manufacturing + engineering week

NEC BIRMINGHAM | 6-10 JUNE 2022

Net-Zero Enabling Lightweight Technology for Mass Production

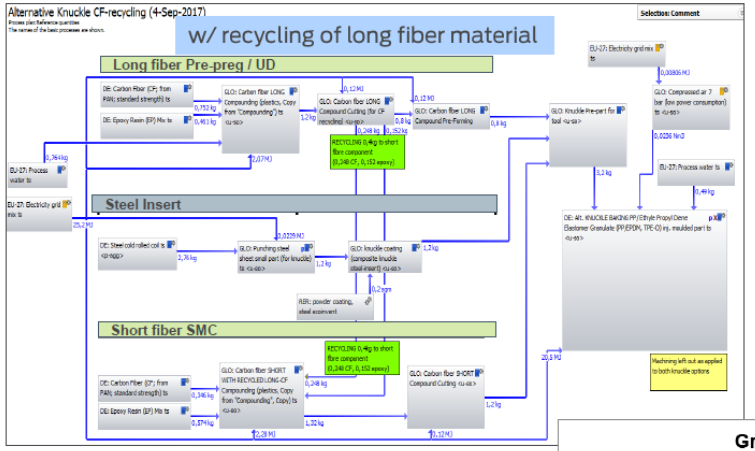
Alan Banks, Ford Motor Company

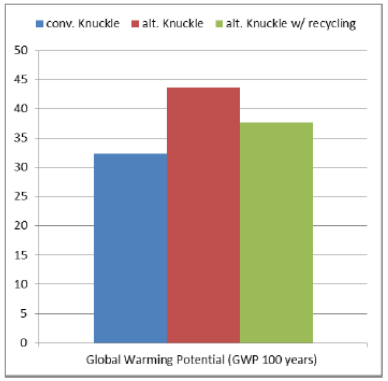
CLASS Project

- SMC, prepreg and steel (over-moulded by SMC)

Composite Lightweight Automotive Suspension System

Life Cycle Assessment of a Composite Knuckle (cont.)

