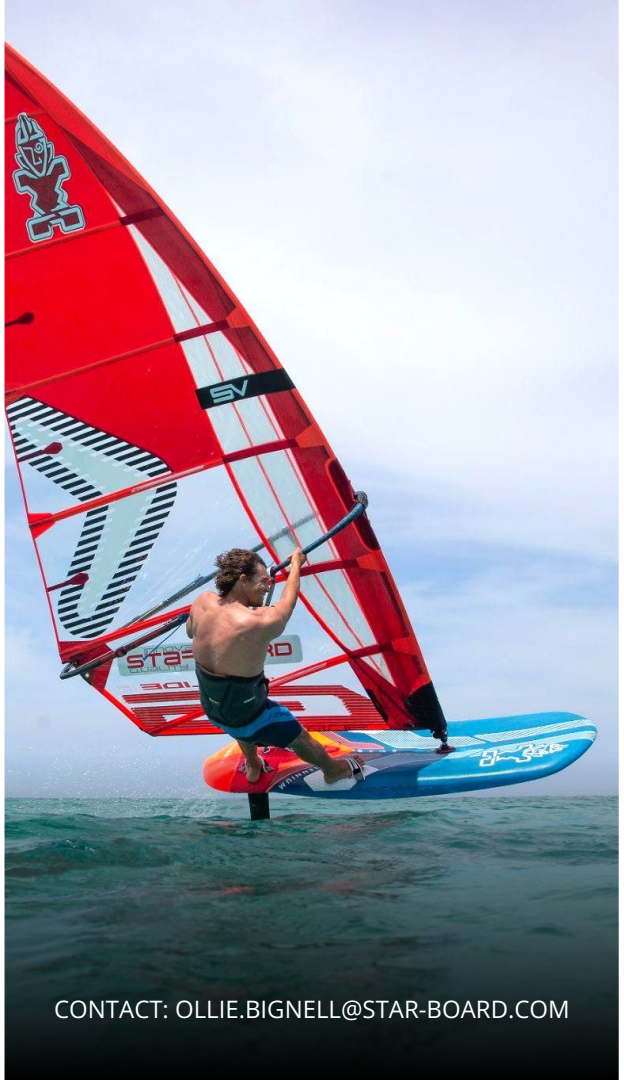
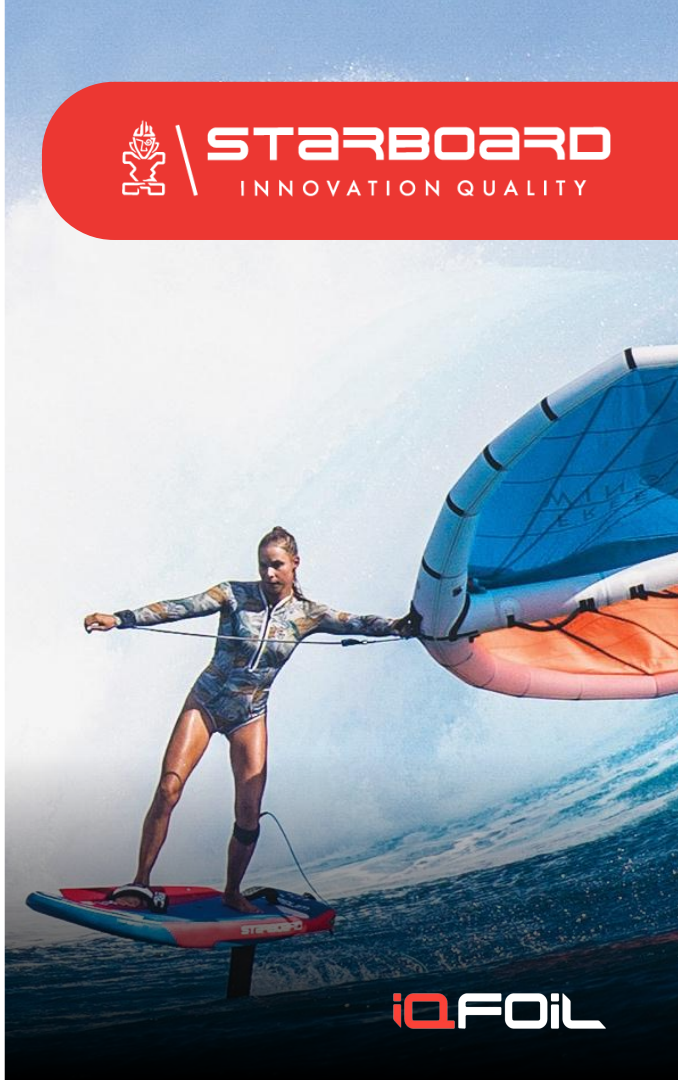
Navigating Sustainability in the World of Equipment Design

OLLIE BIGNELL, MATERIALS R&D MANAGER - STARBOARD


STARBOARD
INNOVATION QUALITY


CONTACT: OLLIE.BIGNELL@STAR-BOARD.COM


STARBOARD
INNOVATION QUALITY
iQFOiL


iQFOiL
Class
FRA 629
HKG 33
ESP 211
HKG 8
FRA 312
FRA 4
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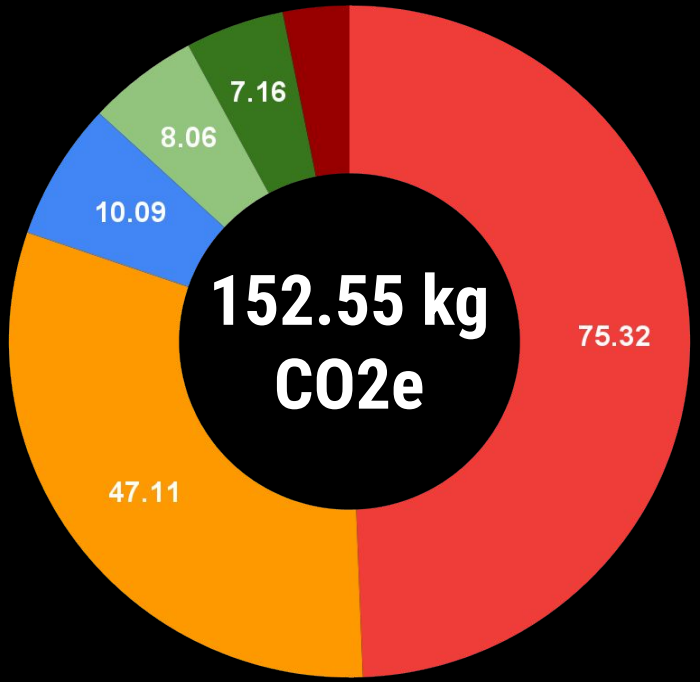
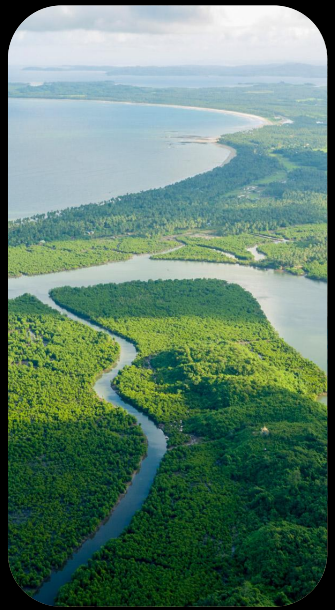
iQFOiL

