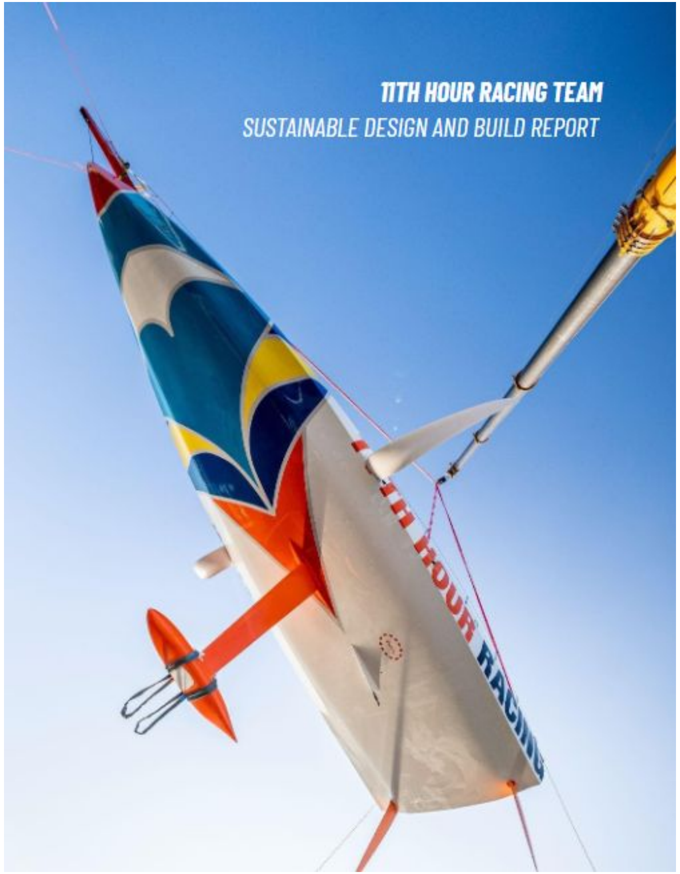
SUSTAINABLE DESIGN & BUILD

11TH HOUR RACING
SAILING TEAM

DESIGN AND BUILD REPORT - PLUS ASSETS



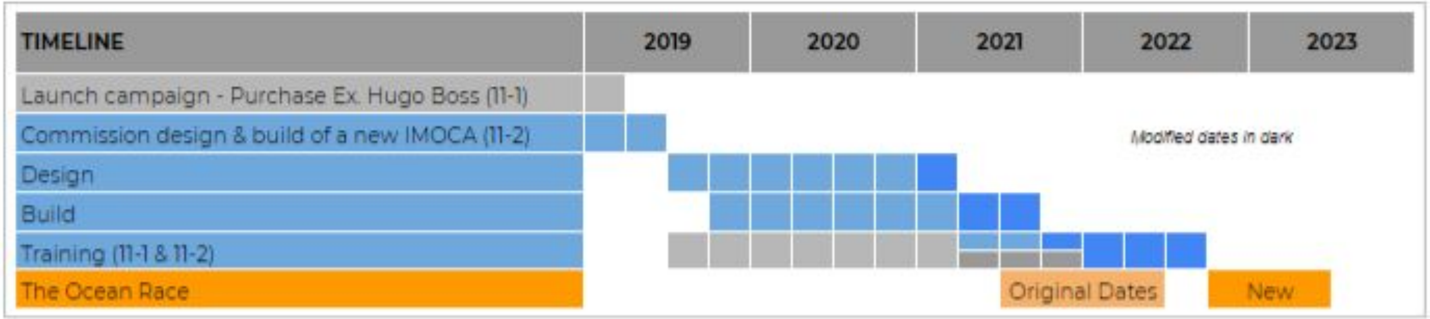
DOCUMENT
Document register
Sustainable design and build report
Worksheet - Lifecycle inventory
Study - Digital footprint of an IMOCA
Study - LCA 11-2 Molds
Scenario analysis - Foils
Scenario analysis - Energy
Scenario analysis - Packaging
Scenario analysis - Metal
Scenario Analyis - Transport
Scenario analysis - 10m2 Composite panel
Worksheet - GHG processing
Worksheet - Manufacturing waste analysis
Worksheet - Improvement paths
Worksheet - 11-2 LCA 2 results
Worksheep - End of Life
State of the art
Internal price of carbon
Glossary

PERFORMANCE

BUILD MISSION

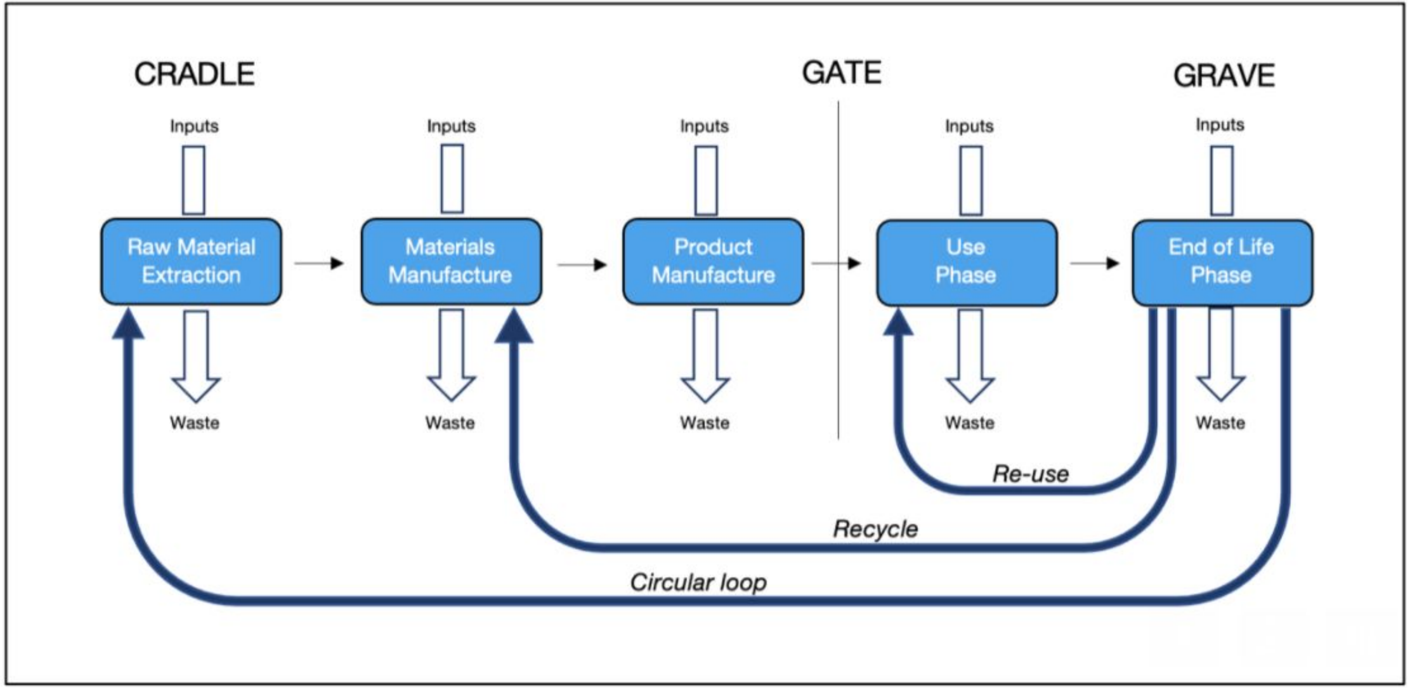
To design, build and optimize a new IMOCA, integrating the best knowledge and technology available to achieve the best possible performance on the race track.

TIMELINE



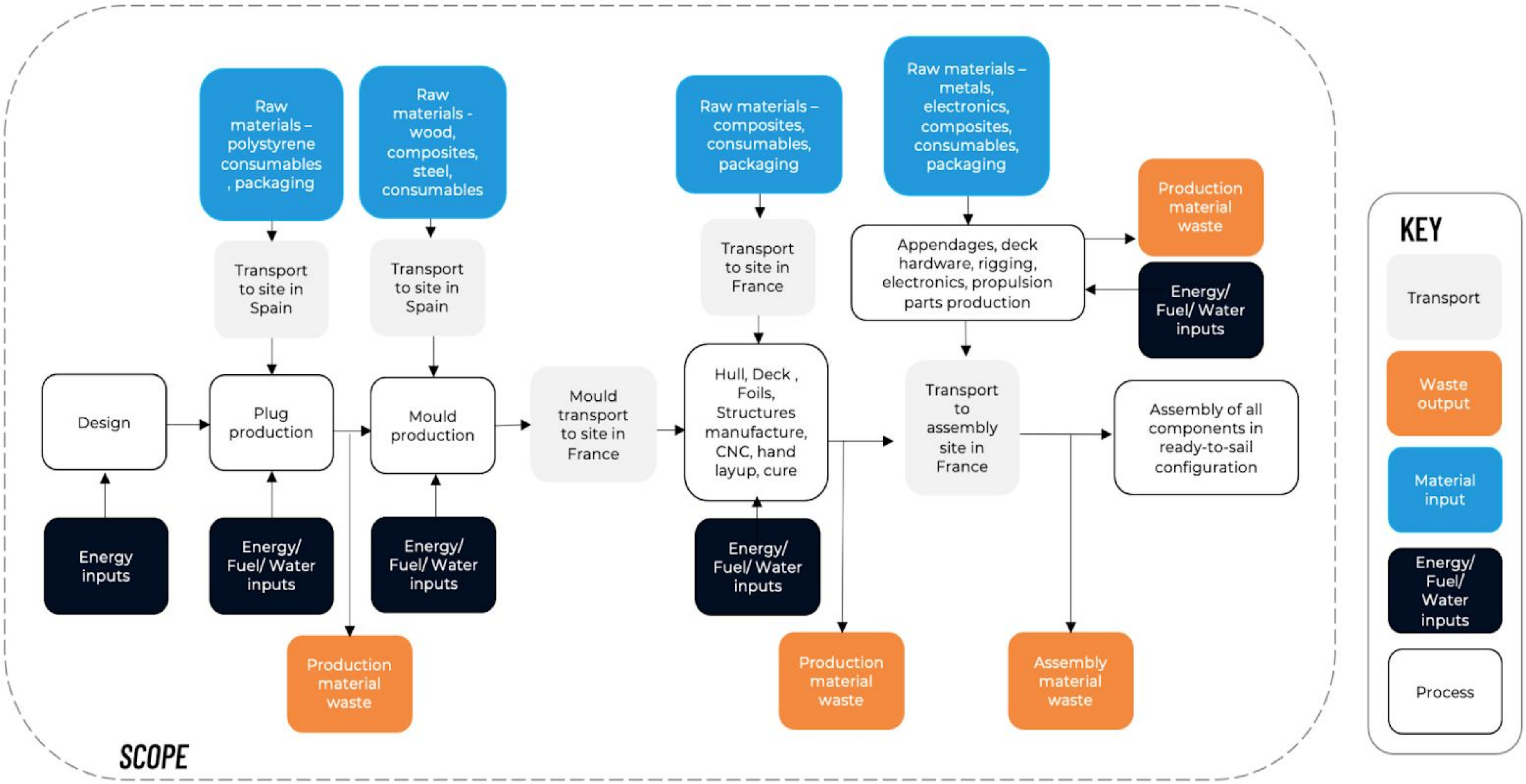
TOO LATE, OR JUST IN TIME?

