

Siemens PLM

Bill Of Sustainability (BOS)

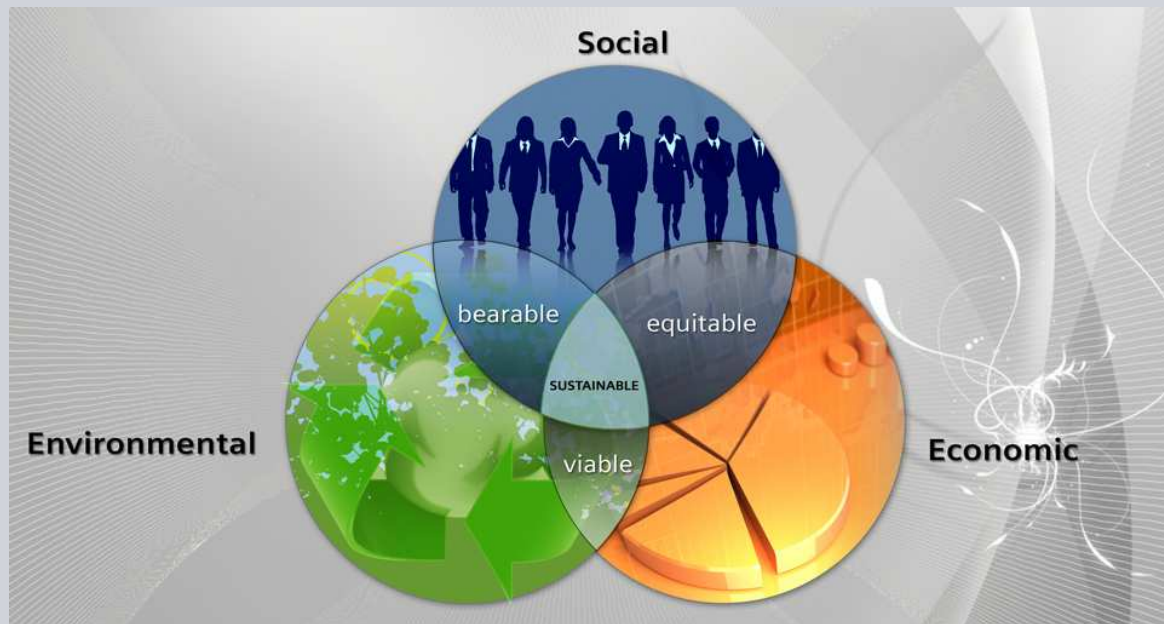
Enabling Lifecycle-Thinking at Decision Time

