



Eco-Efficiency
Analysis



Validated

Eco-Efficiency
Analysis

 **BASF**
The Chemical Company

**Renewable Resources
and Biorefineries**

Assessing biobased materials and processes with the Eco-Efficiency Analysis and SEEbalance[®] of BASF

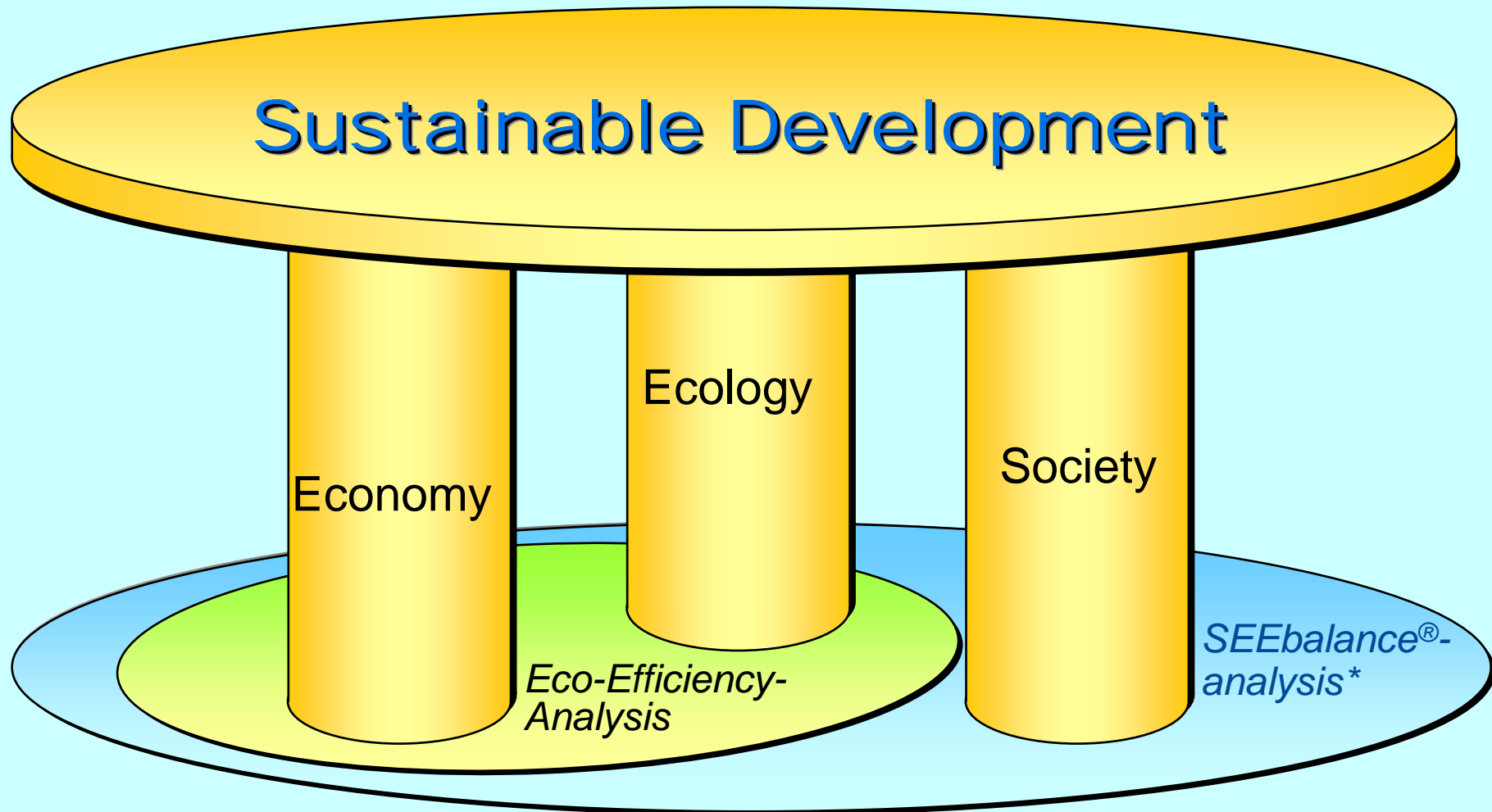
Dr. P. Saling, -

BASF Eco-efficiency analysis group

Ludwigshafen

Ghent, 19th - 21st of September 2005

Sustainable Development is based on three Pillars



Value for ourselves and our partners and customers



Ensure sustainable development



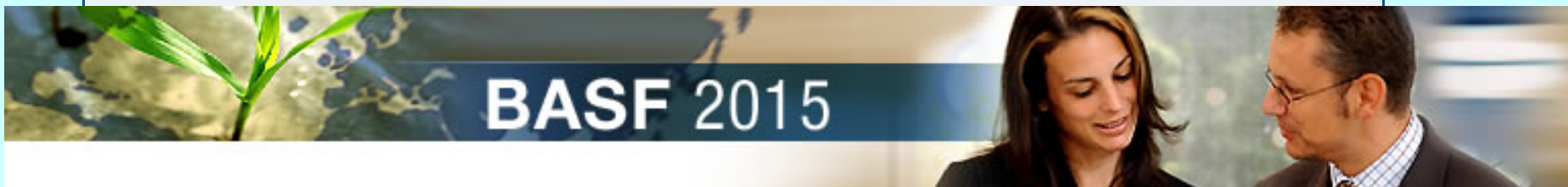
We combine economic success with environmental protection and social responsibility



We see sustainability as a long-term competitive advantage



We use our eco-efficiency analysis to identify the best economical and ecological solutions



What is the Eco-Efficiency Analysis? How does it work?



**Renewable Resources
and Biorefineries**

- Method for the **comprehensive assessment** of products and processes.
- **Ecological and economic aspects** will be measured and are given equal weight in assessments.
- The products are analyzed from the **angle of the end customer** with a „**cradle-to-grave**“-approach based on LCA-methodology
- **(Future) scenarios** and effects of various action options are presented.
- Eco-Efficiency analysis is a **standard** tool in the **BASF Group**; more than **250* analyses** have been carried out; e.g. for automotive industry, packaging, nutrition, cosmetics, energy supply, varnishes and pigments, chemicals, plastics, etc.
- Identification of the most **sustainable** BASF alternative for a defined customer benefit is possible

Eco-Efficiency Analysis: Comparison of 22 different approaches were assessed by TÜV in 2002



