Sustainable Manufacturing in the Consumer Electronics Sector

Sean Aldrich and Len Drago
Environmental Engineer's
Intel Corp

Intel Snapshot

Intel is the world's leading innovator in advanced silicon technology, with more than 35 years of leadership in computing and communications.
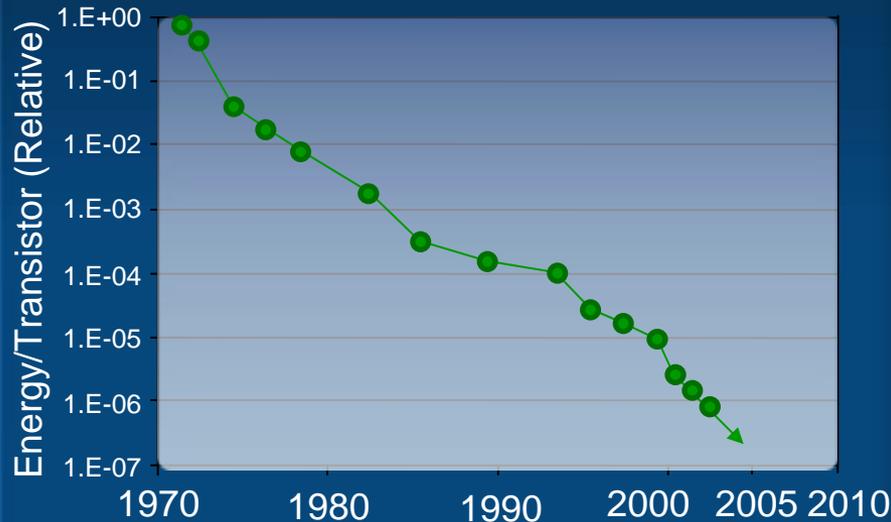
- Year founded: 1968
- Number of employees: over 80,000
- Revenues: $37.5 Billion (2008)
- Products and services: over 450
- Stock symbol: INTC
- Worldwide offices and facilities: 294

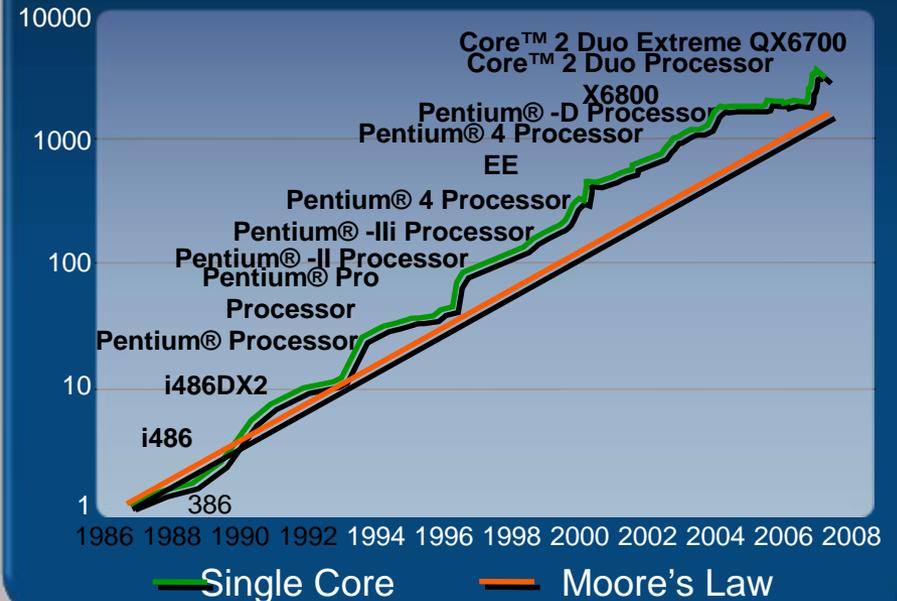According to *BusinessWeek* & Interbrand Intel is the world's 5th most valuable brand

The Intel audio signature is heard somewhere in the world every 40 seconds

Benefits of Moore's Law

Power reduction Over Time*

Energy/Transistor (Relative)

- 1.E+00
- 1.E-01
- 1.E-02
- 1.E-03
- 1.E-04
- 1.E-05
- 1.E-06
- 1.E-07

1970　1980　1990　2000　2005　2010

Core Integer Performance Over Time*

10000
1000
100
10
1

Core™ 2 Duo Extreme QX6700
Core™ 2 Duo Processor
X6800
Pentium® -D Processor
Pentium® 4 Processor
EE
Pentium® 4 Processor
Pentium® -Ili Processor
Pentium® -II Processor
Pentium® Pro
Processor
Pentium® Processor
i486DX2
i486
386

1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008

—— Single Core　　—— Moore's Law

~ 1 Million Reduction In Energy/Transistor Over 30+ Years Delivering Great Performance Within Power Envelope Compute Energy Efficiency ➔ Positive Impact On Environment

Extending Intel Architecture ...

