Life Cycle Assessment of Flowtite GRP Pipes

Christian Wiedergut

Februar 2018

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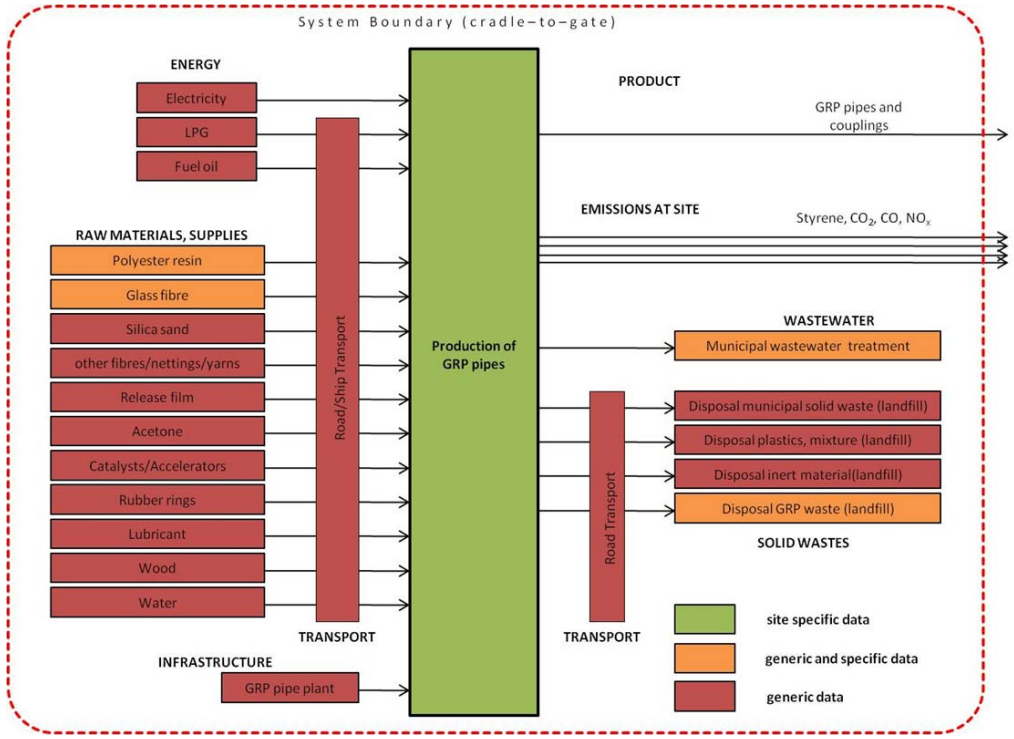
History of LCA-Work

LCA work started in 2009



Data Collection Sheet
LCA Flowtite

RMA
Projektentwicklung · Consulting · Planung · Projektmanagement
Ressourcen Management Agentur GmbH

Data Collection Sheet - LCA Flowtite

Production-Site:

Jear: 2009

All relevant material and energetic in- and outflows of the production site should be described. Their source, quality, quantity and function should be specified as far as possible. The goal of this first data collection is to gain a deeper understanding of the system and to provide a solid basis for further analysis.

P R O D U C T (S) :

Specify the products and by-products which are produced in the facility.

Product, By-Product	Quantity [t/a]	Notes
Total Products produced, Pipes, Couplings, Fittings		
(including Reject) for 2009		

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Life Cycle Assessment was conducted acc. to ISO 14040

- **Cumulative Energy Demand (CED, "Embodied Energy")**
  - **Investigates energy use (primary energy) throughout live cycle, which includes**
    - direct use of energy (e.g. electricity in the production process)
    - indirect („grey") consumption of energy (e.g. energy used for raw material production and transport)
- **Impact Assessment - CML-Method**
  - **Environmental profile, 10 indicators (impact categories)**
    - Abiotic depletion
    - Acidification
    - Eutrophication
    - Global warming ("Carbon Footprint")
    - Ozone layer depletion
    - Photochemical oxidation
    - Human toxicity
    - Fresh water aquatic ecotoxicity
    - Marine aquatic ecotoxicity
    - Terrestrial ecotoxicity

