Technologies for Sustainable ICT

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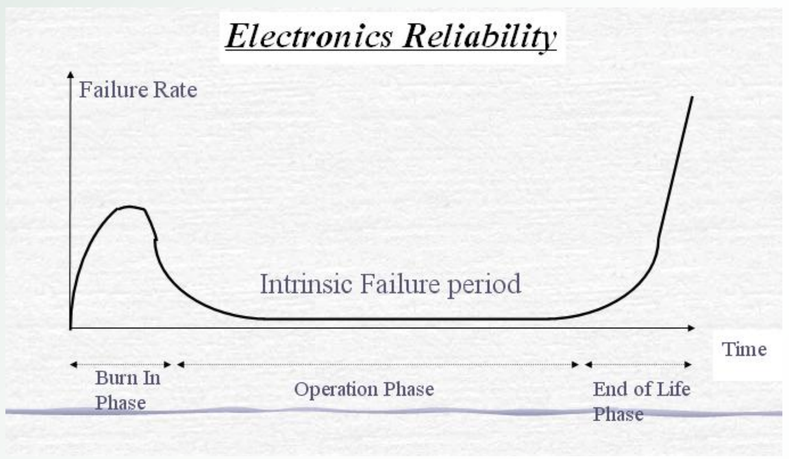
Abstract

When evaluating the environmental performance of electronic products it is very important to consider all aspects of their life cycle. This ensures that any action to improve the performance contributes to the overall reduction in environmental impact and avoids the transfer of burdens from one life cycle phase to another. Most often with these products, it is the Manufacturing & Use Phases of the life cycle that have the largest associated environmental burden. When it comes to product end of life, embodied energy and material recovery from the constituent components is small relative to the energy consumed in manufacturing, hence re-use of old products and especially components in new product is considered to be of considerable environmental benefit. However, the practice of reusing components challenges many concerns, the most critical being the quality level of the used components with the difficulty in predicting the remaining reliable usage. This project aims to address this issue with regard to personal computers.

Electronics Reliability

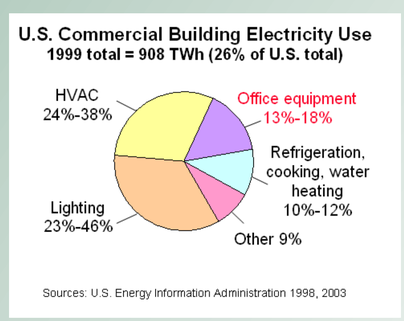


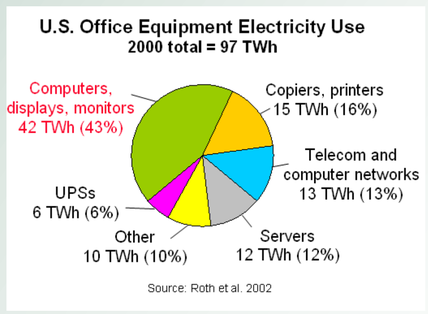
Basic Reliability Concepts:
MTTF, MTBF.

Electronics Lifetime:
- Electronics exhibit varied lifetimes.
- Potentially 15-20 yrs service life with certain electronic products/subassemblies

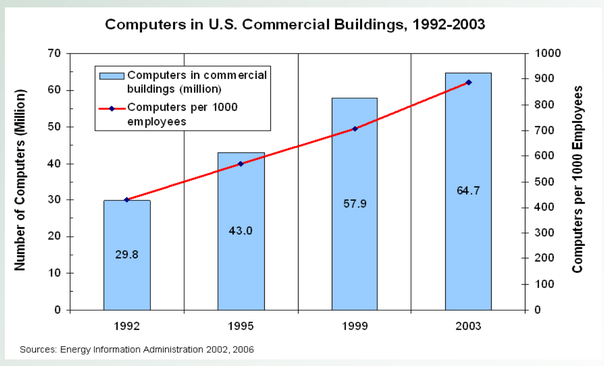
Failure Mechanisms:
- Temperature, Vibration, Shock, Transient Conditions, Mains variations, Humidity.
- Wear-out detection difficult when compared to mechanical systems.

The Problem!

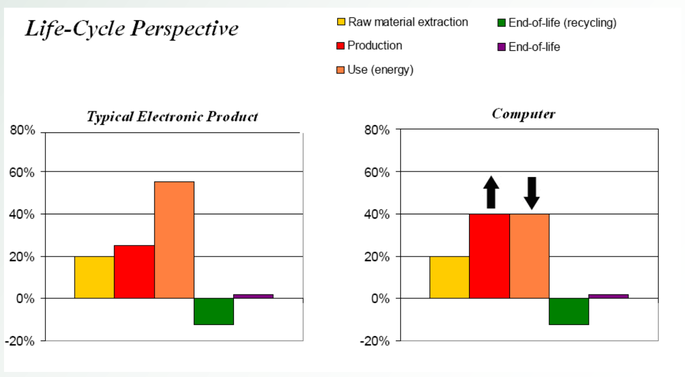




In 2000, PCs in U.S. commercial buildings:
Consumed roughly 1% of the national electricity
Accounted for 0.5% of total U.S. greenhouse gas (GHG) emissions
(equivalent to the annual GHG emissions of over 6,200,000 automobiles)



The Volume of PCs continues to grow and cannot be ignored by the PC industry from either a competitive or environmental standpoint.