- best case
- existing



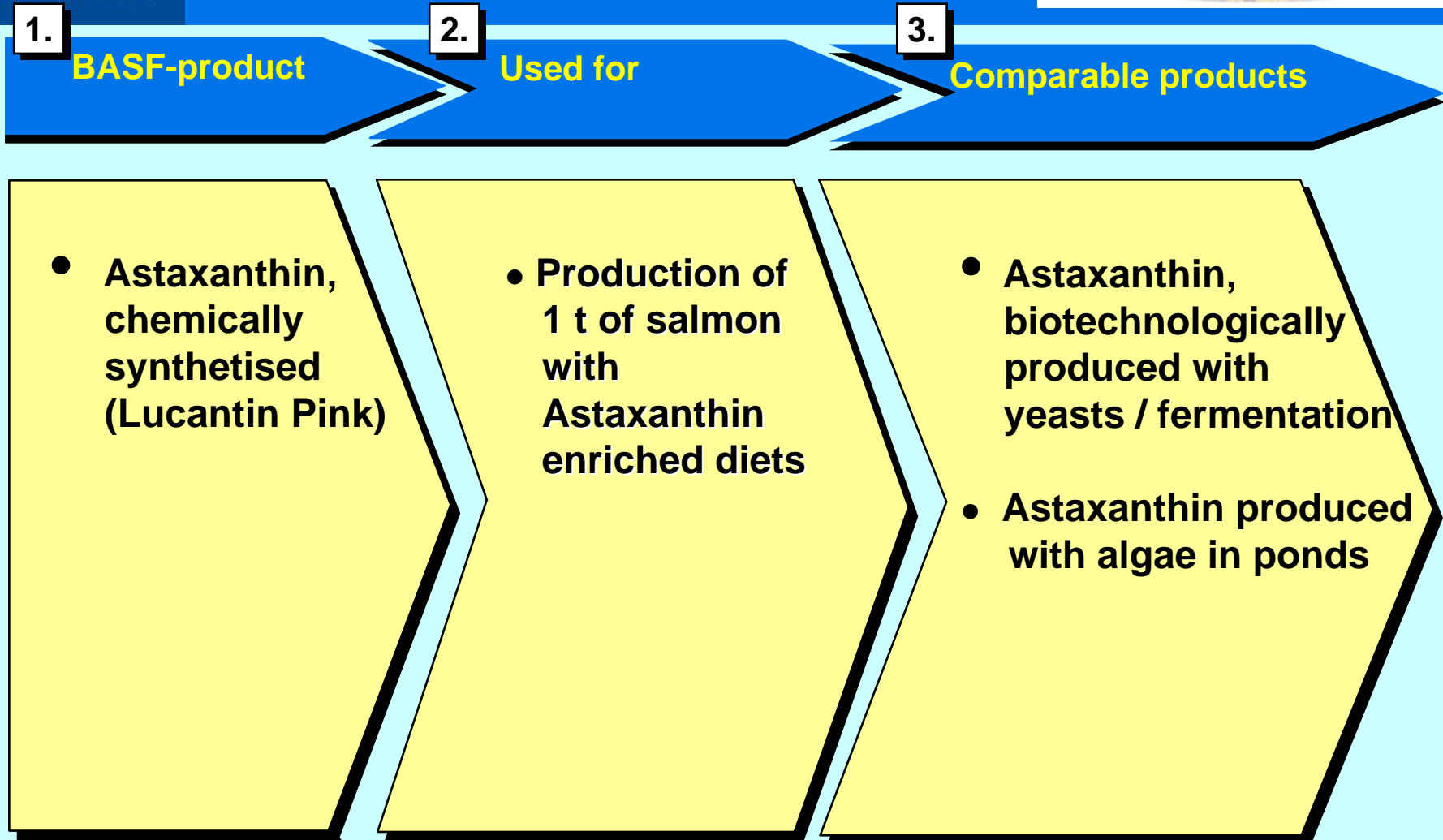
	emission	material/waste	(waste-) water	energy	risk-potential	toxic effects	recycling	durability	service intensity	land use	quality	market emotion	life cycle	costs
BASF	●	●	●	●	●	●	●	○	○	●	○		●	○
Storebrand	○		○	○		○					●			
WBCSD	●	●	○	●			●	●	●					
Shell	○	○	○	○	○	○				○		●	●	●

Eco-Efficiency study of Lucantin Pink for Salmon Production



food

Alternative Systems for the Production of Astaxanthin



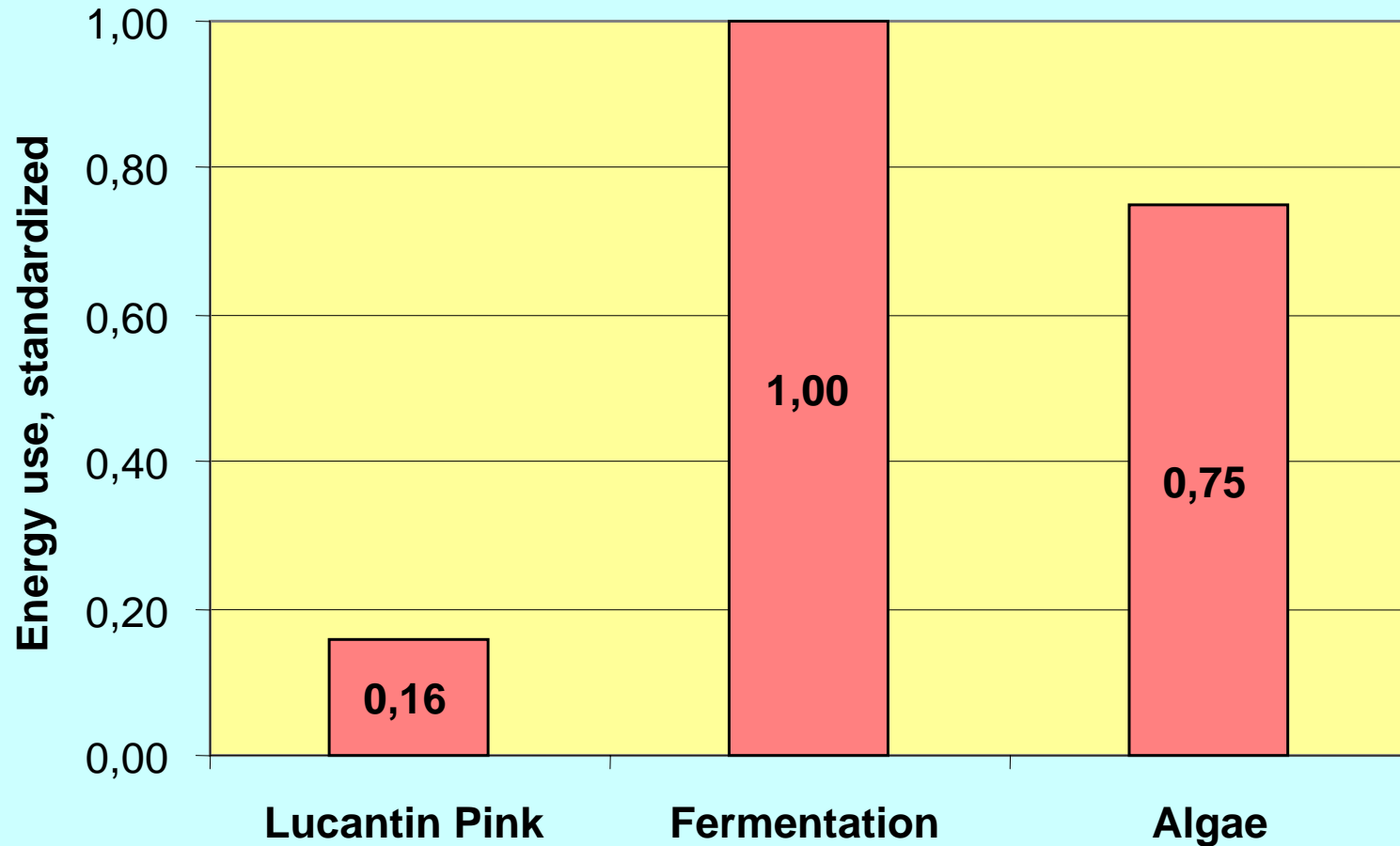
Environmental Data



**Renewable Resources
and Biorefineries**



Energy Use of Alternatives (per Ton of Salmon)

