



# Eco-Efficiency Study for Gasoline Additives

## *Single scenario*

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 **BASF**

The Chemical Company

# Summary



Eco-Efficiency  
Analysis



- The study was made to compare additized gasoline with non-additized gasoline.
- The most eco-efficient alternative in the base case is the additized gasoline. The non-additized gasoline has the lowest eco-efficiency.
- It was shown that the function of additives are useful and eco-efficient.
- The efforts to produce the additives are much lower than the fuel energy that can be saved by using the additives.
- The alternatives in the differentiation calculation are very high. Possible uncertainties have low impact to that result due to the big positive impact of the additives in their useful life.
- The amount of additives that are needed are very low. Their function is very powerful and sustainable.

# Objectives and Use of the Eco-Efficiency Study



- The study was made to compare different alternatives for fuels. The alternative in focus is the use of additives for fuels. It is not only the price and environmental impact of the alternative materials, which are important to the comparison. A life-cycle view should identify the strengths and weaknesses of the different alternatives.
- The study used the methodology of the eco-efficiency analysis, developed by BASF as a life-cycle tool to show and assess different parts of the life-cycle of the chemical reactions and related materials which are required to achieve the desired product. It is one method between others that are able to assess environmental data over the whole life cycle.
- The ecological calculations of the single results in each category are following the ISO-rules 14040 ff in the main points. The quantitative weighting step to get the ecological fingerprint and the portfolio are not covered with the ISO-rules. The eco-efficiency analysis has more features than are mentioned in the ISO rules.
- The methodology has been approved by the German TÜV. This methodology was used by the "Öko-Institut - Institute for applied ecology" in Freiburg Germany in different APME-studies. Öko-Institut uses a quite similar methodology with a different weighting system ("Ecograde"). . TNO in the Netherlands using the BASF standard method with a different weighting system. The Wuppertal Institute accepts the method: "Basically, the large number of indicators used in the eco-efficiency analysis of BASF make relatively reliable statements possible ...". The method was initially developed by BASF and Roland Berger Consulting, Munich.



**Validated  
Eco-Efficiency  
Analysis method**

# Objectives and Use of the Eco-Efficiency Study



- This study might be another step for the BASF to assess different opportunities in the fuel and lubricant business. The weaknesses and strengths of using them in comparison to other cleaning systems might be an opportunity for benchmarking the BASF technology with others.
- Especially the growing market in Asia can be supported by assessing costs and environmental data over the whole life span and over the whole life cycle of products that are involved.
- Another objective might be to inform customers in a B2B-communication, to show them the relative advantages of using the most eco-efficient alternative. Therefore a different presentation of the results like a publication in a public available journal can be initiated.
- The presentation of the results to decision makers in the business will support the use of the most sustainable alternative in the future.
- The information coming out of this study might be also helpful for supporting R&D activities for the optimization of the product and for the market implementation of the new developed product.
- After finalization of the study, including a Critical Review, the labelling of the most eco-efficient product with the eco-efficiency label will be done by the TÜV Rhineland in Germany. A description of this critical review is introduced in the study, the important comments are also published directly. The whole CR-report can be sent out after request.

# Limits and Reglementation for the use of the Results



- Results are valid for materials in the defined applications. They are not valid for different applications, which have nothing to do with the original process defined in the study.
  - The “cradle-to-grave” view focuses on all steps of the cleaning process. Steps before and after this process step are not considered.
  - The protection and safety issues for workplaces are calculated in this study following the German Law and regulation, even if different country scenarios were worked out.
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- Further information on the eco efficiency methodology: <http://www.oekoeffizienzanalyse.de>

# Eco-Efficiency Analysis Label



Eco-Efficiency  
Analysis

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- After the eco-efficiency analysis was worked out and reviewed by a third party, the eco efficiency label can be awarded following the rules in ISO 14025. The attached label can be employed for fuels, which are using additives delivering a performance level similar to the one observed with the additive that was under investigation compared to a fuel without additives under the given conditions mentioned in this study.
- BASF SE is the owner of the label, all rights are reserved.

# Questions around the sustainability of fuel additives



- Is there any benefit in using additized fuel?
- How sustainable is additized fuel?
- How can the end consumer perceive those benefits?