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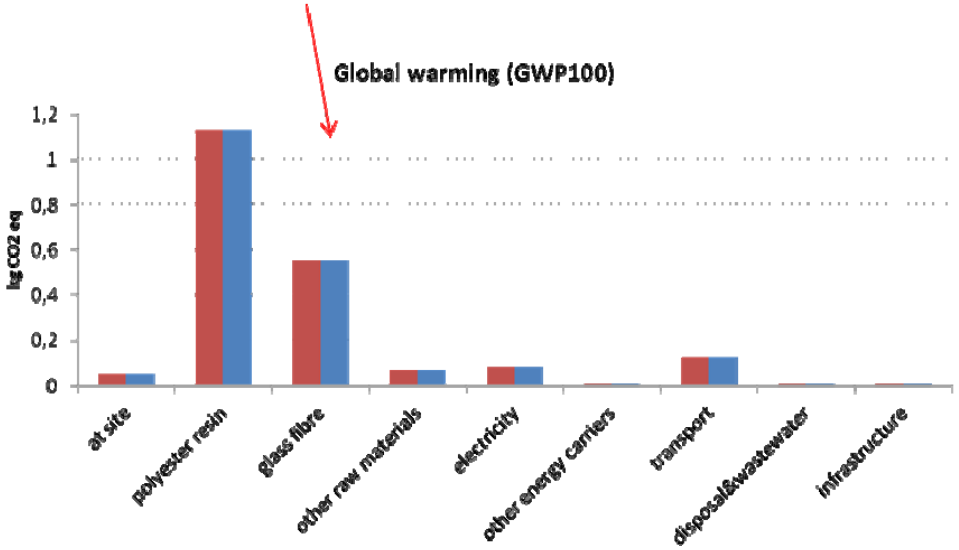
Carbon Footprint

Global Warming (GWP 100)

- anthropogenic emissions of greenhouse gases
- reference substance CO_2 [kg CO_2-Equivalents]
- "Carbon Footprint"

mainly CO_2 emissions from energy conversion and transport processes



Global Warming
(per kg GRP-Pipe) :

2,01 [kg CO2-Eq] (ST+LT)
2,01 [kg CO2-Eq] (ST)

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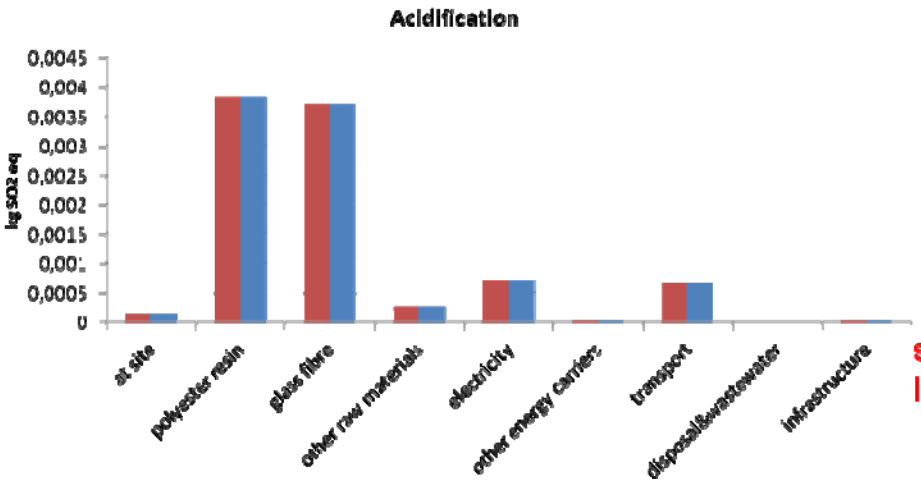
Acidification

Acidification

- decrease in the pH causes forest dieback, nutrient deficiencies, formation of acid lakes, damage of buildings, etc.
- reference substance Sulfur Dioxide [kg SO_2-Equivalents]



Acidification
(per kg GRP-Pipe) :

9,42E-03 [kg SO2-Eq] (ST+LT)
9,42E-03 [kg SO2-Eq] (ST)

shortterm emissions: <100 years
longterm emissions: > 100 years

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Data Quality/Source and related discussions in 2010?

- Ecoinvent Database was used as input source for the Environmental Impact data of Raw Materials > Who is verifying such data-sets? are they upto date/correct?

- From Raw Material suppliers we only got limited information about LCA Data > some suppliers are working currently on their studies, little was published yet....

- Polyester Resin and E-Glass have major influence on the Results (overall about 80%) > this should be applciable for most composite industry > how to get an updated „Reference Data Set" for these two Material Categories to be used for General Environmental Studies of Composite Material ?

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How to declare the Data?