ProStep iViP Symposium 2010
28.04.2010

Mohsen Rezayat, Ph.D.
Chief Solutions Architect
SIEMENS PLM

Objective of BOS

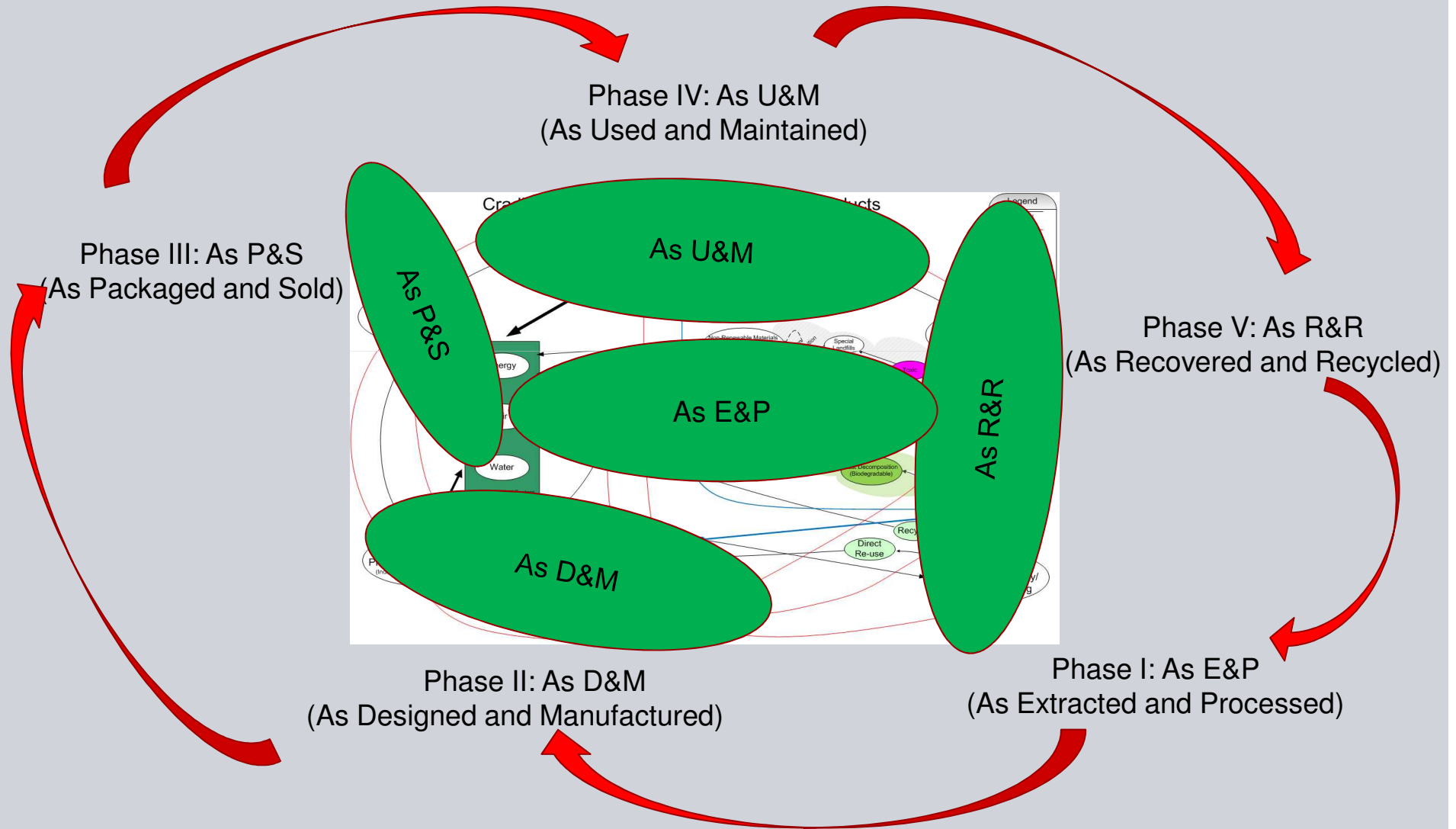
Create a BOM/BOP-driven representation that takes into account ***environmental, social, and economic*** aspects of product and process solutions in all phases of the lifecycle, and can at any time integrate these **sustainability** dimensions or dissect and analyze them individually.



High-Level Benefits of BOS for our Customers

1. BOS can visually indicate the overall efficiency of decisions and activities associated with **any product** in **any industry**, and facilitate comparison of alternate sustainability solutions for a single or groups of products.
2. By dissecting BOS into phases and components, we promote the concept of top-down and bottom-up design and analysis and make it possible for our customers to deal with a very complex problem in a simple and straightforward manner.

