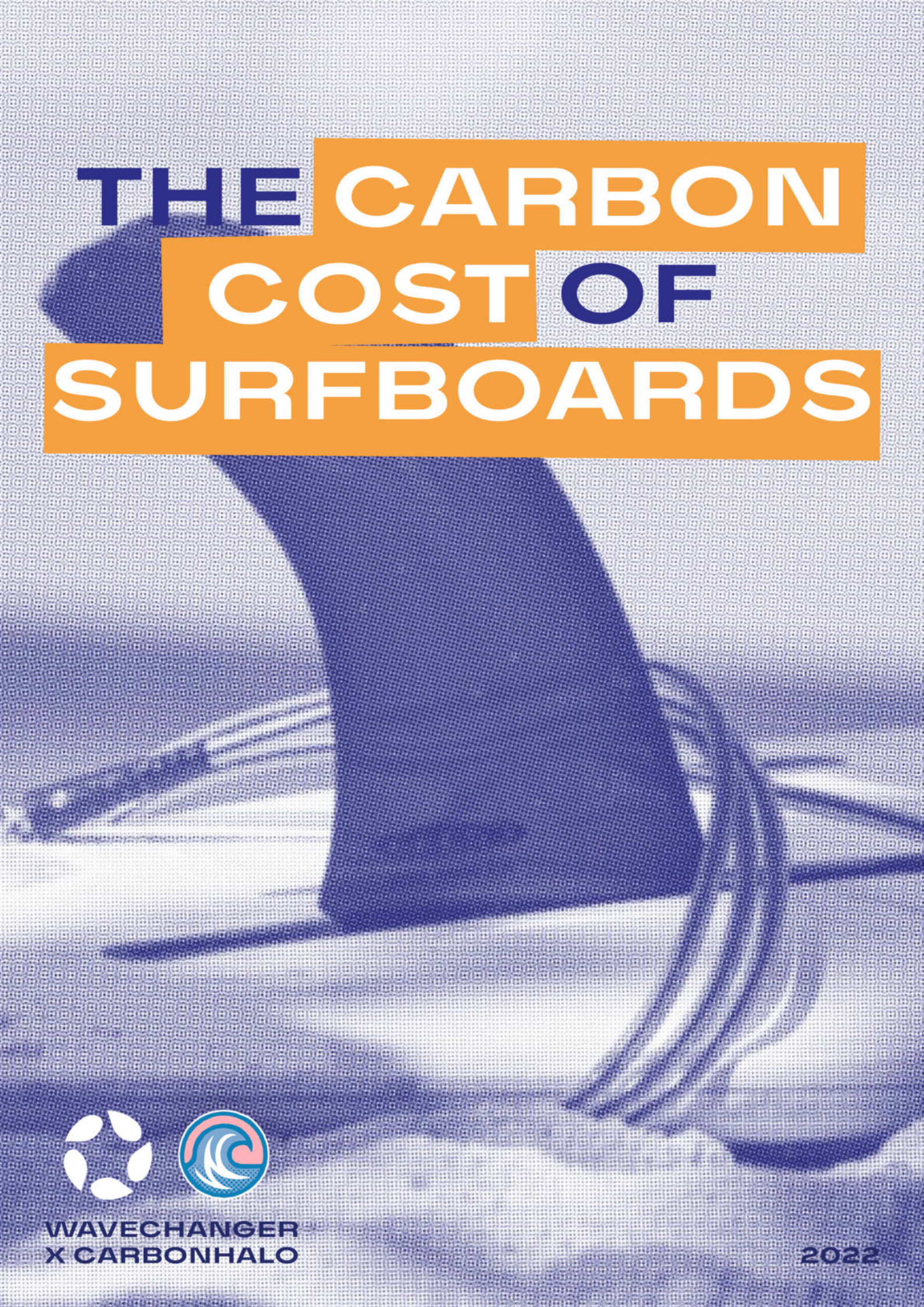
THE CARBON COST OF SURFBOARDS



WAVECHANGER
X CARBONHALO

2022

Design for this project was very kindly supported by UTS Shopfront at the Centre for Social Justice and Inclusion and the Faculty of Design, Architecture and Building at the University of Technology Sydney. The Visual Communications team were Subin Yoon, Aleksander Vujinovic, Thi Thu Nguyen, Kara Liebenberg & Michelle Wiranata – supervised by Nicola Hardcastle.

The featured products, services and organisations shown in this publication are intended to give an overview of what's currently available and potentially on the horizon, to the best of our knowledge. The content of this guide has in no way been paid for or sponsored.

WAVECHANGER

wavechanger.org

carbonhalo

carbonhalo.org

UTS SHOPFRONT
Community-University-Engagement

uts.edu.au

In the pursuit of low cost, high performance, and sheer volume of boards delivered to the growing number of surfers, the manufacturing of surfboards (chiefly the materials and technologies) has evolved from hand-crafted pieces of art to mass produced, cookie-cutter expendable consumables. It's only in recent years that we're seeing that the tide is changing to pause, reflect, and ask...