- Energy required in manufacturing is likely to increase with the transition to nano-technologies
- Energy use in the operational phase is decreasing due to reduced product life cycles

The Solution!

Re-use of parts or components is most desirable from both an economic and environmental perspective

Drivers

- **Society:** Search for the development of or evolution to a more sustainable society
- **Kyoto Protocol:**
- **Legislation:** WEEE, ROHS & EUP Directives. (Possible revision of WEEE to include Re-use targets)

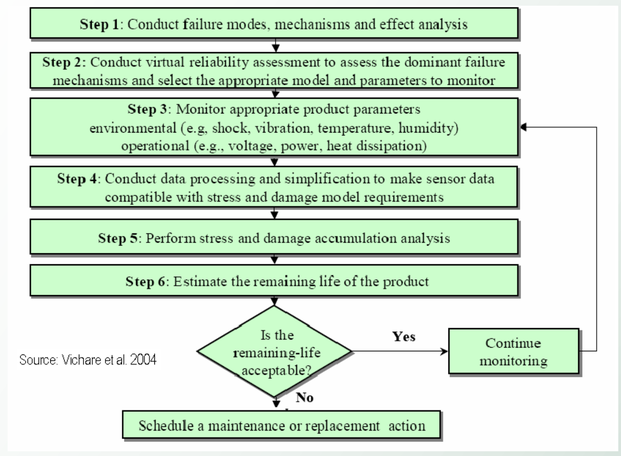
Barriers to Reuse

- Competition from falling new PC prices.
- Piracy: Transferring operating system licenses
- Import tariffs and high transportation costs restrict export volumes flowing from new markets (Western Europe, the United States, Japan and Australia) to emerging markets
- Quality and reliability of the used components

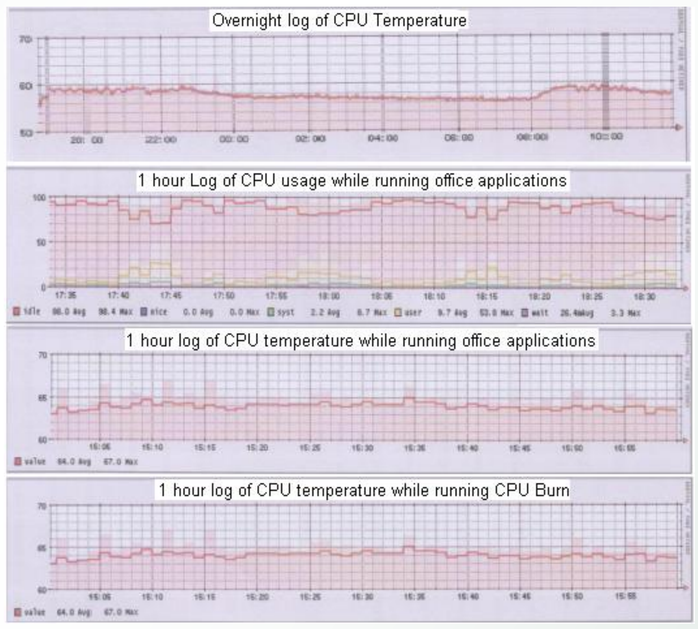
Approach: Life Consumption Monitoring (LCM)

LCM is a method of monitoring parameters related to a system's life cycle "health" and converting the measured data into life consumed. The "remaining life" of the product is the predicted reliability.

Conventional Approach: Use Integrated Data Unit (IDU) for monitoring and storage of operating & environmental conditions.
Our Approach: Use existing onboard SMART diagnostics(presently incorporated in all current motherboards) with system for monitoring, processing of operating & environmental conditions and storage of "re-use metric"
Goal: To develop an integrated software solution that can enable real time health and usage monitoring of desktops in their application environment, with the aim of determining re-use potential.



Data Logging with SMART



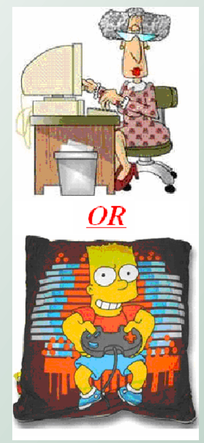
Characterising Usage Profiles

Typical Office User:

- Internet browsing, word processing & e-mail.

Gaming Enthusiast Power User:

- Power consumption can increase by up to 80W depending on the application.



Thermal Environment

- Thermal environment is one of the most critical factors in the design of PC systems.
- As a general rule lowering the temperature by 10 degrees will in fact increase the reliability of your product by a factor of 2.
- CPU Life and Temperature are inversely related (true for all integrated circuits).

Possible Application:

- Prevent obsolete or damaged PCs being sent to developing countries under the pretence of re-use.
- Evade the requirement of exhaustive testing prior to export.

Closing the Loop (Possible Solutions)