Five Lifecycle Phases of BOS for typical OEMs



Twelve Evaluation Criteria for Each Phase of BOS

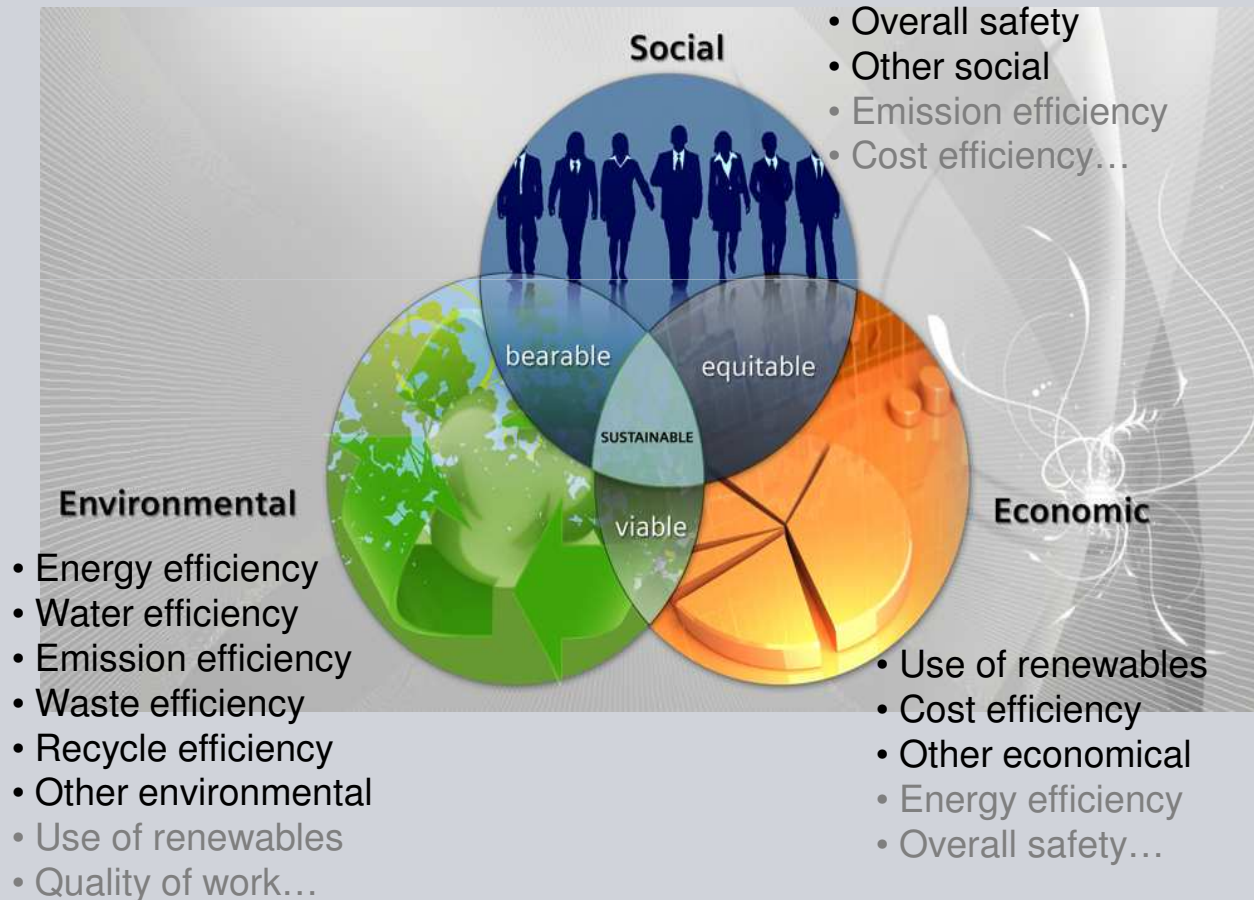
Each phase of BOS consists of the same twelve sustainability criteria:

- § Energy efficiency
- § Water efficiency
- § Emission efficiency
- § Waste efficiency
- § Recycle efficiency
- § Other Environmental