**... an Eco-Efficiency Analysis of BASF  
can help to answer those questions!**

# Overview of Study

Compare environmental impacts and costs between

1. Gasoline additized with Keropur<sup>®</sup> additive
2. Non-additized Gasoline

## Gasoline Additives

- Coats the intake system of the engine with a protective film;
- Prevents deposits from developing in the intake system and on the inlet valves;
- Keeps fuel injectors and carburettors clean

# Conclusions



## Costs

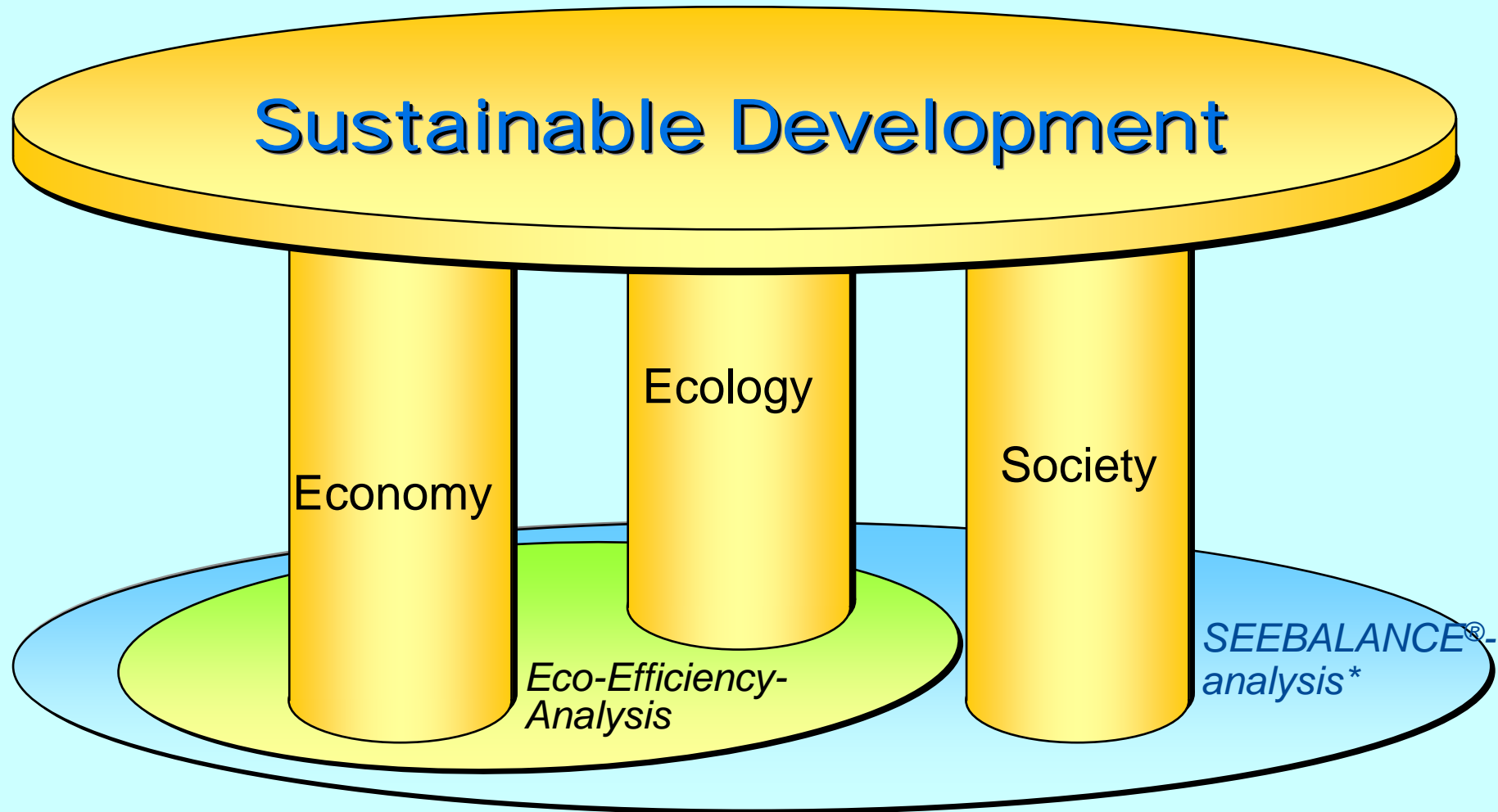
Gasoline with Keropur<sup>®</sup> additive has lower cost impact on the consumer due to **better fuel economy**

## Environmental Impacts

- Gasoline with Keropur<sup>®</sup> additive
- Produces less air emissions
  - Conserves fuel and energy resources
  - Lowers toxicity potentials

**Gasoline with Keropur<sup>®</sup> additive has significant **economical and ecological** advantages over non-additized gasoline.**

# Sustainable Development is based on three Pillars



## What is it all about?

- Assessing economic and ecological impact of products and processes
- Analysis of the products from the angle of the end consumer (whole product life cycle)
- Simultaneously optimizes total cost and environmental impact\*
- Standard tool in the BASF Group (more than 300 analyses have been carried out)

\* Social aspects can be included as well.

