







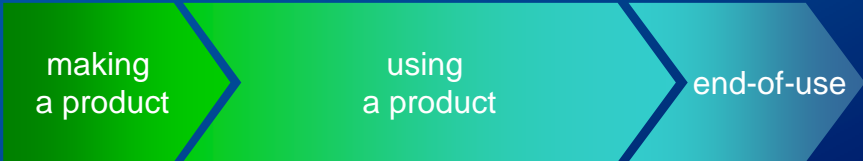
Ben Drogd

- Aerospace Engineer (MSc), Tech. University of Delft, Netherlands
- 25 years in R&D and Business Management positions at DSM
- Since 2010 Owner and Independent Consultant of BiinC
- Since 2009 involved in Sustainability Groups of EuCIA, AVK and CompositesNL






The life cycle of a composite part



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graph LR; A[making a product] --> B[using a product]; B --> C[end-of-use]
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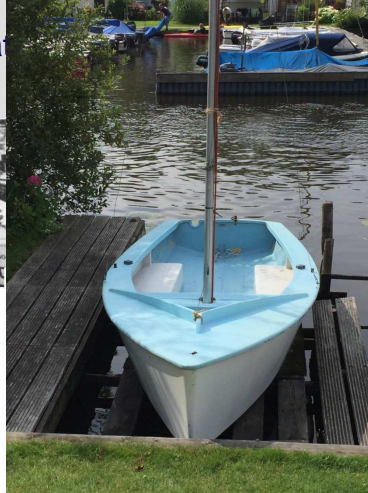
End-of-use Solution are Required

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Composite materials are not always the best solution at the time.....



Source: Eric Green Ass.



launched in 1952

10 Year Tests	20 Year Tests
5990	6140
1	10
12200	12210
2	10
9410	10850
1	10
6560	6146
3	10

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End-of-use Solution are Required

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..... composite products sometimes not



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End of Use in Perspective



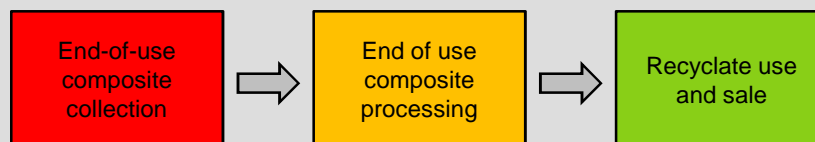
- Composite production in EU is 1.118 ktons in 2017
- Total waste production in EU is 2.515.110 ktons (2012)
- Composite production is less than 0,05% of total EU waste production

[illegible]

http://ec.europa.eu/eurostat/statistics-explained/images/b/b1/Waste_generation_by_economic_activities_and_households%2C_2012_%28thousand_tonnes%29_YB15.png



Important for Recycling of Composites



Logistics

Technology

Application development

Revenue

Costs

Revenue

Eco-costs

Eco-costs

Eco-revenues



End-of-use Solutions Are Available

- Re-use of parts (in same or different application)
 - Design for re-use/design for dis-assembly
- Re-use of material
 - Use of composite: University of Applied Science Windesheim
 - Separation by pyrolysis, solvolysis or mechanical
- Recovery of energy
 - Incineration; glass fiber residue is an issue
- Landfill
 - Inert waste but temporary solution, not sustainable

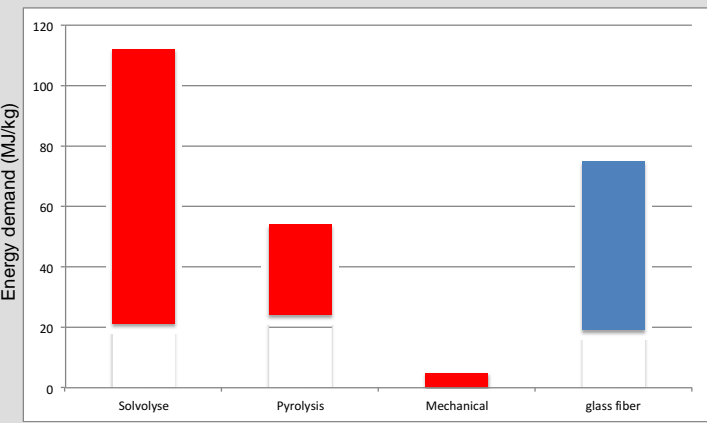




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Eco Impact of Recycling


Energy demand of recycling of composites



Recycling Method	Energy demand (MJ/kg)
Solvolysis	~110
Pyrolysis	~55
Mechanical	~5
glass fiber	~75