Ultra Low Power
Sufficient Performance
Extreme Integration

Performance
Performance/Watt
User Valued Features

Intel
Architecture

PLATFORMS

MID   CE   Ultra
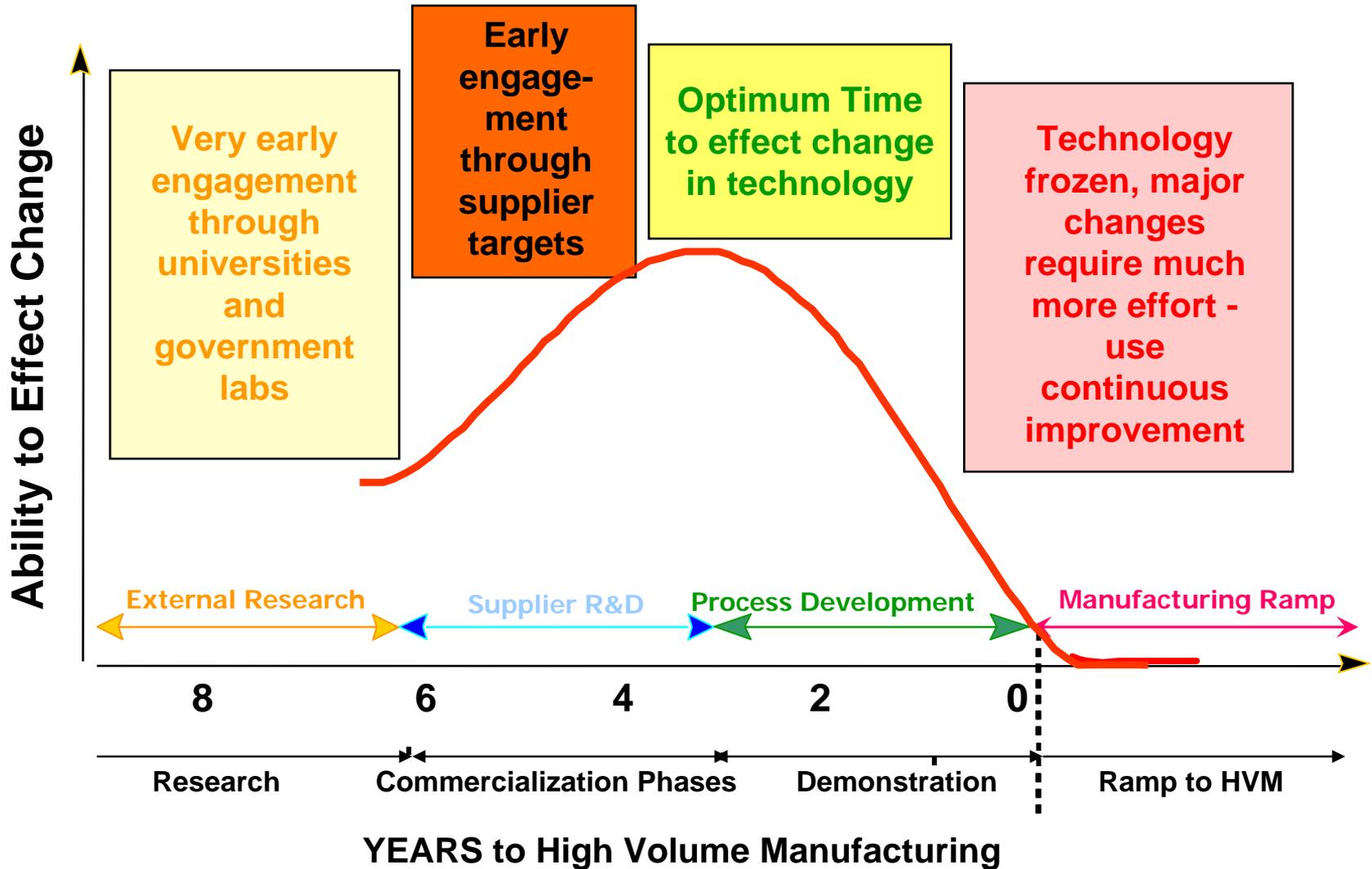Low-Cost PC   Notebook   Desktop   Server