# Study overview



Eco-Efficiency  
Analysis



Compare environmental impacts and costs between

**1. Gasoline additized with Keropur® additive**

**2. Non-additized gasoline**

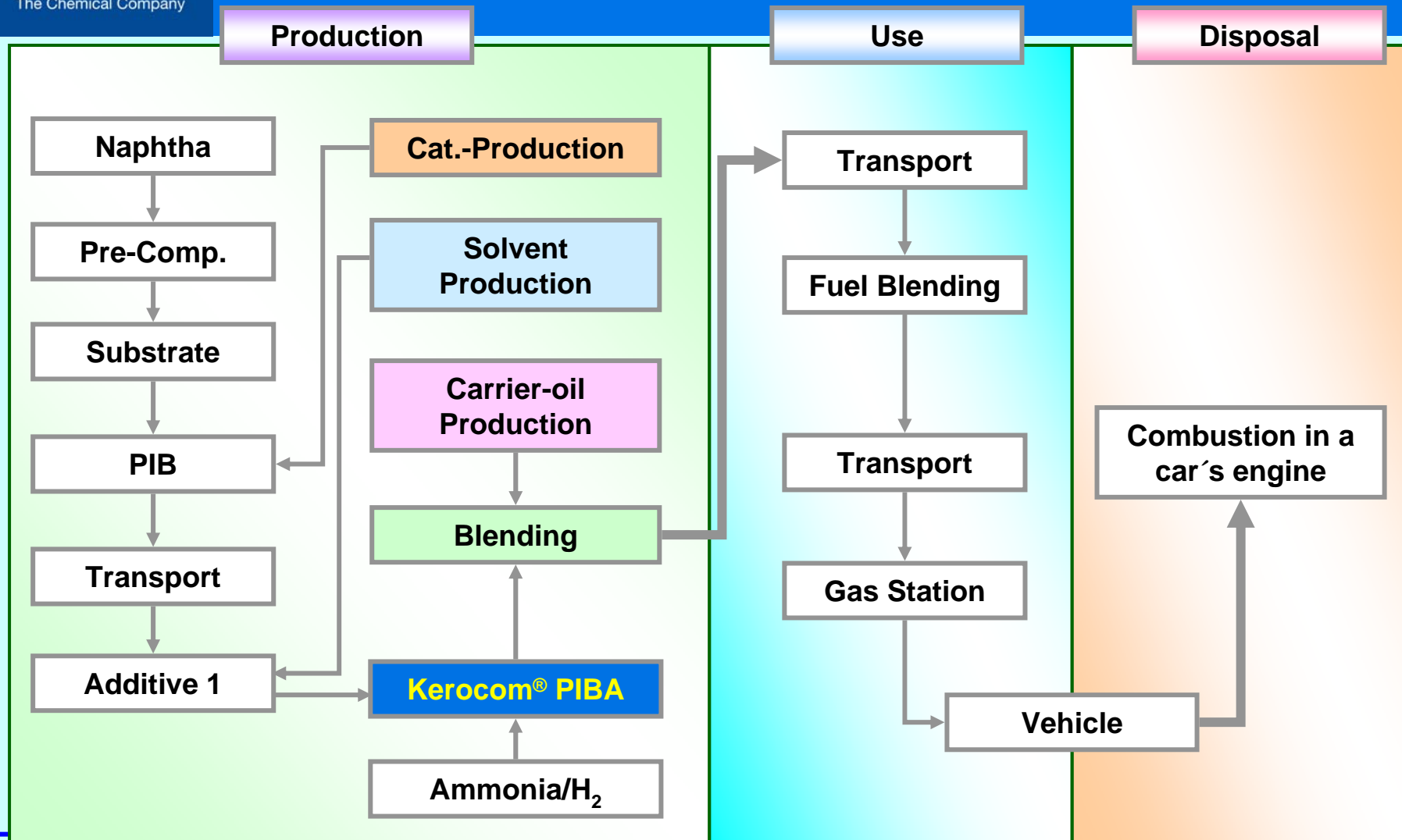
- **The BASF has an leading expertise in the world**
  - **BASF has a high level of competence in sustainability matters and professes itself to sustainable management**
  - **BASF has three competence centers around the world concentrating on this topic**
  - **the BASF-method is unique and has been validated by the TÜV**
  - **BASF cooperates trustfully with governmental departments, NGO's, the UN, the GTZ etc.**



