



Life Cycle Assessments

What Are they? – How They Can Help!

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Manager of Life Cycle Thinking
Owens Corning, February 2, 2011



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Objectives

- **What is a Life Cycle Assessment – LCA?**
- **Types of Environmental Impacts.**
- **Types of LCAs.**
- **How is an LCA used.**
- **Importance of an LCA & Functional Unit**
- **Examples of Life Cycle Data**
- **ACMA Committees – LCI Project**



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ISO Definition of LCA

- It's a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system through out its life cycle.



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What is an Life Cycle?

- The term “life cycle” refers to the notion that a fair, holistic assessment requires the assessment of the following items;
 - Raw Material Production
 - Product Manufacturing
 - Distribution
 - A “Use” Phase
 - Disposal Phase
 - Inclusion of all intervening transportation steps.

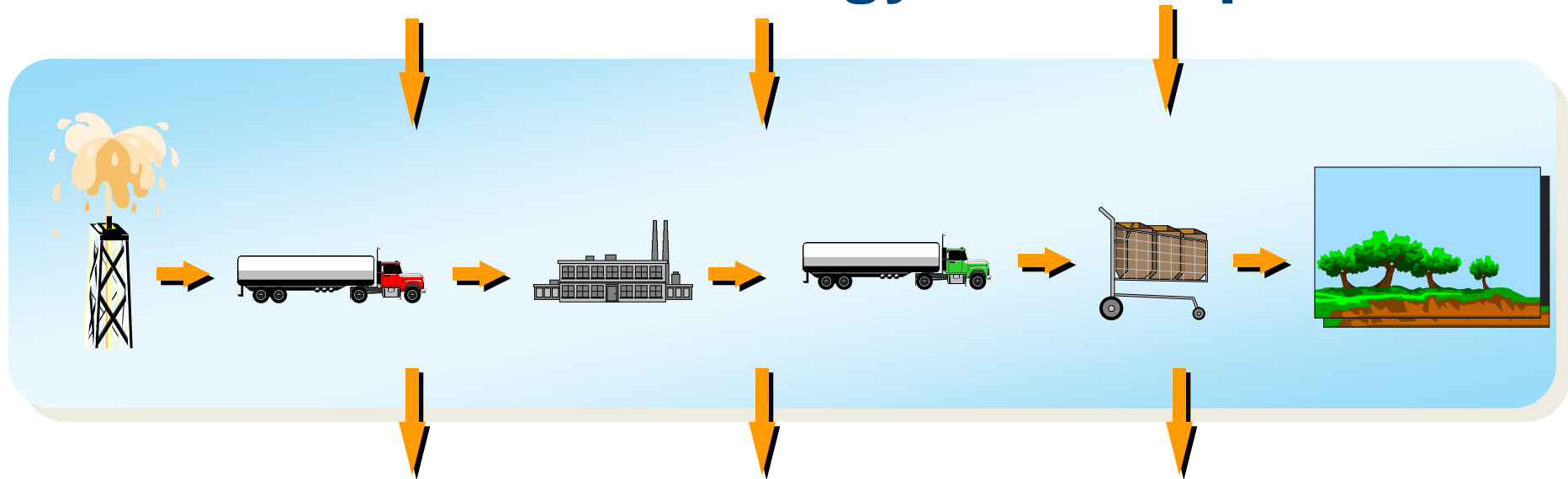


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Life Cycle Graphic

Raw material and energy consumption



Emissions to air, water and soils



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Typical Impacts Examined

Energy consumed (renewable & non-renewable)

Global warming (greenhouse gases)

Acidification (soil & ocean)

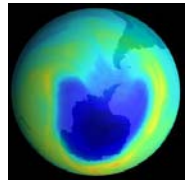
Smog

Ozone depletion

Eutrophication (excess nutrients to water bodies)