iQFOiL Carbon Reflex Sandwich 95 Footprint



11.2kg
Board Weight

Turning negatives into positives ⬆️⬇️



22 Mangroves
planted for every board

10X CLIMATE POSITIVE

Worldview International Foundation

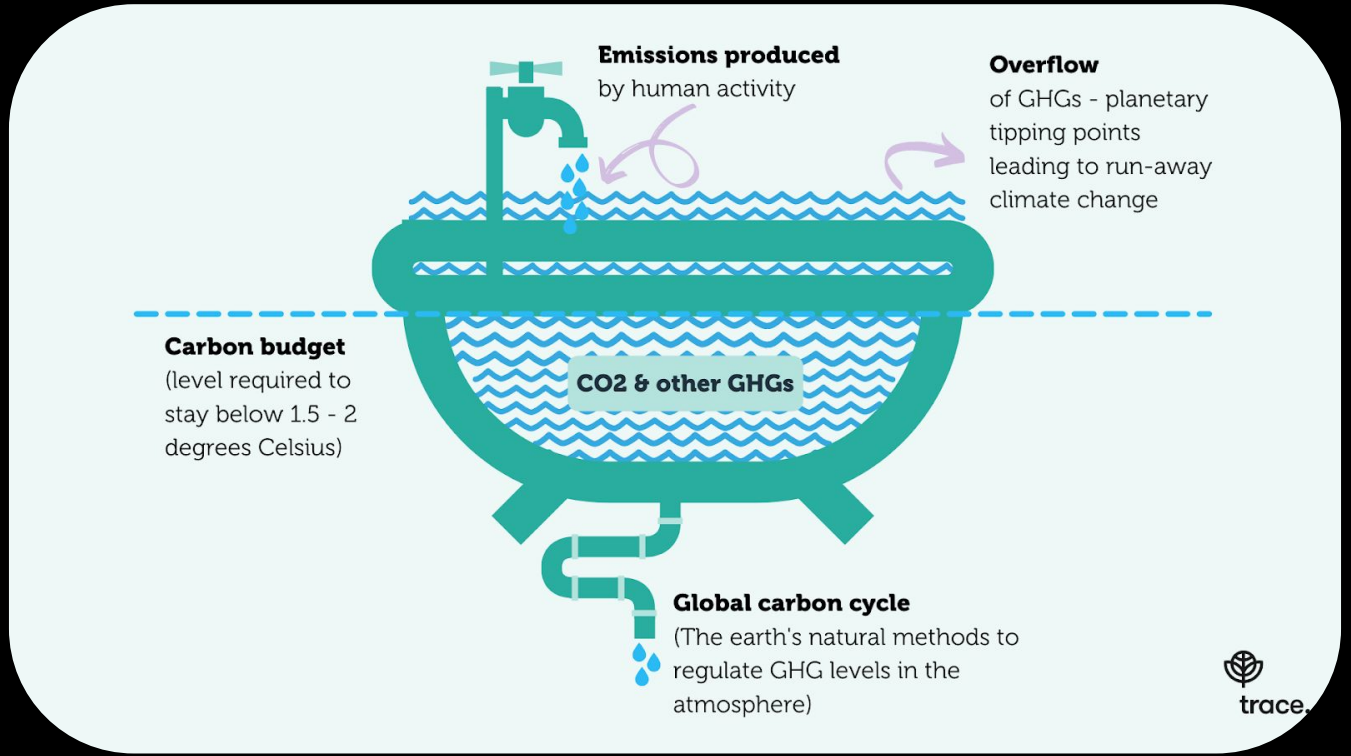
VERRA

Cleaning up beaches and supporting communities

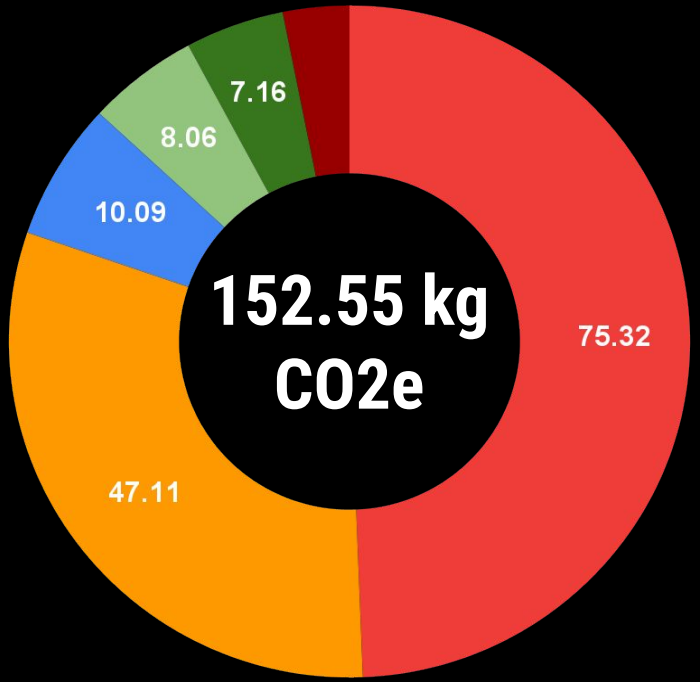
11.4kg beach plastic
collected for every board