Validated

Eco-Efficiency  
Analysis

# The life cycle view: System boundaries



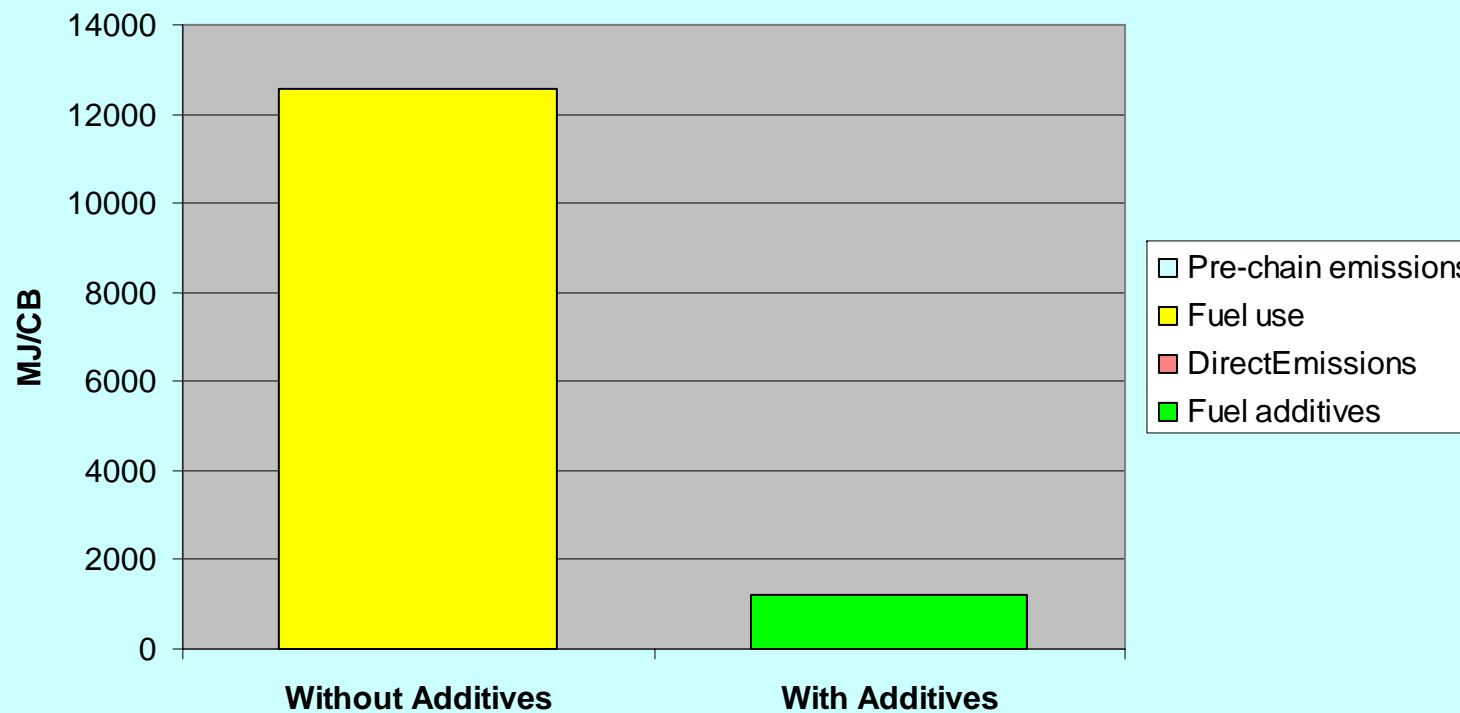