Figure: Benchmarks and greenhouse gas emission totals, 11th Hour Racing team



DISCLAIMER

The team's LCA results were calculated using MarineShift360.
Backed by 11th Hour Racing as Founding Sponsor, MarineShift360 is a purpose-built marine industry life cycle assessment tool.
MarineShift360 is an ISO 14040:2006 & ISO 14044:2006 compliant and certified life cycle assessment tool. LCA results herein are calculated using MarineShift360, which is under development and is currently in beta stage.
No statements regarding accuracy are made and results may change over time as the development of MarineShift360 continues.

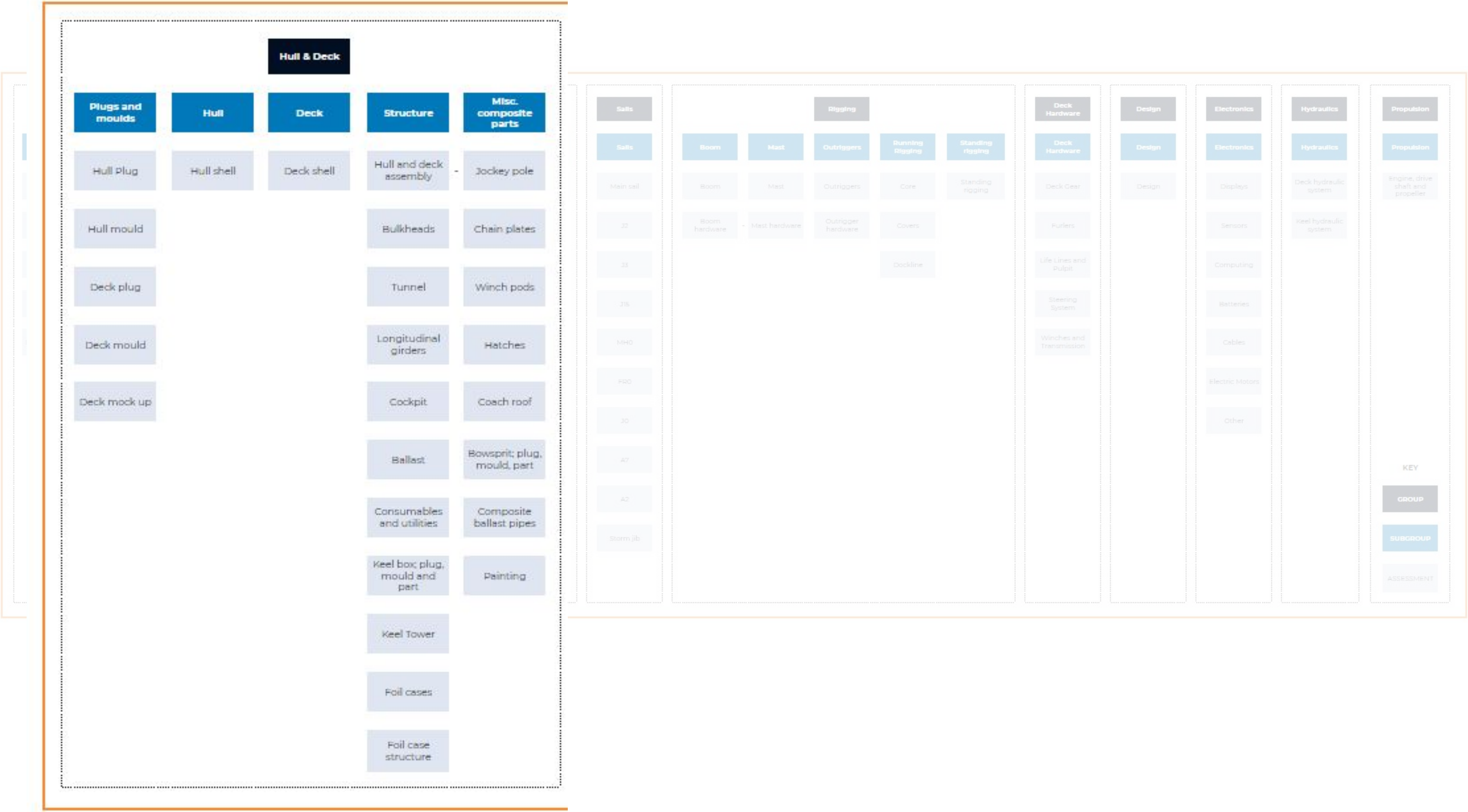


Raw materials – polystyrene consumables , packaging
Raw materials - wood, composites, steel, consumables
Raw materials – composites, consumables, packaging
Raw materials – metals, electronics, composites, consumables, packaging
Production material waste
Transport to site in Spain
Transport to site in Spain
Transport to site in France
Appendages, deck hardware, rigging, electronics, propulsion parts production
Energy/ Fuel/ Water inputs
Design
Plug production
Mould production
Mould transport to site in France
Hull, Deck , Foils, Structures manufacture, CNC, hand layup, cure
Transport to assembly site in France
Assembly of all components in ready-to-sail configuration
Energy inputs
Energy/ Fuel/ Water inputs
Energy/ Fuel/ Water inputs
Energy/ Fuel/ Water inputs
Production material waste
Production material waste
Assembly material waste
SCOPE
KEY
Transport
Waste output
Material input
Energy/ Fuel/ Water inputs
Process

- **Hull & Deck**
  - **Plugs and moulds**
    - Hull Plug
    - Hull mould
    - Deck plug
    - Deck mould
    - Deck mock up
  - **Hull**
    - Hull shell
  - **Deck**
    - Deck shell
  - **Structure**
    - Hull and deck assembly
    - Bulkheads
    - Tunnel
    - Longitudinal girders
    - Cockpit
    - Ballast
    - Consumables and utilities
    - Keel box; plug, mould and part
    - Keel Tower
    - Foil cases
    - Foil case structure
  - **Misc. composite parts**
    - Jockey pole
    - Chain plates
    - Winch pods
    - Hatches
    - Coach roof
    - Bowsprit; plug, mould, part
    - Composite ballast pipes
    - Painting
- **Appendages**
  - **Rudders**
    - Rudder case
    - Rudder moulds; blades and stock
  - **Keel**
    - Keel fin
    - Keel trailing edge
    - Keel bulb
    - Keel bearings
  - **Foils**
    - Foils
- **Sails**
  - **Sails**
    - Main sail
    - J2
    - J3
    - J15
    - MH0
    - FR0
    - J0
    - A7
    - A2
    - Storm jib
- **Rigging**
  - **Boom**
    - Boom
    - Boom hardware
  - **Mast**
    - Mast
    - Mast hardware
  - **Outriggers**
    - Outriggers
    - Outrigger hardware
  - **Running Rigging**
    - Core
    - Covers
    - Dockline
  - **Standing rigging**
    - Standing rigging
- **Deck Hardware**
  - **Deck Hardware**
    - Deck Gear
    - Furlers
    - Life Lines and Pulpit
    - Steering System
    - Winches and Transmission
- **Design**
  - **Design**
    - Design
- **Electronics**
  - **Electronics**
    - Displays
    - Sensors
    - Computing
    - Batteries
    - Cables
    - Electric Motors
    - Other
- **Hydraulics**
  - **Hydraulics**
    - Deck hydraulic system
    - Keel hydraulic system
- **Propulsion**
  - **Propulsion**
    - Engine, drive shaft and propeller

KEY

- GROUP
- SUBGROUP
- ASSESSMENT


Hull & Deck
Plugs and moulds
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Deck
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Deck plug
Tunnel
Winch pods
Deck mould
Longitudinal girders
Hatches
Deck mock up
Cockpit
Coach roof
Ballast
Bowsprit; plug, mould, part
Consumables and utilities
Composite ballast pipes
Keel box; plug, mould and part
Painting
Keel Tower
Foil cases
Foil case structure
Sails
Rigging
Deck Hardware
Design
Electronics
Hydraulics
Propulsion
KEY
GROUP
SUBGROUP