- § Quality of work
- § Overall Safety
- § Other Social

- § Use of renewables
- § Cost efficiency
- § Other Economical

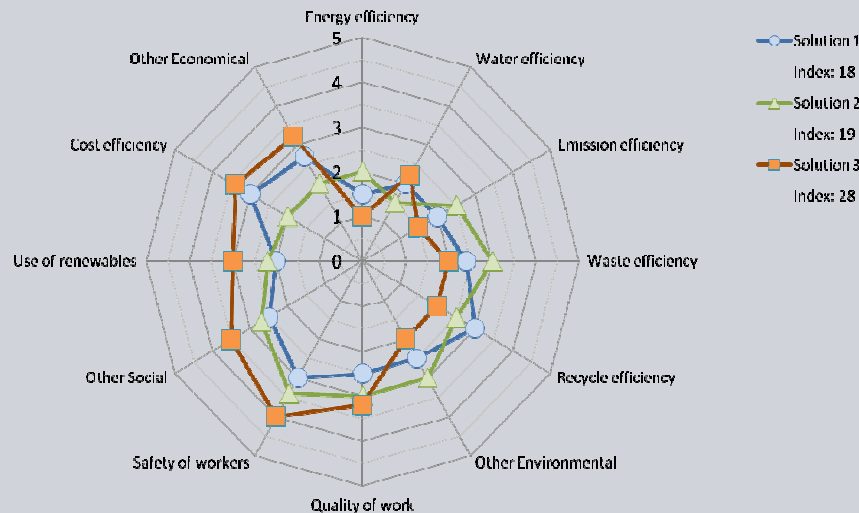
- Quality of work
- Overall safety
- Other social
- Emission efficiency
- Cost efficiency...



BOS “Sustainability Indices” Scoring for Phase-Based Product Development and Industry Comparisons

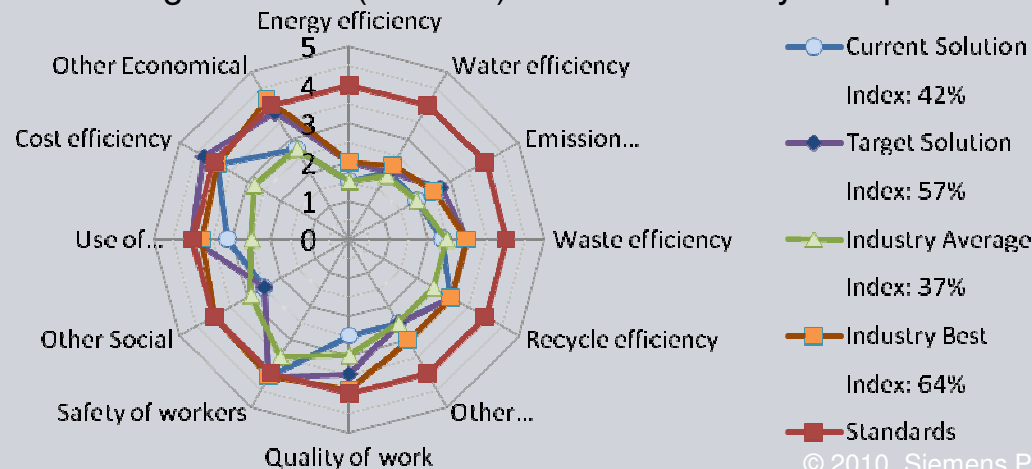


As Packaged & Sold (As P&S) BOS for Solution Alternatives



Example Result: For this phase of BOS, “Solution 3” seems to offer the optimal solution with an Index of 28, but this is only one part of the complete lifecycle...
 (In this example, all shown results are based on equal weighting.)

As Packaged & Sold (As P&S) BOS for Industry Comparisons



Example Result: For this phase of BOS, “Solution 3” is compared with industry best and average solutions, but again this is only one part of the complete lifecycle...
 (In this example, all shown results are weighted with higher weight for energy efficiency but lower weight for quality because this is the packaging phase.)