# Environmental results, high performance

# Energy consumption



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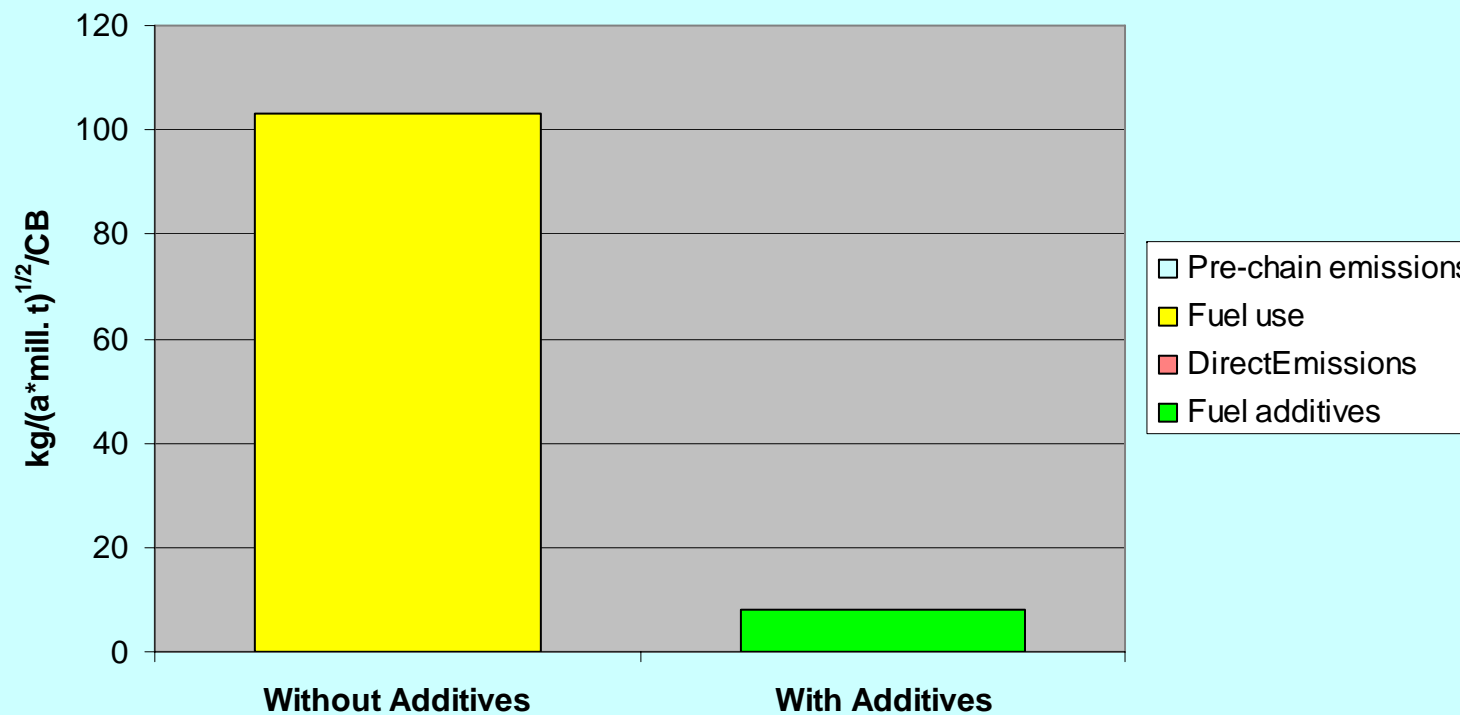


