

# Computational Design Tools for Global Sustainable Product Development

Bryony DuPont, Ph.D.

Assistant Professor

Department of Mechanical, Industrial, and Manufacturing  
Engineering

Oregon State University

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# Product Design for Sustainability

## *Sustainability:*

“development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [1]

## *Sustainable Products:*

“products that provide environmental, societal, and economic benefits while protecting social health and welfare, and *maintaining the environment over their full life cycle* from raw materials, extraction, and use, to eventual disposal and reuse [2]

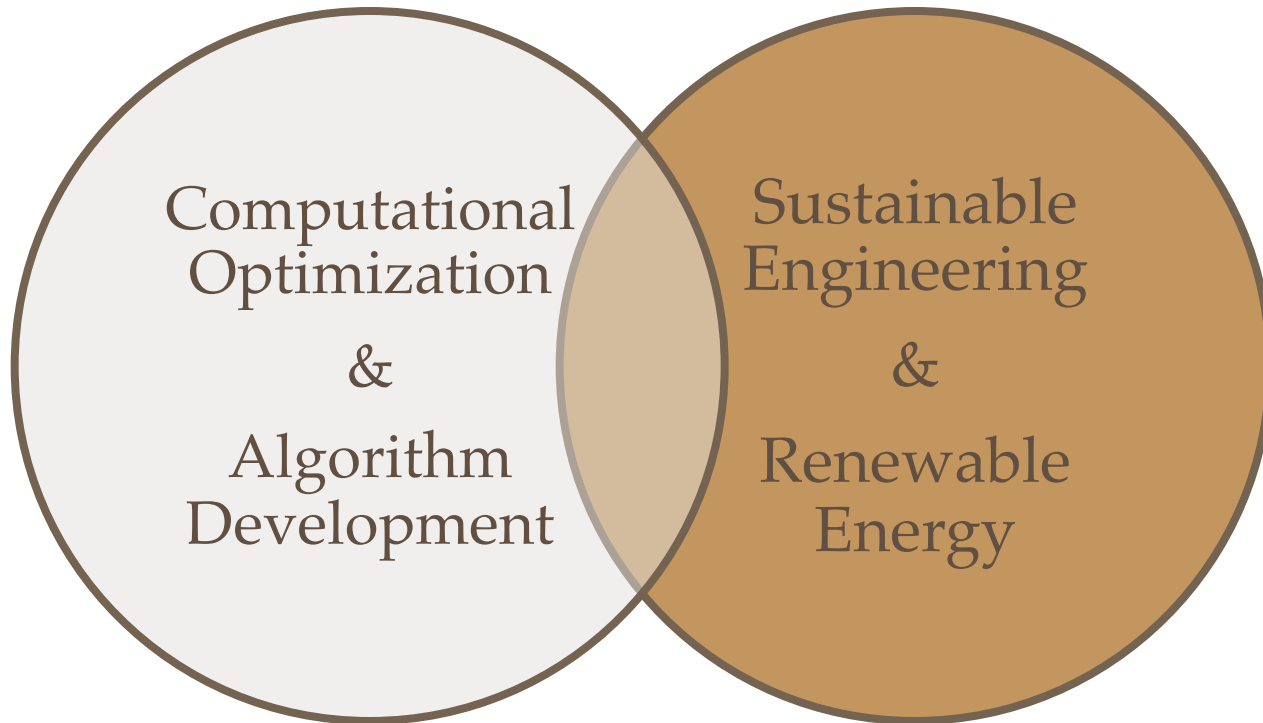
[1] Brundtland Commission, “Our Common Future: From One Earth to One World”, 1987. Oxford University Press, pp 22-23 IV.