ENGAGING SUPPLIERS - RESULTS

1600 lines of raw data

From 50 suppliers

Using input forms and interviews

57 days of data collection

71 assessments

Processing raw data into component assessments formats for MS360

60 days of data processing

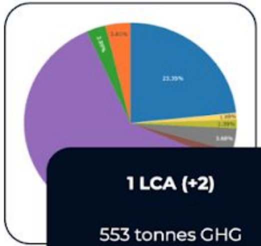
23 subgroups

Sorting and entering data within 23 groups

30 days MS360 development support

9 groups

Plugs & Moulds, Hull & Deck, Appendages, Sails, Rigging, Deck Hardware, Electronics, Hydraulics & Propulsion



1 LCA (+2)

553 tonnes GHG

1 main LCA

2 Supporting LCAs

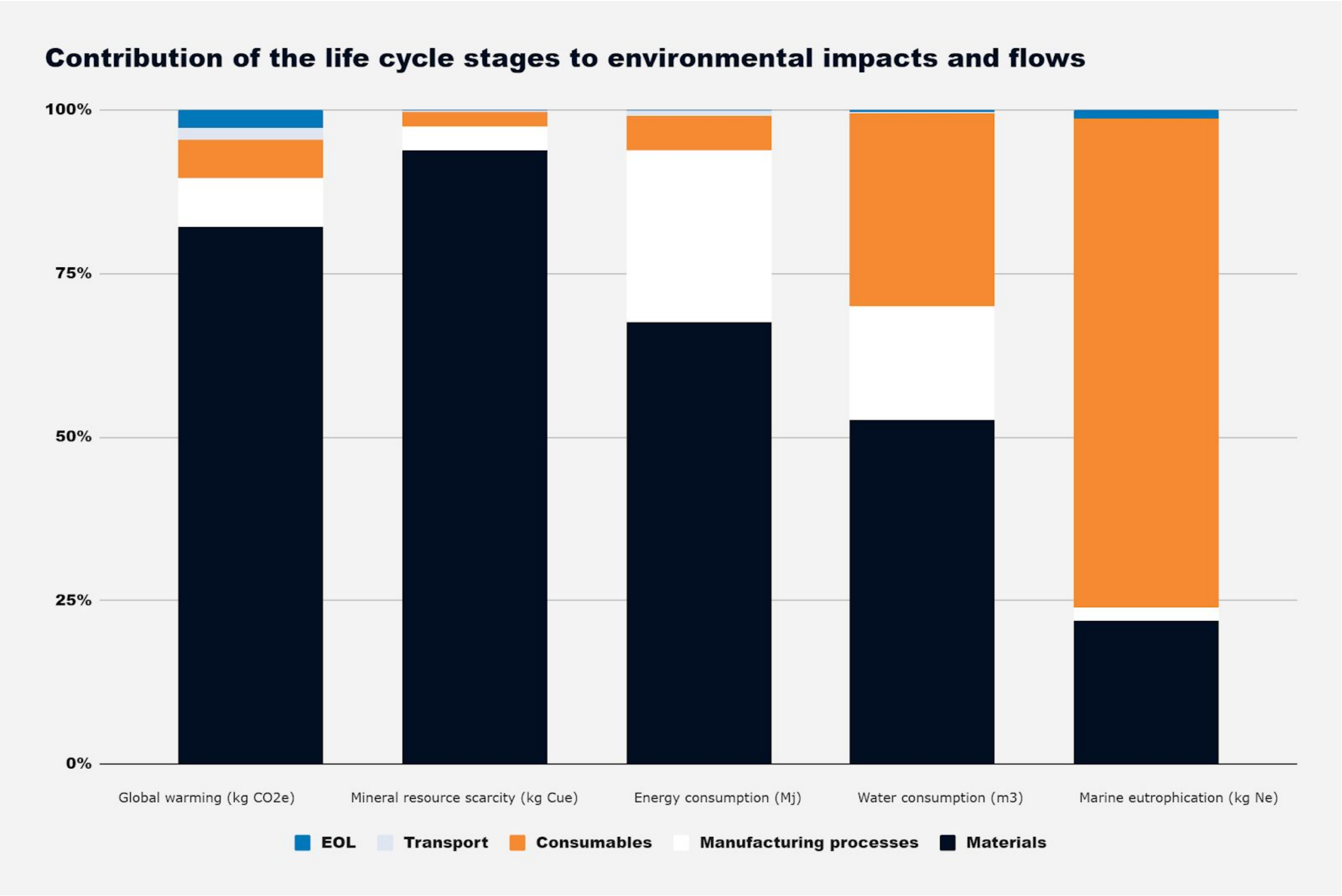
20 days analysing results and ISO14040 report writing

16 Months

The team's LCA results were calculated using MarineShift360 beta tool, October 2021

Global Warming	Mineral Resource Scarcity	Energy consumption	Water consumption	Marine Eutrophication
tC02e	kg Cue	MJ	m3	kg Ne
553	**10,300**	**15,900,000**	**7,500**	**231.7**

- **Global Warming Potential (C02e)** The total emission of greenhouse gases was **553 tCO2e** (metric tons of carbon dioxide equivalent). This amount is the equivalent to 2.2million kms driven by an average passenger vehicle, the annual electricity consumption of 100 US homes, or the manufacture of 100 average Renault cars.
- **Mineral resource scarcity (Cue)** represents the total extraction of minerals on available reserves (Stated as Cue - copper equivalent). The mineral resources needed to build 11-2 were **10,300 kgCue**, or enough to produce 130 electric cars.
- **Energy consumption (MJ)** The energy consumed by the production of materials and building process of the IMOCA was **15.9million MJ**, this is equivalent to 370 North American homes' energy use for one year.
- **Water consumption (m3)** represents the total quantity of water used in production of the goods and services associated with the design and build of the IMOCA. The total, **7,500 m3** (7.5 million litres or 2 million US gallons) is the equivalent of three olympic swimming pools, 50,000 baths, or the Annual consumption of 115 people.
- **Marine eutrophication (Ne)** , stated as nitrogen equivalent, is the modification and degradation of an aquatic environment due to excessive supply of nutrients, particularly nitrogen and phosphorus. The impact of the design and build of the IMOCA was **231.7 kgNe**.



The team's LCA results were calculated using MarineShift360 beta tool, October 2021

IMPACT GHG

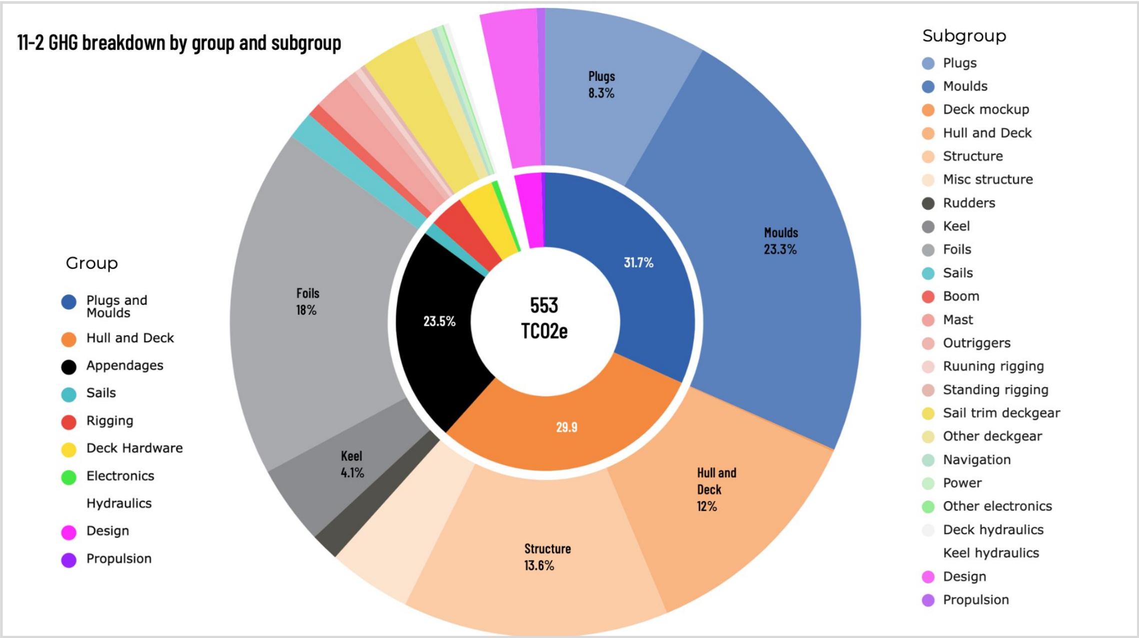
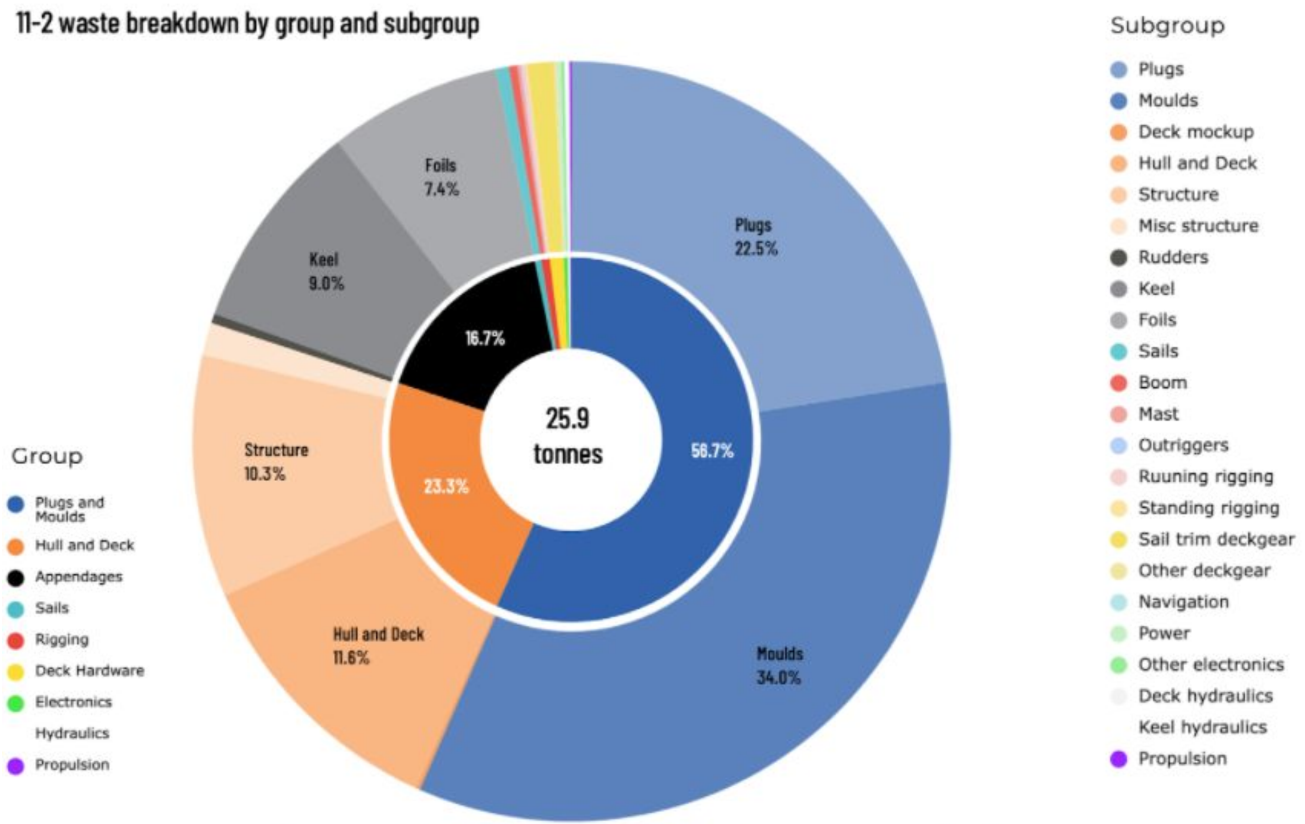