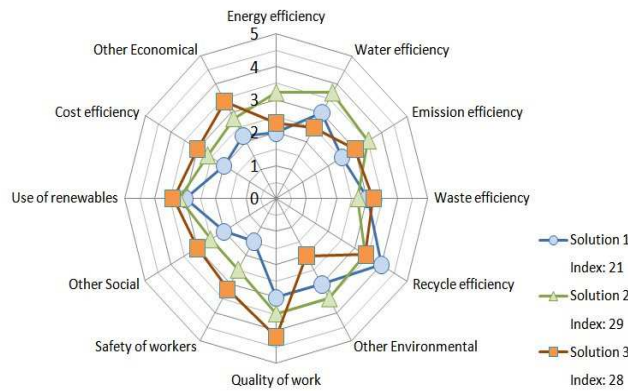
© 2010. Siemens Product Lifecycle Management Software Inc. All rights reserved

BOS for C2C Business Process Improvements Using a “Full Lifecycle Thinking” Approach

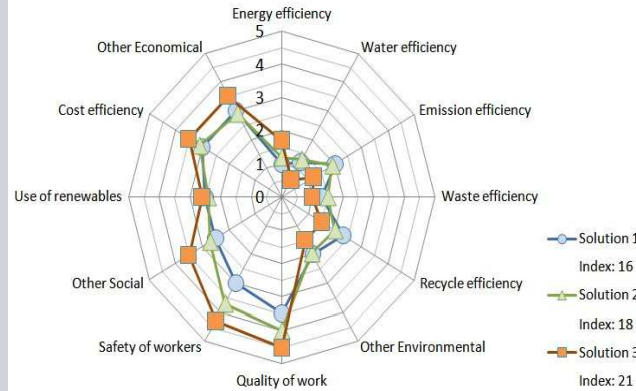


BOS can represent a C2C solutions dashboard for product alternatives or industry comparisons