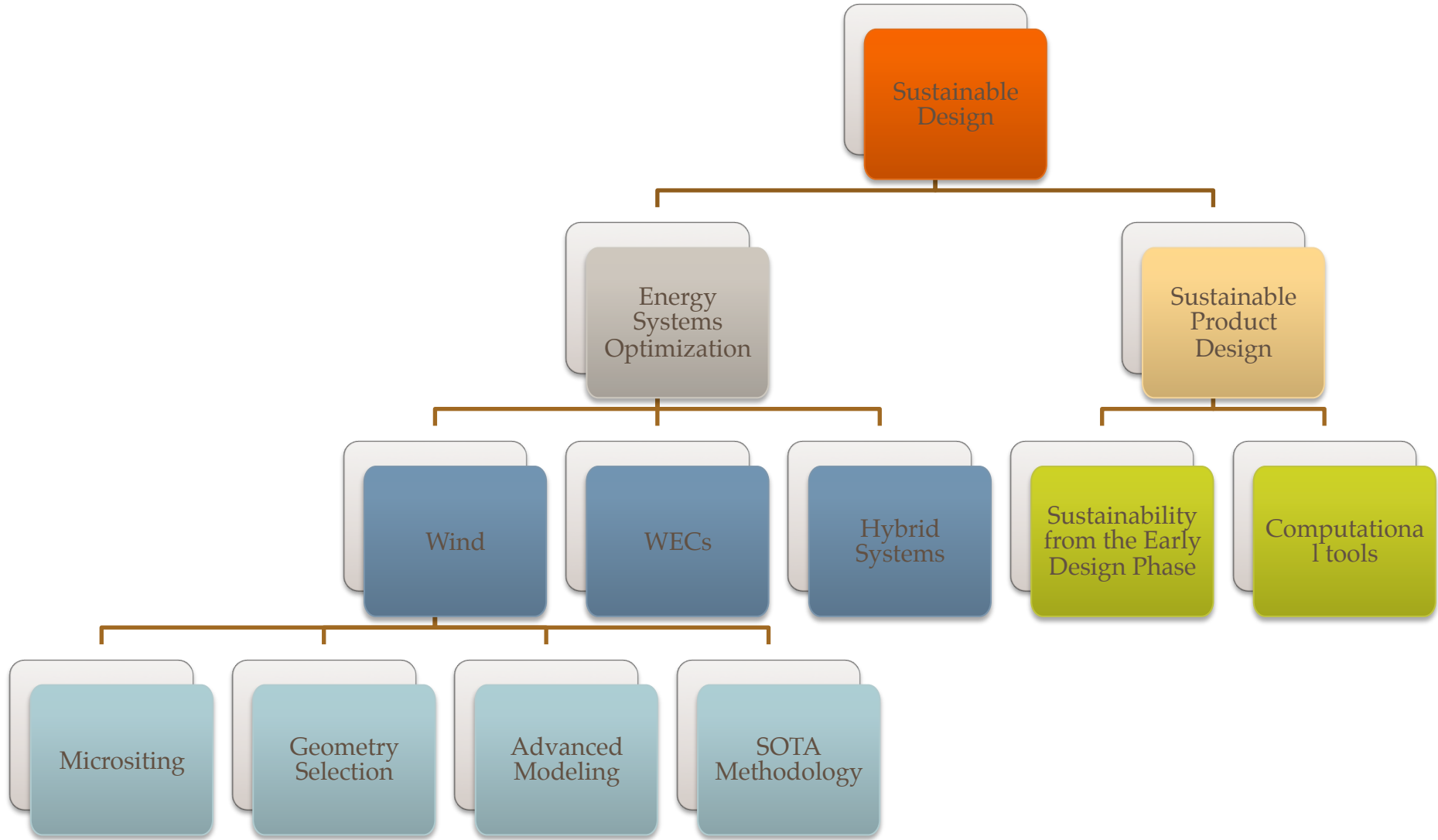
[2] The Institute for Market Transformation to Sustainability (MTW), Sustainable Products Corporation, Washington, D.C <http://MTW.sustainableproducts.com>

# Sustainable Engineering

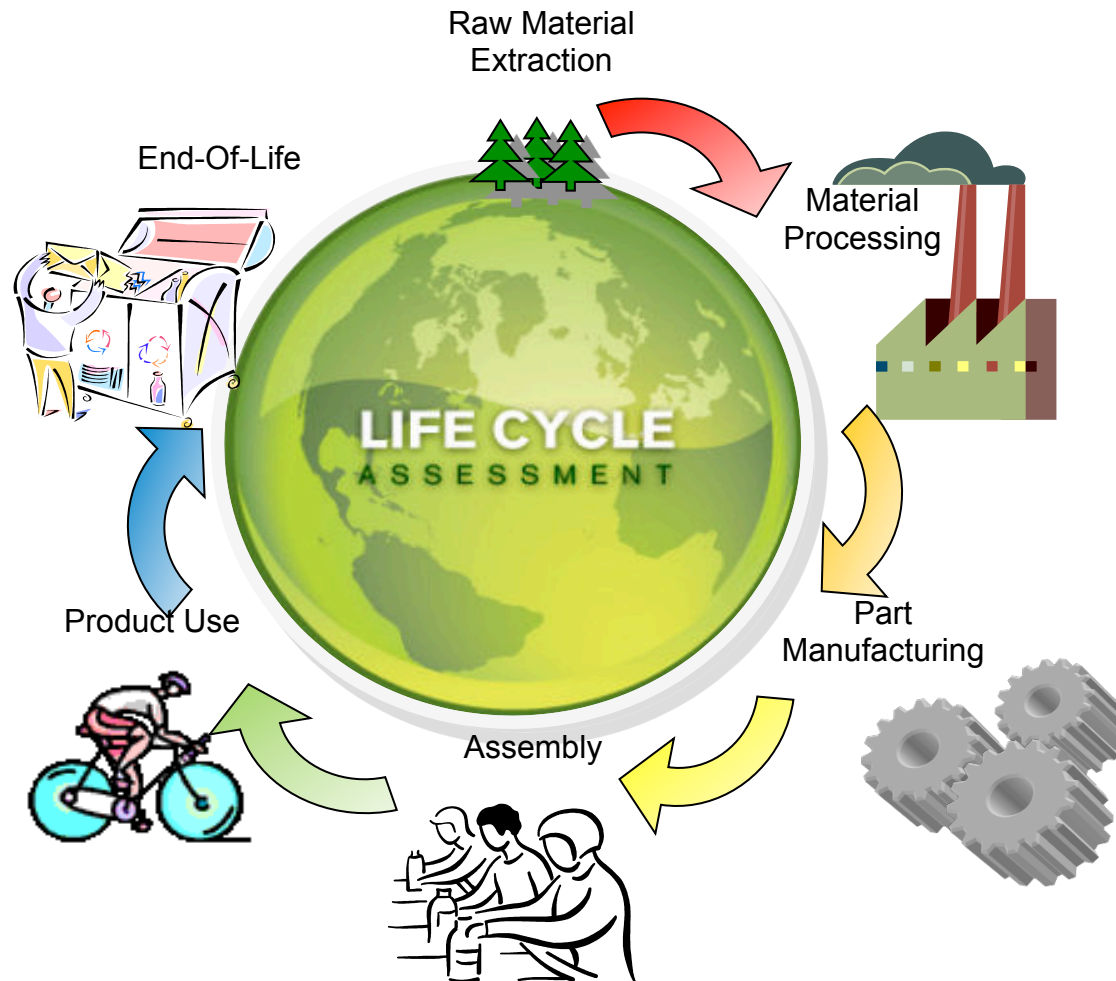
- Sustainability is today's "key driver" for innovation
- Like the IT revolution and the Quality revolution, moves toward sustainability and sustainable engineering are the current paradigm
  - Product Development
  - Manufacturing
  - Energy Production
- Barriers to implementation