Figure: 11.2 GES par sector
Calculated with MarineShift360 beta software on October 1st, 2021



GROUP	Kg WASTE	%
Plugs and Moulds	14,714.12	56.7
Hull and Deck	6,051.78	23.3
Appendages	4,343.70	16.7
Sails	147.36	0.6
Rigging	200.97	0.8
Deck Hardware	320.32	1.2
Electronics	90.58	0.3
Hydraulics	54.01	0.2
Propulsion	22.53	0.1

Figure x: 11.2 waste breakdown by group and subgroup

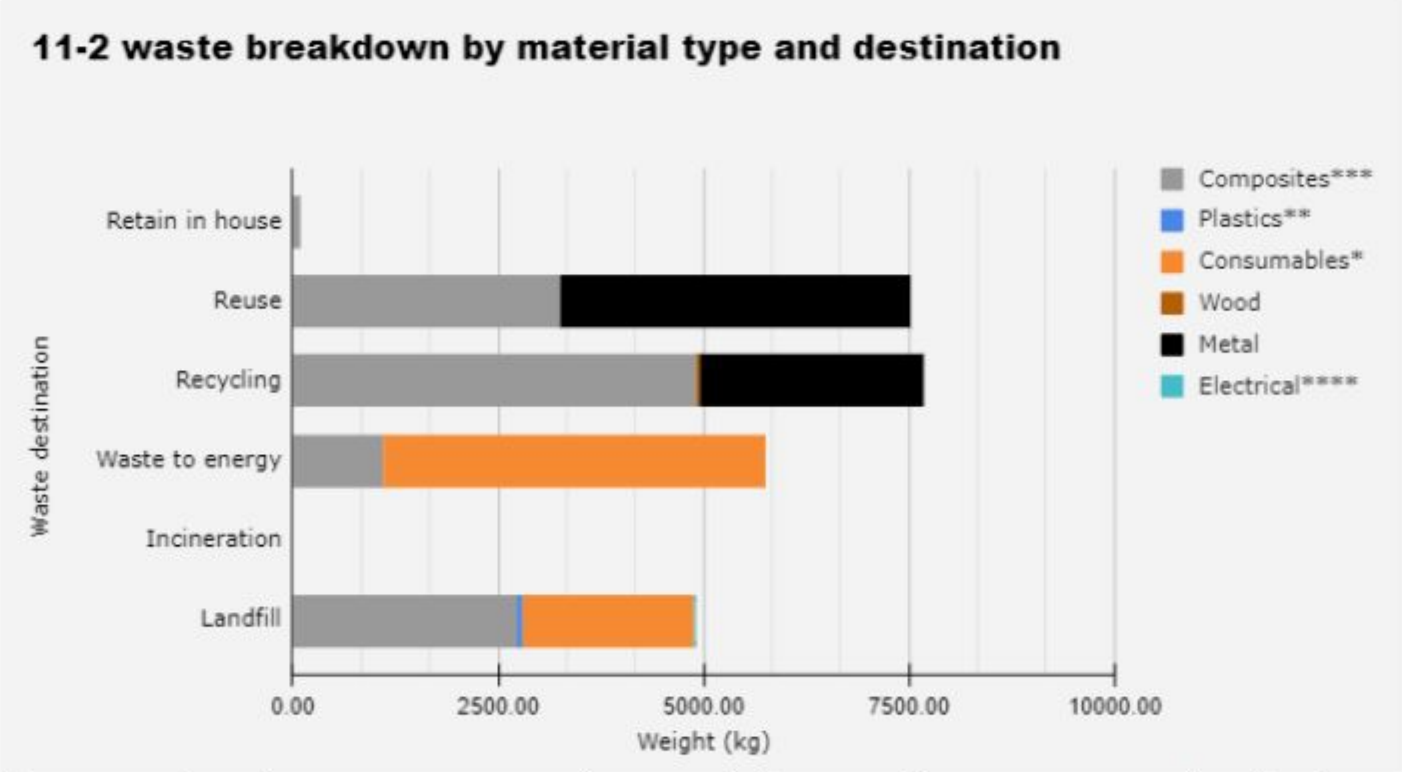


Figure: Manufacturing resource recovery/waste analysis – Material types to Next use/Destination

The total resource recovery/waste across the system was 25.9 metric tons, of which 7.6t (30%) was retained/Reused; 7,6t (30%) was recycled; 5.7t (22%) went to generate energy; and 4.9t (19%) went to landfill

KEY OBSERVATIONS FROM RESOURCE RECOVERY/WASTE MANAGEMENT			
EOL	Item	Kg	Plan
Retain in house	Bowsprit mould	94	Bowsprit mold is currently retained at CDK, for reuse or recycle
Reuse	Hull/Deck/Keel box molds	3278	Hull and deck molds were reused immediately by IMOCA team MC5, saving a total of 7528 Kilos and 171t C02e
	Molds, metallic structure	4250	
Recycling	EPS plugs	3367	EPS foam from male plugs was mechanically recycled by contractor
	Foils offcuts	1550	11.2 foils were built using the out of plan method which means no tooling was needed. However, 1.5 metric tons of composite waste is generated from this construction process and particularly after the water jet cutting process. The type of waste is a cured CF/epoxy composite (photo) which will be recycled through partnership with Gen2 Carbon
	Deck mock up	42	Built for deconstruction using PEFC certified wood, reused onsite, remainder recycled
	Keel fin	2278	Recycled by contractor
	Keel bulb	110	The manufacturer of the keel bulb reuses a 'generic' mold/cast, reused for each IMOCA contract, it is optimised to within +/- 10mm of the final shape, thereby generating significantly less lead metal waste which is then recycled by the manufacturer.
	Rig, electronics and hydraulics hardware	294	Hydraulic manufacturer data confirmed very low wastage due to optimised initial material use, reuse and recycle inhouse
Waste to energy	CF prepreg offcuts	841	Uncured CF prepreg offcuts generated by CDK during the layout process are sent to energy recovery. This EOL option has been recently put in place (Dec 2020). Very few recycling lines exists in France for CF/Epoxy prepreg. Since the build of 11.2, CDK has taken the lead to collaborate with a local company from the building sector for a reuse alternative. The rate of prepreg offcuts is estimated to be 30% of the total prepreg layup creating 700kg of waste for an IMOCA build. The potential environmental gain associated to the reuse scenario was evaluated using MS360 and shows a saving of 1.7 tons of CO2
	Prepreg backing	1210	During the build of 11.2, 1.2 metric tons of pre-preg PE plastic backing were generated, (every square meter of prepreg cloth generates twice as backing plastic), for want of a better solution this plastic went to waste-energy. However, the team have subsequently made contact with local specialist recyclers who can recycle this material with potential savings of 2.85 tC02e
	Vacuum bags	2200	CDK Technologies systematically reuse vacuum consumables debulking bags, economising between 25% plastic
	Tenting plastic – Painting process	350	120 linear metres of single use poly tenting used during the painting process
Landfill	Plugs and moulds CF/GF offcuts	4892	19% or 4.9t of all waste went to landfill, all of which was associated with the plug and mold manufacturing
Total		25939	Total resource recovery/waste was 26 metric tons of mixed waste, 7.6t (30%) retained/Reused, 7.6t (30%) Recycled, 5.7t (19%) waste-energy, 4.9t (22%) to landfill