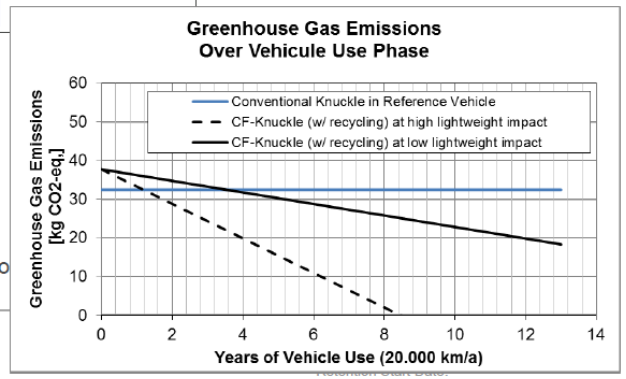


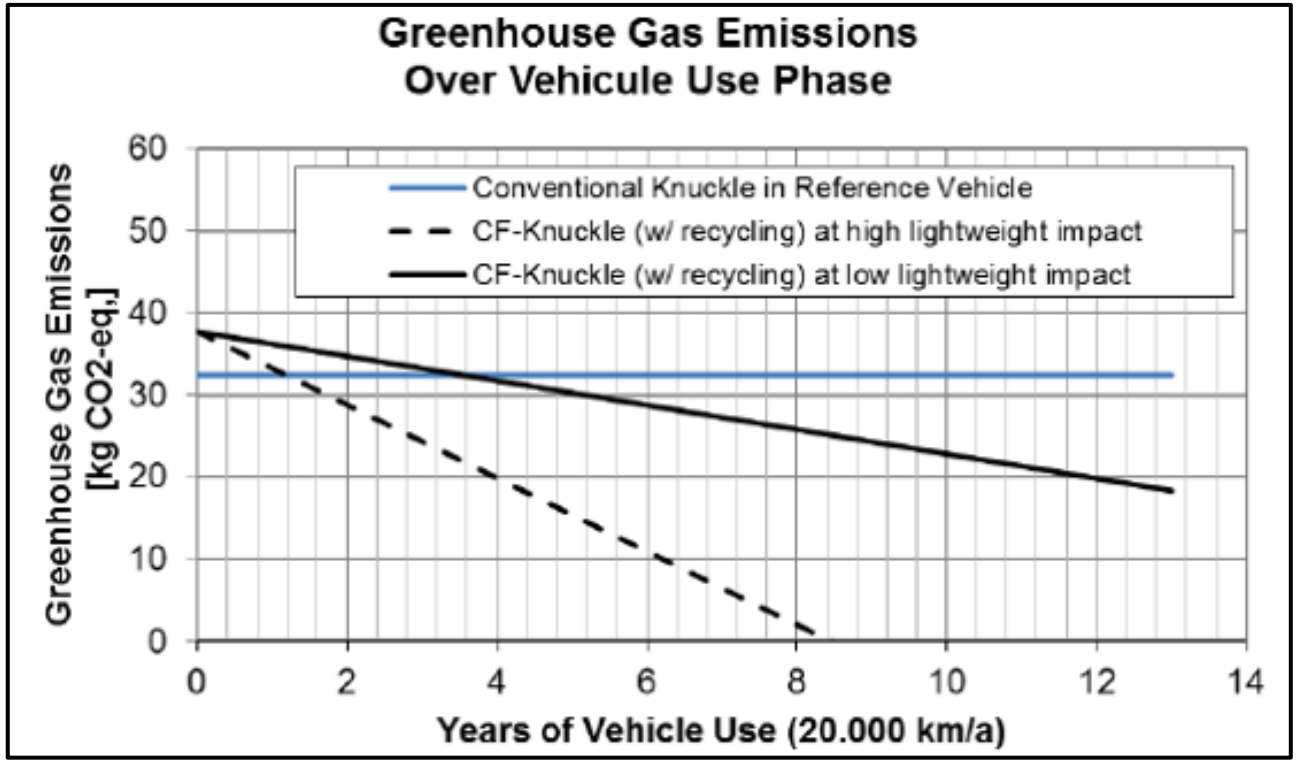


Result:

- With the current knuckle the greenhouse gas emission (CO_2) will increase with manufacturing
- After ~ 7 years in use the break even point is reached (worst case)
- Using the car 10 years will lead to a reduction of 10kg CO2

- Recycling of long fiber material in the process will lead to a break even point after ~ 1 year of usage





When this LCA was performed, a sustainable method of re-using the long fibre waste and disassembling the different materials was unknown