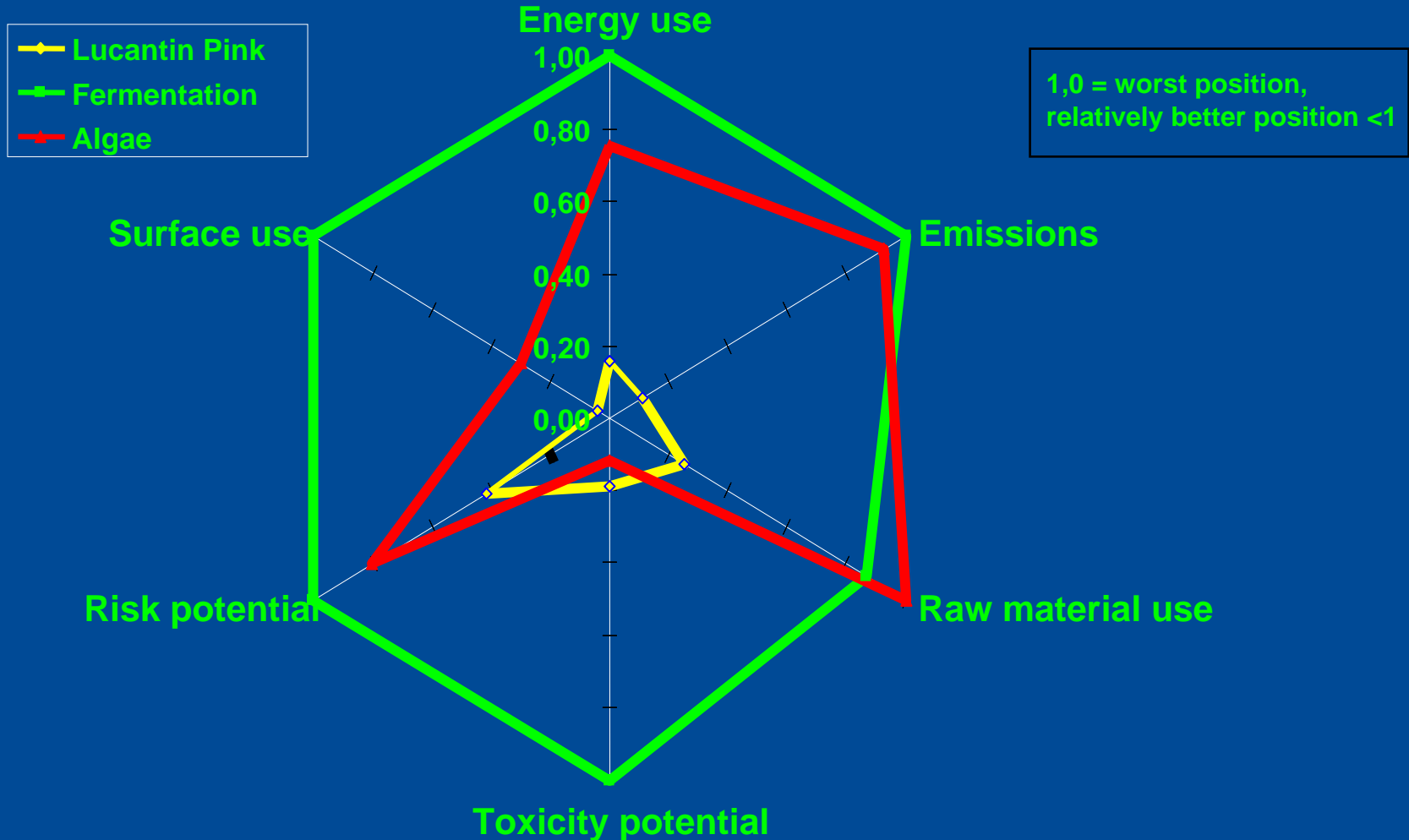


Ecological Fingerprint after BASF

- **Base case** (per Ton of Salmon)



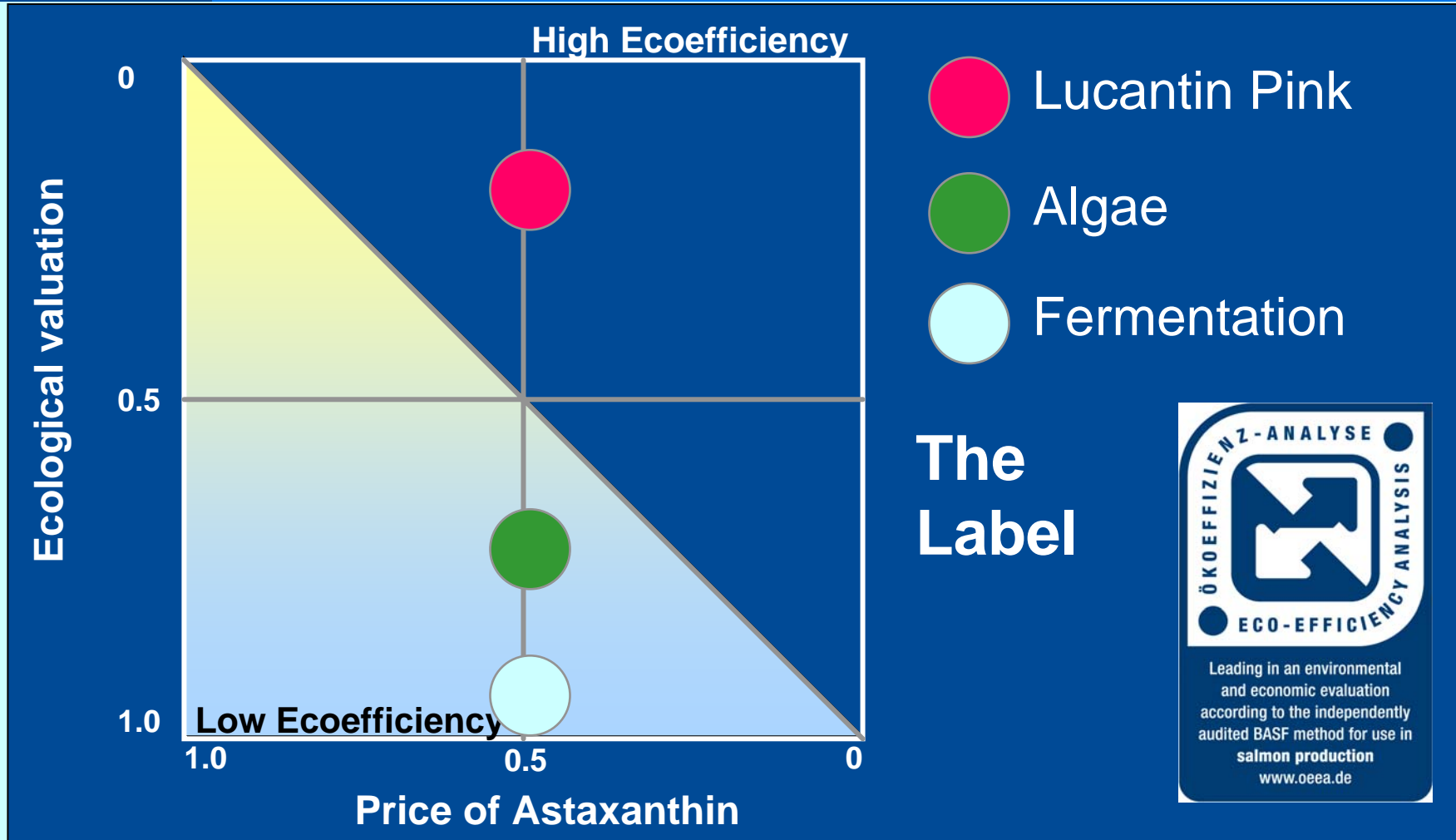
**Renewable Resources
and Biorefineries**



Ecoefficiency Portfolio (sales product have the same price per unit of active ingredient)