# Resource consumption

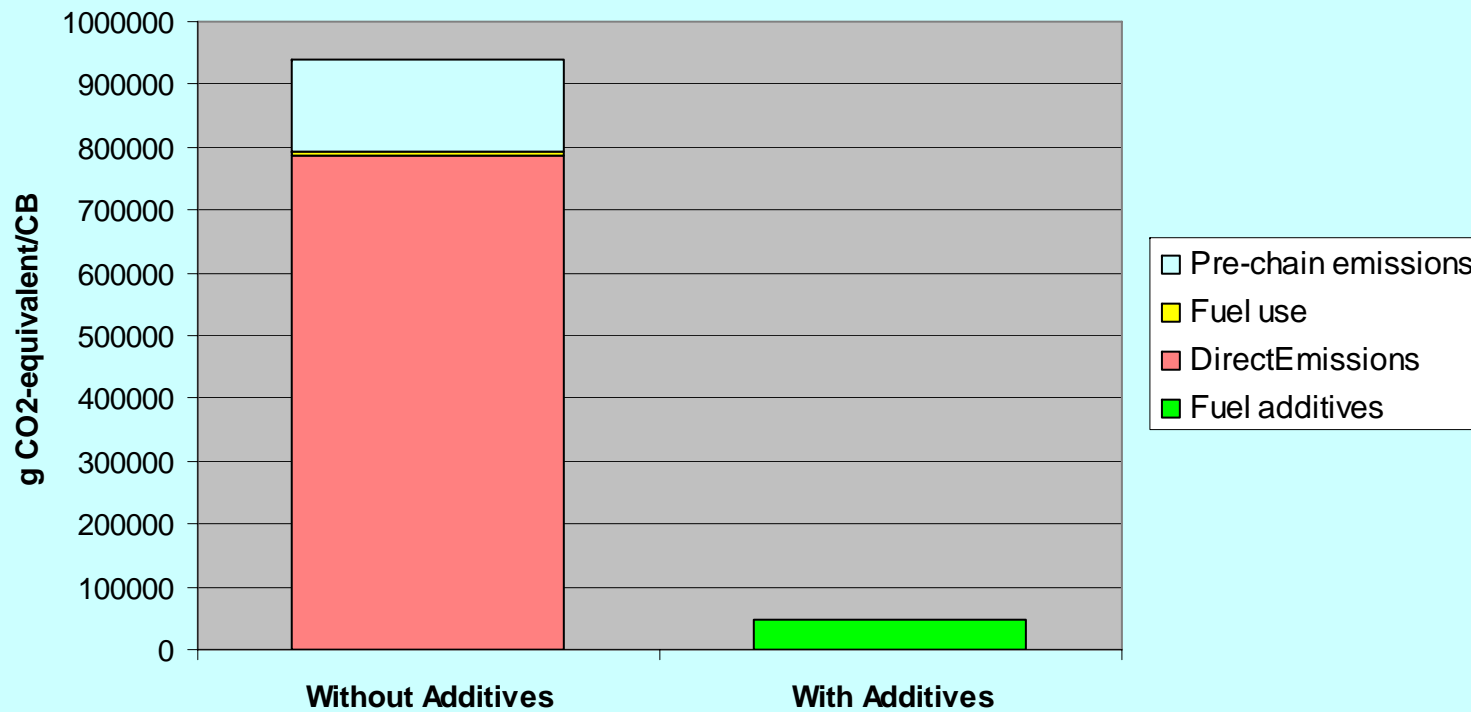


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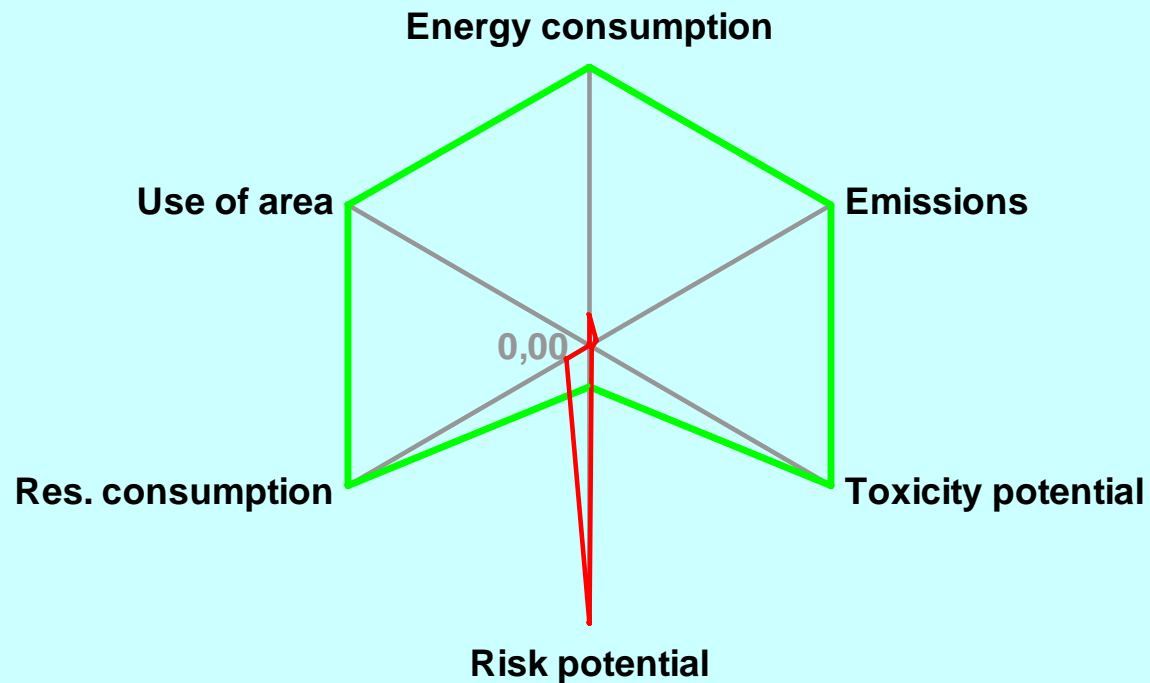
# Air Emissions: Carbon Dioxide



