Lifecycle Assessments of Telecom Products

Process and Results

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Product Eco-environmental Life Cycle Analysis (LCA)

Goal:

- Analyze significant environmental impacts assignable to defined products
- Make continuous improvements based on analyzed results

Expectations:

- Impacts evaluated over the life cycle stages of a product
  - Development & procurement
  - Manufacturing
  - Product packaging & transportation
  - Distribution & installation of product at customer site
  - Functional use by customer (including field servicing, repair & reuse)
  - End of life treatment and disposal
- LCA information needs to have relative accuracy
- Meet customers and stakeholders expectations (market trends / best practices)
- Auditable process (e.g., meet ISO 1404x standard series)

Standards relevant to LCA

- ISO 1402x environmental declaration series; ISO1404x LCA methodology series
  - Status: Published standards
- IEC TC108 environment conscious design (audio, video and ICT products)
  - Status: standard published in January 2008
- IEC TC 111 environmental information of electrical and electronic equipment (electrical and electronic products)
  - Status: publicly available specification published in January 2008
- IEC TC111 environment conscious design (electrical and electronic products)
  - Status: draft standard. Availability: mid 2009 earliest

Product Eco-environmental LCA

Lifecycle Thinking and Experience

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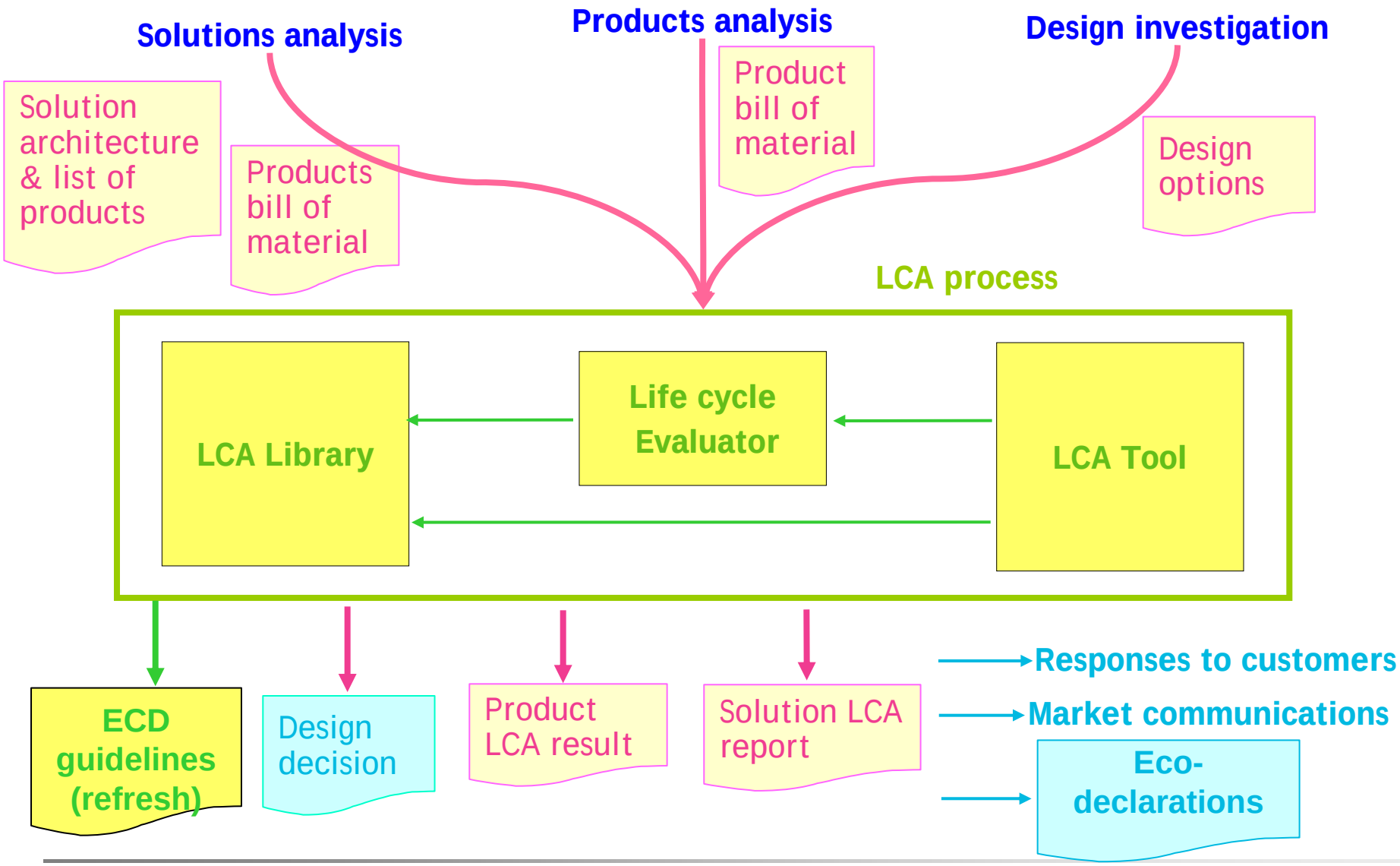
LCA Process Architecture