Eco-toxicology & human toxicology

Depletion of minerals and fossil fuels



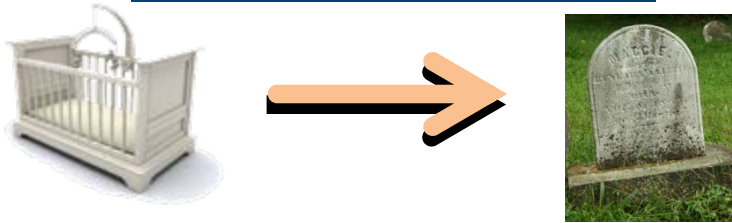
Revised 3/11/2011

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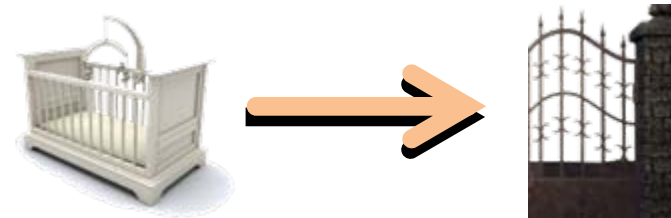


Types of LCAs

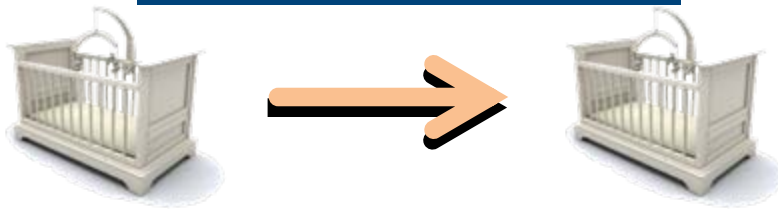
Cradle-to-Grave



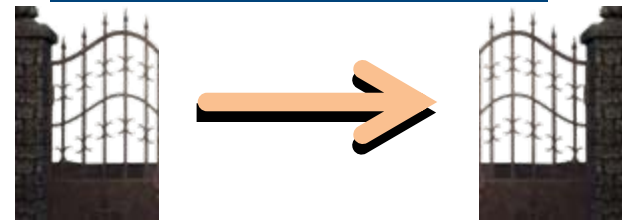
Cradle-to-Gate



Cradle-to-Cradle



Gate-to-Gate

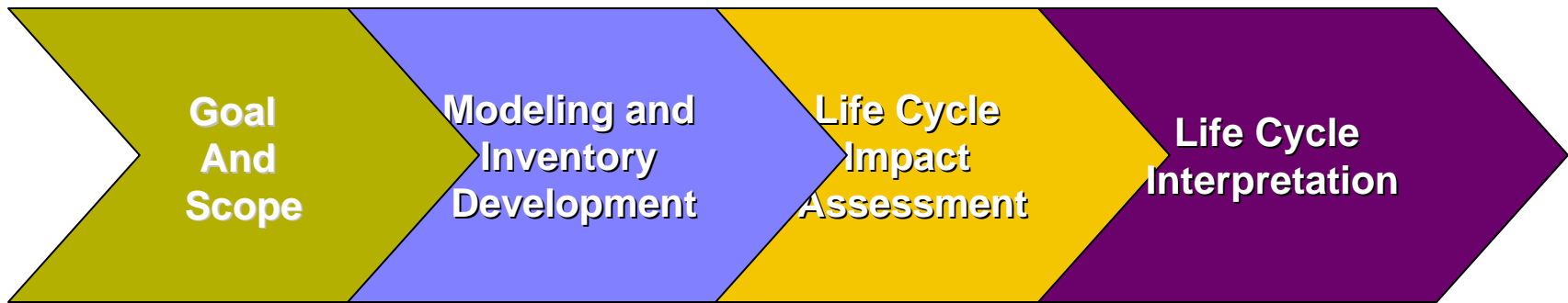


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Four Main Phases of LCA



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How is a LCA Used?

- **Project work**
 - Optimize environmental product performance
 - Optimize environmental plant performance
- **Organizational Use**
 - Optimize environmental company performance
- **Marketing**
 - Product environmental claims
 - Competitive comparisons



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Why is the LCA Important?

- It uses a quantifiable means for Multiple Attributes.
- It addresses all the Life Cycle Stages.
- It can allow for a more complete comparison because it uses the Functional Unit Concept.

The Functional Unit Makes it Comparable



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What is a Functional Unit?