Basis = fuel consumption 8.7 litre per 100km; range 200,000km

## Assessing 6 ecological criteria

1,0 = worst position,  
relatively better position <1

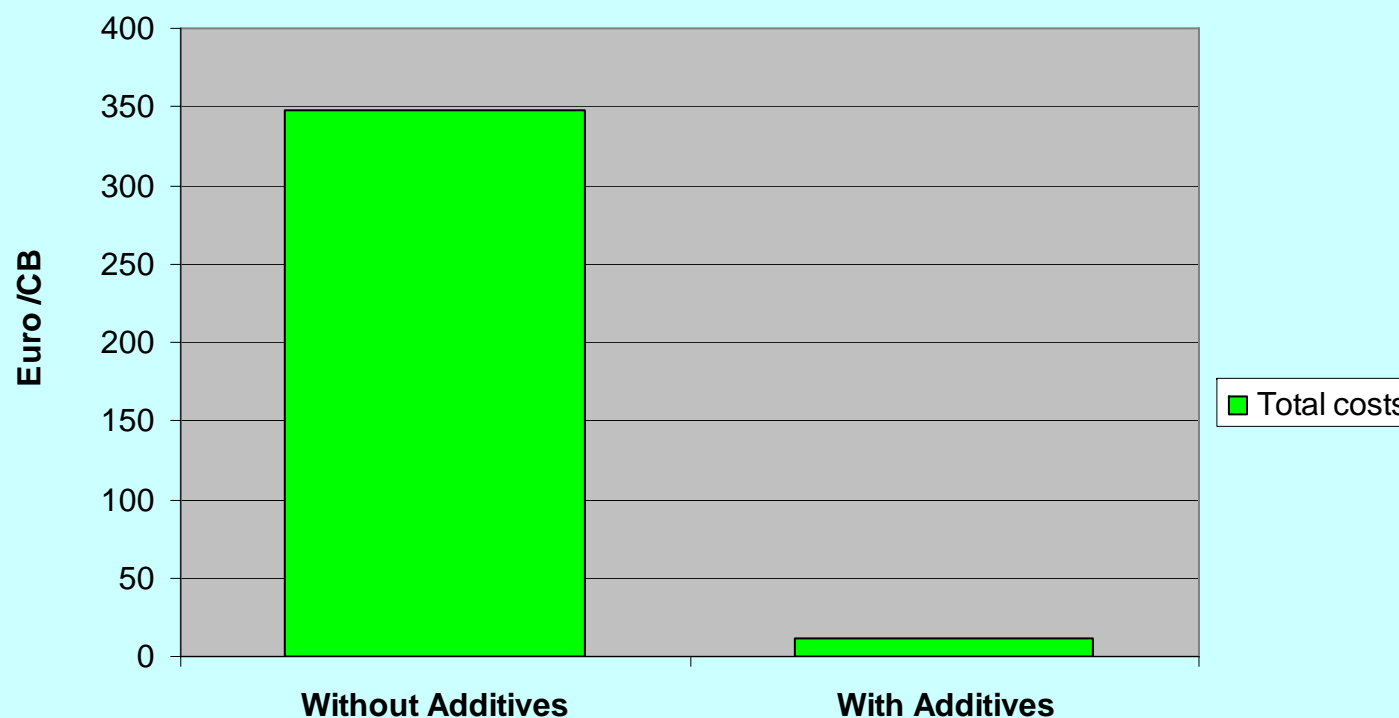


— Without Additives  
— With Additives

# Total costs evaluation



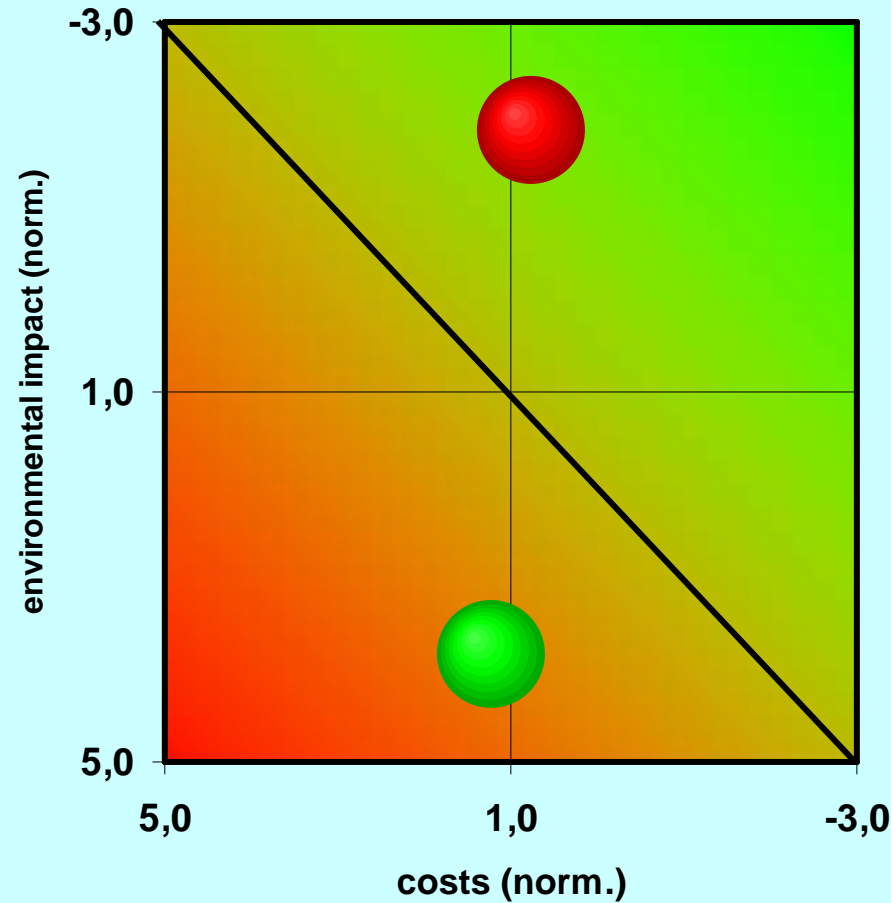
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# Eco-Efficiency Portfolio: Base case



Base case:  
Based on  
improvement in  
fuel economy  
for driving  
200,000km  
Estimated fuel  
price:  
1Euro/litre



