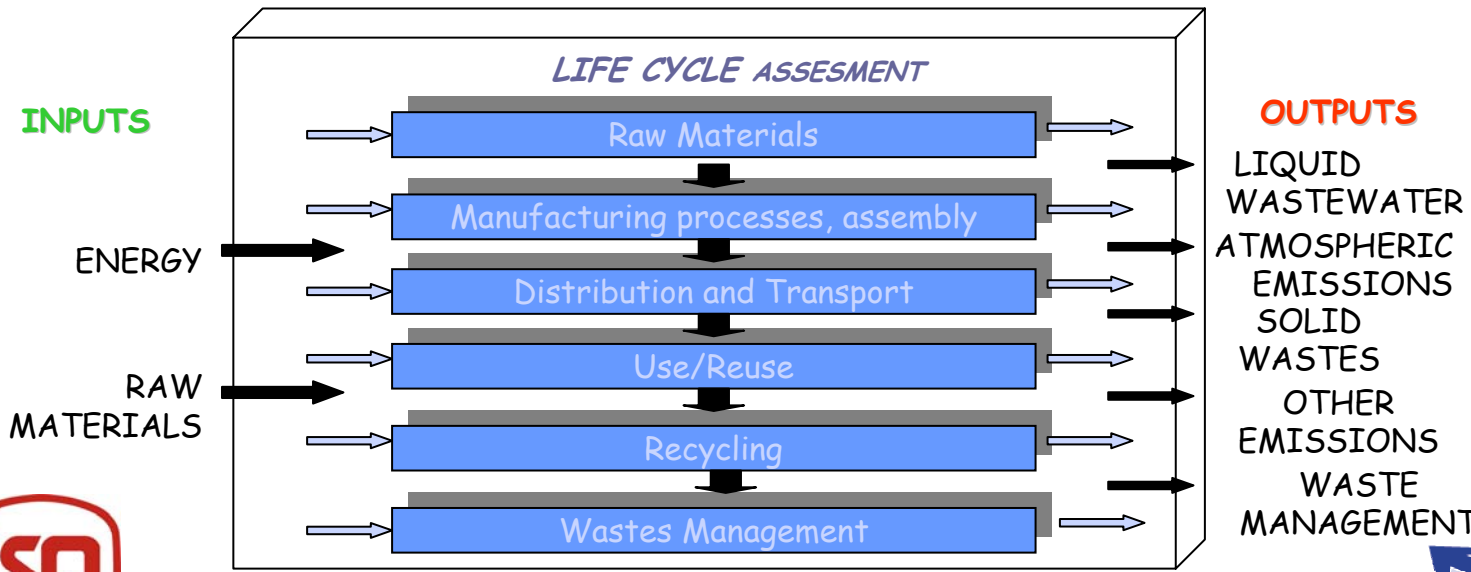
Workplace and wider environmental considerations

Deliverables:

- Health and Safety Report on Lead-Free Soldering - April 2006
- Life-Cycle Assessment of Lead-Free Soldering Technology - April 2006
- H&S Impact Report on the use of Lead-Free Solders at SMEs - Jan 2006
- Environmental Impact Report on the Industrial Use of Lead-Free Solders - Sept 2007

Life Cycle Analysis

- ***Life-cycle analysis (LCA)*** measures and combines the energy and raw material consumption, emissions and other factors related to a specific product over its entire life cycle from an environmental point of view.
- The IS0 14040-14043 is considered to be the LCA standard.



LCA for LEADOUT project

1. Goal and scope

✓To quantify the environmental impacts of the two different solder employed in two processes

	Solder Sn-Pb	Solder lead-free
Wave technology	✓	✓
Reflow process	✓	✓

2. Possible waste treatment scenarios:

✓Reuse of parts and components

✓Recycling of metals

✓Incineration

✓Controlled landfill disposal

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Proposed Environmental Impacts to be Analyzed

✓Greenhouse effect	✓Heavy metals emissions (to water and air)	✓Summer smog (NOx & VOCs)	✓Industrial wastes generation
✓Depletion of energetic resources	✓Depletion of natural resources (mining, water,...)	✓Ecotoxicity (to water, land,...)	