Type I environmental labelling – certified eco-labels

- ISO 14024
- third party certification
- environmentally preferable products within a product category
- based on lifecycle considerations and specific performance levels according to product categories

Type II environmental labelling – self-declared environ. claims

- ISO 14021
- aims at correct and verifiable environmental claims
- no third-party certification
- regulates the use of specific terms (e.g. environmentally friendly, green, recyclable, compostable,…)

Type III environmental labelling – env. product declaration (EPD)

- ISO 14025
- quantified environmental data (LCA and additional environmental information)
- standardised description but no evaluation (no statement if the product is environmentally preferable or not)
- comparison between competing products has to be made by the customer
- specific requirements according to product category rules (PCR)

Establishment of Product Category Rules with National Bodies > not unified/regulated throughout Europe

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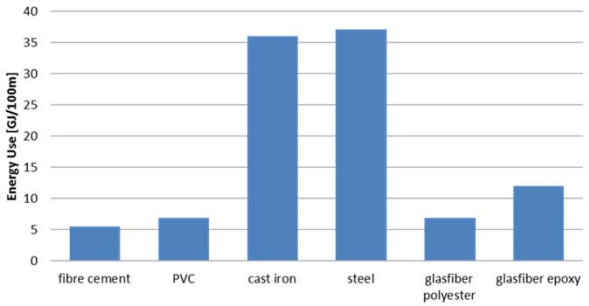
Data Comparison – how to do it?

Association of waternet operators in the Netherlands, 1992

piping system: sewer pipes

Functional Unit: 100m, DN 100

System boundaries: Cradle-to-grave



[KIWA, 1992]

Comparison by European Plastic Pipe and Fitting Association, 1999

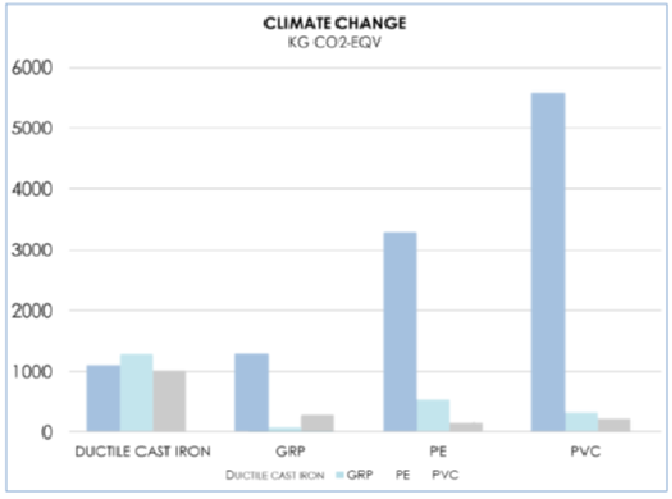
	KIWA	CLAUS-THAL	INTRON	FICU	EMPA	GEBERIT	NORDISKA	GASTEC
PVC	+++	++	+	+	++	++	+++	+++
PE		++		+	++	+++	+++	+++
PP						+++	+++	
PEX								+
ABS						+++		
GRP	++							
CAST IRON	+	++		+++	++	+		+
CONCRETE		+++	+++	+++			+	
CLAY		+++	++	++	++			
FIBRECEMENT	++			++		++		
STEEL	+							+

Qualitative cross check of the results of each material

\+ bad results
++ medium results
+++ good results

SELECTING MATERIALS FOR POTABLE WATER PIPES FROM AN ENVIRONMENTAL PERSPECTIVE
– life cycle assessments of four chosen pipe materials

UNIVERSITETET FOR MILJØ- OG BIOVITENSKAP
INSTITUTT FOR MATEMATISKE REALFAG OG TEKNOLOGI
MASTEROPPGAVE 30 STP. 2012



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Comparison of LCA Studies;

- A number of different Studies were conducted over the years to compare pipe materials - following different Methodology's, Standards and Assumptions > very different and sometimes contradictory results were achieved;

- LCA Comparisons and critical reviews can be done in accordance with ISO 14040 and ISO 14044;

- When comparing LCA data of different products > a "Critical Review Panel of interested parties" has to be formed;

- Still the comparison topic is discussed within the industry and authorities > how to carry out a "fair" comparison > set (assumed) comparison criteria's and weighting of certain factors can have a large impact on the results (e.g. Transport Distances, Installation scenarios, Predicted Life time, Maintenance) etc.

Current Status

Where have we reached – summary?