- Without Additives
- With Additives

Fuel with Keropur® additive has higher ecoefficiency

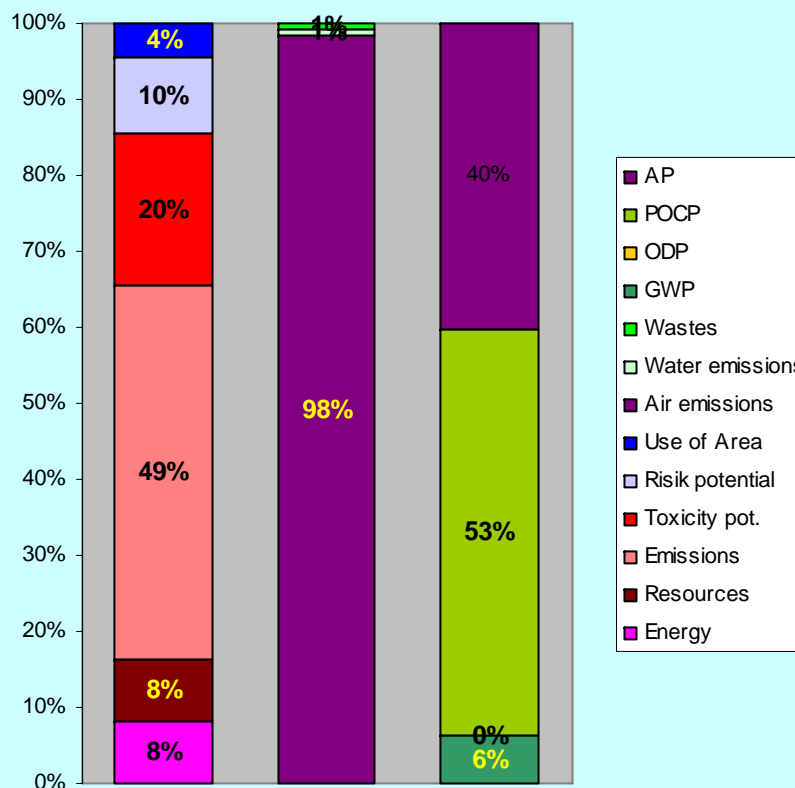
- Distance evaluated: 200,000 km (125,000 miles)
- Fuel consumption (unadditized): 8.7 l / 100 km
- 0.7 % fuel economy gain due to additization
- Adopted reduction of emissions reduction
- Fuel price 1 €/l
- Difference calculating



# Relevance Factors

Air emissions carries a high weighting compared to other emissions

Relevance factors

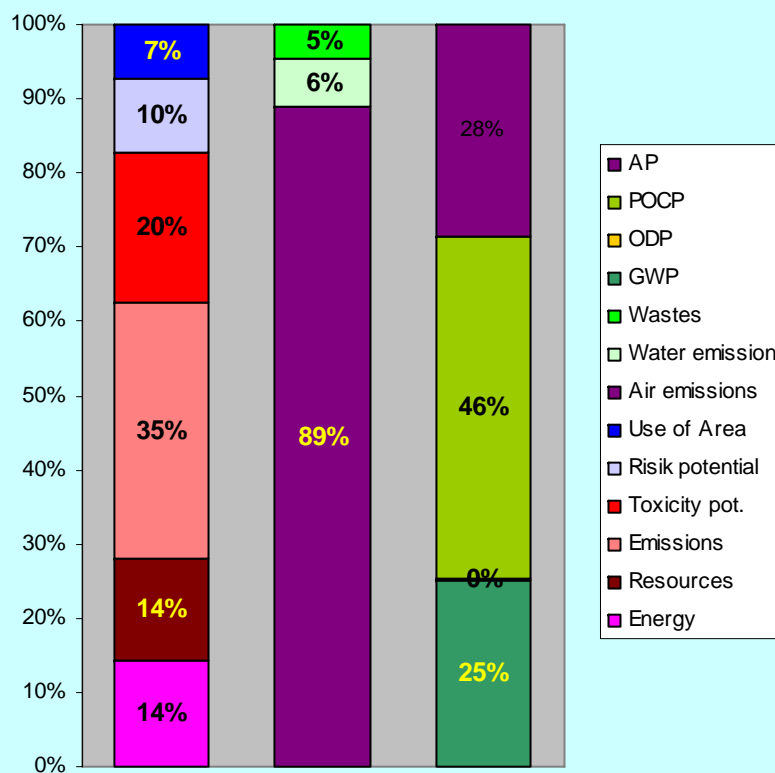




# Calculated Factors

Air emissions carries a high weighting compared to other emissions

Calculation factors



## The competence center of product safety within BASF- your partner in questions of:



- **Eco-Efficiency Analysis, LCA**
- **Sustainability, SEEBALANCE**
- **Eco-Efficiency Internet managing tools**
- **Eco-Efficiency Label**
- **Business Development**
- **REACH**
- **Publications, conferences, Internet-Information**



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

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