PLASTIC OFFSET PROGRAM
WE ARE OFFSETTING OUR PLASTIC USE
By STARBOARD

BALANCING OUR NEGATIVE/POSITIVE IMPACT

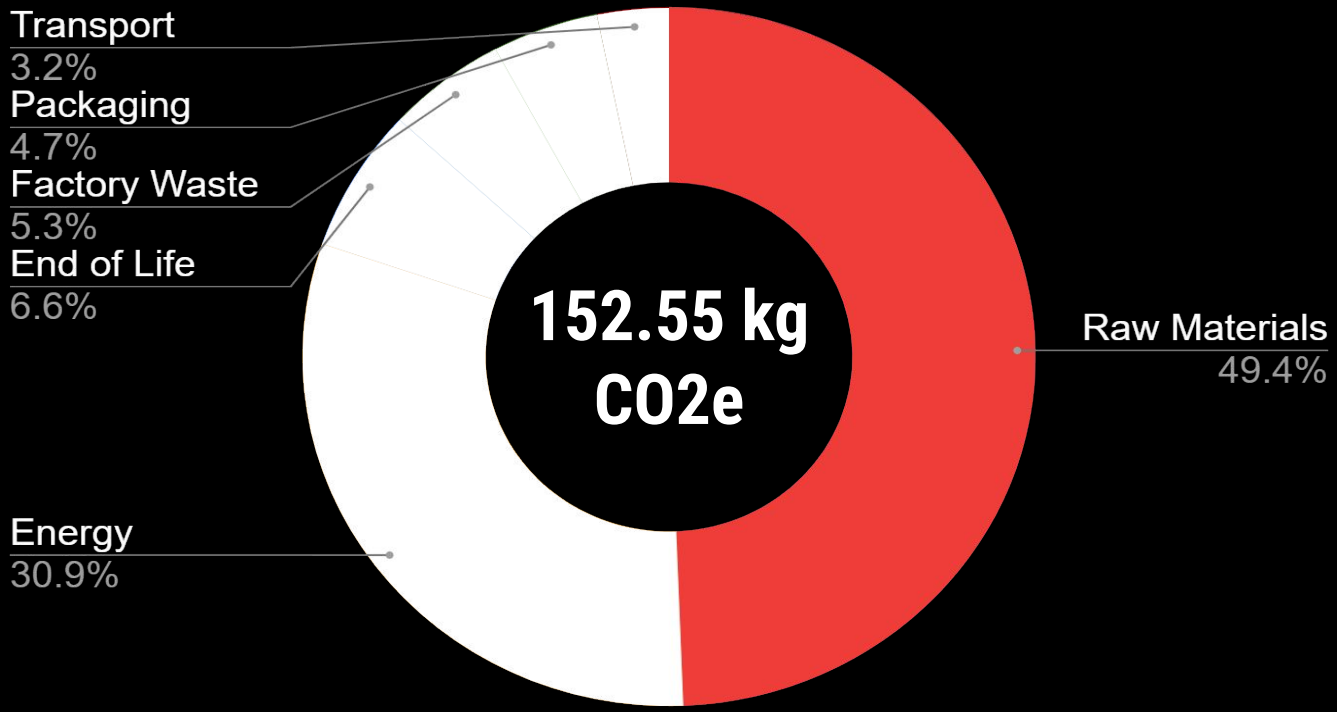


REDUCING OUR NEGATIVE IMPACT



We need to reduce this too…

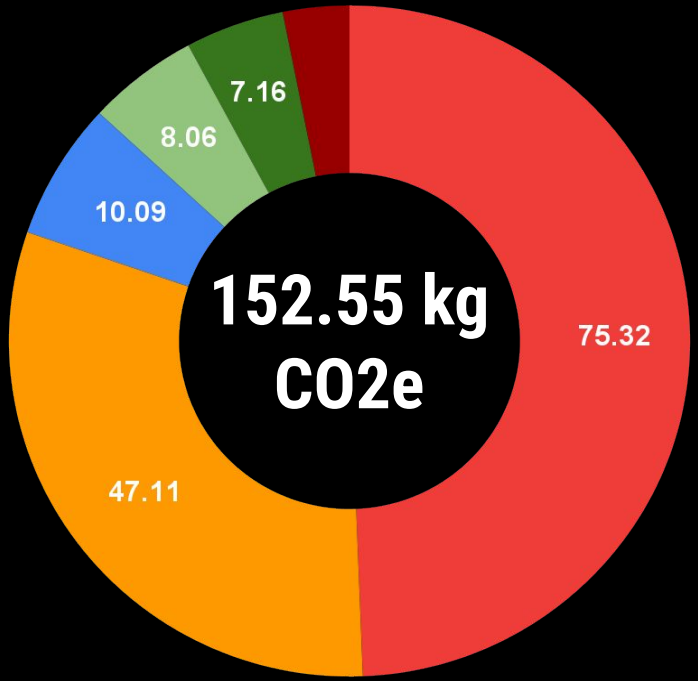
iQFOiL Carbon Reflex Sandwich 95 Materials Footprint



TODAY'S AGENDA:

- The Process
- The Progress
- Plans for the Future

THE PROCESS



1.

Start by measuring.

How did we get here?

THE PROCESS - What is LCA?

- Tool to assess environmental impact of a product, process or service.
- Differs from carbon footprint
- Wide scope of metrics and lifecycle

THE PROCESS - Why use LCA?

- Identify environmental hotspots
- Compare alternatives
- Inform decision-making
- Scientific basis for environmental performance claims

THE PROCESS

MARINE SHIFT 360

A tool for boatbuilders to easily calculate their impact.

SAIL GP

INEOS
Royal Yacht Squadron
CHALLENGER OF RECORD 37TH AMERICA'S CUP

Materials - Composite OPTIONAL

Item	Ordered quantity (kg)	Final quantity (kg)	
Core - Polystyrene	2.896	2.896	−
Dry fibers - Fibreglass	0.579	0.579	−
Resin - Epoxy / Petrolbased	3.778	3.778	−
Dry fibers - Carbon Standard Modulus	0.1409	0.1409	−
Dry fibers - Basalt fibre	0.74418	0.74418	−
Core - PVC Foam	0.536	0.536	−
Core - PET Foam (recycled)	0.497	0.497	−
Core - PET Foam (virgin)	0.607	0.607	−
_____-			−

+ Add Another

Materials - Paint OPTIONAL

Ordered quantity

Global warming - fossil
49.37
kg CO2e

Global warming - non-fossil
7.60
kg CO2e

Mineral resource scarcity
0.11
kg Cue

Energy consumption - non-renewable
1075.91
MJ

Energy consumption - renewable
77.32
MJ

Water consumption
0.96
m3

Marine eutrophication
0.01
kg Ne

Waste production
0.00

THE PROCESS

MARINE SHIFT 360

5 Key Areas Of Environmental Impact

THE PROCESS: Using MarineShift360

Global Warming Potential (kg CO2e)

Measures heat trapped in the Earth's atmosphere

Assesses emissions of greenhouse gases like Carbon Dioxide and Methane.