Inputs and outputs



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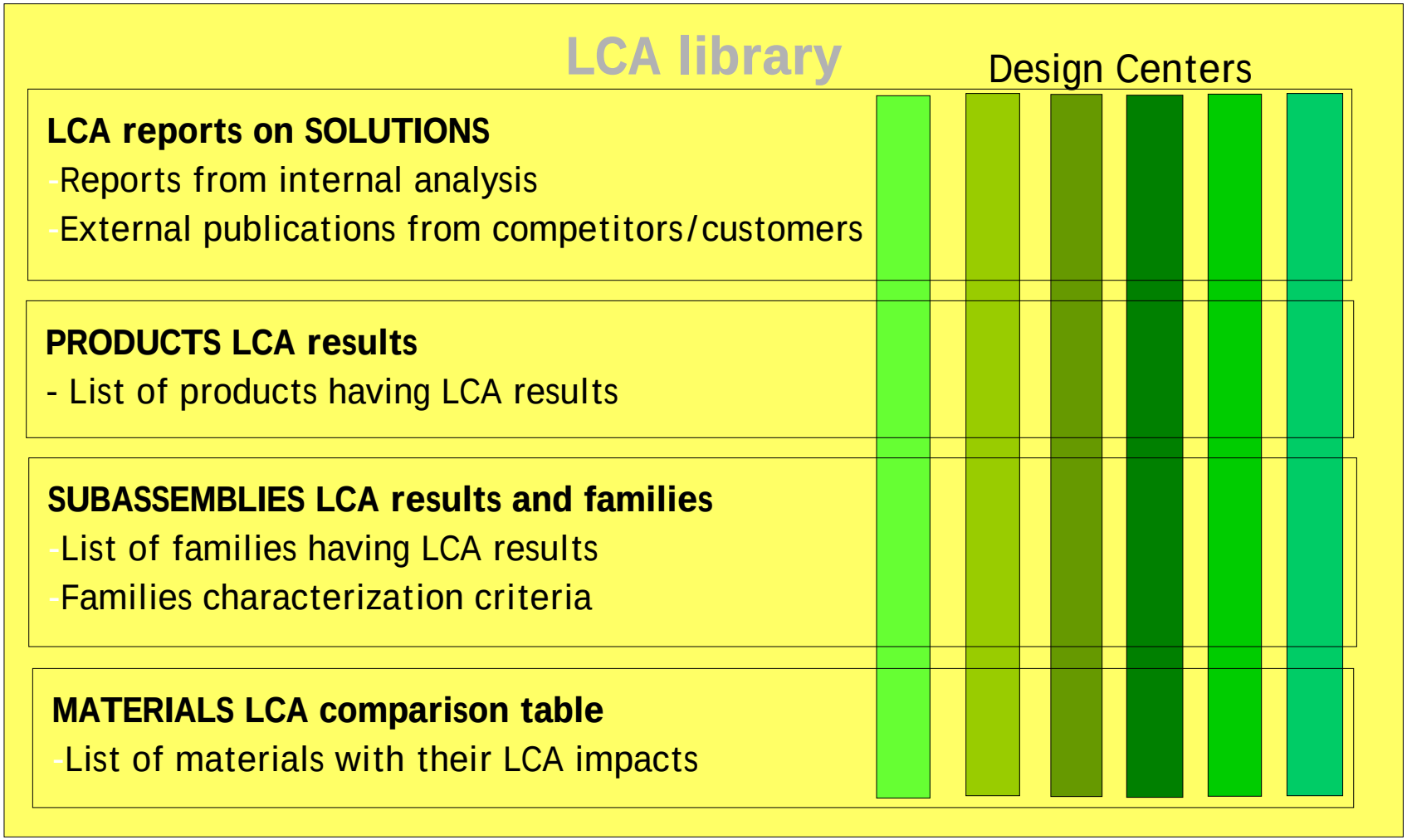
LCA Process Architecture