- ❑ Flowtite-LCA was updated using European Average Environmental Data for main Raw Materials > Glass Fiber and Polyester Resin
- ❑ Flowtite-LCA was critical reviewed by **thinkstep** one of Europe's leading LCA consultants;
- ❑ The updated EPD-Report is now available at Amiblu/Flowtite;
- ❑ Amiblu is now working on a Calculation Tool to produce tailored EPD-Declarations for specific projects;
- ❑ Amiblu participates in different European Workgroups, including TC155/WG27 > PCR Standard for Plastic Pipes is in final stage

thinkstep

FLOWTITE
ENVIRONMENTAL PRODUCT DECLARATION (EPD)

Flowtite® Pipe Systems are the first choice for the Environment:

- Light weight and easy to install
- Corrosion Resistance
- Outstanding Service Live
- Leak- and Maintenance free Operation
- Low Energy Production Process
- Recyclable

CompoCycle

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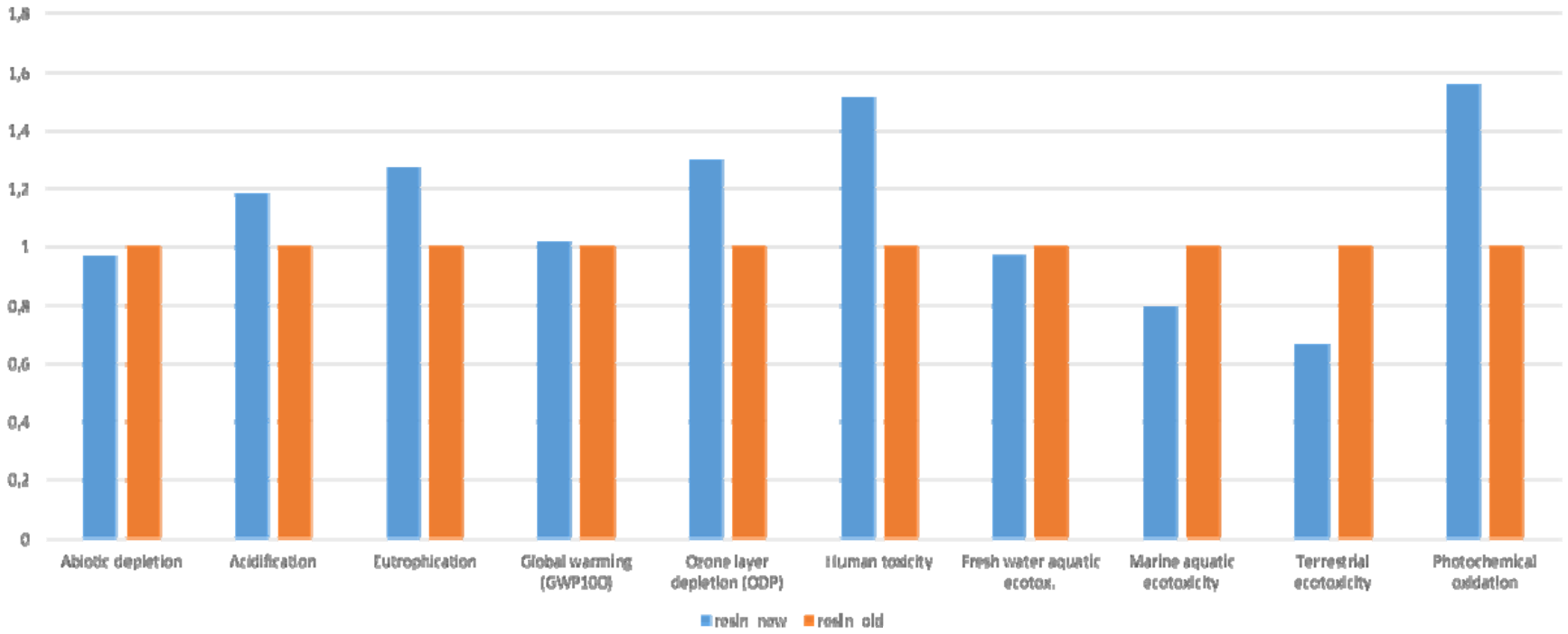
Updated LCA-Study