Source: recycling brochure Composite UK, 2016





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End-of-use Solutions Are Available

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End-of-use Solutions Are Available

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Example of Commercial End-of-Use Solution

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neocomp



collection and
on-site size reduction
of used rotor blades



rotor blade pre-prep.
in an environmentally
friendly way



residue-free thermal
& material utilization

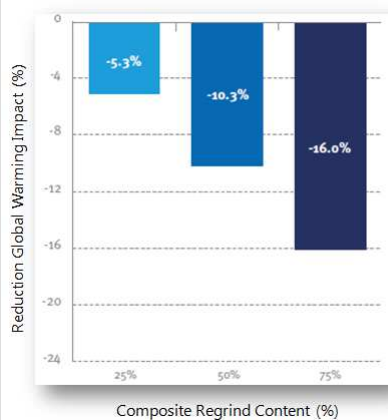


re-use e.g. in foundations
of wind power plants

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Example of Commercial End-of-Use Solution

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"In certain production processes such as co-processing, waste can be used in an operation combining two waste management recovery options at the same time. The energy content of the waste is recovered (R1 operation) as thermal energy, thus substituting fuels, while the mineral fraction of the waste can be integrated (hence recycled) in the matrix of the product or material produced, e.g. cement clinker, steel or aluminium [...]" (Subchapter 1.4.5).

Source: Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, European Commission, June 2012

Model developed with Swiss Federal Institute of Technology (ETH) in Zürich (reviewed by industry experts), analysis carried out by Holcim and DSM/Aliancys LCA experts

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Sustainability is Driver for Choice for Composites

- Composites are the unique material for renewable energy generation
- Composite contributes to lower energy consumption
- Composites require low maintenance and have a long life time

Three images are stacked vertically on the right side of the slide, demonstrating the use of composites in various industries. The top image shows several white wind turbines against a blue sky. The middle image shows a blue and white commercial airplane in flight. The bottom image shows a white naval ship with the number '1862' on its hull. In the top right corner, the 'BiinC' logo is displayed with the text 'composites innovations sustainability' below it. In the bottom right corner, the 'EuCIA' logo is shown with the text 'European Composites Industry Association' below it.

Landmark 1: Wind Turbines

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A 2 MW wind turbine produces 31x the energy it costed to be produced

(LCA Vestas V110)

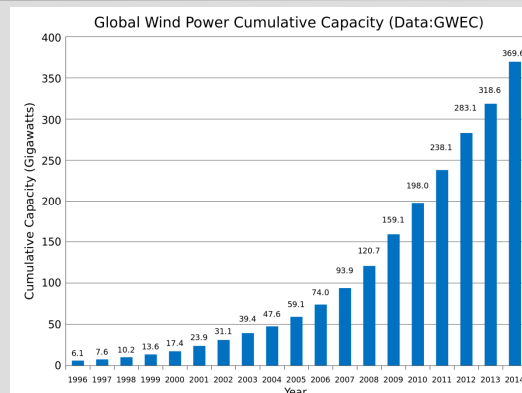
The composite blades of wind turbines produce 6 times the energy that is used to produce all composites in the world

Composites are the unique applicable material for the production of windmill blades; the increasing size of blades require new and higher performance materials

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Composites for Wind Energy: the Material of Choice

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Special Materials for New Renewable Energy Sources

1,2 MW turbine in the Oosterschelde, NL

Landmark 2: The Boeing 787 Dreamliner

Advanced Composite Use

- carbon laminate
- carbon sandwich
- other composites
- aluminum
- titanium
- other