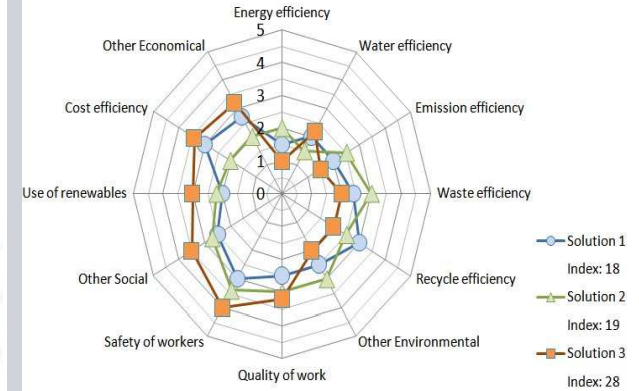
As E&P



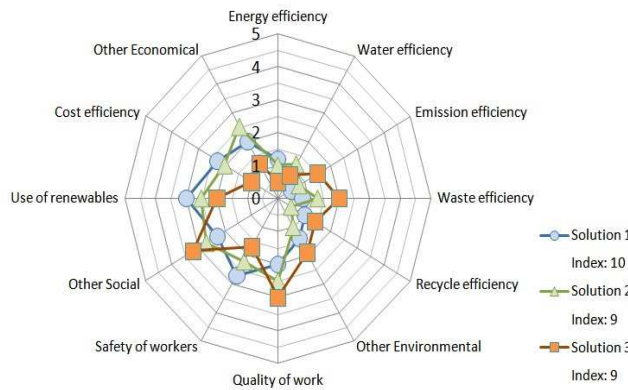
As D&M



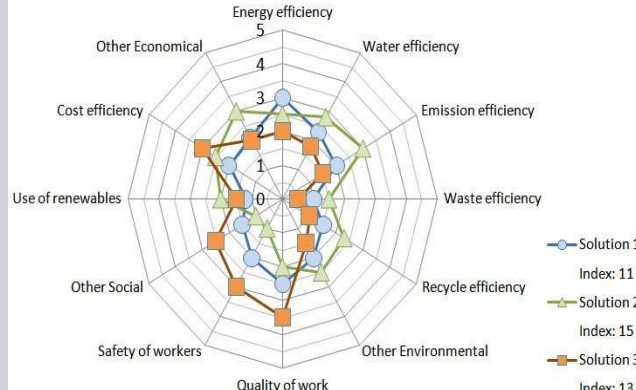
As P&S



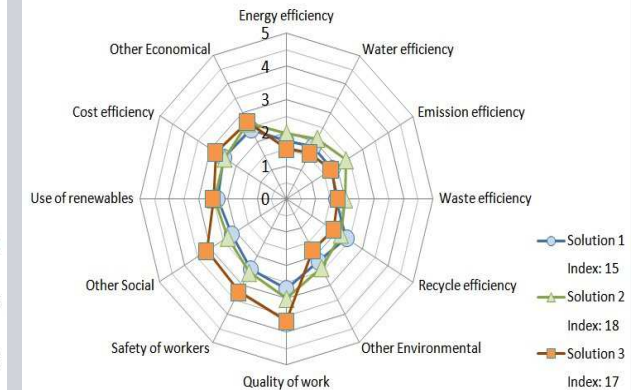
As U&M



As R&R



BOS Total



C2C Solution Scoring = “Sustainability Index”

Scoring is done based on a “Sustainability Indices,” which is either the **area of the region** for each solution or a **percentage of “target” area**.

Index scoring can be compared for each phase of the BOS. An overall C2C Sustainability Index can be obtained by adding all five indices.

Should use **weighting factors** to show that certain criteria in a specific phase are more important than others due to timescale, industry, or impact.

Optimal solution is obtained by comparing the weighted overall C2C sustainability indices of various solutions and industry best practices.

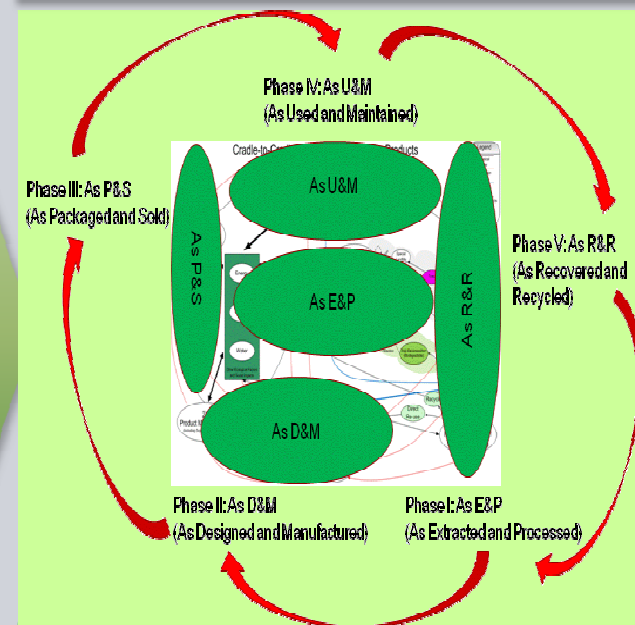
Summary of Bill of Sustainability: Meeting Green Targets and Achieving Cost Efficiency

SIEMENS

- ▶ Sustainability Governance, Compliance & Reporting
- ▶ Design for Sustainability
- ▶ Sustainable Manufacturing
- ▶ Life Cycle Assessment
- ▶ Supply Chain Management
- ▶ End of Life Management
- ▶ Energy efficiency
- ▶ Water efficiency
- ▶ Emission efficiency
- ▶ Waste/Recycle efficiency
- ▶ Quality of work, Safety of workers, Cost efficiency, Use of renewables