New data for polyester resin



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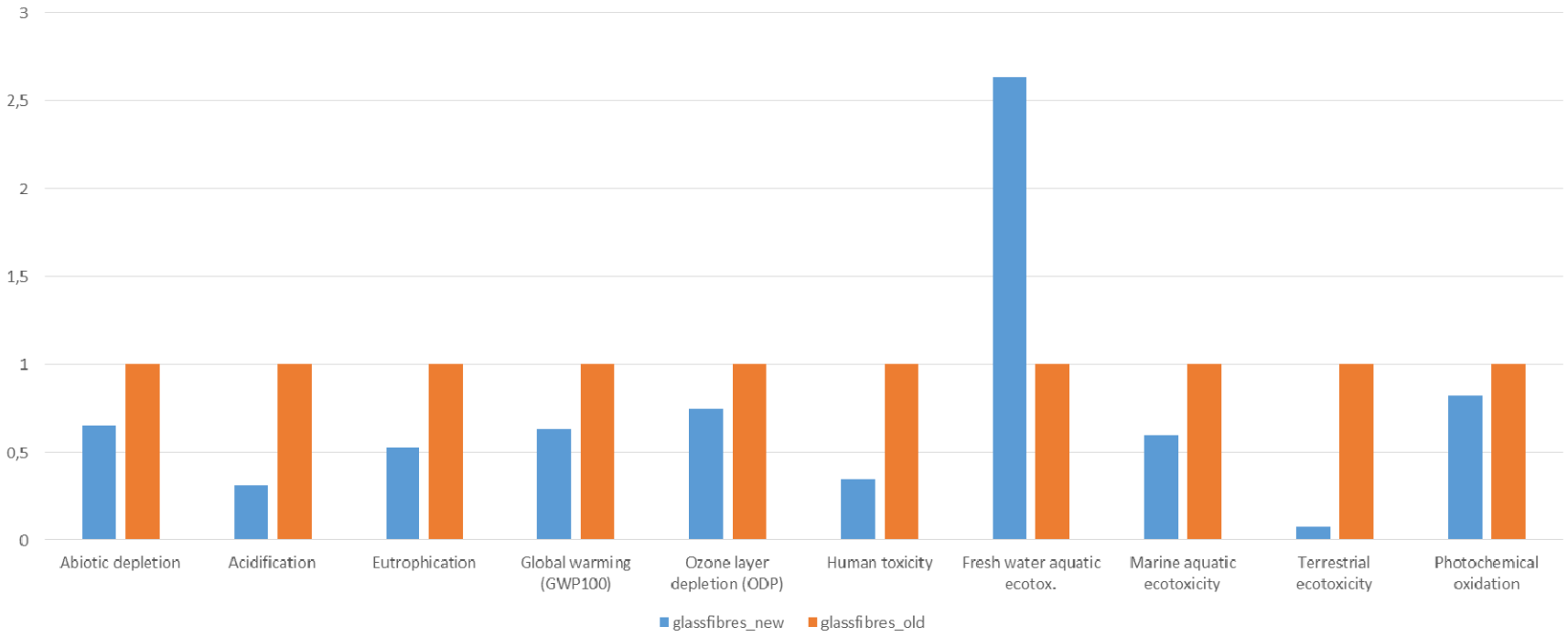
Updated LCA-Study