SCENARIOS - ENERGY

Table: Comparing GHG impacts of different electricity sources to build an IMOCA, calculated with MarineShift360 beta software on September 1st, 2021

	Total tC02e	Improvement from EU average tC02e	% improvement from EU average baseline
100% EU grid scenario	651	n/a	n/a
Actual build	553	-98	-15%
100% renewable scenario	441	-210	-32%

Table: Total breakdown digital footprint of the design & build

Digital footprint - 11.2	Design & Build group	Other suppliers
2019 Research and development	7.69	
2020 Design and build coordination	2.79	0.5
2021 Design and Build	2.79	1.0
TOTAL	15 tC02e 3% of total design build footprint	

SCENARIOS - MATERIALS

FIBERS

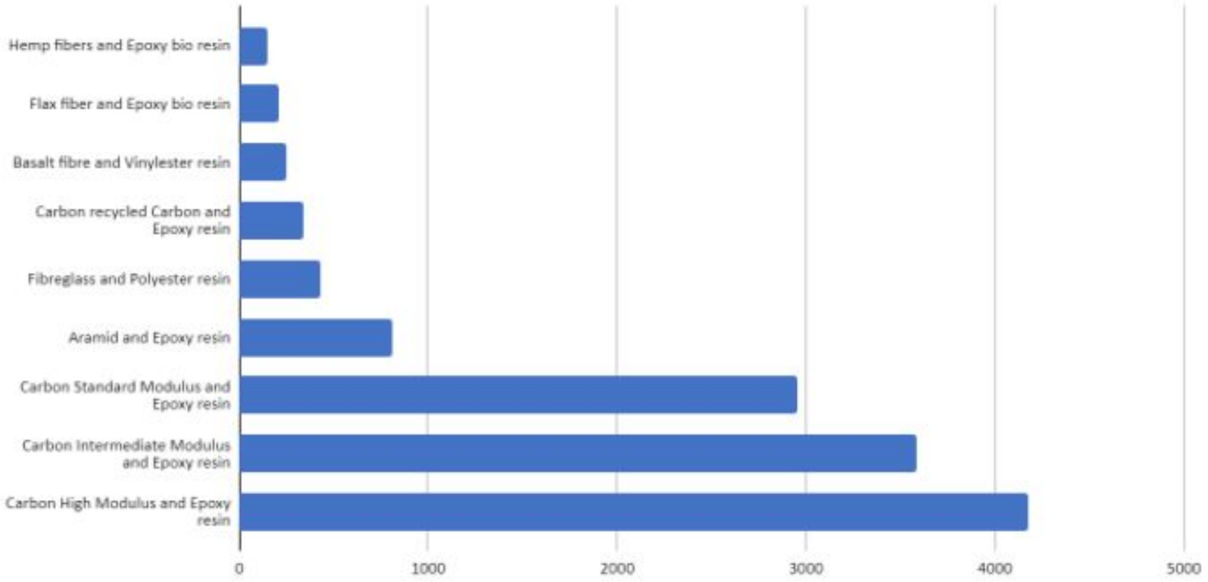


Figure: Comparing relative GHG impacts of different fibers, Source Michel Marie Calculated with MarineShift360 beta software on October 14th, 2021

SCENARIOS - MATERIALS

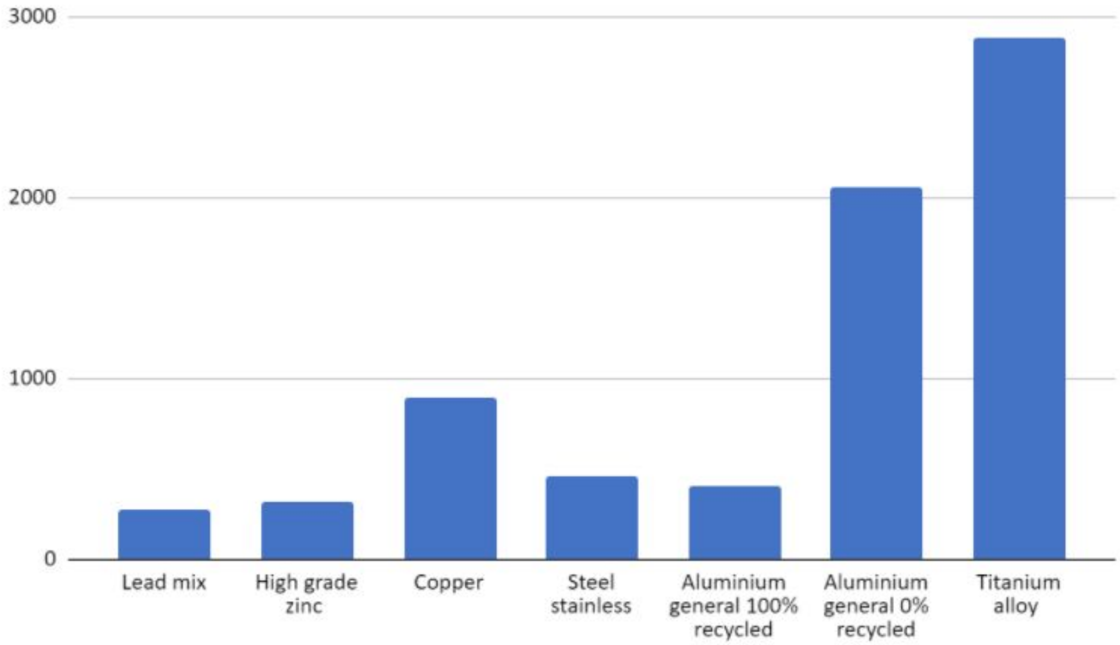


Figure: Comparing relative GHG impacts of different metals, Calculated with MarineShift360 beta software on October 1, 2021

SCENARIOS - MOLDS

IMPROVEMENT TRACKS

Table: Hull and deck molds, impact reduction potential, compared to the full system (IMOCA launched and ready to sail - 553 tC02e)
Calculated with MarineShift360 beta software, June 2021

	FEASIBILITY	tC02e	Global Warming (%)	Mineral Resource Scarcity (%)	Energy consumption (%)	Water consumption (%)	Marine Eutrophication (%)
1. Reuse of steel structure at 50%	GOOD	-6.6	-1.2	-2.9	-0.4	-1	-0.2
2. Recycling of production waste (EPS,foams,CF/GF)	POSSIBLE	-2.2	-0.4	-0.1	-0.3	-0.5	-0.1
3. Integrate recycled carbon fibre	POSSIBLE	-23.8	-4.3	-0.3	-4.1	-2.6	-1.6
4. 100% Bioresin	GOOD	-2.7	-0.5	-0.1	-0.3	-0.5	0
5. Local supplier	GOOD	-5.6	-1	-0.1	-0.6	-0.1	0
6. No Plugs	POSSIBLE	-46	-8.3	-4.6	-6.3	-13.5	-13
All improvements tracks		-87	-15.7	-8.1	-12	-18.2	-14.9
Best improvement track Reuse of the molds	EASY	-171	-31	-10	-26	-32	-34

SCENARIOS - TRANSPORT

Table: Assessing the GHG impacts of international freight choices, Calculated using GHG protocol, 2021

INTERNATIONAL FREIGHT	Quantity	Mode	km	Weight	Factor	Factor	kgC02e	% Total GHG (553 tC02e)
Boom	1	Air	18500	0.13	ton.km	1.01	2,429	0.44%
Hull and deck molds	3	Road	1500	8	Truck.km	1	4,500	0.81%
Total							6,929	1.25%

SCENARIOS - FOILS

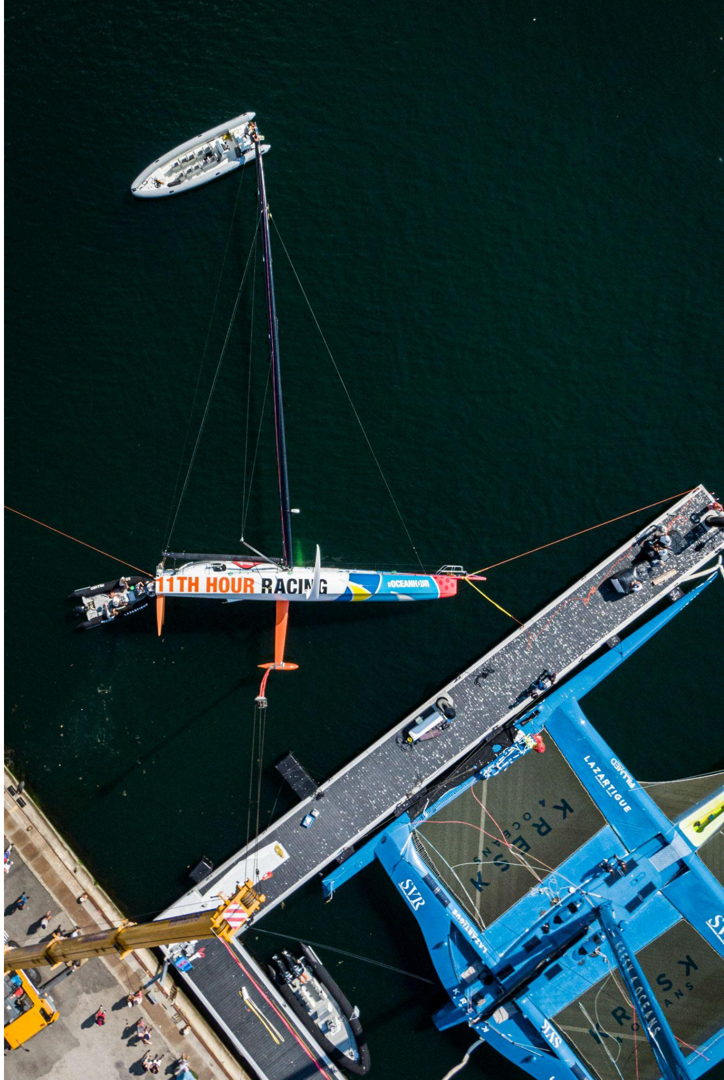
Table: Comparing GHG & waste impacts of foil construction methods adjusted for weight, Calculated with MarineShift360 beta software on October 1st, 2021

Set of foils (600 kilos)	Without mold	From mold
GHG impact (kgco2e)	90	96
Percentage waste	371%	524%

The integration of foils in the IMOCA Class has transformed performance in certain conditions, however at **+/- 100tC02e** a set of foils represent almost **20%** of the total greenhouse gas emissions of the design and build.