10 kg CO2e/kg

0 kg CO2e/kg

THE PROCESS: Using MarineShift360

Mineral Resource Scarcity (kg Cue)

This evaluates the depletion of non-renewable, scarce material sources used like metals and minerals.

Increasing use of biobased and recycled materials lowers this.

10 kg Cue/t

0 kg Cue/t

THE PROCESS: Using MarineShift360

Water Consumption (L)

The amount of freshwater used to produce this item.

High water use can impact local water sources significantly

50 L/kg

0 L/kg

THE PROCESS: Using MarineShift360

Energy Consumption (MJ)

Energy consumed in order to produce this the item,

Differs to CO2 as high energy consumption even from renewable sources still places large demand on resources for production.

100 MJ/kg

0 MJ/kg

THE PROCESS: Using MarineShift360

Marine Eutrophication (kg Ne)

Marine eutrophication is the over enrichment of ecosystems from release of high nutrient chemicals like nitrogen and phosphorus.

Common in manufacturing activities if wastewater is not properly treated to avoid this.Material choices impact this as some processes are worse than others.

200 g Ne/t

0 g Ne/t

BUSINESS CONSIDERATIONS

- Quality and Durability
- Weight
- Cost
- Workability
- Commercial Availability

Making boards last as long as possible.

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BUSINESS CONSIDERATIONS

- Quality and Durability
- Weight
- Cost
- Workability
- Commercial Availability

Keeping weight low and performance high.

BUSINESS CONSIDERATIONS

- Quality and Durability
- Weight
- Cost
- Workability
- Commercial Availability

Keeping prices reasonable for the customer.

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INNOVATION QUALITY

BUSINESS CONSIDERATIONS

- Quality and Durability
- Weight
- Cost
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Ensuring we can scale production.

BUSINESS CONSIDERATIONS

- Quality and Durability
- Weight
- Cost
- Workability
- Commercial Availability

Avoiding supply issues when producing at scale.

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AN IMPACT CONSCIOUS DESIGN

Lab

Key improvements:

1. LOWER CO_2 EMISSIONS
2. BETTER RECYCLABILITY + E.O.L
3. LOWER TOXICITY

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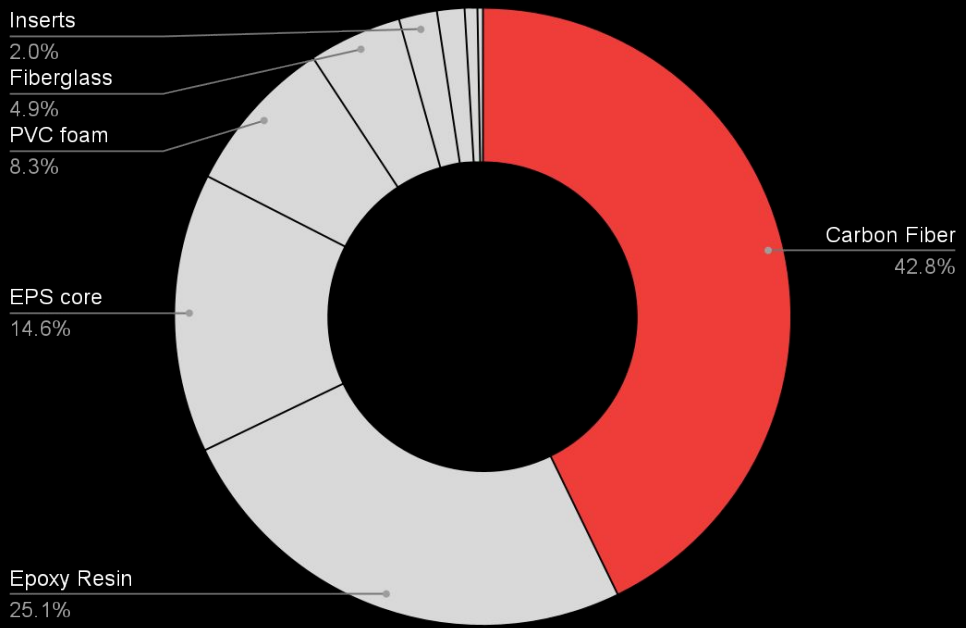
TODAY'S AGENDA:

- The Process
- The Progress
- Plans for the Future

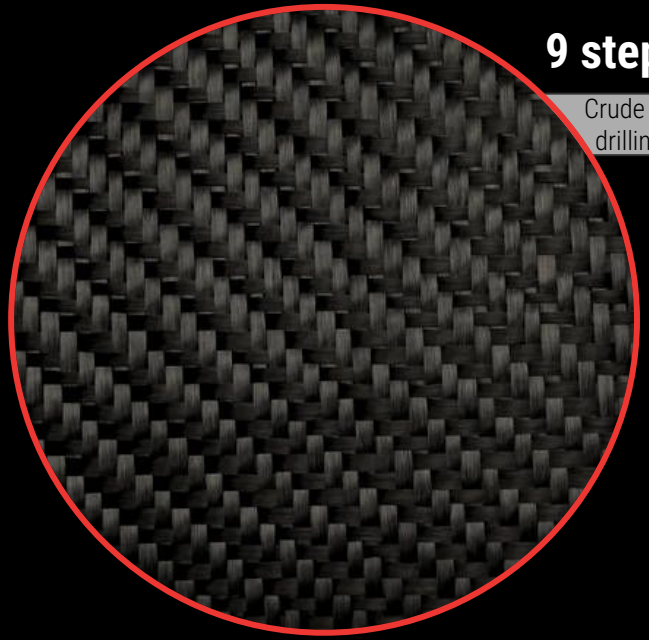
1. LOWER CO_2 EMISSIONS



OUR FIRST TARGET:

- Reducing our reliance on **Carbon Fiber**.