New data for glassfibres



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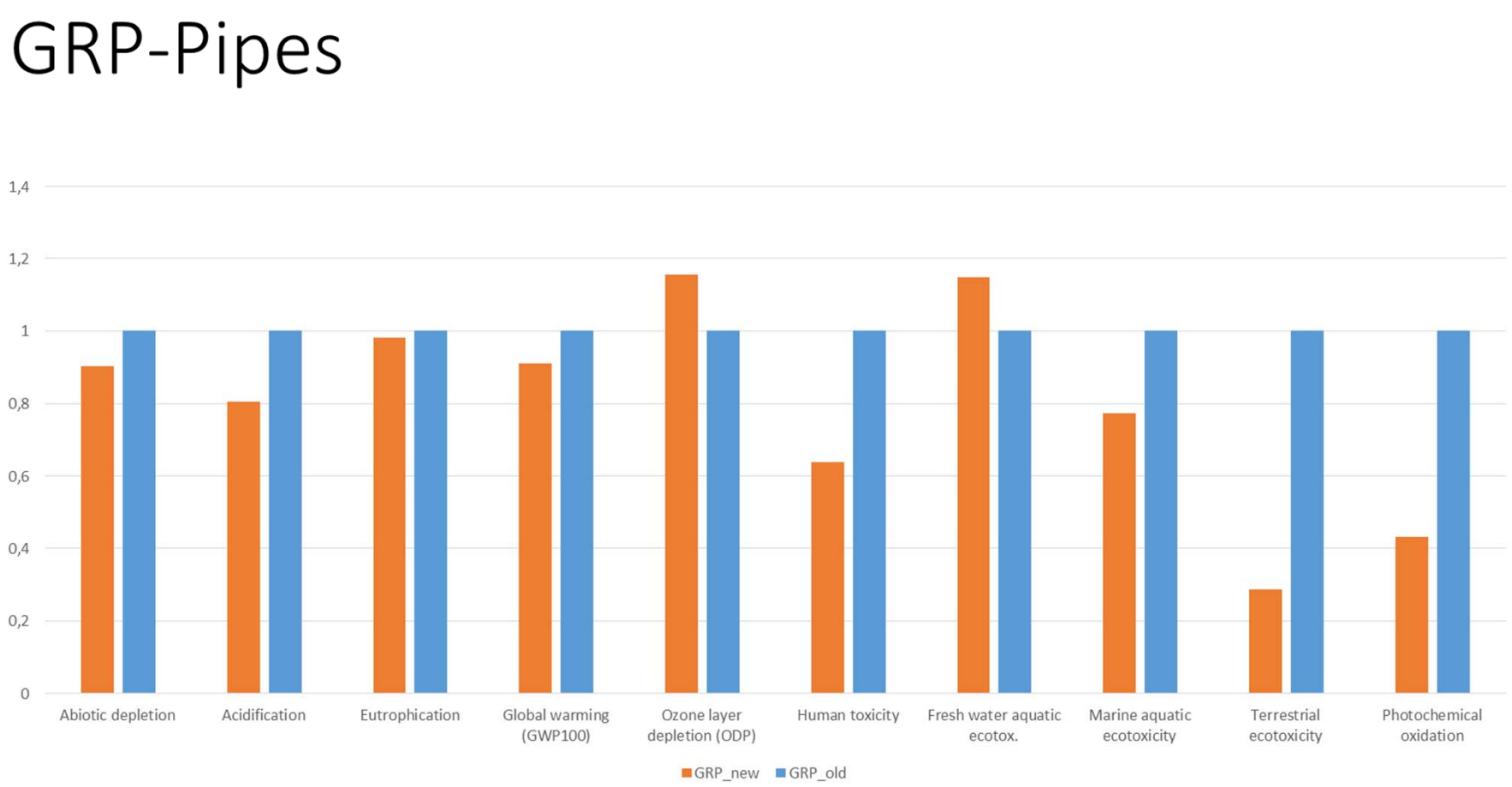
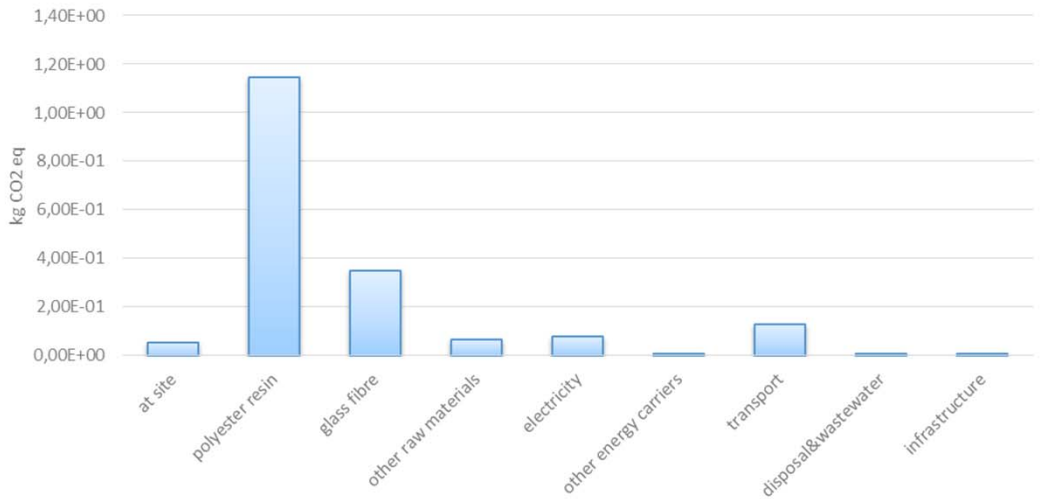
Updated LCA-Study



Updated LCA-Study

Global Warming (GWP 100)

- anthropogenic emissions of greenhouse gases
- reference substance CO2 [kg CO2-Equivalents]
- “Carbon Footprint”
- mainly CO2 emissions from energy conversion and transport processes



Global Warming :
(per kg GRP-Pipe) :

1,83 [kg CO2-Eq]

(old: 2,01 [kg CO2-Eq] -9%)

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Updated LCA-Study

Conclusion

- in all considered impact categories **polyester resin** is clearly the largest contributor to the environmental impact of GRP-pipes. contribution of the other main raw material, **glass fibre**, is significantly smaller
- **Energy consumption** at the production site and the transport of raw materials to the factory does not have a very large influence on the environmental impact.
- **Process emissions** at the factory (mainly styrene emissions) play a significant role in one impact category (photo chemical oxidant formation). In all other impact categories they only play a minor role.
- Looking at the whole lifecycle of a GRP pipe (**cradle-to-grave**) the LCA results are dominated by the impact of the pipe production process (cradle-to-gate results). Transportation (factory to construction site; construction site to sanitary landfill) only plays a minor role.