KEY AREAS

1. Timeline & status quo
2. Renewable energy
3. Design for longevity & reuse
4. Breakdown of the build footprint
5. Molds
6. Alternative materials
7. Waste & circularity
8. Policy & rules
9. Carbon emissions - Cap & Internal price



RENEWABLE ENERGY

Ensure manufacturing energy needs are sourced from 100% renewable energy tariffs

Compared to an average European electricity source, **potential reductions of 30%**

Recommendation:
Make this a key point of discussion across your supply chain, and sourcing contracts

PLUGS & MOLDS

50% of an IMOCA 60 design & build GHG emissions relate to plugs and molds

This is an sector that offers relatively quick and significant reductions

Recommendations:

- Avoid the use of male plugs - **potential gain 2% or 8.3 tC02e**
- Build molds for reuse - **potential gain 50%**
- Build molds from recycled materials

Example:

- The mold for 11.2 is already being used by another IMOCA team

- Certain sectors of the composite industry are already using rCF and/or flax as an alternative to virgin carbon fiber in molds

EOL IMOCA COMPONENTS

End of life plans for IMOCA components and their respective reductions or impacts

SUB - GROUP	Component	Short term - First cycle: Actual	Short term - First cycle: Planned	Final cycle: Actual	Final cycle: Planned
PLUGS AND MOULDS	HULL & DECK PLUG			**Partial recycle - Most to landfill**	
	HULL MOULD	**Reused**			Recycle or waste to energy
	DECK MOULD	**Reused**			Recycle or waste to energy
	DECK MOCK UP			**Recycled**	
HULL & DECK	HULL SHELL		Reuse		Recycle or waste to energy
RUDDERS	RUDDER CASE		Reuse		Recycle or waste to energy
	RUDDERS		Reuse		Recycle or waste to energy
KEEL	KEEL FIN		Reuse		Recycle
	KEEL TRAILING EDGE		Reuse		Recycle or waste to energy
	KEEL BULB		Reuse		Recycle
	KEEL BEARINGS		Reuse		Recycle
FOILS	FOIL SET		Reuse		Recycle or waste to energy
	FOIL BEARINGS		Reuse		Recycle or waste to energy
SAILS	ALL SAILS		Reuse		Waste to energy
BOOM	BOOM		Reuse		Recycle or waste to energy
	BOOM HARDWARE		Reuse		Recycle
MAST	MAST		Reuse		Waste to energy
	MAST HARDWARE		Reuse		Recycle
OUTRIGGERS	OUTRIGGERS		Reuse		Waste to energy
RUNNING RIGGING	ROPE		Reuse		Recycle
STANDING RIGGING	STANDING RIGGING				Waste to energy
	STANDING RIGGING HARDWARE				Waste to energy
SAIL TRIM DECKGEAR	FURLERS		Reuse		Recycle
	DECK GEAR		Reuse		Recycle
	WINCHES AND TRANSMISSION		Reuse		Recycle
OTHER DECKGEAR	STEERING SYSTEM		Reuse		Recycle
	LIFE LINES AND PULPIT		Reuse		Recycle
NAVIGATION	INSTRUMENTATION		Reuse		Recycle
POWER	BATTERIES		Reuse		Recycle
	CABLES		Reuse		Recycle
	ELECTRIC MOTORS		Reuse		Recycle
DECK HYDRAULICS	DECK HYDRAULIC SYSTEM		Reuse		Recycle
KEEL HYDRAULICS	KEEL HYDRAULIC SYSTEM		Reuse		Recycle
PROPULSION	ENGINE, DRIVE SHAFT AND PROP		Reuse		Recycle

Table: End of life plans for IMOCA 11-2 and components

EOL IMOCA COMPONENTS

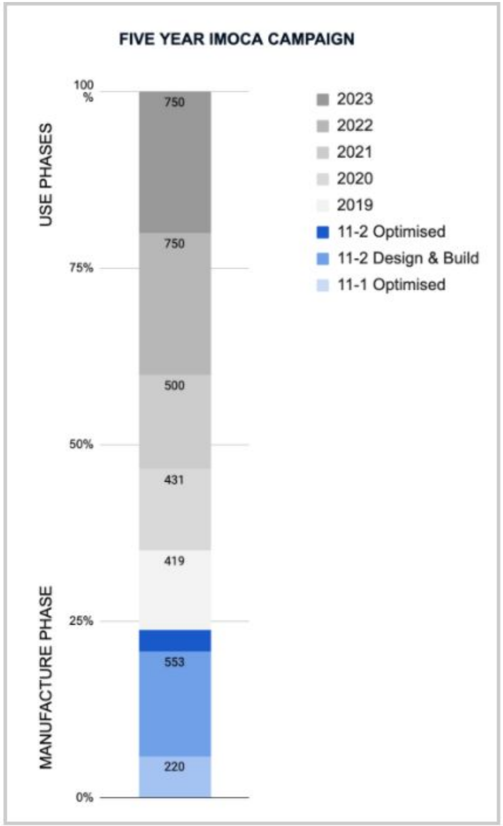
End of life plans for IMOCA components and their respective reductions or impacts

SUB - GROUP	Component	Short term - First cycle	Final cycle
		Actual	**Actual**
		Planned	Planned
PLUGS AND MOULDS	HULL & DECK PLUG		**Partial recycle - Most to landfill**
	HULL MOULD	**Reused**	Recycle or waste to energy
	DECK MOULD	**Reused**	Recycle or waste to energy
	DECK MOCK UP		**Recycled**
HULL & DECK	HULL SHELL	Reuse	Recycle or waste to energy
RUDDERS	RUDDER CASE	Reuse	Recycle or waste to energy
	RUDDERS	Reuse	Recycle or waste to energy
KEEL	KEEL FIN	Reuse	Recycle
	KEEL TRAILING EDGE	Reuse	Recycle or waste to energy

CAMPAIGN FOOTPRINT

Table: Full campaign greenhouse gas emissions
Calculated using MarineShift360 beta software, October 1st, 2021

Design & Build	11.1 Optimised	11.2 Launched & ready to sail		11.2 Optimised for TOR	
Inventory	Ex-Hugo Boss plus 4 foils (1 set plus 2 others) 1 set sails + 3 1 set rigging	Launched & ready to sail with IMOCA Class inventory 1 set foils 1 set sails 1 set rigging		1 spare rudder 1 set foils 1 set sails 1 set rigging	
$tC02e$	220	553		116	
Operations	**2019**	**2020**	**2021**	**2022**	**2023**
$tC02e$	419	431	500 +/-	750 +/-	750 +/-



COMPARING KAIROS 2010 REPORT

2010 KAIROS REPORT COMPARISONS

The team used the Kairos 2010 report as a benchmark to indicate key initial research topics, and a reference for potential improvements for the actual build process.

In comparing results between the two reports, it is worth noting the similarities and limitations to such a comparison.

Teams
Both reports focus on the build of an IMOCA for a round the world race, over a similar time period, but the Kairos report included the use phase associated with the operations of the team participating in the Vendee Globe, a three year project. - Comparisons have taken this into account by extracting the use phase.

Molds
Both reports took into account the hull and deck molds, and the fact that both teams passed the molds onto another team to be used again. However, the method of allocating the mold's impact was approached differently by each team:

- Kairos split the impact of the molds, allocating only 50% of the impact to life cycle analysis total (300 tC02e)
- 11th Hour Racing team allocated 100% of the impact of the molds (171 tC02e), to the total calculation of greenhouse gas emissions (**553 tC02e**[15]) and passed the mold on to the next team as zero impact[16]

By adding 12.5% (40 metric tons) to include the remaining 50% of the mold, an adjusted assessment for the Kairos IMOCA built in 2010 is estimated to be **343 tC02e**

Database
While both studies did not use the MarineShift360 software, the data used by both studies were sourced from the Ecoinvent database, at ten years apart, certain factors will have changed because of either better data or impact assessment methods to process the data - Without a more detailed comparison of these changes, or re-calculation of one of the studies, we assume the error factor of +/- 10%

COMPARING KAIROS 2010 REPORT

Electricity
One factor that has changed over time is that GHG emissions associated with electricity have significantly reduced. Using the UK as an example it represents a 50% reduction per kWh.