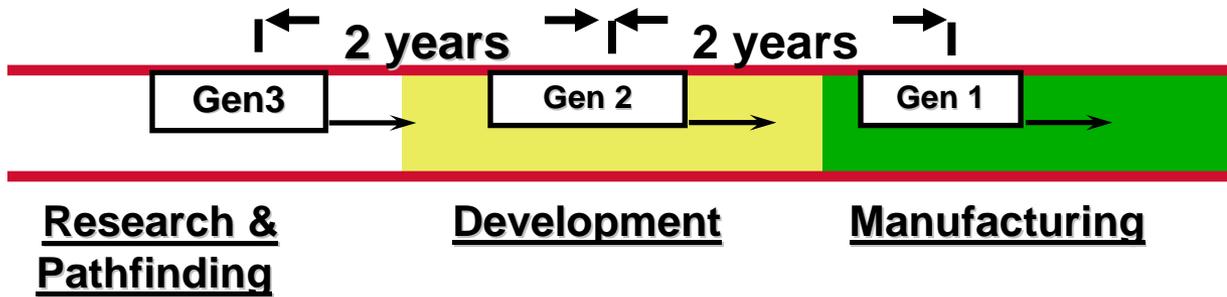## Common Element: The Internet

(intel)

Manufacturing Approach to Sustainability

- Understand the business model
- Analyze impacts
- Integrate sustainability throughout the business model
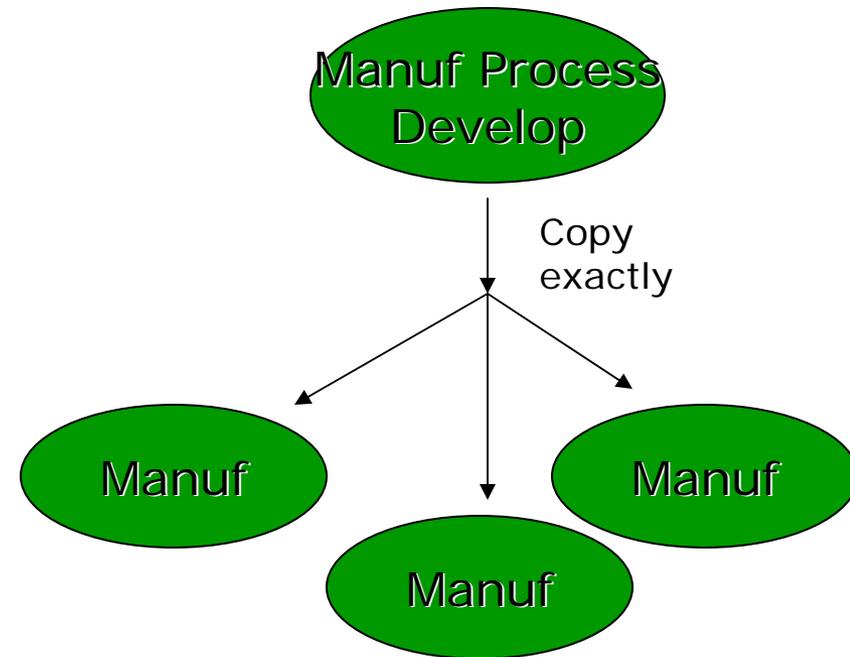- Accountability
- Continuous improvement