20% better fuel economy
44-65% less maintenance hours

Landmark 3: The BMW i3

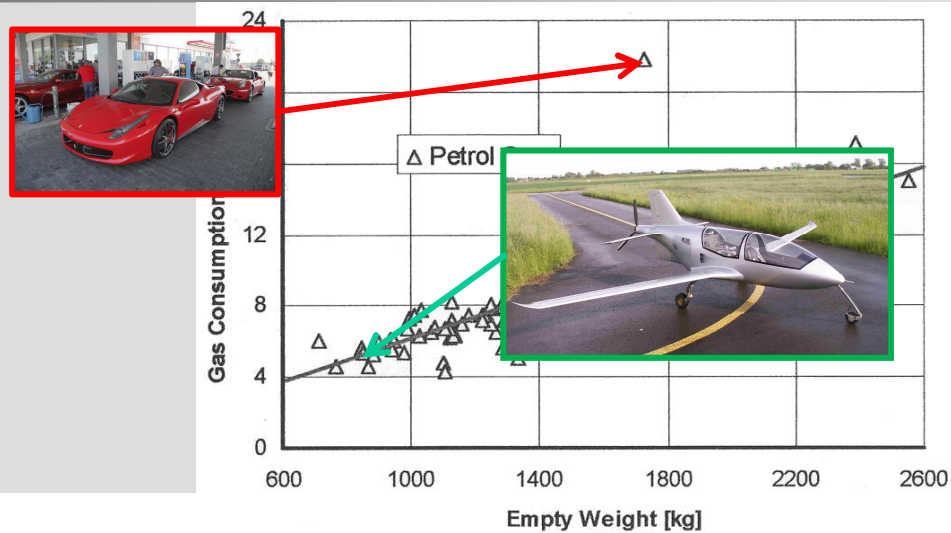
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Weight Reduction Helps

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- The ultimate low emission vehicles

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Landmark 4: the Spieringsluis, NL

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Low traffic interruption due to
very quick installation
=
reduced environmental impact

posite
ring

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Landmark 5: the Eye Catcher Building

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Sustainability is Driver to Use Composites

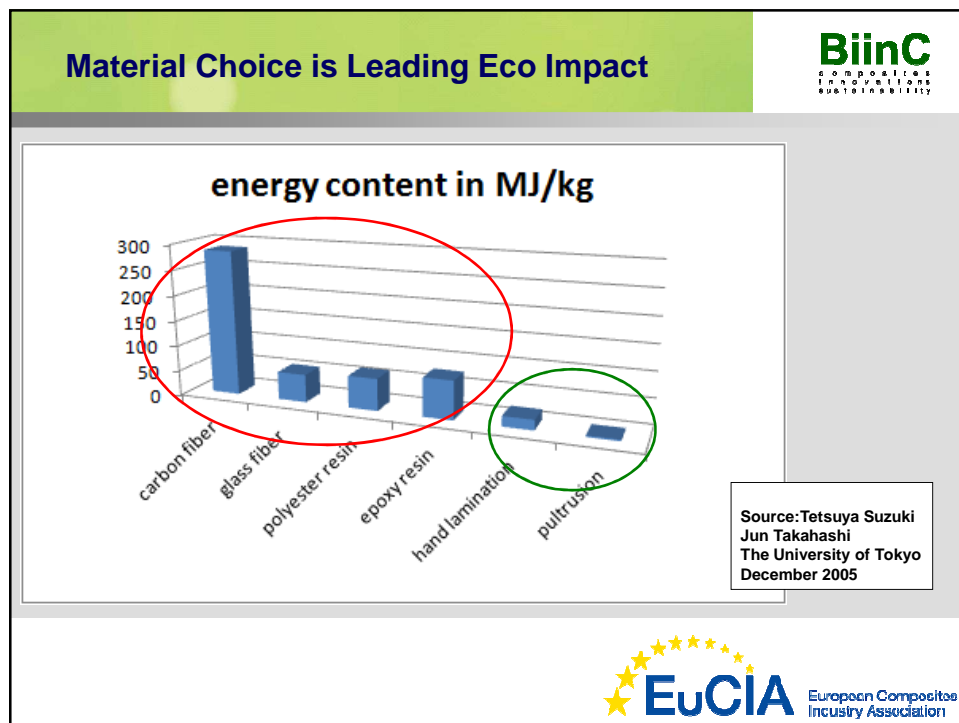
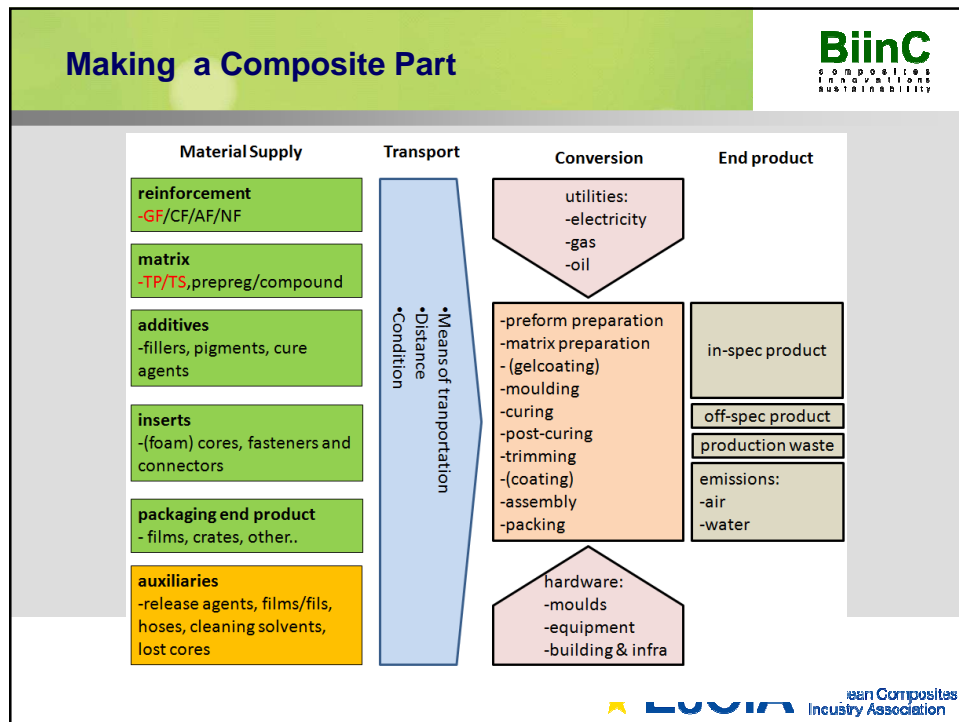
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In all “Landmark examples” sustainability was one of the drivers to chose for compositess