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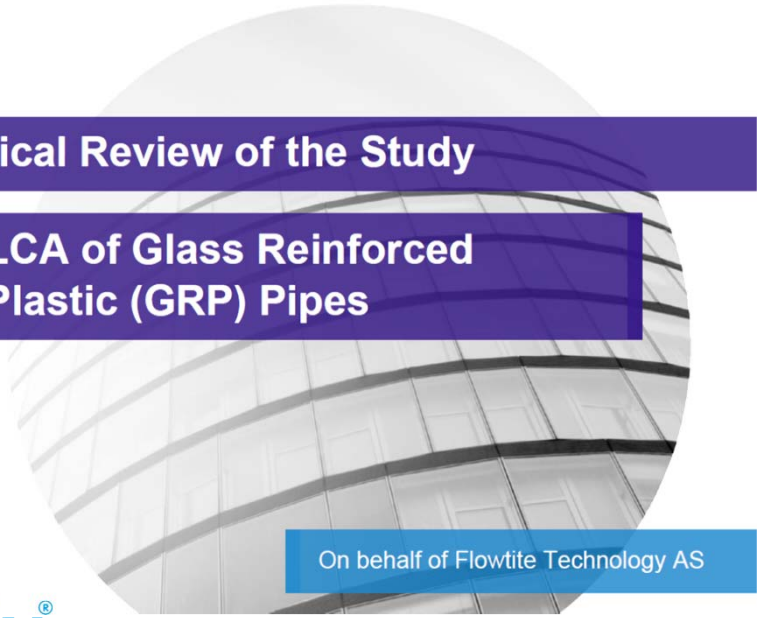
LCA-Study Critical Reviewed



Critical Review of the Study

LCA of Glass Reinforced Plastic (GRP) Pipes

On behalf of Flowtite Technology AS

thinkstep

5. Conclusion

thinkstep

The study has been carried out in conformity with ISO 14040 and ISO 14044. The critical reviewer found the overall quality of the methodology and its execution to be of a high standard for the purposes of the study. The study is reported in a comprehensive manner and includes appropriate and transparent documentation of its limitations in scope.

Adolf Daniel Merl

21st May 2015

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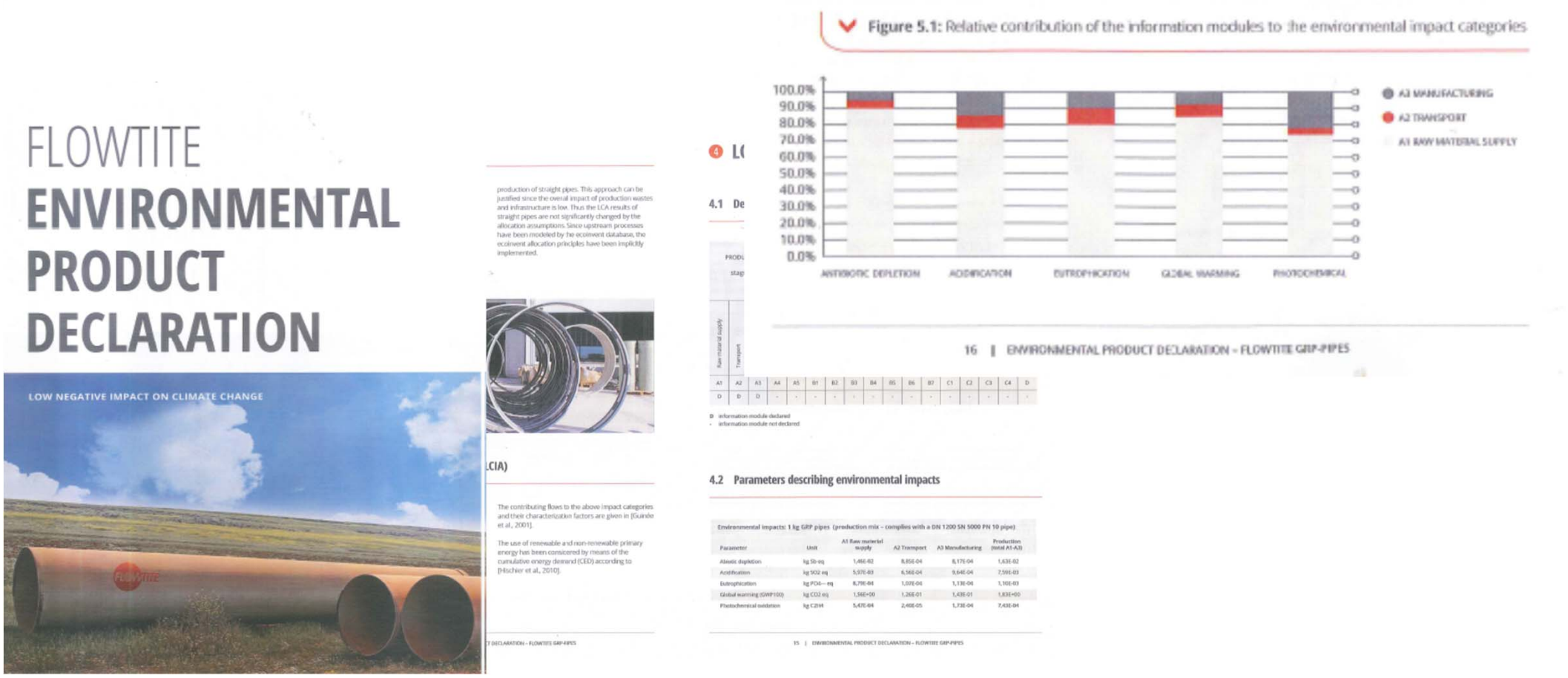
Environmental Product Declaration (EPD)