Composite Hybrid Automotive Suspension System Innovative Structures

Front Subframe

Steel Component

21.1 Kg

Hybrid Concept

12.7 Kg

Hybrid Component

12.5 Kg

Flax Component

12.1kg

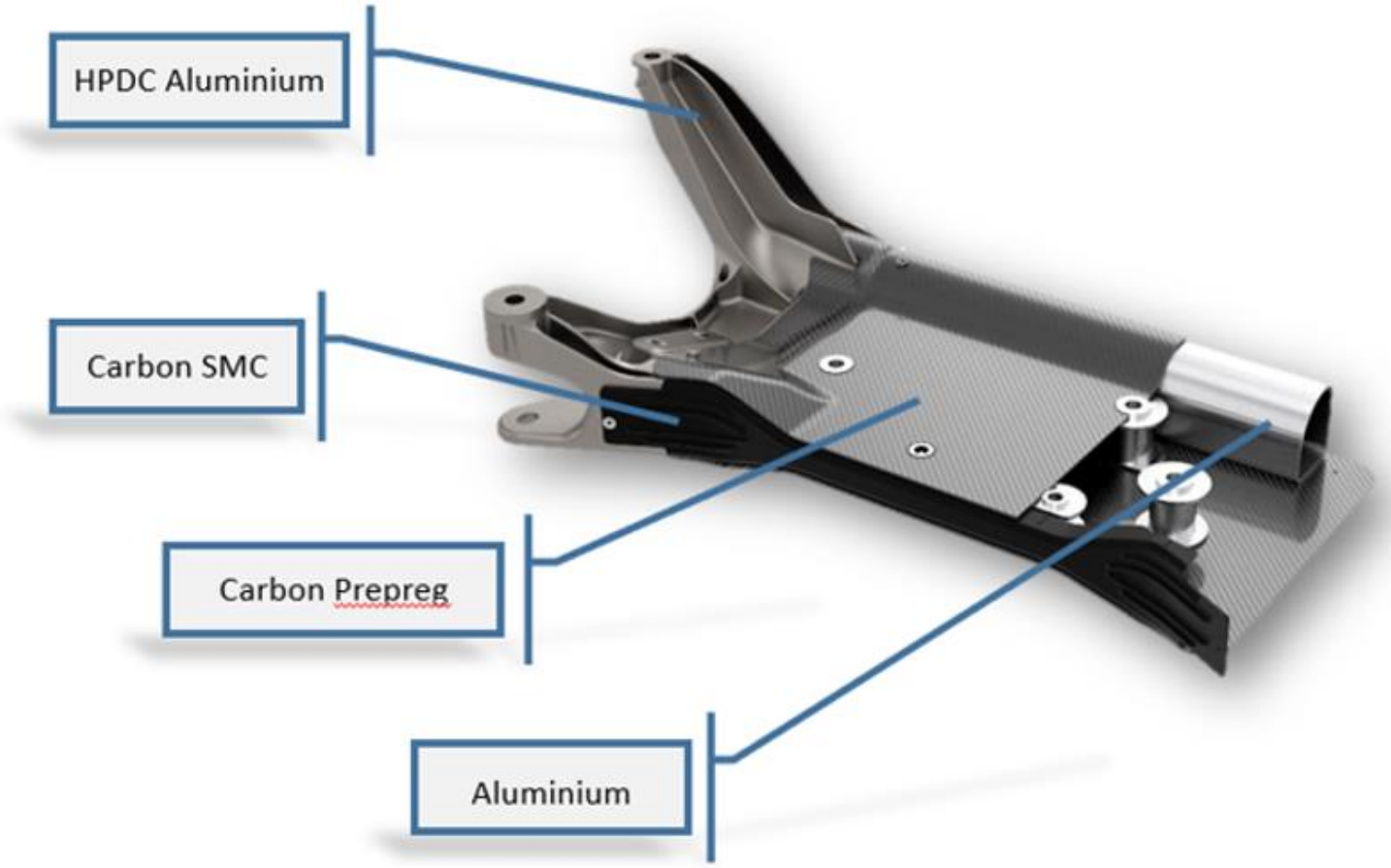
40.7 % weight save

42.7 % weight save

Composite Hybrid Automotive Suspension System Innovative Structures

Front Subframe

- Hybrid Material construction
- 18 fewer components in assembly
- **Innovation**
  - Right material right place
  - Alloy load paths for strength loads
  - Optimised Layups for cost / weight
  - Designed for Adhesive bonding
  - Designed for tolerance



Processes : HPDC, Extrusion, Forging, Compression moulding, Machining…

Composite Hybrid Automotive Suspension System Innovative Structures

Front Control Arm

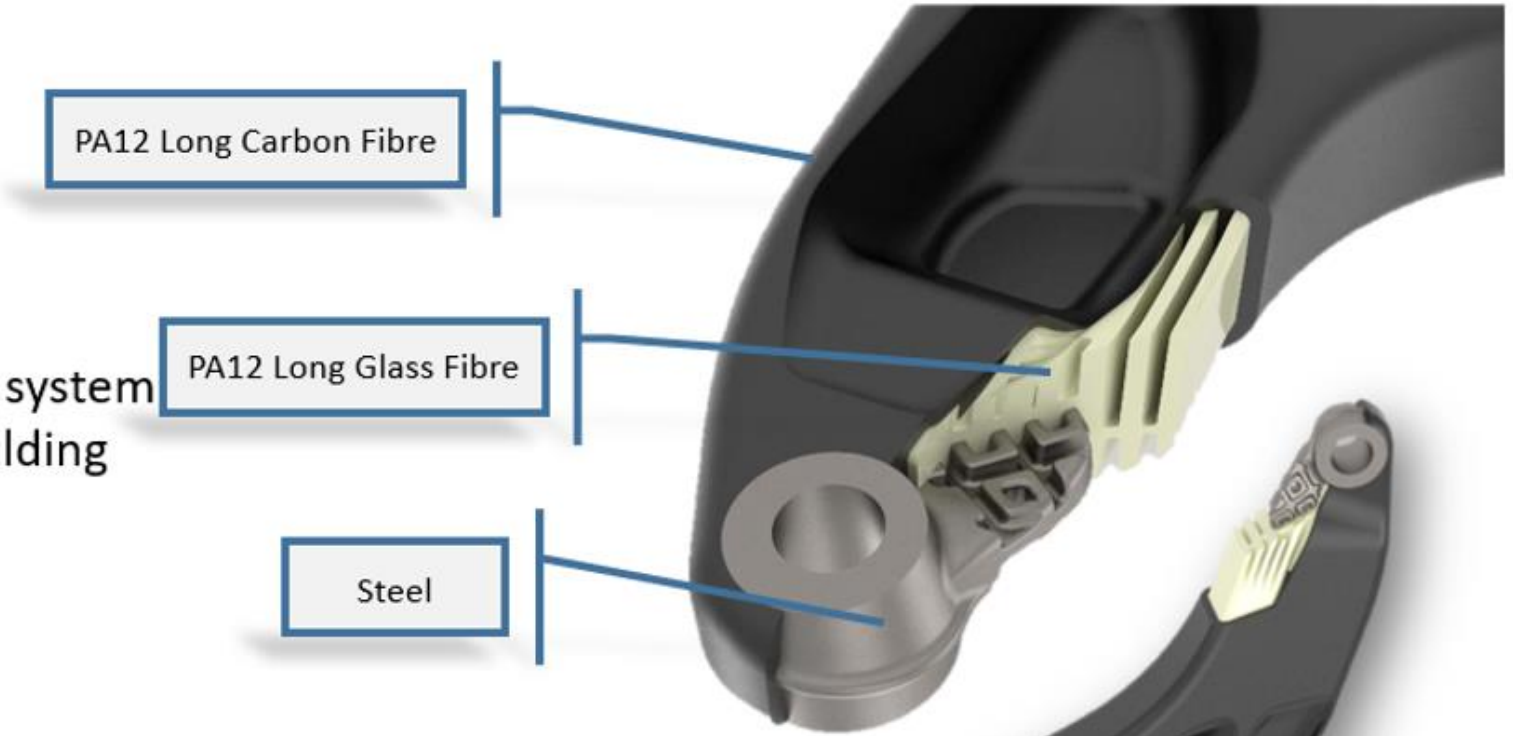
Steel Component	Hybrid Concept	Hybrid Component
4.4 Kg	3.2 Kg	**3.1 Kg**