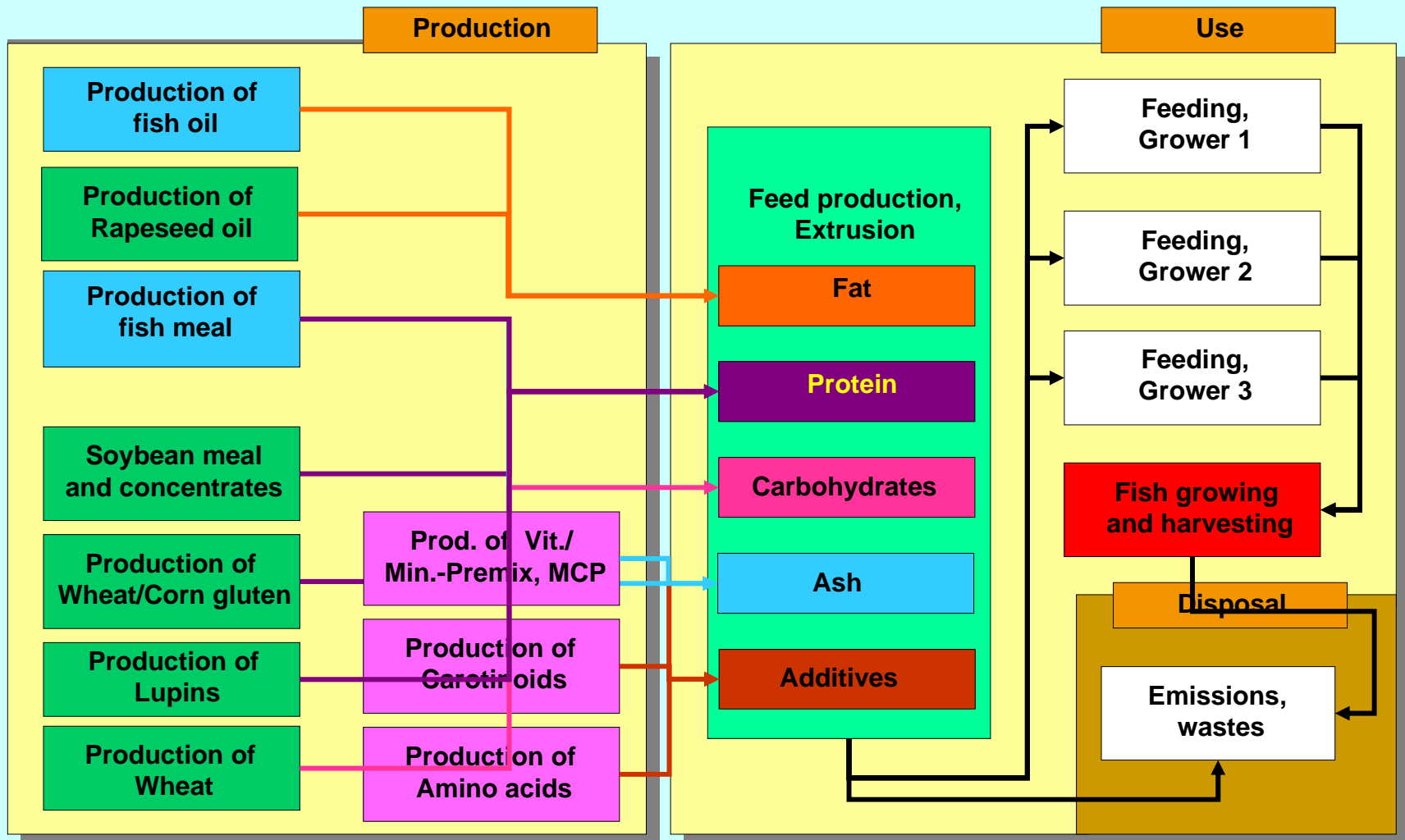


Renewable Resources and Biorefineries

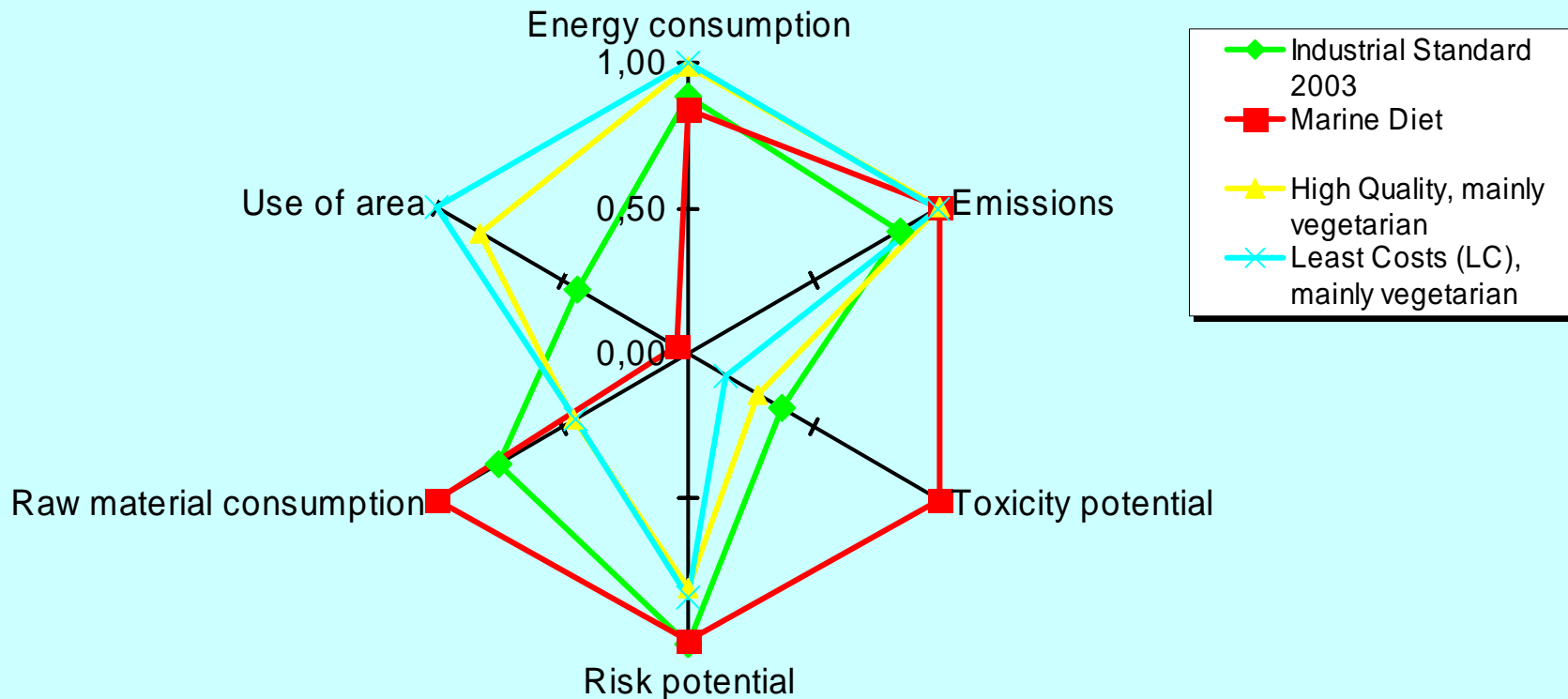


Total fish diet systems

System boundaries, example for Industrial Standard



Ecology fingerprint for base case: Current situation



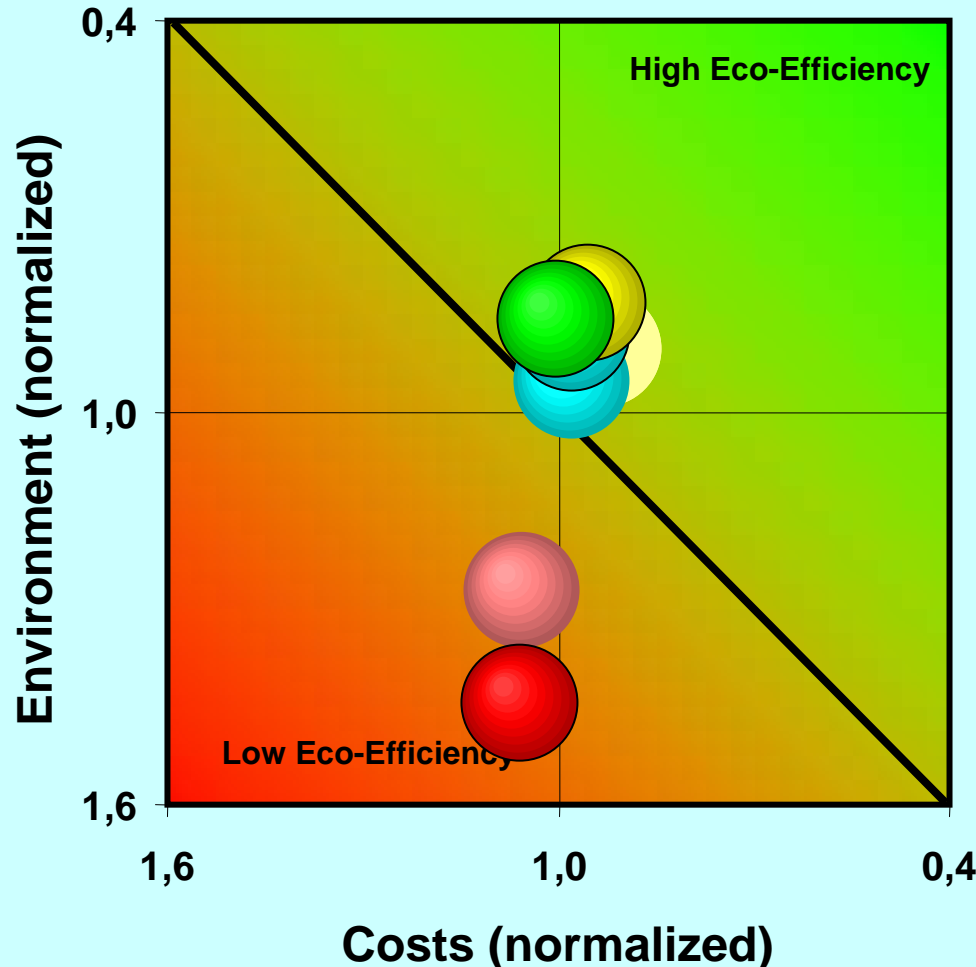
1,0 = worst position
Better results ordered relatively < 1

As 2, assuming over fishing with a 20-year grow-back period

3

Customer benefit:

Production of 1000 kg of Salmon in the saltwater phase in Western Norway by growing from 100 g to 4000 g of harvesting weight in cage of 15000 cbm



- Industrial Standard 2003
- Marine Diet
- High Quality, mainly vegetarian
- Least Costs (LC), mainly vegetarian

In this Scenario **High Quality** is the most Eco-Efficient alternative.

Objectives of the eco-efficiency analysis for fish diets



Use Eco-Efficiency-Analysis to

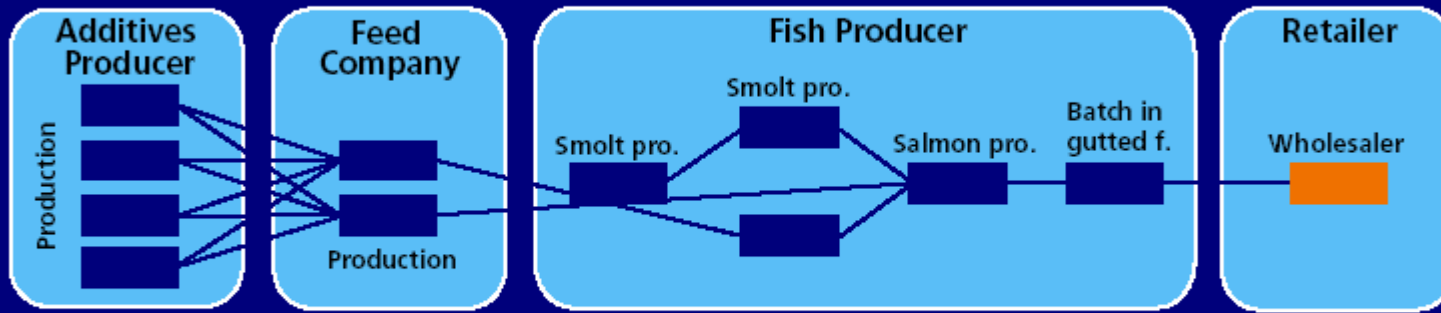
- Illustrate **economical** and **ecological** consequences of feedstuffs choices in salmon feeds
- Show the most **sustainable / eco-efficient** alternative(s) at different scenarios
- Discussion of the results with experts in the fish feed industry
- The **Eco-Efficiency Manager Tool** is able to help our customers in the individual development of more sustainable fish diets.

Link between supply chain management, sustainability and traceability



and Renewable Resources and Biorefineries

GLOBAL CHAIN VIEWED FROM RETAILER



Covering the entire value chain, the TTGTNet is an on-line exchange of links between independent companies' traceability information.

INDUSTRIAL GIANT TO ACT AS TRACETRACKER'S AGENT

BASF Includes the GTNet in its Product Portfolio



tracetracker

TraceTracker
Christian Krohgsgate 32, N-0186 Oslo, Norway
Tel: +47 48 20 30 00, Fax: +47 22 20 50 46
www.tracetracker.com