Work on Calculation Tool for EPD-Data

Input

Pipes

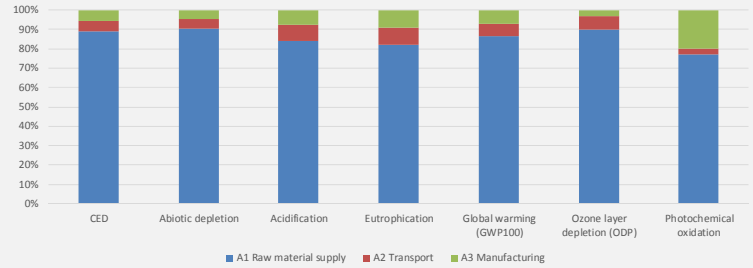
DN	350
PN	15
SN	5000
pipe produced in	Europe

Project Data

project length	100	m
pipe length	10	m
Number of couplings	10	

Project Results

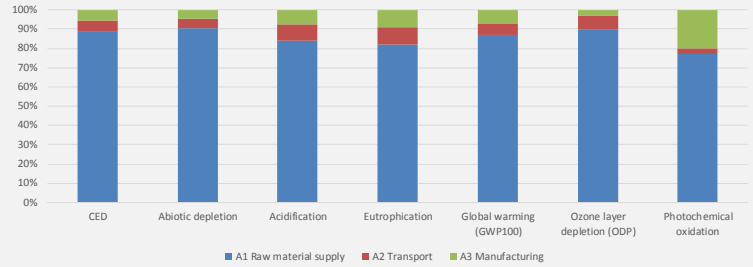
Results - pipe [per m1]



Results - pipe [per m1]

	CED	Abiotic depletion	Acidification	Eutrophication	Global warming	Ozone layer depletion	Photochemical oxidation
	MJ/m1	kg Sb_{eq}/m1	kg $SO_{2\,eq}$/m1	kg $PO_{4\,eq}$/m1	kg $CO_{2\,eq}$/m1	kg CFC-11 $_{eq}$/m1	kg $C_2H_{4\,eq}$/m1
A1 Raw material supply	7.234	3,25	1,30	0,149	330	4,01E-05	0,100
A2 Transport	299	0,13	0,09	0,015	18	2,72E-06	0,003
A3 Manufacturing	27	0,01	0,03	0,009	9	2,00E-07	0,020
Total	7.560	3,38	1,42	0,173	356	4,30E-05	0,124

Results - project [total]



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Participation in CEN-TC 155 – WG27

DRAFT

ÖNORM

EN 16903

Edition: 2015-09-15

Plastics piping systems — Sustainability of construction works — Product Category Rules (PCR) for buried plastics piping systems

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Challenges in the Market

- Different Requirements from Customers (what Eco-Data's are needed?)
- Product Comparison is not standardized – „tailored" and „sponsored" comparison-reports are creating challenges
- Country Specific Systems (e.g. Netherlands > Cradle to Cradle Certification, CO2 Performance Ladder…)
- PCR-System is still somehow run by „National" bodies;
- Other Environmental Declaration Systems are currently discussed (also on EU-Level);
- Declared Values/Reports are copied by Competitors and presented as "Generic Results"
- Recycling of GRP > Solution in the Cement Industry currently only available in Germany
- Specific Data from a lot of Raw Material Suppliers not yet available

THANKS for your ATTENTION

www.flowtite.com

www.amiblu.com