29.5 % weight save

Composite Hybrid Automotive Suspension System Innovative Structures

Front Lower Control arm

- Hybrid Material construction
- 2 fewer components in assembly
- **Innovation**
  - Right material right place
  - Allow load paths for connection to system
  - Hybrid Thick Section Injection moulding
  - Designed for Quick Cycle time
  - Designed for tolerance (one piece)
- Carry over bushes from Steel arm
- Patent Pending (Gestamp)



Processes : Forging, Injection moulding....

Composite Hybrid Automotive Suspension System Innovative Structures

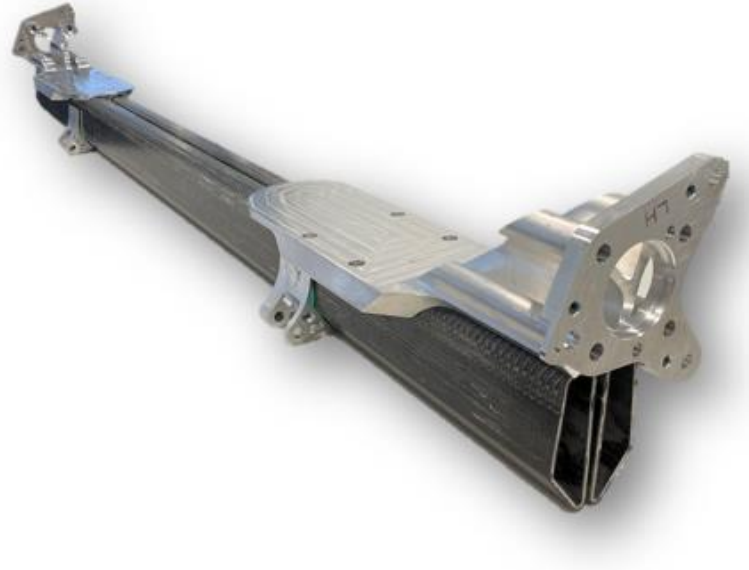
Deadbeam

Steel Component

39.75 Kg

Hybrid Concept

19.7 Kg



Hybrid Component