How do we make  
Sustainable Products  
*Cheaply* and  
*More Efficiently*?





# Life Cycle Analysis

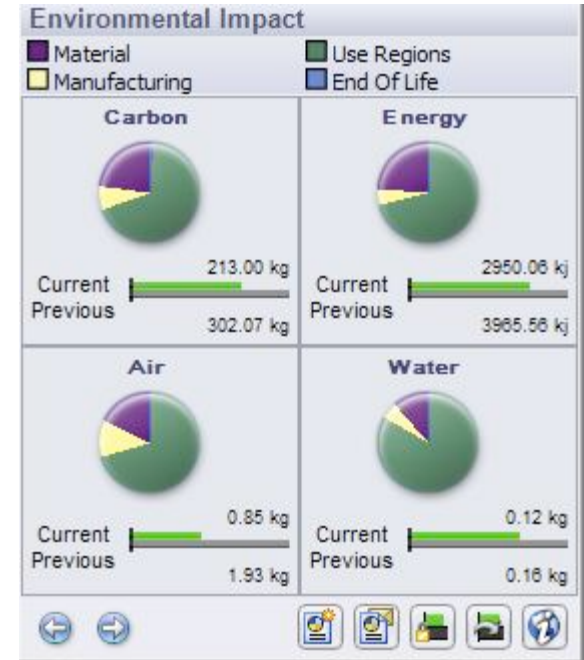


# How do product developers make sustainable design decisions *now*?

- Software
  - GaBi
  - Sustainable Minds
  - Solidworks Sustainability
  - SimaPro
  - TEAM

The screenshot shows the Sustainable Minds software interface. The main content is a table with the following columns: Functional Unit, Impacts / Functional Unit, Difference from reference, Difference from reference %, Impacts per Lifetime, Units of svc delivered, and Assessment type. The table lists three concepts for comparison against a reference 'Original Little Tykes'.

| Functional Unit  | Impacts / Functional Unit                      | Difference from reference | Difference from reference % | Impacts per Lifetime | Units of svc delivered | Assessment type |
|------------------|--|---------------------------|-----------------------------|----------------------|------------------------|-----------------|
| 1 Year of Use    | Impacts/Func. Unit                             | mPa                       | %                           | mPa                  | Svc. Units             | Assessment type |
| Reference        | Original Little Tykes                          |                           |                             | 559.62               | 10                     | Estimate        |
| Best Okala Score | Wooden WAVS No Transport ALT SLIDE Material    | -430.46                   | -76.93%                     | 129.05               | 10                     | Estimate        |
|                  | Wooden WAVS Mass Production ALT SLIDE Material | -406.32                   | -72.61%                     | 1532.4               | 10                     | Estimate        |





# Techniques to Reduce Environmental Impact

1. Design to minimize Material Usage
2. Design for Disassembly
3. Design for Recycling
4. Design for Remanufacturing
5. Design to minimize Hazardous Materials
6. Design for Energy Efficiency
7. Design for Regulations and Standards

# Design to Regulations and Standards

Consumer Product Safety Improvement Act (2008)

EPA Clean Air Act (1970)

EPA Clean Water Act (1977)

EPA Comprehensive Environmental Response, Compensation, and Liability Act (1980),

EPA Pollution Prevention Act (1990)

OSHA Occupational Safety and Health Act (1970)

OSHA Resource Conservation and Recovery Act (1976)

OSHA Toxic Substances Control Act (1977)

OSHA Food, Drug, and Cosmetic Act (1938)

The Restriction of Hazardous Substances (RoHS) Directive (2002)

ISO 14040: Environmental management - Life cycle assessment (2006)

The Waste Electrical and Electronic (WEEE) Directive (2002)

The Energy Using Product (EUP) Directive (2005)

# Potential Collaboration