FOOD SAFETY EUROPE
Your production runs to food safety & compliance

TRACE:
THE EU TRACEABILITY PROJECT

The Global Food Safety Initiative
Safety Showcase
Product Recalls

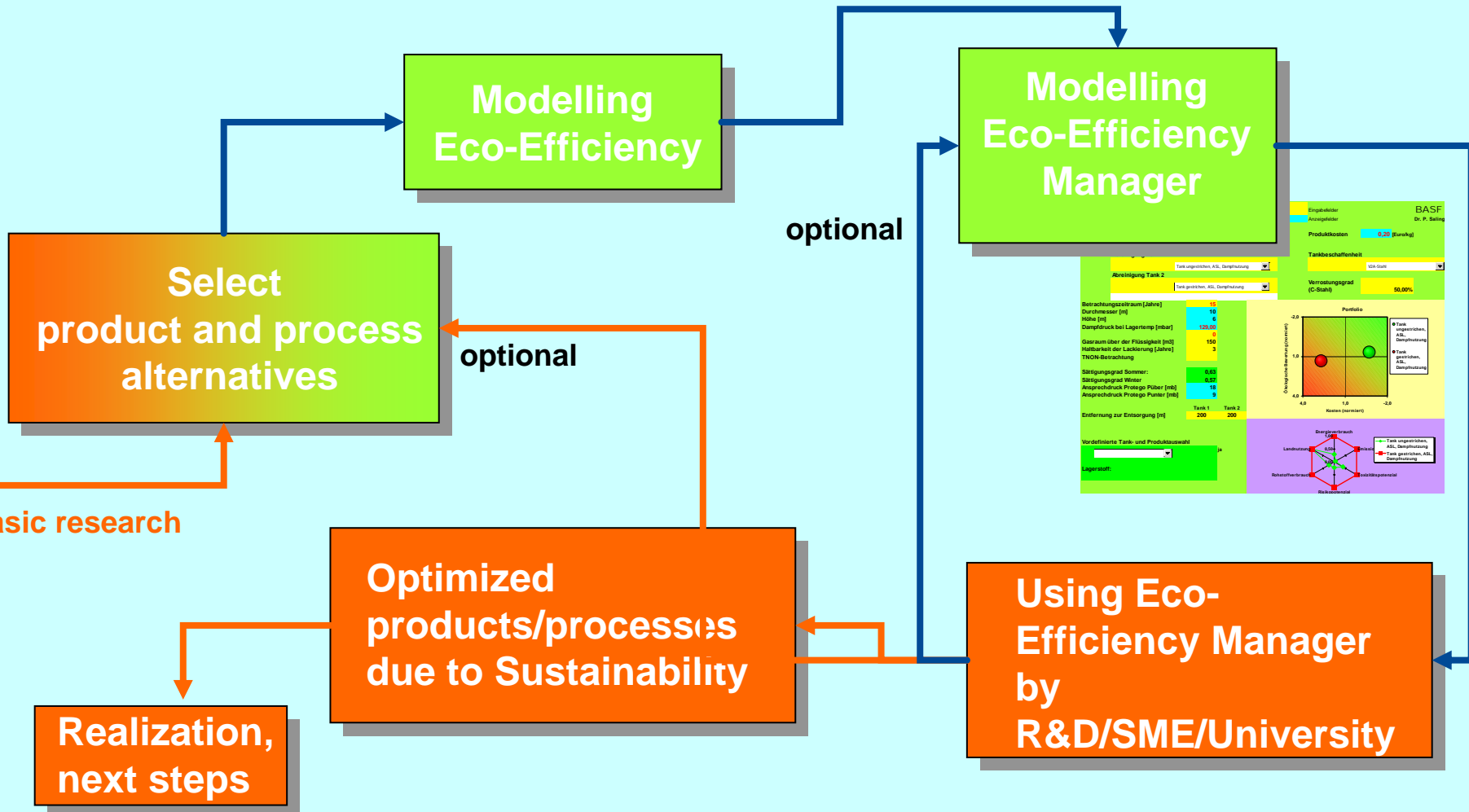


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Using Eco-Efficiency in Decision-Making Processes of R&D

