Sustainability - The Ultimate Reality check

Development of a Science-Based Impact Assessment Methodology

Peter T. Peterson
Director, Marketing -Automotive
United States Steel Corporation

Sustainability

- Requires impact assessment
  - Site specific
    - Spatial Considerations
    - Temporal Considerations
    - Threshold Analysis
- Is not for the faint of heart

Science-Based Methodology Strawman

- Life-Cycle Stressor-Effects Assessment
  - LCSEA **not** the only possible methodology
  - A tool for generating meaningful dialog
  - A peer-reviewed Steel Industry Case Study -
    - "Comparing Sustainability of Steel and Wood Studs Through LCSEA"

Green Marketing

- Sustainability - the ultimate claim
  - Careful definition
- Residential Construction - studs
  - Steel
  - Wood
- Challenge - comparing relative sustainability

LCI & LCA

- Document system inputs and outputs
- Frequently ignore "use-phase"
- Miss entirely land-use effects
  - loss of habitat
  - biodiversity reduction
  - ecosystem disruption

LCSEA

- Scientific Certification Systems
  - Dr. Stanley Rhodes
- Environmental superiority of steel studs
  - ecosystem disruption < 1% of wood
  - significantly reduced environmental impact

Life Cycle Assessment

- Drivers
  - Customer demands
  - Competitive considerations
  - Improvement Analysis

Improvement Analysis

- Raw Materials use analysis
  - Economic
  - Environmental
- Waste Reduction
  - Zero Waste

Competitive Considerations

- Wood
  - Entrenched competitor
  - Strong Green Marketing claims
- Response Required
  - Responsible
  - Credible
  - Draw Upon Broader LCA Principles

Customer Demands

- Enhanced Environmental Performance
- Recycled content
- www.recycle-steel.org
- Unasked Questions
  - Embodied Energy
  - Thermal condustivity
  - Finite Resources

Customer Demands

- Competitive negatives don't arise
- Neither do Steel's environmental benefits
- LCSEA provides a balanced analysis

Launch & Completion

- Participants
  - Scientific Certification Systems, Inc.
  - Steel Recycling Institute
  - American Iron & Steel Institute
  - United States Steel Corporation
- Study
  - Begun September 1996
  - Completed January 2000
  - Peer Reviewed

Calculation Methodology

- ISO 14042
  - Including its comparative assertion provisions
- Key Indicators include -
  - energy resource depletion
  - renewable resource depletion
  - mineral resource depletion
  - ecosystem disruption
  - emission loadings
  - residual hazardous waste

Goals, Objectives & Scope

- Environmental relevance
  - known material inputs
  - emissions
- Cradle to Gate
  - Raw materials extraction

    through
  - Production of galvanized steel sheet

System Description

- Major unit process for manufacturing
  - AISI 1006 Carbon Steel
    - Hot Dip Galvanized
  - 22- 26 GA
  - 60 inch wide coils

Functional Unit

- Sufficient stud material to construct 30 % of new homes for one year
  - 30% of 1.3 million houses = 390,000
  - 2.31 million metric tons of steel

Allocation Protocols

- By Products
  - Chemicals
  - Slags
  - Methane
- Used to Scale Coke & Byproduct production

Inventory Assumptions/Results

- Primary & Secondary data sources
  - inventory input/output
- Major unit processes
  - raw material extraction
  - energy production
  - coke production
  - galvanized steel production
- **Site Specific**

Impact Indicator Results Calculation

- Known Environmental Effects compiled
  - published literature
  - government records
  - selected databases
  - designated experts
    - inside and outside steel industry
- Activity in key stressor-effects networks

Resource Depletion & Emission Characterization

- Conversion of Inventory Results into Impact Indicators
  - Characterization Factors
    - Quantitatively relate
      - system stressors
      - actual environmental impact
    - Resource Depletion Factors
    - Stressor Characterization Factors
    - Environmental Characterization Factors

Ecosystem Disruption - Steel

- Measurement of large scale habitat change
- Surrogate for biodiversity change
- Comparative analysis
- Disruption
  - Manufacturing - permanent
  - Mining - temporary

Ecosystem Disruption - Wood

- 390,000 homes
- Stud production land use requirement
  - Wood - 600,000 hectares
  - Steel - 4,707 hectares

Air & Water Emissions

- Readily available data
  - Clean Air Act
  - Clean Water Act
  - National Pollutant Discharge Elimination System
- All data is in public domain

Emission Loading Factors

- Air & Water Emissions
  - Human health effects
  - Environmental effects

Findings

- LCI data - Environmental Confusion
- LCSEA - Environmental Relevance
  - Minimal ecosystem disruption
  - acidification & ground level ozone 70% / 75% below previous estimates
  - Air loadings - below de minimus risk
  - No eco-toxicity effluents over standard
  - No hazardous residual waste

Conclusions

- LCSEA - Environmental Comparison
  - Powerful
  - Credible
  - Adaptable to other steel
    - Manufacturers
    - Markets