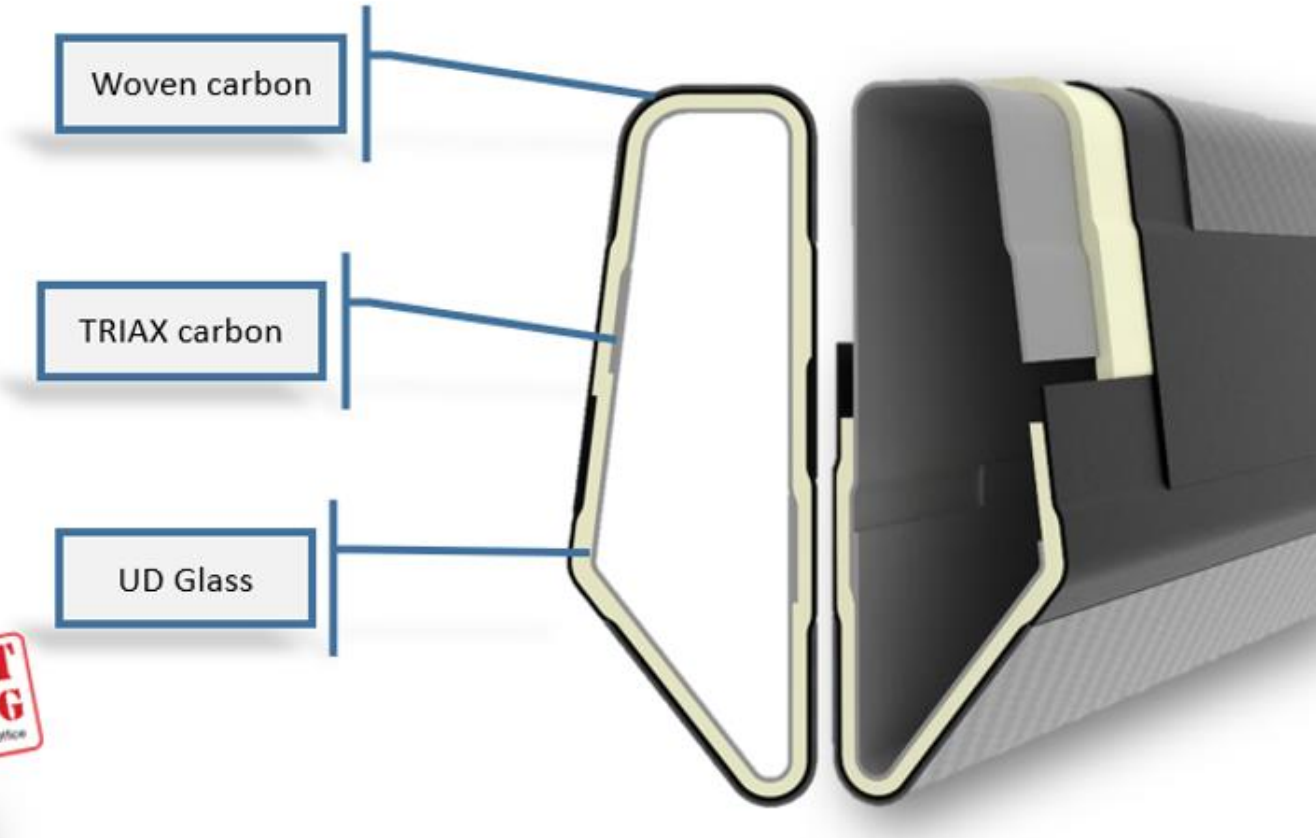
18.7 Kg

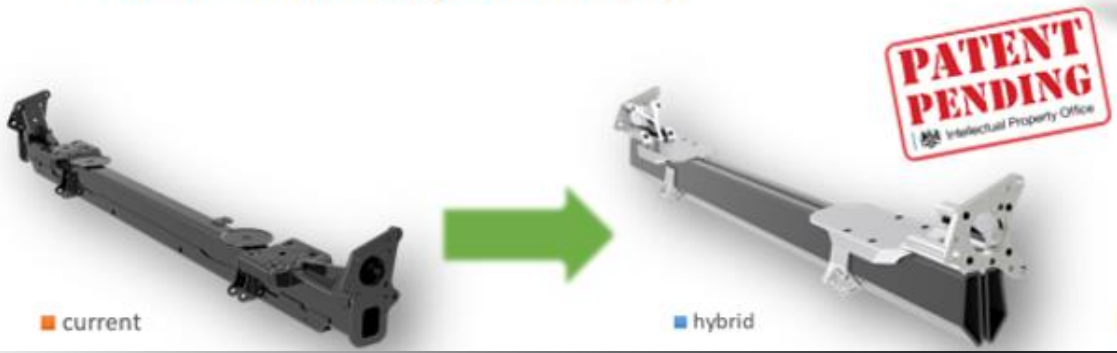
53.2 % weight save

Composite Hybrid Automotive Suspension System Innovative Structures

Rear Dead Beam

- Hybrid Material construction
- 8 fewer components in assembly
- **Innovation**
  - Right material right place
  - Alloy load paths for strength loads
  - Optimised Hybrid Pultruded beam
  - Part integration
  - Designed for Adhesive bonding
  - Designed for tolerance
- Patent Pending (Gestamp)





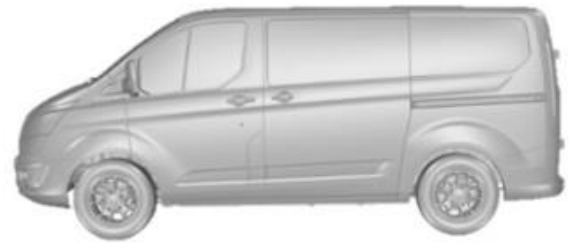
Processes : Extrusion, Pultrusion, Fine Blanking, Machining…

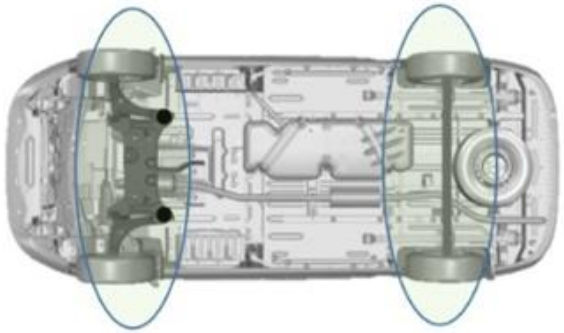
Composite Hybrid Automotive Suspension System Innovative Structures