CARBON FIBER:



9 step process:

Crude oil drilling → Fractional distillation → Propane by-production → PP formation from Propane → Steam cracking → Polymerisation of PAN → Polyacrylonitrile (PAN) Processing & Spinning → Stabilization of fibres → Carbonisation of fibres

✓ Very lightweight

✕ high embodied CO_2

CO2				
35.72	38.74	246.6	1.01k	6.64k

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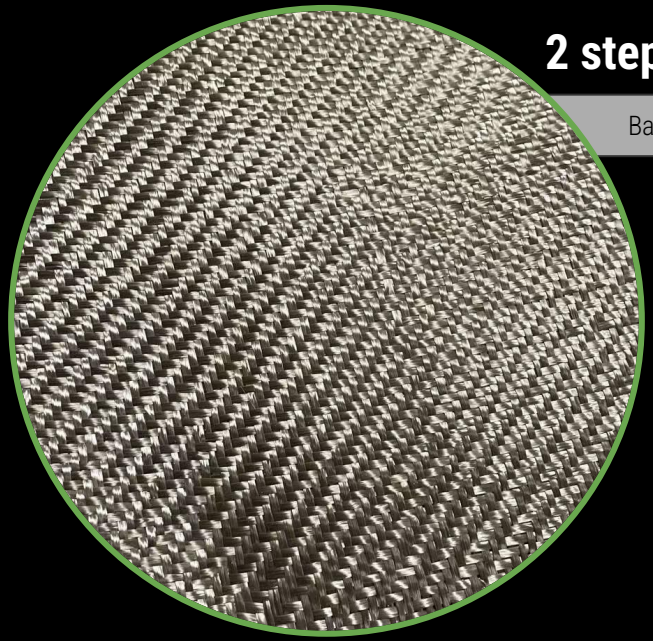
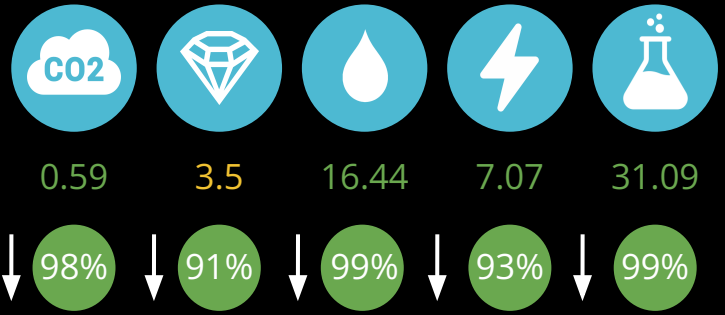
BASALT FIBER:



2 step process:

Basalt rock mining → Melting and spinning fibres

- ✓ Strength can keep up with carbon in most applications
- ✓ Handling is easy and less toxic
- ✓ Naturally occurring and plentiful



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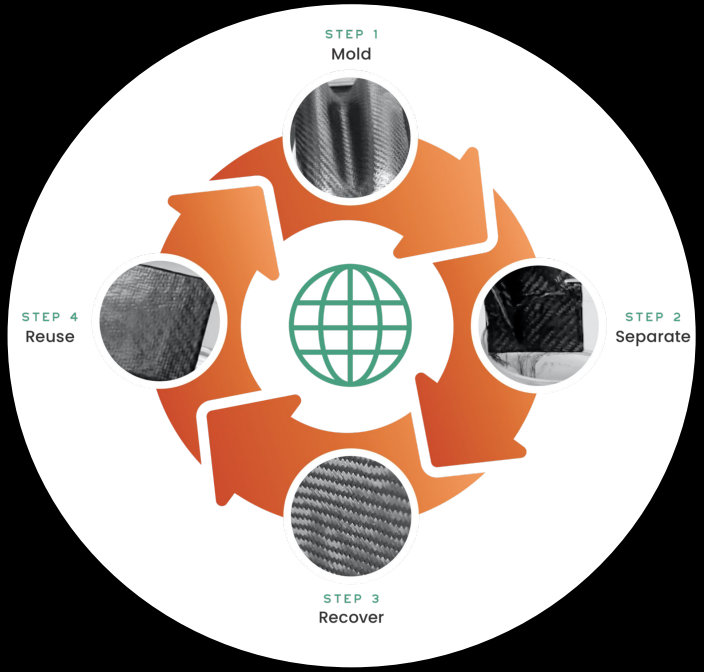
2. RECYCLABILITY

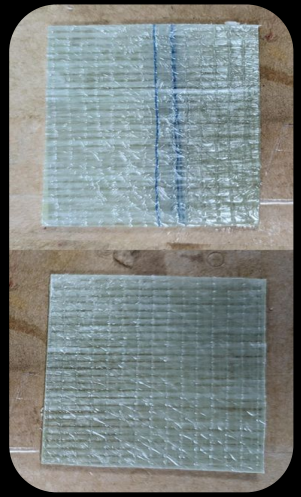


OUR NEXT TARGET:

- Use recyclable **resins**

VITRIMAX
BY MALLINDA

Recyclable resin testing:



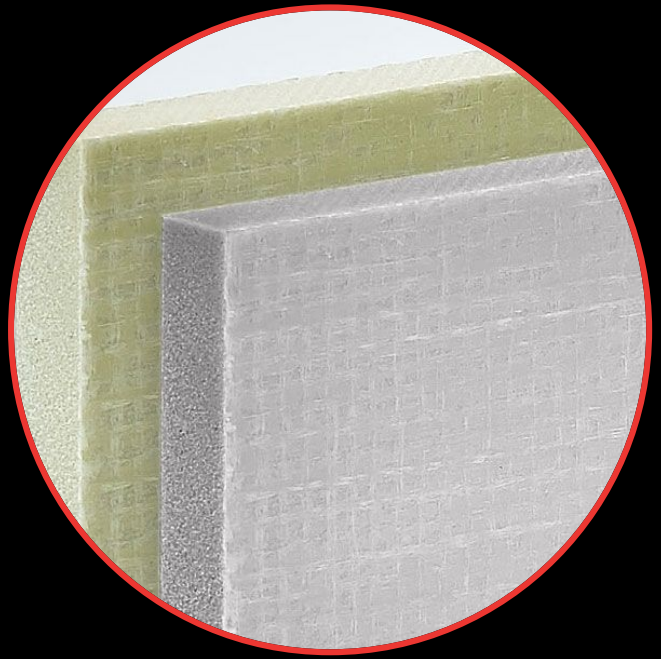
SWancor®
Green Energy & Environmental Protection & Safety

2. RECYCLABILITY

Composite Recycling

Logistical difficulty

PVC FOAM



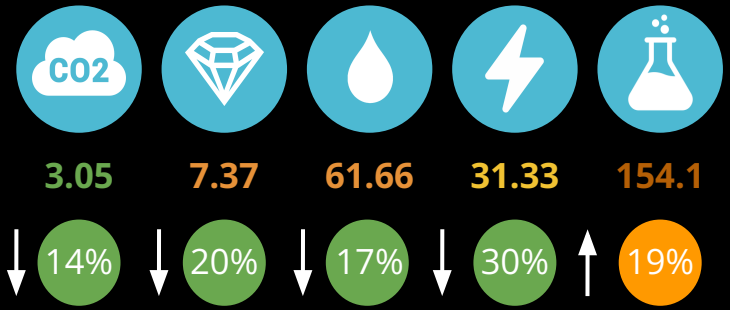
✓ Very strong
✕ High cost
✕ Creates chlorine gas when melted
✕ PFA ‘forever chemicals’