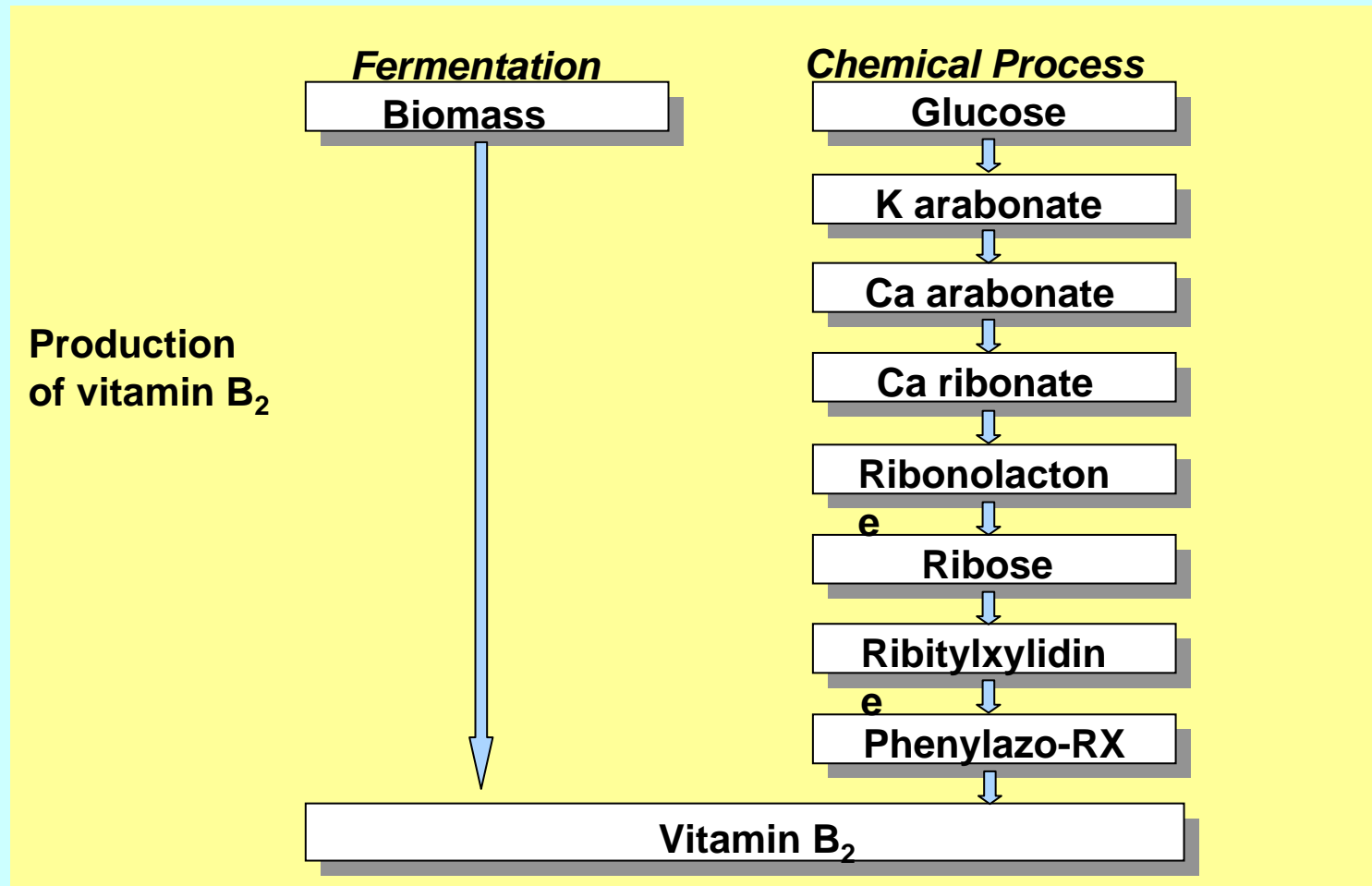


Renewable Resources and Biorefineries



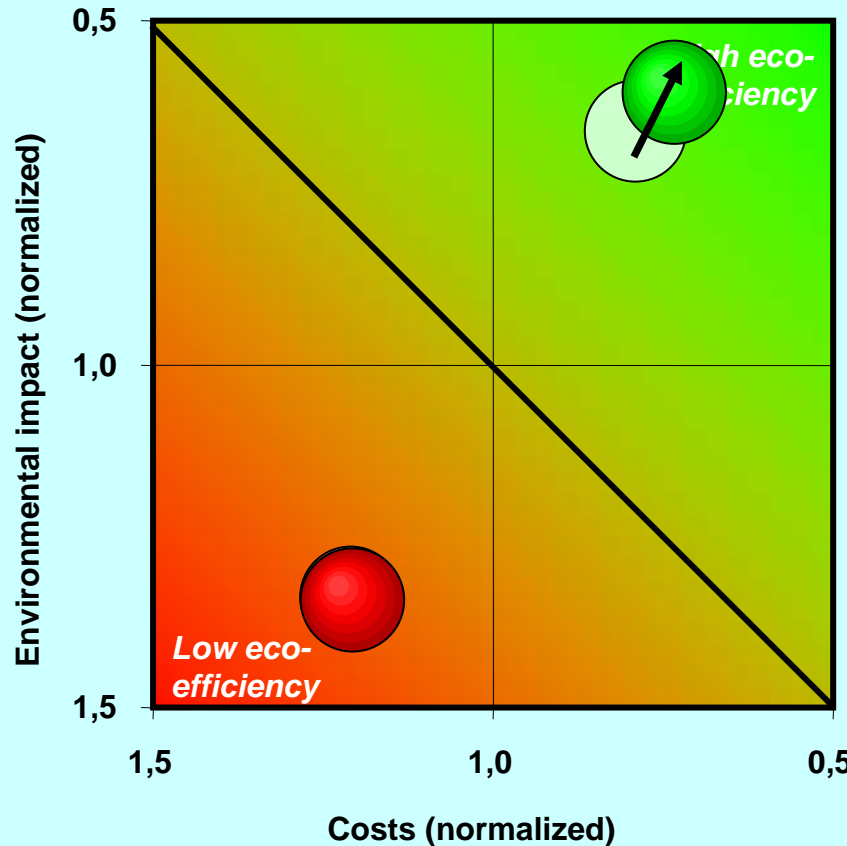
Synthesis with biobased materials

Alternative Pathways of the Synthesis of Vitamin B₂



Portfolio - Szenario: 20% Increase of the Yield in the Biotechnological Process

Customer-related-benefit: 100 kg Vitamin B₂ as supplement for feed



- BASF fermentativ Vitamin B₂
- Chemical process Vitamin B₂
- Base Case biotech.

An increase of the yield improves the eco-efficiency of the biotechnological process.

ENVIRONMENT: DECREASING THE FOOTPRINT, Project of EuropaBio

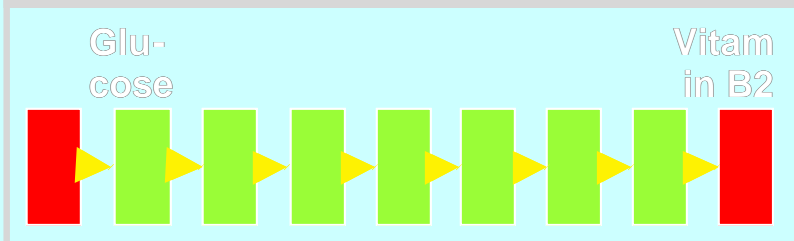


Renewable Resources and Biorefineries

Case studies	Environmental impact			Economic impact
	Energy efficiency	Raw materials consumption	CO ₂ emissions	Production costs
<ul style="list-style-type: none"> Vitamin B2 (BASF) Antibiotic Cephalexin (DSM) 	+	++	+	+
<ul style="list-style-type: none"> Scouring enzyme (Novozymes) 	+	+	0	+
<ul style="list-style-type: none"> NatureWorks™ (Cargill Dow) Sorona® (DuPont) 	+	++	++	0
<ul style="list-style-type: none"> Ethylene from bio-mass (future scenario) 	0	++	++	--

COSTS AND STEPS REDUCED IN VITAMIN B2 SYNTHESIS

Conventional process



Biotechnological process (BASF)



Reduced:

- Purification steps
- By-products

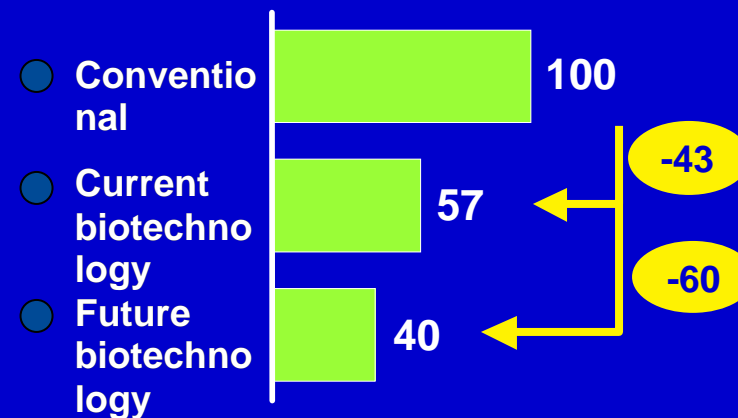
Impact

Environmental

- Reduction of CO₂ emissions by 30%
- Reduction of hazardous substances

Economic

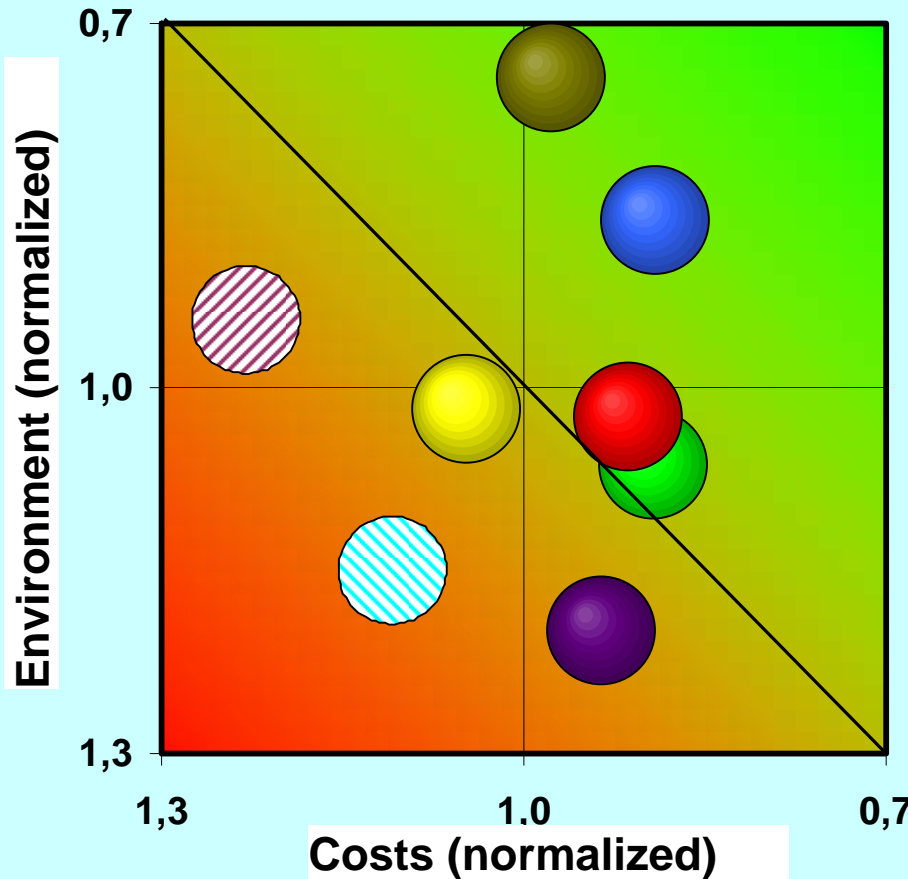
Costs in percent



Eco-Efficiency of different future engine concepts

Biobased materials can be sustainable

Using a car
(Middle class:
5 Seats, 100 PS)
Commuter-Profil,
200.000km
in 10 years



- Otto - Gasoline
- Otto - Nat. Gas
- Otto - H2
- Diesel - fossil
- Diesel - Biodiesel
- Diesel - Synf.-Gas
- Elektro - Electricity
- Hybrid - Gasoline
- PEMFC - Methanol

The Hybrid – gasoline and the Otto – natural gas engines are the most eco-efficient alternatives

Assessing the social dimension of sustainability for biobased materials – The SEEbalance[®] of BASF