LCA library structure



Product Eco-environmental LCA

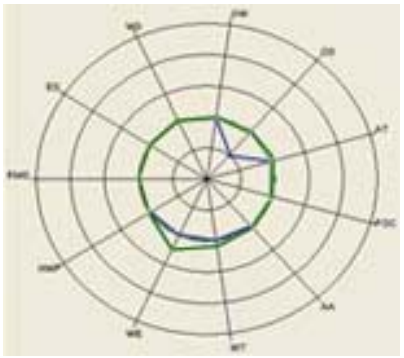
Indicators - Methodology

Environmental impacts are quantified through *indicators* (typically 10 to 12):

- Global warming potential / greenhouse gasses emissions (= carbon footprint)
- Depletion of natural resources (minerals, fossil fuels…)
- Air and water toxicity

The LCA methodology principles (as defined by ISO 1404x series):

- *Goal and scope*: defines system boundaries and assessment method
- *Life cycle inventory*: environmental impacts data collection
- *Life cycle impact assessment*: quantifies impacts through indicators
- *Interpretation*: major contributions to impacts, uncertainties, findings



Alcatel-Lucent's LCA Processes / Methodologies

- LCAs - complete product /solution analysis:
  - Target: internally define improvement areas and communicate to external stakeholders
  - Limited to major products /solutions
    - Examples: network analysis (e.g., Fiber-To-The-Premises access, Long Term Evolution wireless network)
  - Frequency: generally once per product lifetime

- LCAs – product asset / subassemblies:
  - Target: refine / broaden design practice requirements, provide environmental impact information externally
  - Frequency: as needed - question that can be solved through an environmentally conscious design analysis
    - Examples: compare 2 substances for a mechanical part design, determine a product environmental profile or manufacturing carbon footprint
  - Results integrated as eco-design requirements or stored in a knowledge database

Product Eco-environmental LCA

Embedded Carbon Estimation and Use

- "Carbon" is becoming the basic unit of environmental performance.
- Reducing the GHG emissions associated with business activities, including purchases, is considered an obligation as well as a best practice.
- It is essential to take a *life cycle approach* to estimate embedded carbon and carbon footprint of products and services.
- Carbon credits can be passed along the supply chain to the end consumer.
- For more info:
  - *Independent directory of service providers, databases, tools for LCA/Carbon footprint: http://lca.jrc.ec.europa.eu/lcainfohub/directory.vm*
  - *GHG Protocol Initiative – standards, calculation tools: http://www.ghgprotocol.org/about-ghgp*