CO2				
3.52	9.25	74.70	44.62	129.9

rPET FOAM

LAB

✓ Recycled content from recycled PET bottles
✕ Not as strong as PVC



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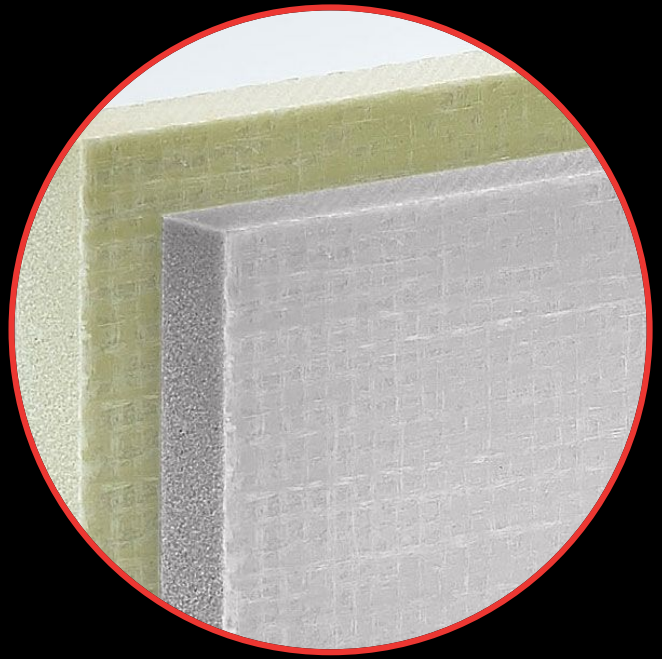
NOT A 1-FOR-1 REPLACEMENT

Lab



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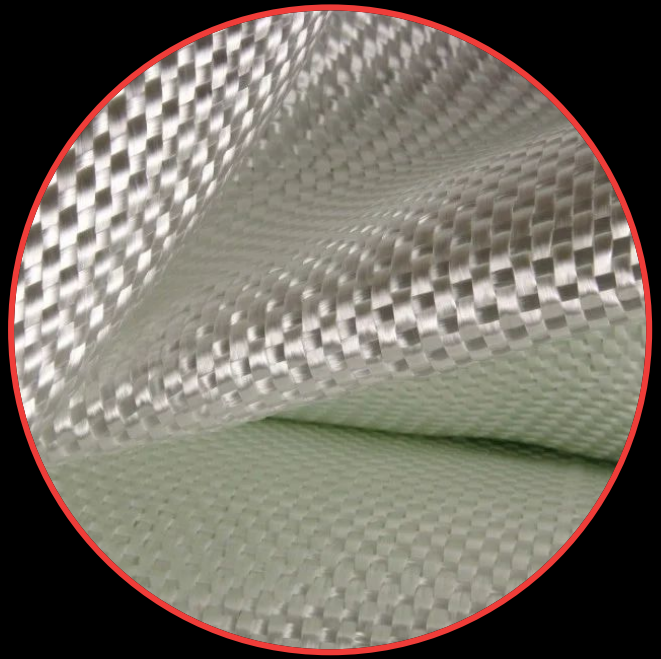
3. LOWER TOXICITY

FIBERGLASS

Lab



✓ Cost effective material
✕ Synthetic material using finite resources
✕ Highly toxic to humans

CO2				
2.46	11.71	37.95	19.32	67.68

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FSC PINE WOOD

- ✓ Biobased material
- ✓ Negative CO2e
- ✕ Large sheets can be difficult to work with

CO2				
-1.75	0.08	0.36	21.06	3.96
171%	99%	98%	45%	94%

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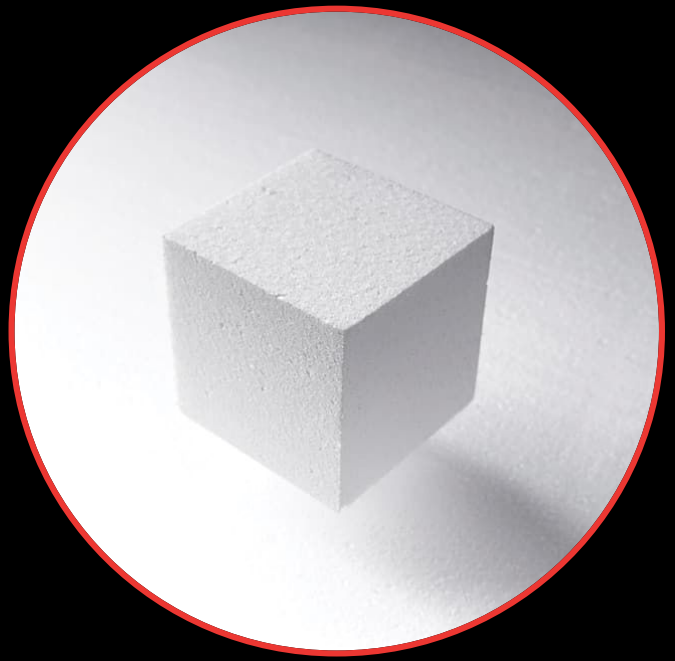
PUTTING IT ALL TOGETHER



EPS Foam Core:

Largest material use by weight

✕ Produces microplastics over 100s years to break down

✕ ‘Technically’ recyclable but not profitable

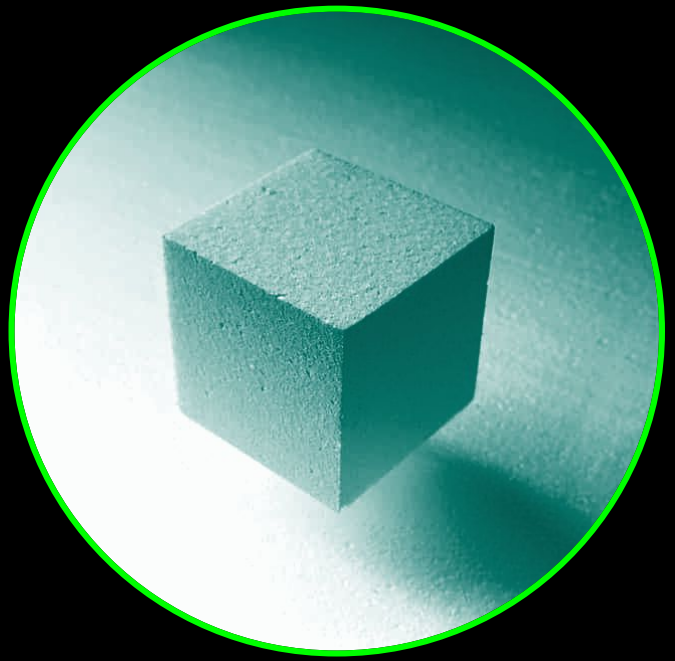
TRIALS & INNOVATION

Lab

3D-printed Core Design

Hollow Construction

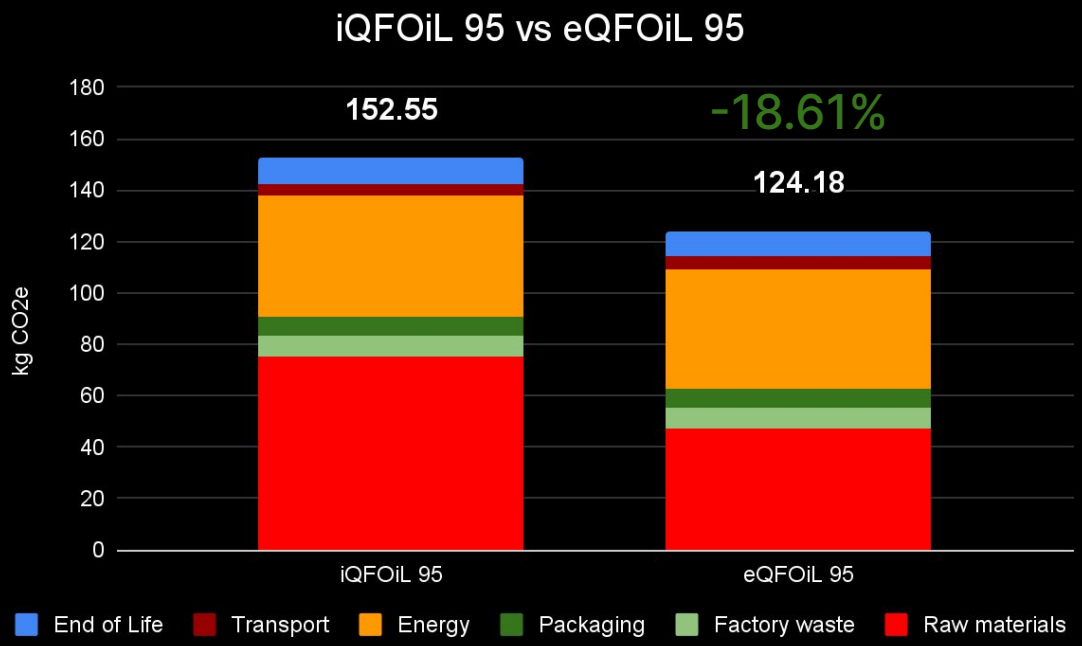
CORE END OF LIFE SOLUTION



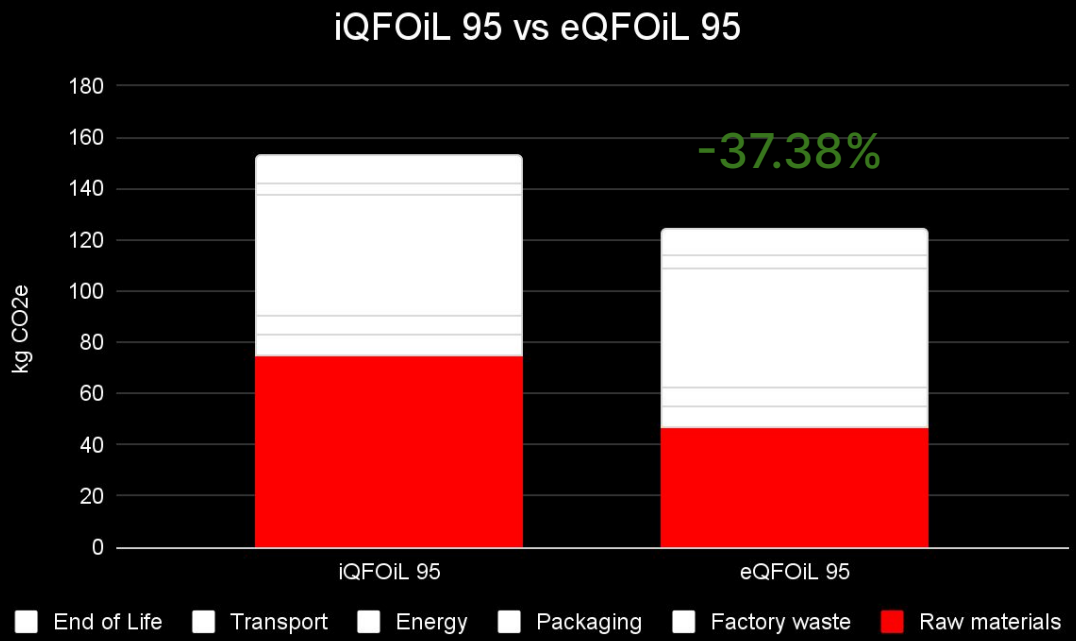
Bio-additive EPS Foam:

- ✓ Microplastic free biodegradation
- ✓ No change in structural performance
- ✕ Not currently available at scale

THE RESULT


iQFOiL 95 vs eQFOiL 95
kg CO2e
180
160
140
120
100
80
60
40
20
0
152.55
-18.61%
124.18
iQFOiL 95
eQFOiL 95
End of Life
Transport
Energy
Packaging
Factory waste
Raw materials