Example

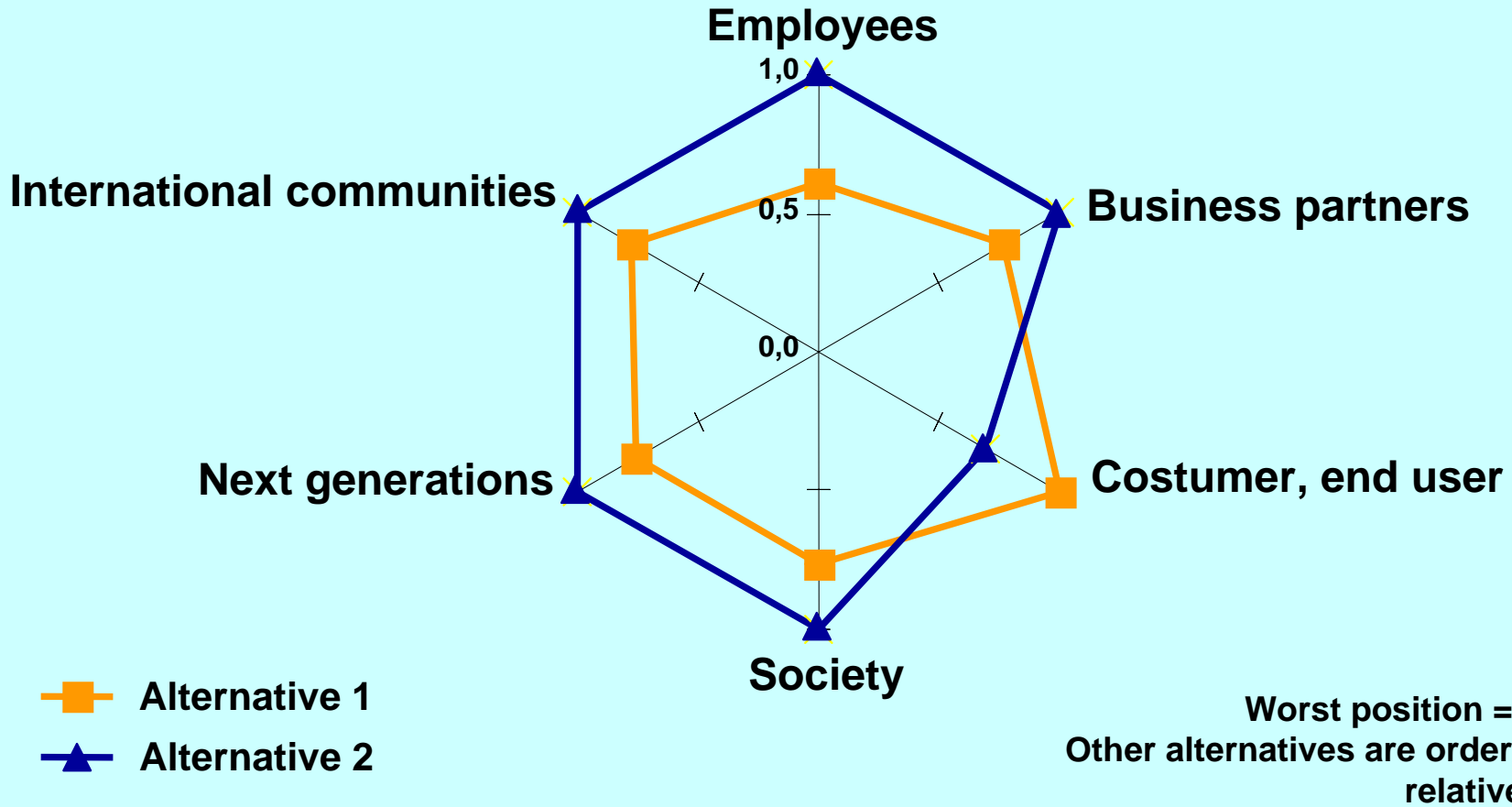


Comparison of the production of a shirt made from

- a) PET
- b) PET and Cotton
- c) Cotton

Example for social goal	Possible, related social indicator
Prevention and reduction of diseases	Number of work-related illnesses
Good relationship to customers: Use of fair marketing methods	Complaints about Marketing of the company
Increase of education and further education	Rate of apprenticeship places in the company

Possible summary: The Social Fingerprint

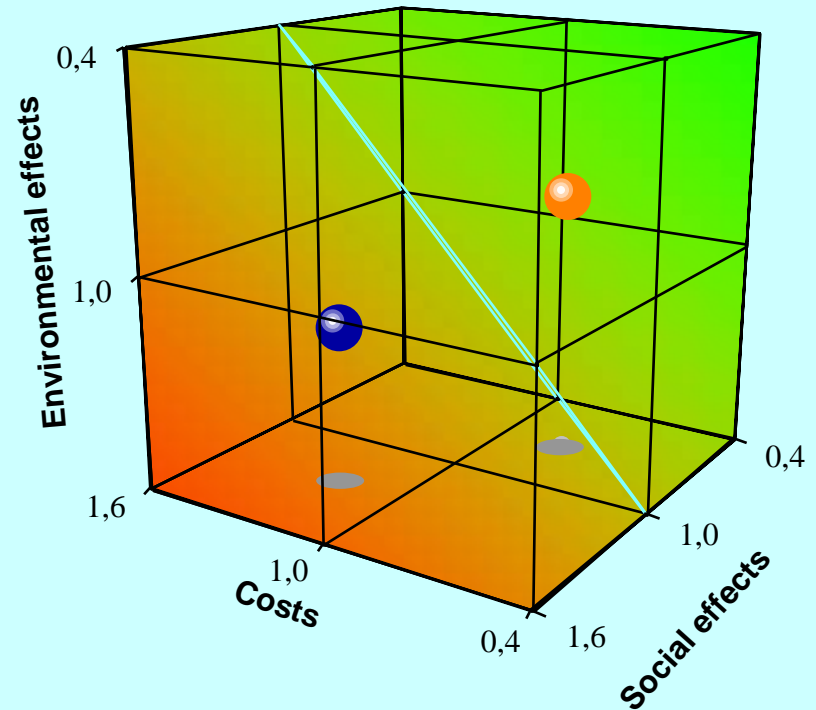


New developed sustainability tool: Integration of the social dimension into the eco-efficiency analysis

Renewable Resources and Biorefineries

- ➔ Integrated assessment of economic, ecological and social aspects of products and processes

- ➔ Cooperation with the University of Karlsruhe, the University of Jena and the Öko-Institut: search for and selection of suitable indicators.



How does BASF use the Eco-efficiency Analysis?



Strategic Decisions

- Investment decisions
- Technology decisions
- Site decisions
- Evaluate product portfolio

Marketing, Customers

- Demonstration of product advantages
- Improved customer relations
- Product Differentiation
- Better understand competitive advantages

Research and development

- Quantification of the most important factors
- Drive sustainable products and processes
- Drive production/process improvements

Stakeholder and Government Dialogue

- Communication with authorities
- Demonstration of Sustainability
- Government “approvals”

Our Homepage: (<http://www.oekoeffizienzanalyse.de/>)

Opportunities of the Eco-Efficiency Analysis



- **Comparison of comparable products and systems**

- **Integral analyses of alternative solutions with:**
 - **Total **cost of ownership** determination**
 - **Calculation of **ecological burden** for the whole life cycle**
 - **A simple and impressive way for presentation the results was developed, using the **Eco-Efficiency Portfolio****

- **Results can give:**
 - **A fundament for strategic decisions and evaluation of product portfolios**

 - **Ideas for improvement of product quality in respect to sustainability**

 - **Identifying sustainable processes and products using biobased materials**

Consequences and conclusions of Eco-Efficiency Analyses

Depending on the position of the analysed product, different strategical recommendations are given.

Environmental Impact (normalized)