Product Eco-environmental LCA

Interactions

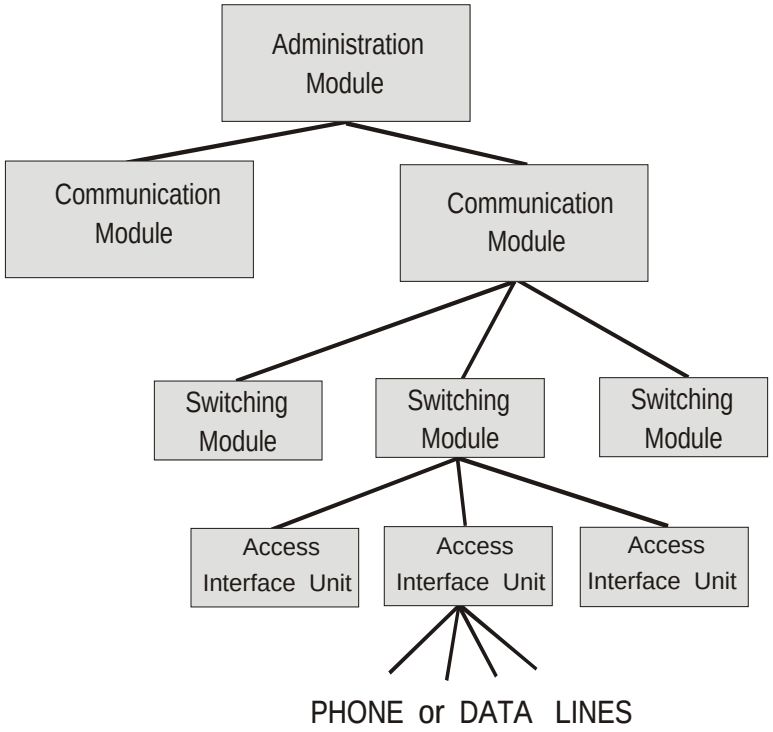
- With internal product development process:
  - Provide guidance for environmental issues
    - Design choices to be made
    - Comparison with environmental target or existing product
  - Set specific requirements via design checklists
  - Source of information for eco-declarations

- With customers:
  - Address customers' environmental queries / requests (e.g. carbon footprint)
  - Provide key messages
    - "Company" evaluates its products to minimize environmental impact
    - "Company's" product architecture minimizes energy use

- With regulators - provide answers to investigations on product eco-environmental impact to influence future requirements

LCA Example Analysis

Switch – Access Interface Unit (AIU)