- The quantified function provided by the product system under study, for use as a reference basis in an LCA.
- Examples:
 - Light Pole
 - Truck Cab
 - Structural Assembly
 - Case Encloser



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Compare Steel Part to Composite Part with a 3.5:1 Weight Ratio

Steel Part Mfg.

	MJ/Kg	Criteria
Primary Steel Production	26	25% Recycle
Secondary Operation	4 to 6	Hot/Cold/Section Roll
Field Install	30 to 35	Blast & Paint
Maintenance "Use" Phase	30 to 35	Blast & Paint
Totals	90 to 106	Cradle to Gate
Total for the Steel part at 3.5 Kg = 270 to 318 MJ		

Composite Part Mfg.

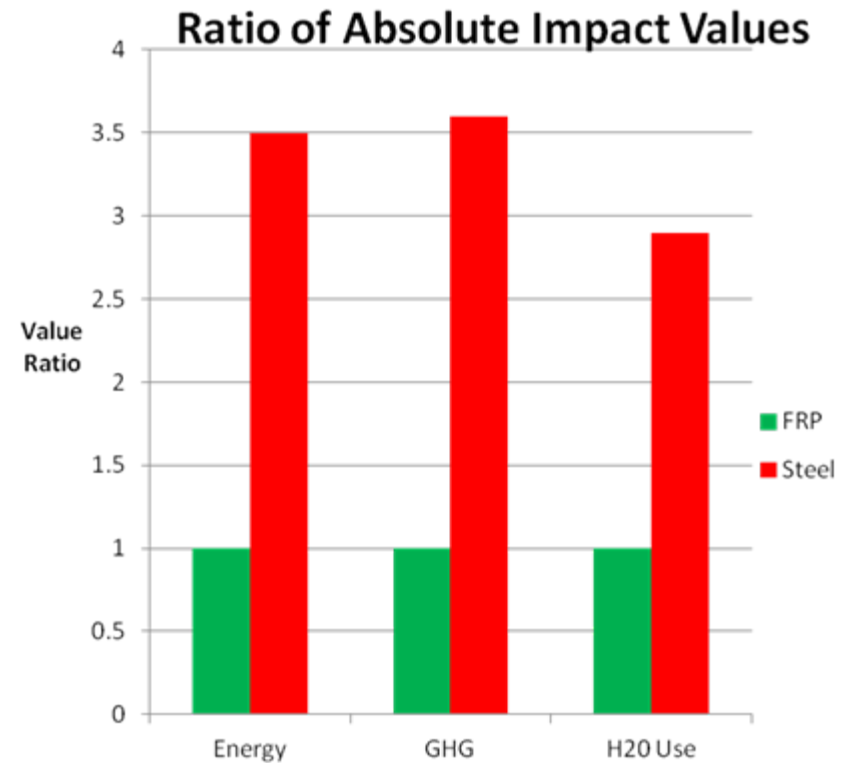
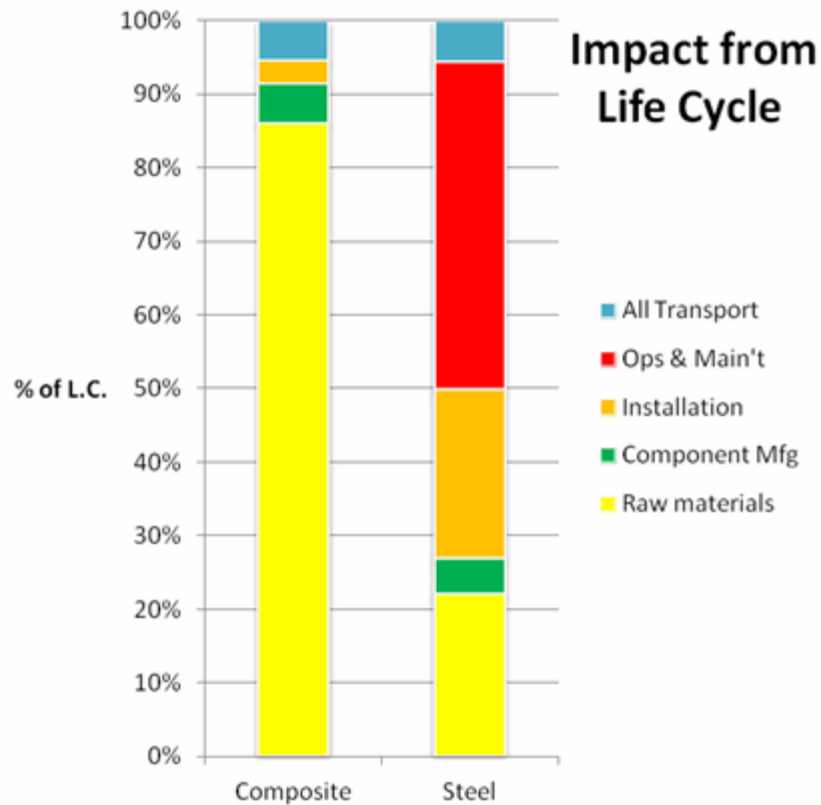
	MJ/Kg	Criteria
Primary Raw Materials	70-74	Glass & Resin Mix
Secondary Operation	4 to 6	Comp. Part Mfg
Field Install	0	Blast & Paint
Maintenance "Use" Phase	0	Blast & Paint
Totals	74 to 80	Cradle to Gate
Total for the Composite Part at 1.0 Kg = 74-80 MJ		