Conclusions

All Steel Chassis

69.3kg





Hybrid Material Chassis

37.4kg

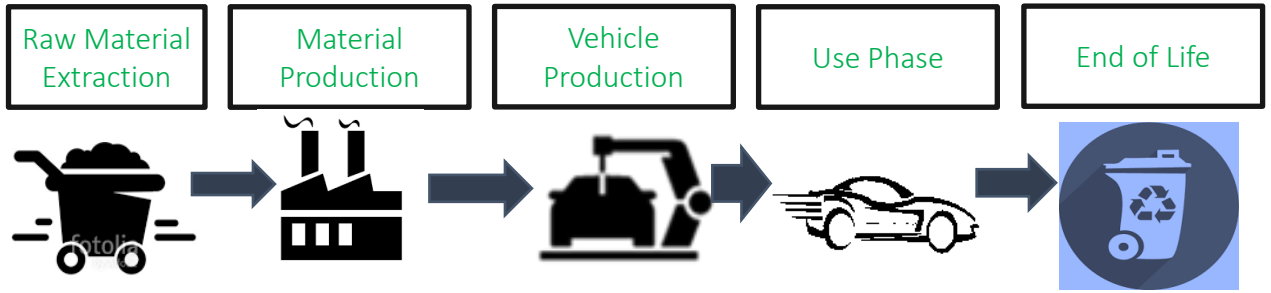
46%
Weight Reduction

31.9kg Weight Save *

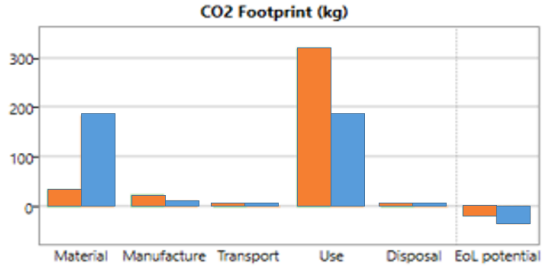
*NOTE : Project Target was **25Kg** weight save across platform

Composite Hybrid Automotive Suspension System Innovative Structures

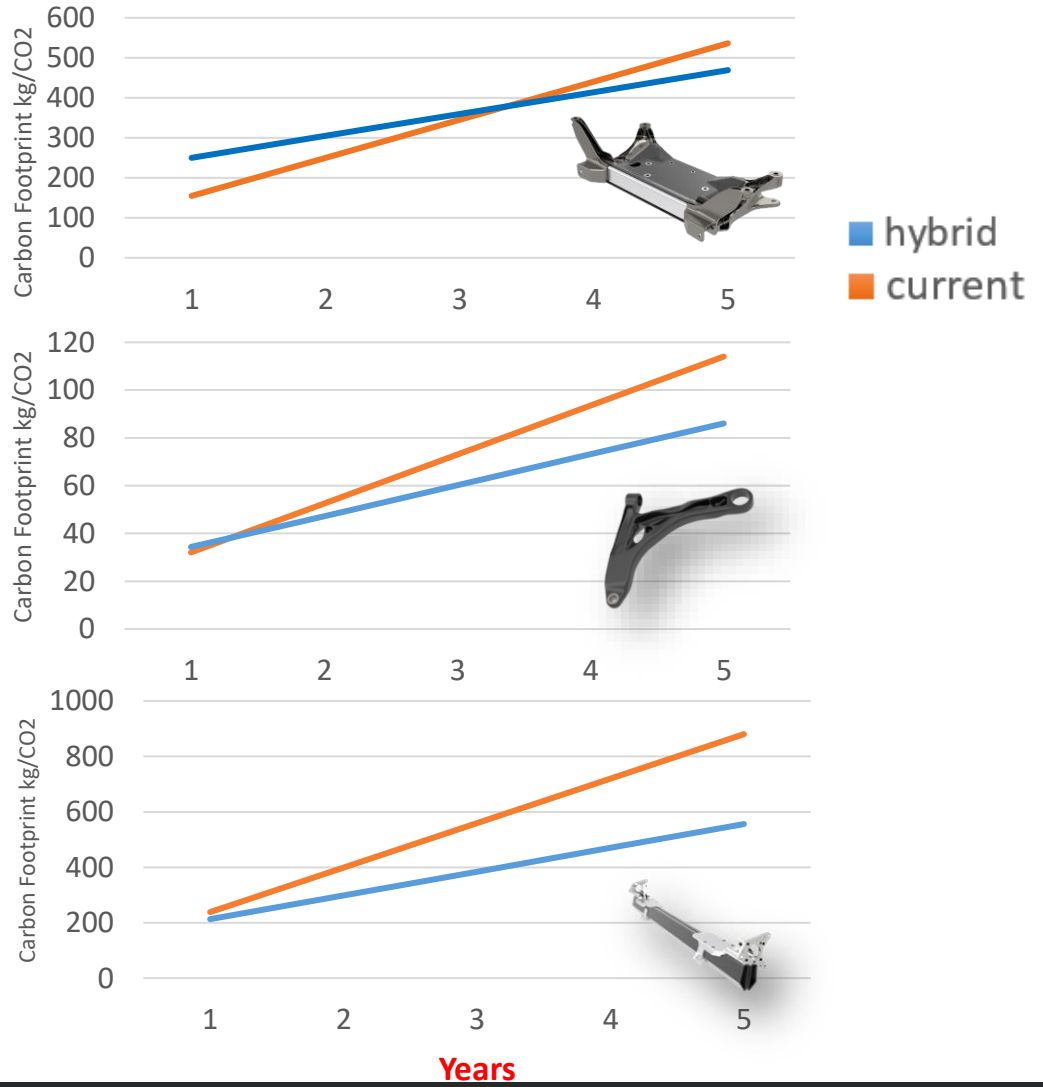
Life Cycle Analysis (LCA) on Lower Control Arm