Switch Architecture

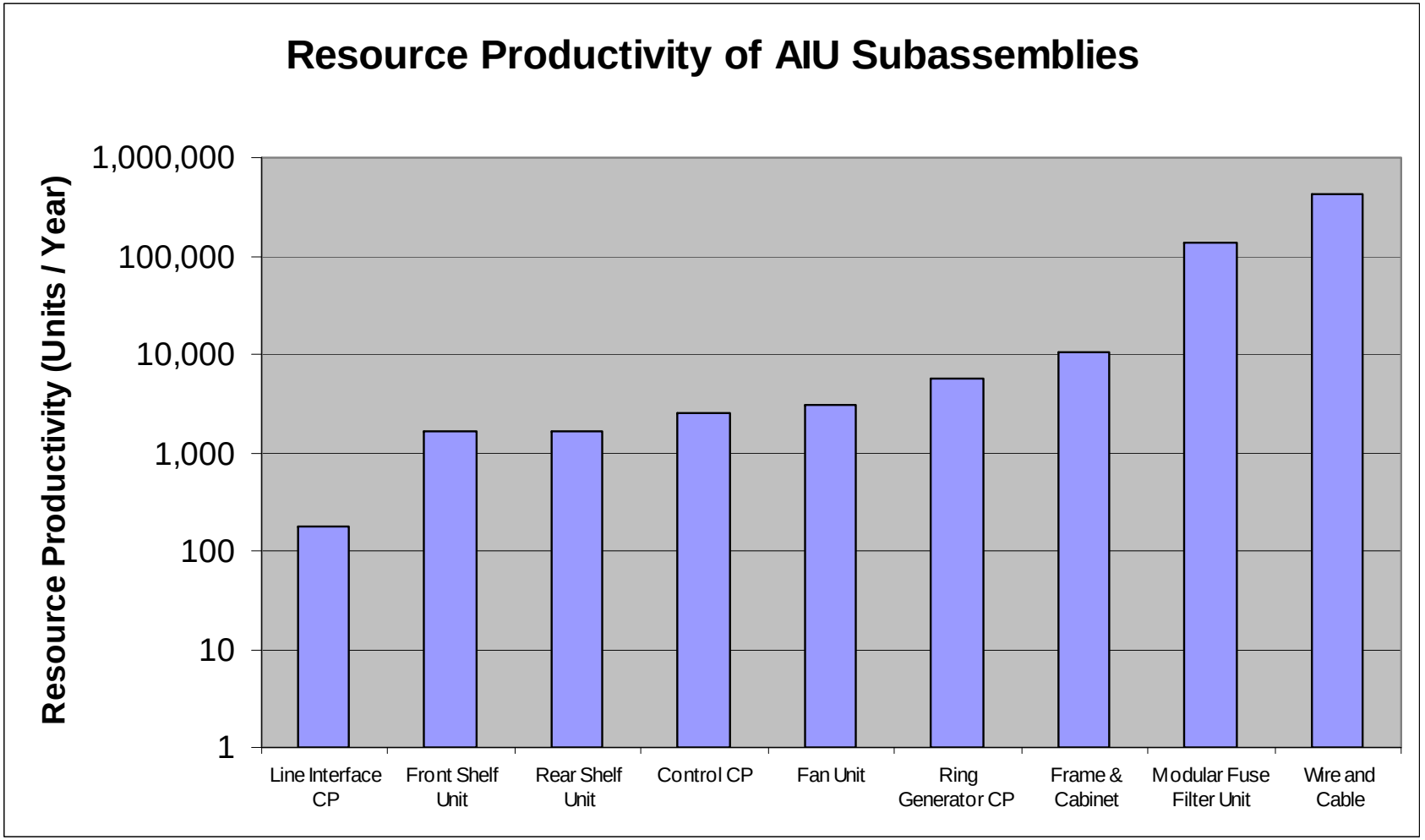
LCA Modeling and Analysis

- Impact data was generated from materials inventory data using SimaPro software.
- Environmental impact “points” based on Eco-Indicator 95 Method.
- Eco-Sustainability Target Method (ESTM) utilizes the impact data generated to calculate Resource Productivity.
  - Single score weighting for environmental impacts
  - Resource productivity **=** # of units produced per unit of combined eco-impact
- Results summarized into graphs and then interpreted into recommendations.