Integrated
Bill of
Sustainability

Tomorrow



Sustainability- Driven Decision Making*

© 2010. Siemens Product Lifecycle

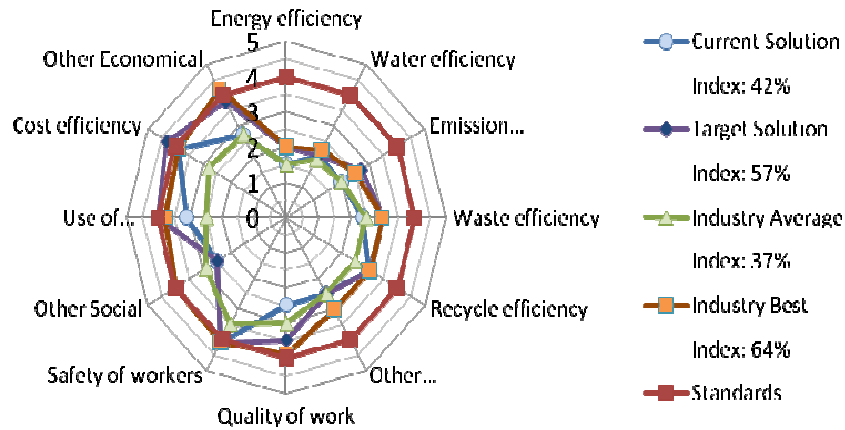
***cradle-to-cradle (C2C) lifecycle**
in distinct but interrelated phases