- 2010: 0.496 kgC02e/kWh
- 2021: 0.212 kgC02e/kWh

As energy is used in transforming raw materials, throughout the supply chain and in the design and build process, impacts in 2021 are certainly lower than in 2010.

Inventory
In comparing both studies the final point below, Inventory, is certainly the most significant difference. Construction processes, materials and components have changed over the ten year period.

IMOCA boats in 2021, have replaced relatively simple daggerboards for complex foils, the foils today represent +/- 100 tC02e (20% total).

The overall design and build process has created more complicated deck, hull, mold and components, this has had an impact on material choices, energy used, and build time which has more than doubled:
2010: 20,000-man hours
2021: 40-45,000-man hours.

It is in these last points that we find the main reasons for such an increase in greenhouse gas emissions for an IMOCA build, and the one of the key reasons for doing the comparison in the first place.

Summary
The limitations of comparing the two different reports/systems do not devalue the importance of this opportunity - to have two LCA studies from similar teams ten years apart. Conclusions made with care to context can therefore provide valuable information.

However, regarding the relevance of the Kairos 2010 report, is that not only are their recommendations and improvement tracks still useful today, but maybe most importantly that the Kairos 2010 report establishes the first benchmark for the IMOCA Class Net zero targets, which we will look at in more detail in the next chapter.

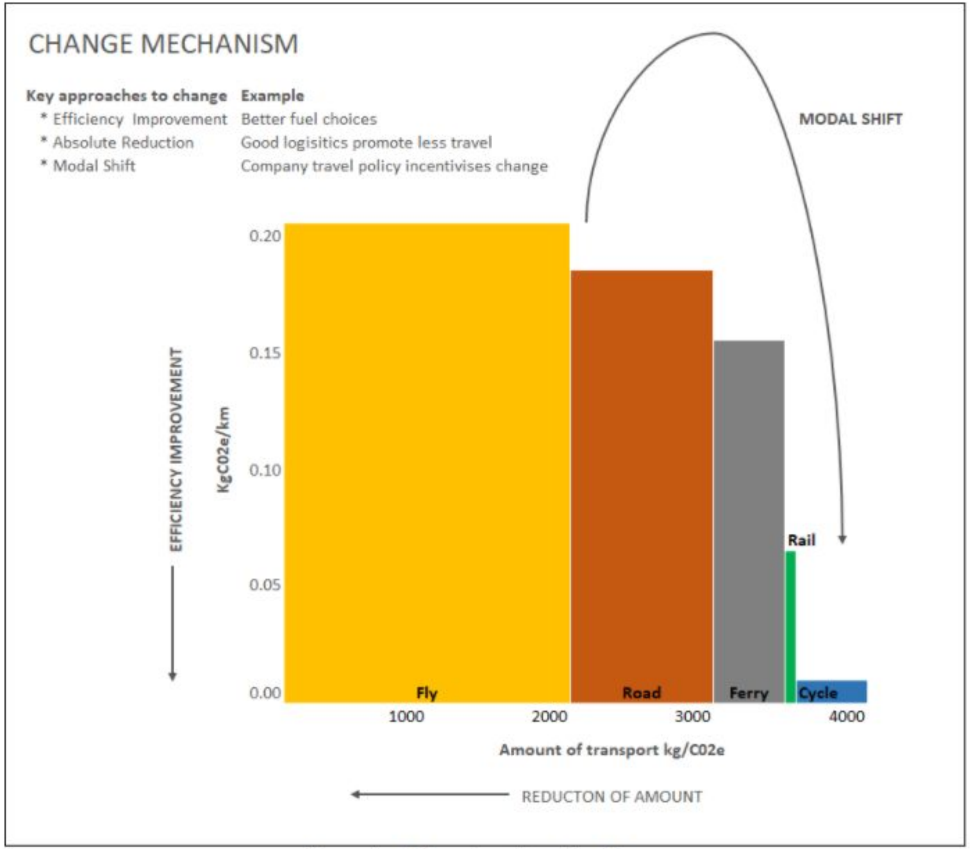
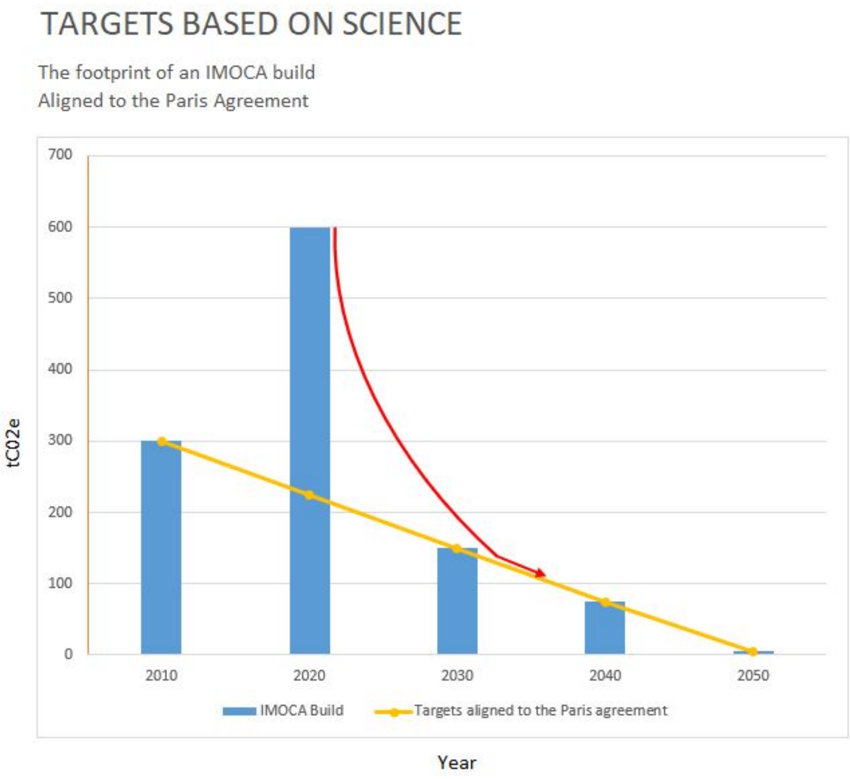


Figure: Looking at options for change

TEN YEARS OF PROGRESS & THE PATHWAY TO NET ZERO



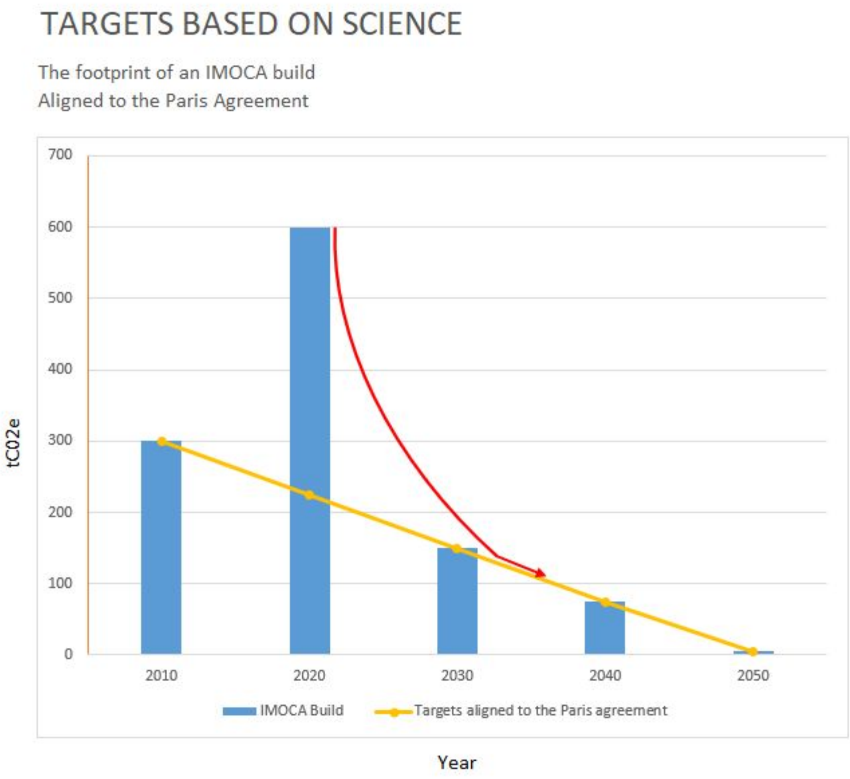
340 tC02e (2010)
553 tC02e (2021)

The RED line shows the pathway to Net Zero by 2050

To create change at this scale we need:

- Efficiency reductions
- Absolute reductions
- A shift to alternative solutions

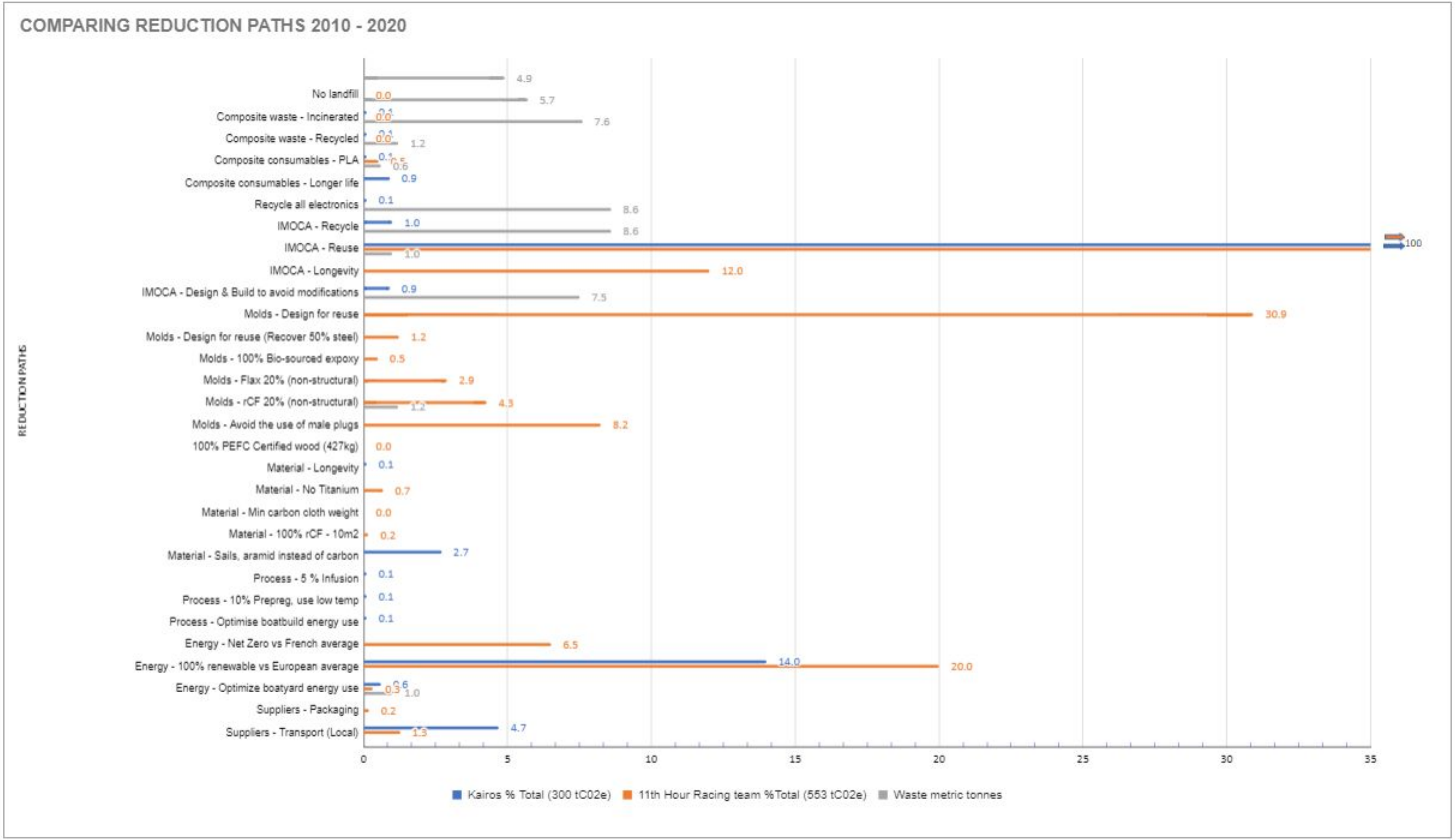
NEW TARGETS



~~340 tC02e~~

45% reduction by 2030
190 tC02e *(Absolute reductions)*

Net Zero by 2050
0 tC02e *(Ongoing reductions and sequestration of remaining C02e)*


COMPARING REDUCTION PATHS 2010 - 2020
REDUCTION PATHS
No landfill
Composite waste - Incinerated
Composite waste - Recycled
Composite consumables - PLA
Composite consumables - Longer life
Recycle all electronics
IMOCA - Recycle
IMOCA - Reuse
IMOCA - Longevity
IMOCA - Design & Build to avoid modifications
Molds - Design for reuse
Molds - Design for reuse (Recover 50% steel)
Molds - 100% Bio-sourced expoxy
Molds - Flax 20% (non-structural)
Molds - rCF 20% (non-structural)
Molds - Avoid the use of male plugs
100% PEFC Certified wood (427kg)
Material - Longevity
Material - No Titanium
Material - Min carbon cloth weight
Material - 100% rCF - 10m2
Material - Sails, aramid instead of carbon
Process - 5 % Infusion
Process - 10% Prepreg, use low temp
Process - Optimise boatbuild energy use
Energy - Net Zero vs French average
Energy - 100% renewable vs European average
Energy - Optimize boatyard energy use
Suppliers - Packaging
Suppliers - Transport (Local)
4.9
0.0
5.7
7.6
1.2
0.6
0.9
0.1
8.6
1.0
8.6
100
1.0
12.0
0.9
7.5
30.9
1.2
0.5
2.9
4.3
8.2
0.0
0.1
0.7
0.0
0.2
2.7
0.1
0.1
0.1
6.5
14.0
20.0
1.0
0.2
4.7
1.3
0
5
10
15
20
25
30
35
Kairos % Total (300 tC02e)
11th Hour Racing team %Total (553 tC02e)
Waste metric tonnes

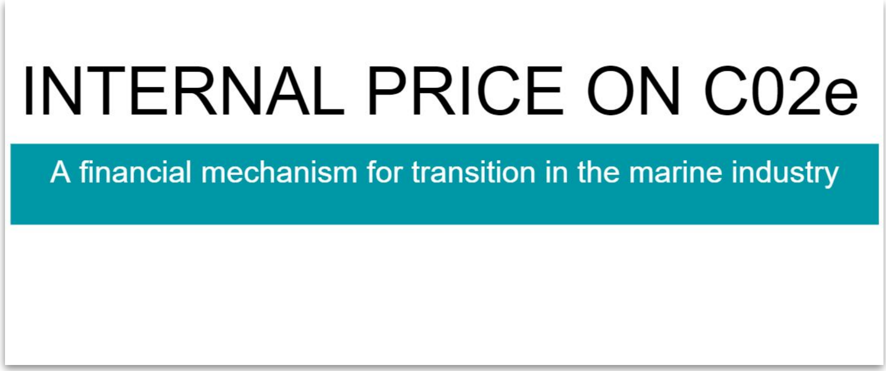
FUTURE BUILD AND IMOCA CLASS CHOICES AND NET ZERO TARGETS

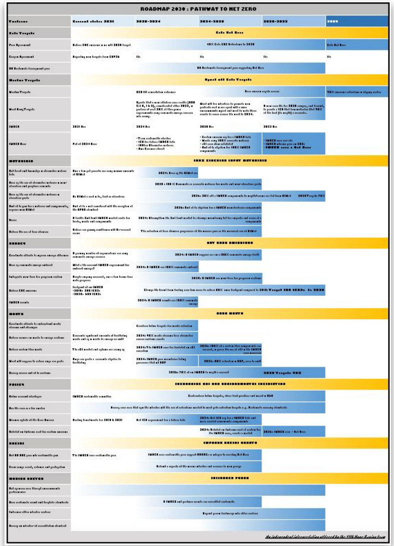
FEASIBILTY	DESCRIPTION
EASY	No barriers
GOOD	Requires basic planning
POSSIBLE	Technically possible, certain barriers to be overcome

IMPROVEMENT TRACKS		FEASIBILITY	REDUCTION tC02E	NEW BUILD	NEW BUILD SECONDHAND MOLD	SECONDHAND BOAT ONLY	IMOCA RULES
TEAMS	100% local suppliers, no international transport or airfreight	EASY	7	☑	☑	☐	☐
	Reuse of the moulds (Once)	EASY	171	☐	☑	☐	☐
	Reuse of boat	EASY	553	☐	☐	☑	☐
SUPPLIERS	Reduce packing through reverse logistics	GOOD	1	☑	☑	☐	☐
	Improve insulation of main build facility	GOOD	1.8	☐	☑	☐	☐
	Net zero energy supplier (Boatyard only)	GOOD	36	☑	☑	☐	☐
IMOCA	Define minimum cloth weight (300 gsqm)	GOOD	0.046	☐	☐	☐	☑
	Prohibit plugs (Female mold only)	GOOD	45.6	☐	☐	☐	☑
	Replace all titanium with stainless steel	GOOD	3.7	☐	☐	☐	☑
ALL	Molds - Integrate rCF (+/- 20%)	POSSIBLE	23.6	☑	☐	☐	☑
	Molds - Integrate Flax (+/-20%)	POSSIBLE	16	☐	☐	☐	☐
	Molds - Substitute all epoxy resin by bioresin	GOOD	2.7	☑	☐	☐	☑
	Use only PEFC certified wood	EASY	0.1	☑	☐	☐	☑
	Built for reuse and longevity (steel structure of moulds	GOOD	6.8	☑	☐	☐	☑
	Collect and mutualise the PE prepreg backing for recycling	EASY	2.9	☑	☑	☐	☑
	Design & Build for four RTW races	GOOD	66.5	☐	☐	☐	☑
TOTAL: Calculated with MarineShift360 beta software on October 1, 2021			tC02e	**80**	**219**	**553**	**152**
			% TOTAL BUILD	**14%**	**40%**	**100%**	**27%**

IMAGINE NET ZERO

POLICY
CARBON EMISSIONS POLICY
INTERNAL PRICE OF CARBON
SUSTAINABILITY FUND
PATHWAY TO NET ZERO





CARBON EMISSIONS POLICY

Two mechanisms that can play a strong role in the transition are setting:

- A threshold for carbon emissions
- An Internal price for carbon emissions

Threshold

A threshold for carbon emissions for each team, component, boat build or similar unit, is a direct method to define limits for the transformation of raw materials to finished boats, as well as boundaries for the use phase. Based on the most recent LCA or use emissions data, thresholds should be set at a level that is achievable but that incentivizes innovation, and should be updated periodically to reflect progress and new targets.

Internal price for carbon emissions

There is a growing recognition that pricing carbon emissions provides a mechanism, at the global, national company/organization level, to support the pathway to Net Zero. Here is a conceptual model of what it might look like for the sailing sector, and the IMOCA Class