An Initial life cycle analysis was assessed for each component over a 5 year period based on 17K miles a year. Each component has different CO_2 breakeven points due to the weight, material selection and manufacturing process



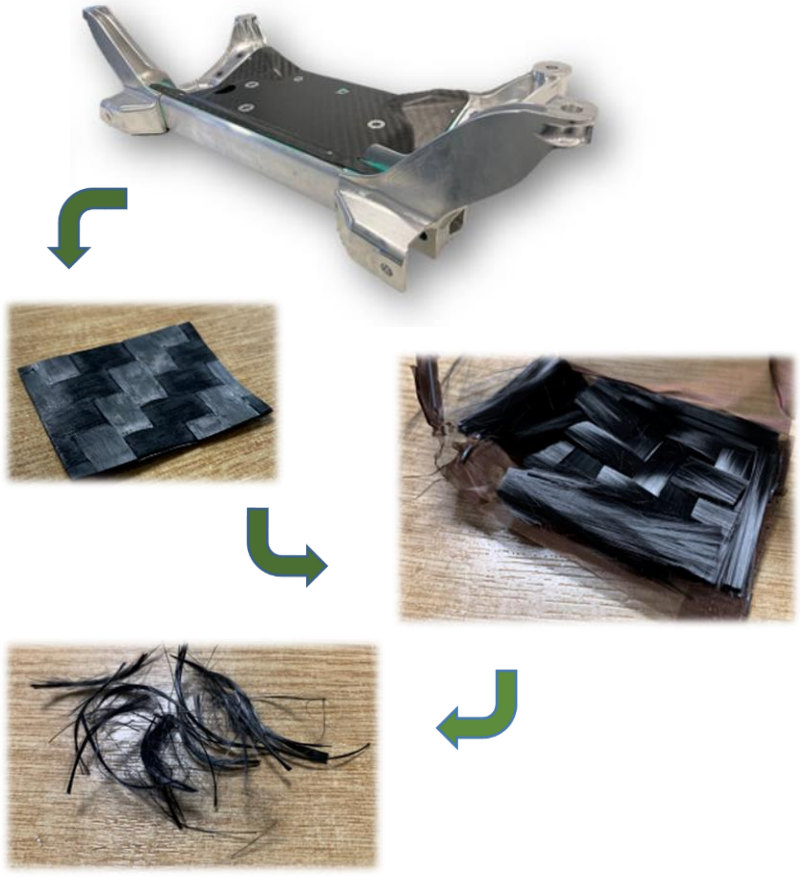
- Front Subframe:-
  - Breakeven time will be 3.35 years for CO_2 output
- Lower Control Arm:-
  - Breakeven time will be 1.3 years for CO_2 output
- Dead beam:-
  - Breakeven time will be 0.65 years for CO_2 output

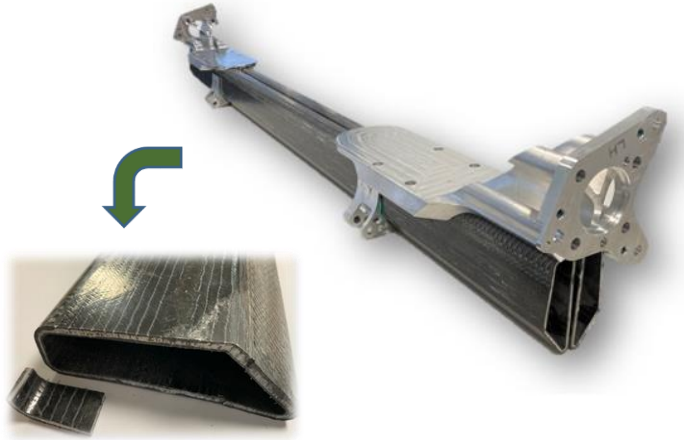


Disassembly and Recycling

Using the B&M Longworth DEECOM® (steam decompression) process of sustainable fibre separation – First iteration