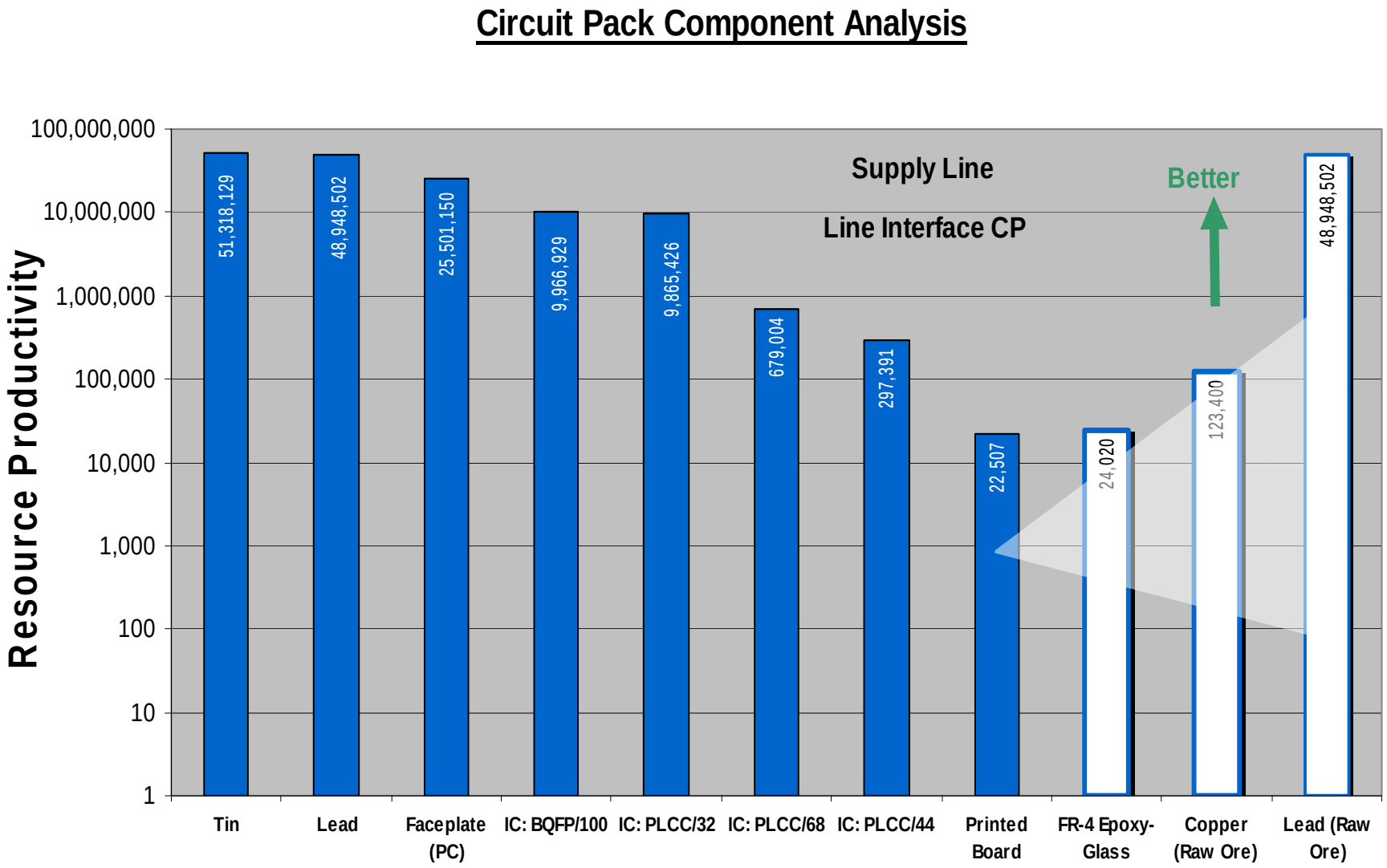
Physical Design Data

- Required Assembly Data:
  - Height / length / depth
  - Weight
  - Material
- Data typically collected from the following sources:
  - Bill of materials
  - Installation drawings
  - Product literature
  - Weigh and measure in lab
  - Destructive assay