BOS Uniqueness: Scope and Presentation

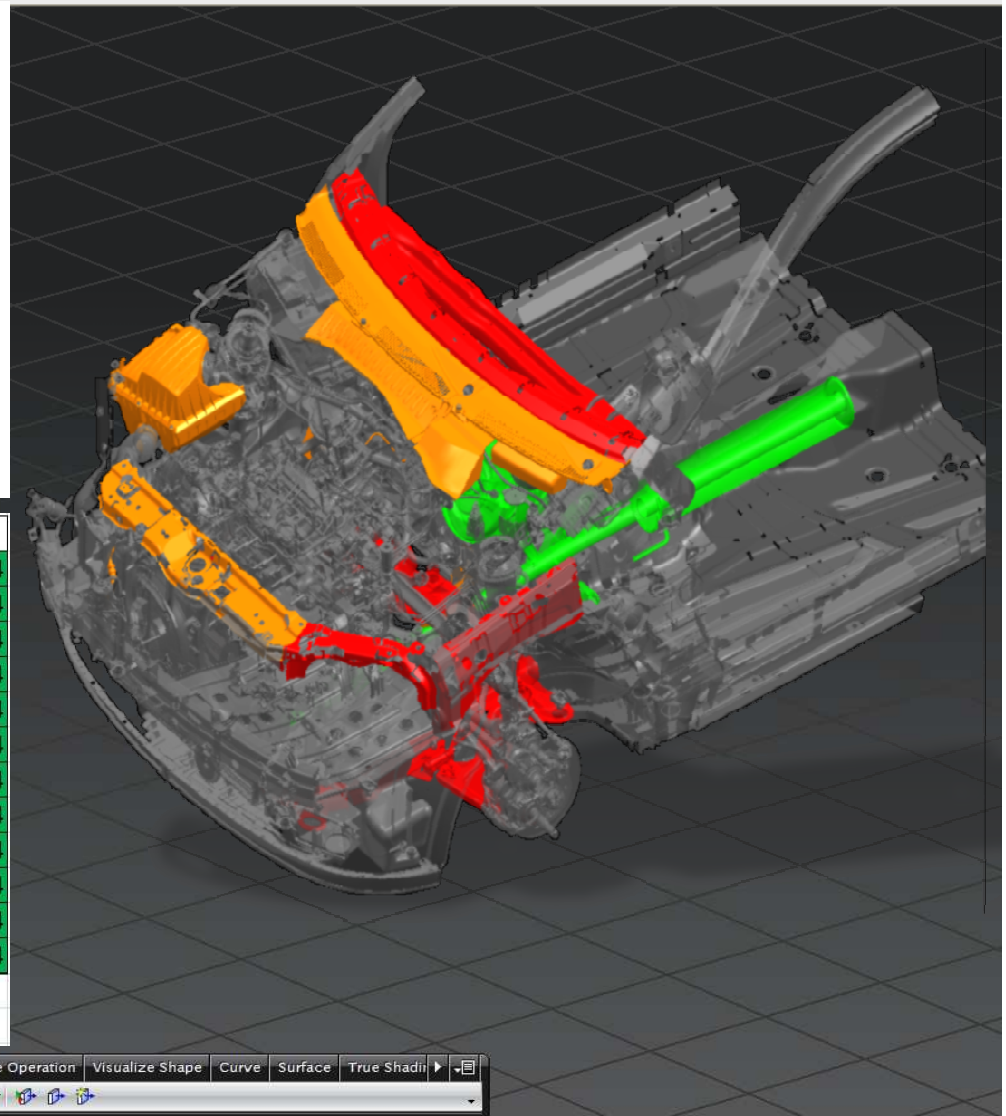
SIEMENS

NX 6.0.0.22 - Modeling - [WorkContext.prt (Modified)]
 Select objects and use MB3, or double-click an object

SIEMENS



Bill of Sustainability Criteria	Current Solution	Industry Average	Industry Best	Standards
Energy efficiency	1.9	1.52	2.22	4
Water efficiency	1.86	1.7	2.24	4
Emission efficiency	1.98	1.62	2.5	4
Waste efficiency	1.88	1.81	2.24	4
Recycle efficiency	2.46	2.05	2.6	4
Other Environmental	2.26	2.054	2.58	4
Quality of work	3.16	2.62	4.24	4
Safety of workers	4.1	2.264	4.1	4
Other Social	2.888	2.41	4.12	4
Use of renewables	3.1	2.27	4.056	4
Cost efficiency	4.2	2.35	4.2	4
Other Economical	2.98	2.35	4.28	4
Percent of Weighted Standards	48.54833333	27.53151042	70.38725	
Standards Index	49	28	70	



Standard View Tables Utility Feature Operation Visualize Shape Curve Surface True Shading

pBOS: Present Information Intuitively For Design of Sustainable Products

SIEMENS

NX 6.0.0.22 - Modeling - [WorkContext.prt (Modified)]

Select objects and use MB3, or double-click an object

My Contexts

Product Status

Phase: Total Life cycle

- Cost
- Weight
- Energy Use
- Water Use
- Air Use
- Emissions
- Waste
- Recycled/Reclaimed

Select Life cycle phase

E&P D&M P&S U&M R&R Total

Standard View Tables Utility Feature Feature Operation Visualize Shape Curve Surface True Shading

STOP Cost Flag
Does not meet cost target
Link for info: [Requirement...](#)

STOP Hazardous Material Flag
Not compliant with REACH requirement
Link for info: [Requirement...](#)
[Material Database for alternate materials...](#)

UI Details Subject to Change

mBOS: Present Information Intuitively For Sustainable Manufacturing

SIEMENS

Select objects and use MB3, or double-click an object

My Context ✕

Plant Europe

Production: Plant "Europe"

95% Inspection

90% Takt Times

97% Safety

Safety: Walkways

Walkway surface texture is too smooth and does not meet manufacturing environmental and safety requirements

Link for info: [Surface texture requirement, Issue](#)

Guard rails along walkway do not meet height requirement

Link for info: [OSHA standards](#)

Inspection: Alert Station 65

Variation in measured quality data approaching max limit: Station downtime 8%.

Link for info: [Requirement, Issue](#)

Link for info: [Weld Point Dist.Report](#)

Compare Inspection

STOP Takt Times: Alert Station 65

Station time 105% of Takt Time.

Link for info: [Line Balancing Study](#)

Time Values		Time Analysis	
Allocated Time:	150.00 sec	Type	Time (Sec)
Base Allocated Time on		Value Added	25.20
<input type="checkbox"/> Estimated Time:	120.00 sec	Non Value Added	20.34
<input checked="" type="checkbox"/> Veiled Time:	150.00 sec	Non Va but Necessary	19.10
<input type="checkbox"/> Total Duration:	151.34 sec	Setup	20.50
		Other	26.2
		Total Work	151.34 sec

AISLE

Standard View Tables Utility Feature Feature Operation Visualize Shape Curve Surface True Shading

www.siemens.com/plm

THANK YOU!