All reclamation pictures courtesy of B&M Longworth

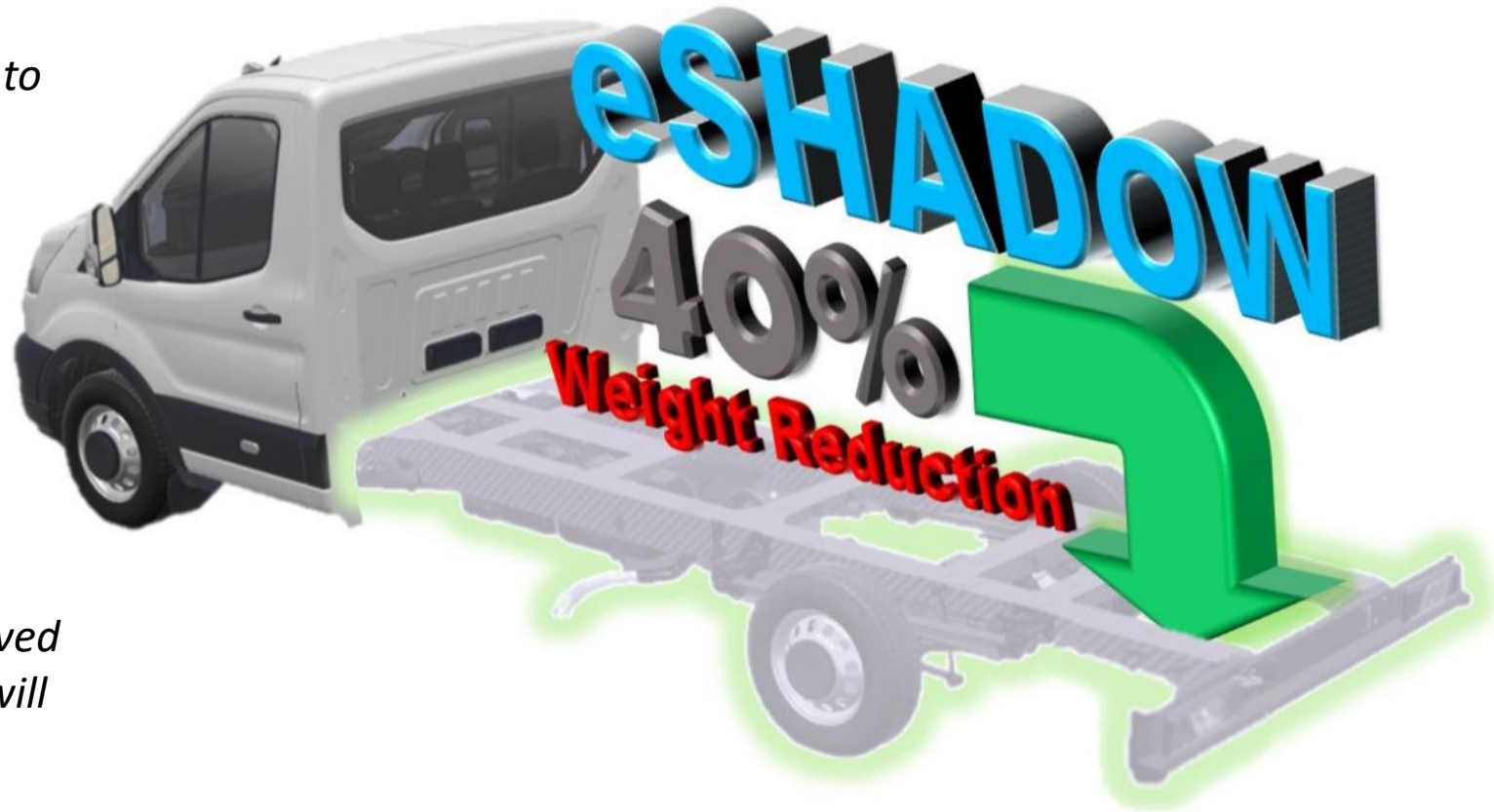




Electrified Structural Hybrid Automotive Designs for Optimised Weight

The eSHADOW project will develop lightweight multi-material solutions for chassis ladder frames for commercial vehicle conversions to improve vehicle efficiency and enable the adoption of zero emission vehicle architectures.

Specifically, using a hybrid material combination of carbon and glass fibre reinforced polymer composite and metallic alloys in volume manufacturing process, weight savings of 40% as compared to conventional all steel systems will be achieved and these step reductions in vehicle mass will promote the adoption of EV technologies.



Thank you

Alan Banks BEng (Hons), MSc, CEng, AWELDI, MSAE, FIKE, FIET

Ford Motor Company
Dunton Campus,
Laindon,
Basildon,
Essex SS16 6EE,
UK

abanks2@ford.com