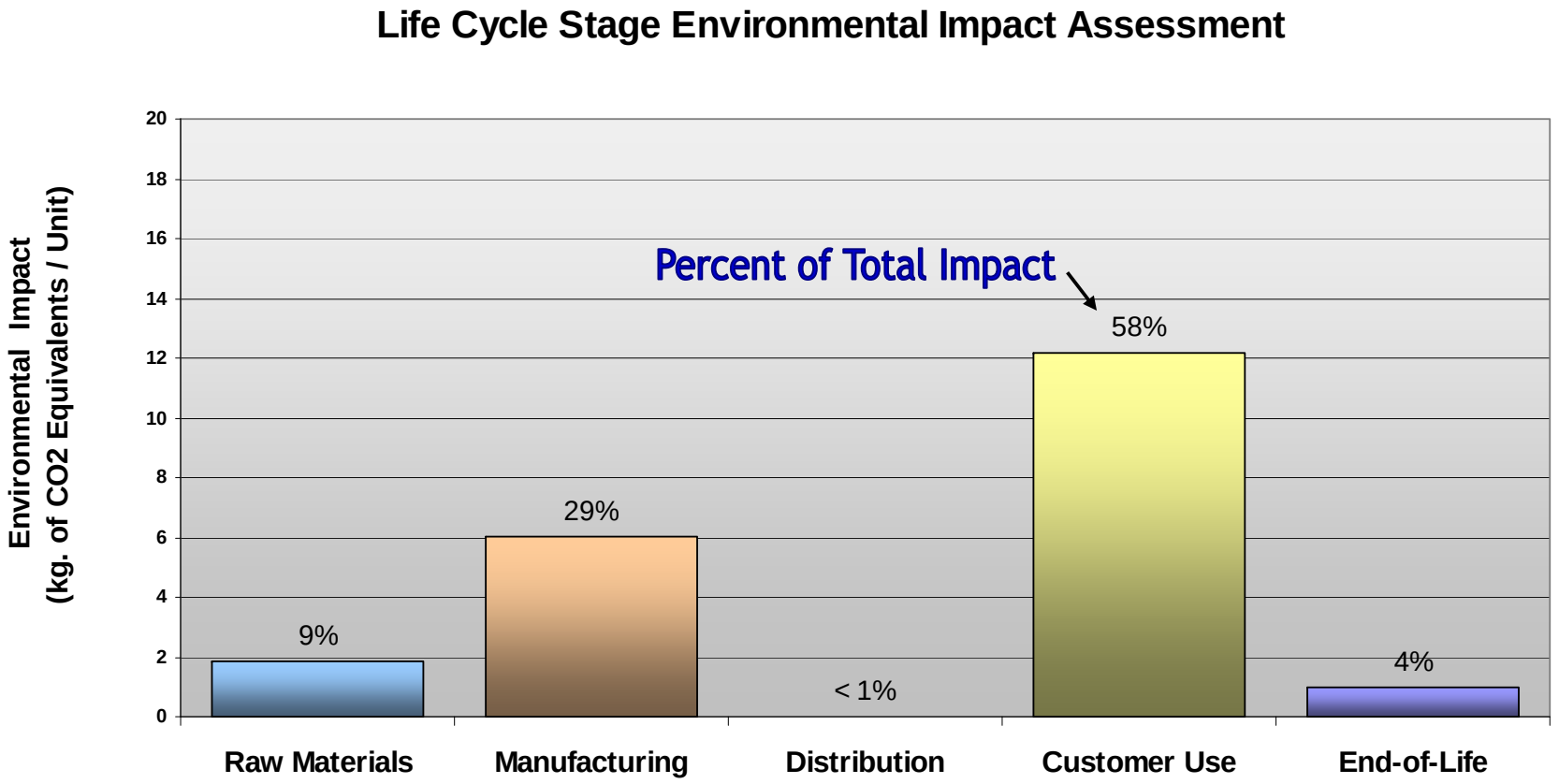
LCA Example Analysis – Switch AIU



LCA Example Analysis – Switch AIU



LCA Example Analysis – Switch AIU



Our studies show equipment **use phase** yields the *greatest* eco-environmental impacts* for telecom products

* greenhouse gases, smog, carcinogens, acid rain, heavy metal contaminants…

LCA Example Analysis – Switch AIU Design Recommendations

Maximize Resource Productivity via improvements in board densification:

- Increased use of ASICs (application specific integrated circuits) and functionality integration (e.g. more termination lines and higher throughput per circuit pack)

Maximize Resource Productivity via improvements in energy efficiency:

- Lower component voltages
- Increased use of ASICs; and passives integrated into chip sets
- Higher component efficiencies

Summary

- "Use Phase" is largest contributor to life cycle eco-environmental impacts (due to long operating life of network telecom equipment consuming much energy).
- Manufacturing phase is 2nd largest contributor (Printed Wiring Boards have large impact – due to size, many layers, and complexity. Integrated circuits come next in impact).
- Recommend smart LCA approach:
  - Simplified tools (e.g. eco-indicator evaluators, Key Environmental Performance Indicators, others) provides quick representative eco-impacts
  - Full LCA → better relegated to new product family introductions, major network / system innovations, and updating simplified tools
- Industry / supply chain should jointly manage environmental issues, share experiences and best practices, and work to reduce our product carbon footprint (e.g., partnership initiatives such as GeSI, Green Grid, Carbon Disclosure Project, etc.)

Thank you

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