THE RESULT


iQFOiL 95 vs eQFOiL 95
-37.38%
kg CO2e
180
160
140
120
100
80
60
40
20
0
iQFOiL 95
eQFOiL 95
End of Life
Transport
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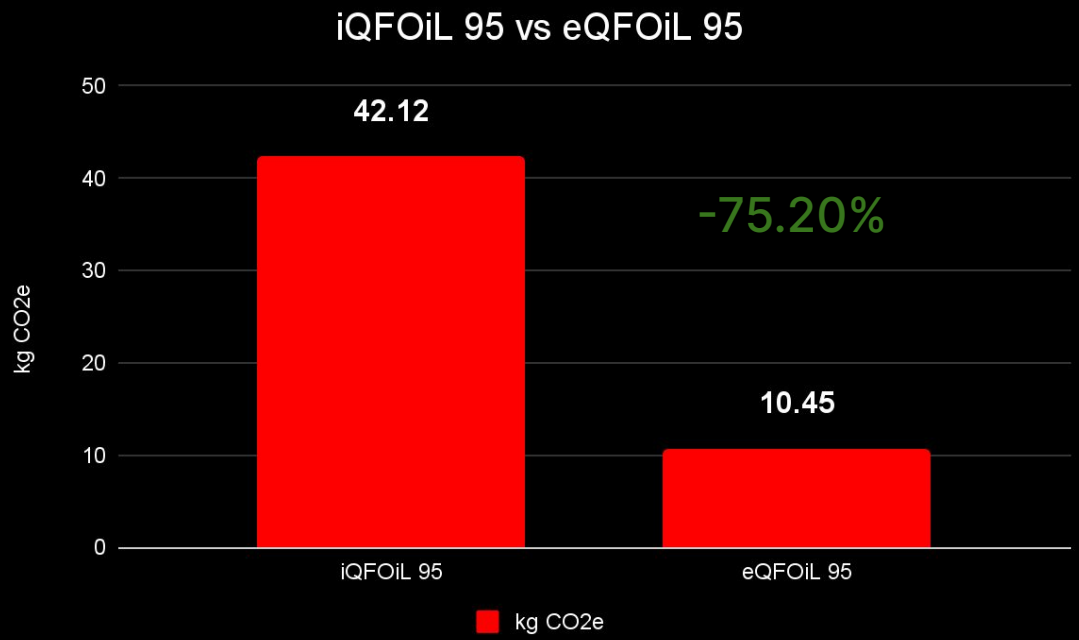
THE RESULT



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THE RESULT

CO2				
152.5	210	147	3.1k	30
19% ↓	14% ↓	10% ↓	23% ↓	33%
124.2	180	132	2.3k	20
CO2				

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SUCCESS?

Key improvements:

- LOWER CO_2 EMISSIONS
- BETTER RECYCLABILITY + E.O.L
- LOWER TOXICITY

Drawbacks:

- Weight increase of around 500g (4%)

Unknown factors:

- Durability + ‘Feel’ for the rider

TODAY'S AGENDA:

- The Process
- The Progress
- Plans for the Future

iQFOiL at Paris 2024

PARIS 2024

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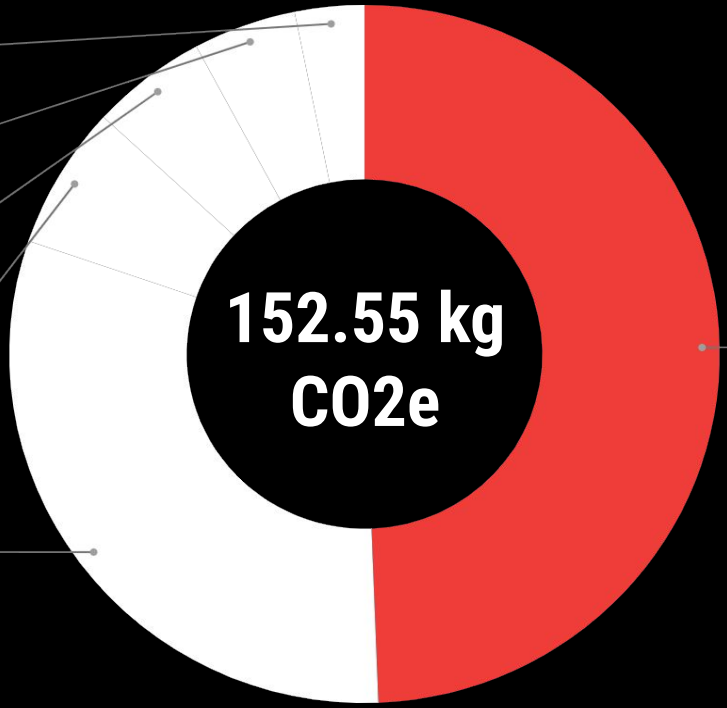
PLANS FOR THE FUTURE



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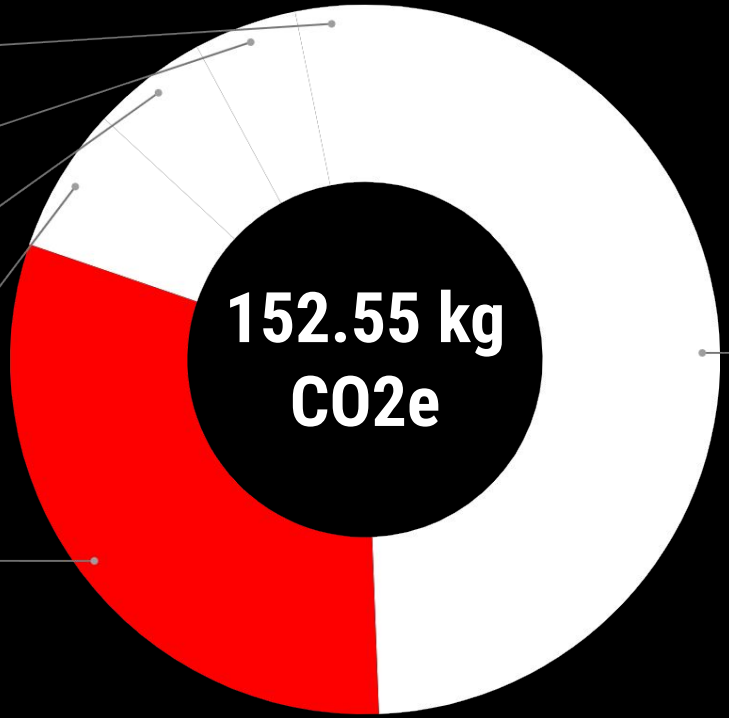
PLANS FOR THE FUTURE



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CONCLUSION AND KEY LEARNINGS

- Material design choice can significantly reduce impact.
- But, there are still lots of other areas to move forward in
- Using impact measurement tools with simple metrics can help understand impact during design phase
- Industry is moving fast, materials available now that weren't around when we started

HOW TO GET STARTED?

- Start measuring
- Carbon footprint first
- Look for easy wins
- Tackle the ‘big offenders’ first