Fume Emissions from Sn-Pb Soldering Processes

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Fume Emissions

- **TRIALS AT WAVE SOLDERING PROCESS**
- CIRCUIT: 170 x 240 mm, WEIGHT: 199 g
  - 22 CIRCUITS PROCESSED, TIME: 35 min
  - PREHEAT 300 °C, 350 °C, BATH: 250 °C
  - NO CLEAN FLUX, SOLDER 63 Sn – 37 Pb
  - TOTAL FUME EXTRACTION FOR SOLDER AND FLUX.
  - 1 MEASUREMENT TRIAL: 30 min.
  - AVERAGE PCB WEIGHT INCREASE (SOLDER): 13.4 g

Fume Emissions

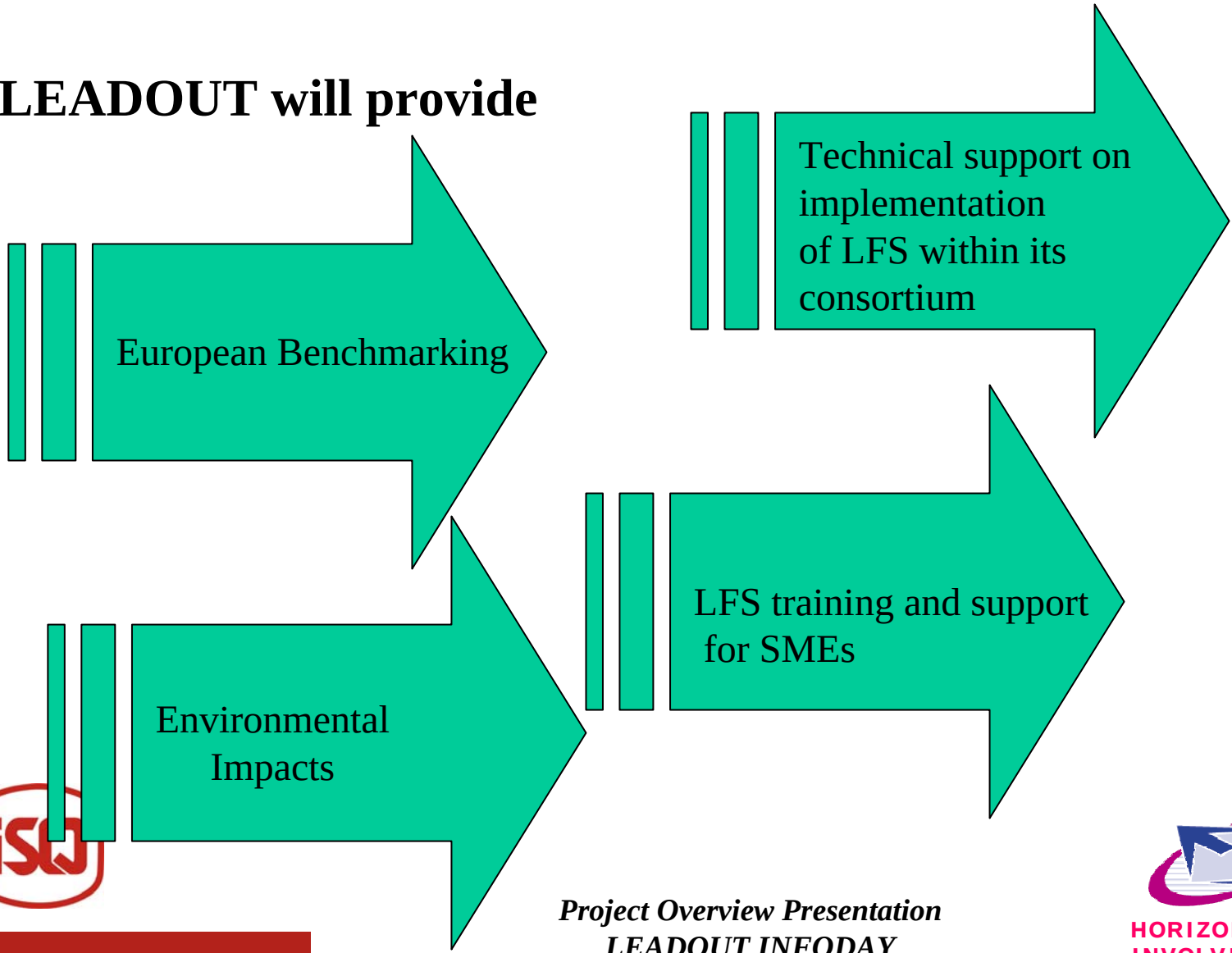
TRIALS AT REFLOW PROCESS:

CIRCUIT: 175 x 240 mm (12 CIRCUITS TOGETHER), WEIGHT: 125 g

- 17 CIRCUITS PROCESSED, TIME: 70 min
- PASTE: 62 Sn – 36 Pb – 2 Ag, NO-CLEAN
- TOTAL FUME EXTRACTION
- 2 MEASUREMENT TRIALS: 30 min each.
- AVERAGE PCB WEIGHT DECREASE IN REFLOW OVEN (FLUX EVAPORATION): 0.3 g

Summary

LEADOUT will provide



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LEADOUT

European working team to support SMEs in Lead-Free Soldering Implementation

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OBRIGADO!

Contacts:

Mrs Margarida Pinto
ISQ-Instituto de Soldadura e Qualidade
mmpinto@isq.pt

Mr Simon Mason
TWI
simon.mason@twi.co.uk

More information available at www.leadoutproject.com

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