Intel EHS Technology Engagement Model

Intel Manufacturing Model

2 years → ← **2 years** →

| Gen3 | Gen 2 | Gen 1 |

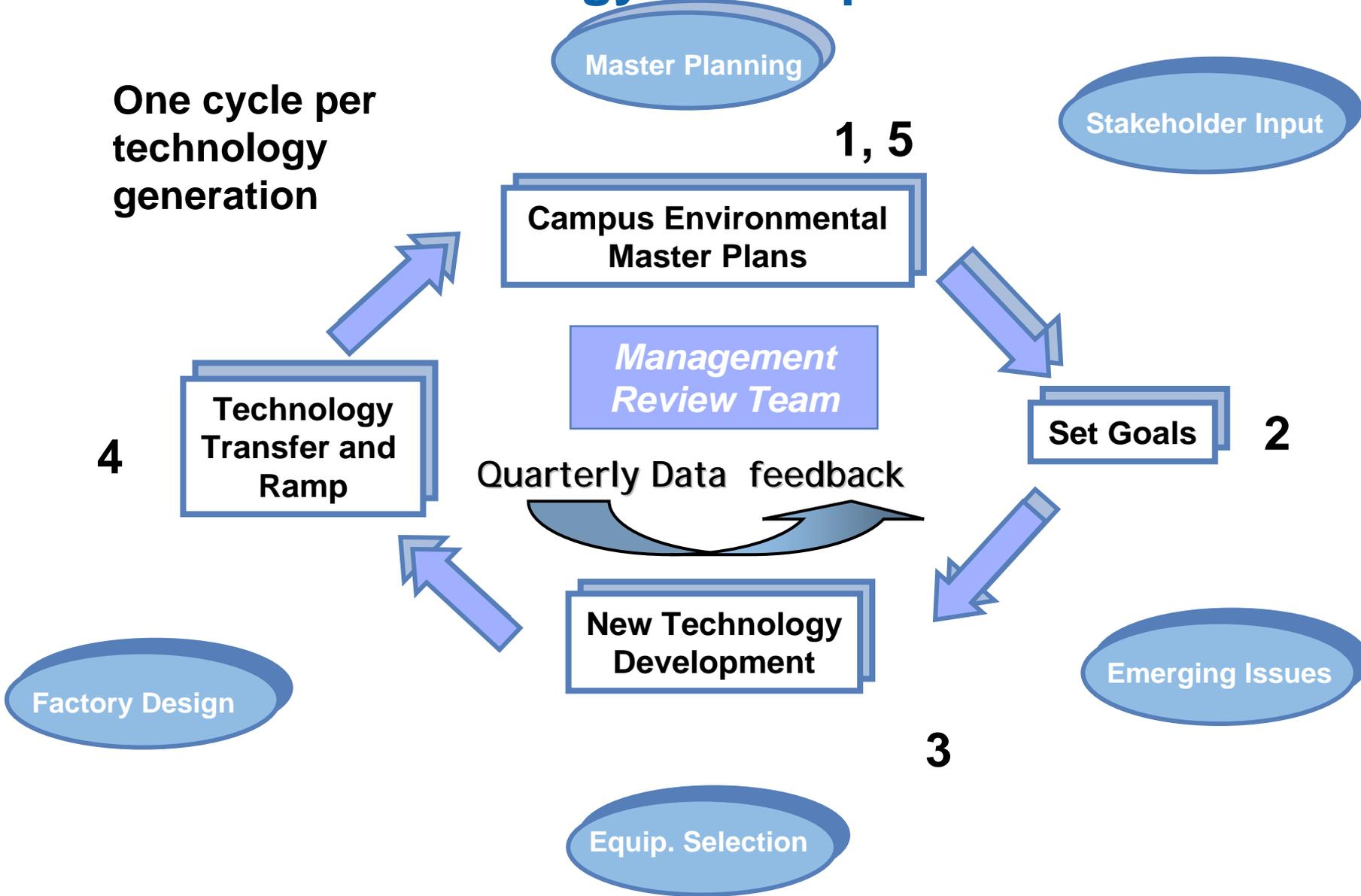**Research & Pathfinding** **Development** **Manufacturing**

- 2-year "Tick Tock"
  - Manufacturing process
  - Chip architecture
- Long development, short manufacturing cycles
  - Copy exactly

Dow Jones Sustainability Index, Technology Super-Sector Leader – 8 years

Manuf Process Develop

Copy exactly

Manuf

Manuf

Manuf

Process Technology Eco-Improvement Model

One cycle per technology generation

Master Planning

Stakeholder Input

1, 5

Campus Environmental Master Plans

Management Review Team

Technology Transfer and Ramp

4

Quarterly Data feedback

Set Goals

2

New Technology Development

3

Factory Design

Emerging Issues

Equip. Selection

Accountability

- Develop indicators
- Set corporate goals
- Performance to goals
  - Measure
  - Audit
- Report to management
- Public reporting

Transfer Environmentally Sound Manufacturing Processes → Environmental Planning At Manufacturing Sites → Set Targets for New Process Development

PARAMETER	MEASUREMENT/ TARGET (By 2010)	2007 RESULTS Absolute/ Normalized	COMMENT
Greenhouse Gases	Reduce greenhouse gas emissions per production unit by 30% (2004 Baseline)		Back on track as factory loadings increased in Q4.
Water Use	Reduce normalized water usage below 2005 levels		A CS/PTD team has been formed; 1st team deliverable (new water goal) was approved by C&NRSCS in January.
Chemical & Solid Waste	Recycle > 70%		Chemical recycle now includes fuel blending
Continuous Improvement	Complete > 200 projects in our operations, products and communities that benefit the environment		152 Projects completed in 2007
Product Ecology	Introduce halogen-free materials in new CPU, chipset and flash memory products		Released halogen-free flash products. Pulled in CPU/chipset plans.

Let's Be Clear
Intel Corporate Responsibility Report 2005
www.intel.com/go/responsibility

Summary

- "Sustainability" depends on business model
- Intel rapid changes
  - get it right the first time
- Manufacturing, product and use of product
- Accountability

Questions?