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Comparison of Impact Results for Material Life Cycle



“Typical for most Impact Categories based on Previous Studies”



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Compare Aluminum Part to Composite Part with 1.2:1 Weight Ratio

Aluminum Part Mfg.

	MJ/Kg	Criteria
Primary Raw Materials	101	50% Recycle
Secondary Operation	40 to 50	Extrusion or other
Field Install	0	Blast & Paint
Maintenance "Use" Phase	0	Blast & Paint
Totals	141 to 151	Cradle to Gate

Total for the Aluminum Part at 1.2 Kg = 169 to 181 MJ

Composite Part Mfg.

	MJ/Kg	Criteria
Primary Raw Materials	70-74	Glass & Resin Mix
Secondary Operation	4 to 6	Comp. Part Mfg
Field Install	0	Blast & Paint
Maintenance "Use" Phase	0	Blast & Paint
Totals	74 to 80	Cradle to Gate

Total for the Composite Part at 1.0 Kg = 74-80 MJ



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Conclusions Based on Function Unit

- **Energy for Composite Part across the functional unit life cycle can be less.**
 - **Steel & Aluminum need Recycle to be competitive!**
- **Other life cycle issues not shown here.**
 - **Transportation of Raw Materials (Kg-Miles)**
 - **Transportation of Finish Goods (Kg-Miles)**
 - **Energy and other burdens for installation**



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Next Steps for Composite Industry

- **ACMA Green Composites Committee – Issued White Paper on proposal to collect LCI data.**
- **ACMA Formed Sub-Committee; LCI Technical Committee**
- **LCI Technical Committee has developed a Process/Product Matrix**
- **2011 LCI Technical Committee to issue RFP to start the data collection process.**



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LCI Product/Process Matrix

PROCESS	Relative Process Importance to Market	MATERIAL IMPORTANCE TO PROCESS			
		Styrenic Thermosetting Resin and LP Additive	"E" glass	Alumina Trihtrate	Calcium Carbonate
Open Molding	1	1	1	1	1
Vacuum Infusion	1	1			
Pultrusion	1	1	1	1	1
Compression molding	1	1	1	1	1
Casting - Closed Mold	1	1		1	1
Secondary bonding	1	1			
Continuous Lamination	2	1	1		
Filament Winding	3	1	1		
Casting - Open Mold	3	1		1	1
RTM	3	1			



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LCI Sub-Committee Members

- **Mike Dettre – AOC, LLC**
- **Peter Emrich – MFG Companies, Inc**
- **John McAlvin – AOC, LLC**
- **Cheryl Richards – PPG Industries, Inc**
- **Dave Lapiro – ECRM, Inc.**
- **Gary Jakubcin – Owens Corning**
- **John Busel – ACMA Staff**
- **Jonathan Roberts – ACMA Staff**



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Questions?



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Life Cycle Assessment Creating Competitive Advantage for Composites

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