- Wind turbines: composite are the only material that meet the mechanical and production requirements for blades
- Aircrafts: lower fuel consumption due to lower weight and better aerodynamics
- Cars: lower weight to compensate for bateries and extend range
- Building and Infra structure: low maintenance and long life time reduce the environmental impact of buildings and constructions

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Environmental Design




“New” approach towards sustainability

- Design and engineer for minimal Life Cycle Impact
 - Durability: double life time = half the eco impact
 - Optimal design for lowest impact all phases: balance
- Design for re-use
 - Define “second life” in design phase
 - Make second-use part of the business case (cost vs. value)
- Design for disassembly
 - “Make it easy”
 - “Make waste collectible”







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EuCIA's Eco Calculator



- EuCIA decided to develop an Eco Calculator Tool for calculating the impact of the production of composites parts:
 - Raw materials
 - Production processes
 - Web-based tool with "intuitive user interface": the average professional is able to generate the Eco Impact data of a composite part
- The Eco Calculator allows the industry to quantify the the manufacturing part of the "balance"
- Input for further Life Cycle Assessment



EuCIA's Eco Calculator



ECO IMPACT CALCULATOR for composites

Welcome

This is the trial version of the EuCIA Eco Impact Calculator for calculating the environmental impact of your composite products from cradle-to-gate: from the raw materials up to the point-of-sale. Users can calculate, save and export the environmental impacts of as many different composite products and components as they seem fit.

The Eco Impact Calculator incorporates a pre-defined set of materials and processes. It also allows the user to enter own data, generating a more precise result for individual composite producers. A report in pdf-format can be generated that summarizes the impact of the composite product under study.


The Eco Impact Calculator will be offered free of charge until Juli 2017.


The materials and processes are under continuous review for quality and consistency, and new data is added to expand and improve the tool. If you are missing certain crucial materials or processes, please do not hesitate to contact us. We sincerely hope that the Eco Impact Calculator can help you and the composites industry to face the opportunities and challenges ahead.


....to be presented this afternoon!





EuCIA's Eco Calculator













To Summarize



- End-of use solutions are available for composites and improved solutions are under development
- Sustainability in the use phase is key driver to select composites
- The balance between the environmental impact in all phases is very important: quantified comparisons
- The EuCIA Eco Calculator for production of composite parts enables the industry to make the right choices





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Thank you for attention



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