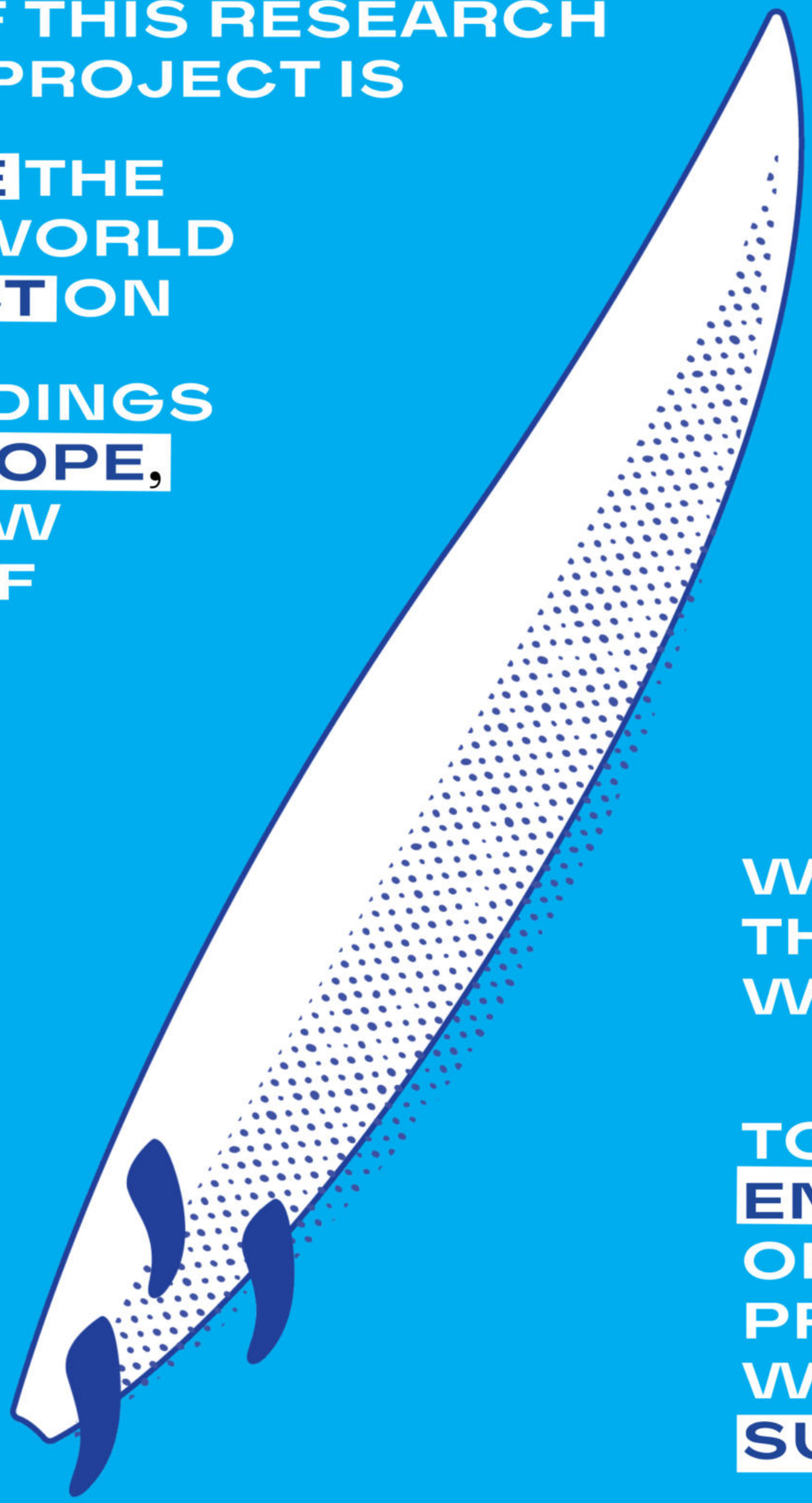
WHAT IS THE REAL COST OF SURFING?

Cost beyond economics, that considers the cost to our landfill sites, coastlines, marine-life and an inescapable social responsibility of the surfing industry and every surfer.

THE AIM OF THIS RESEARCH AND DATA PROJECT IS

TO **ENABLE** THE SURFING WORLD TO **REFLECT** ON

THESE FINDINGS AND, WE **HOPE**, **PLAN** A NEW COURSE OF **ACTION**.



WE **TRUST** THAT THE INFORMATION WILL HELP

TO **REDUCE** THE **ENVIRONMENTAL IMPACT** OF THE MATERIALS AND PROCESSES INVOLVED WITH **MANUFACTURING SURFBOARDS**.

03

DATA SOURCES

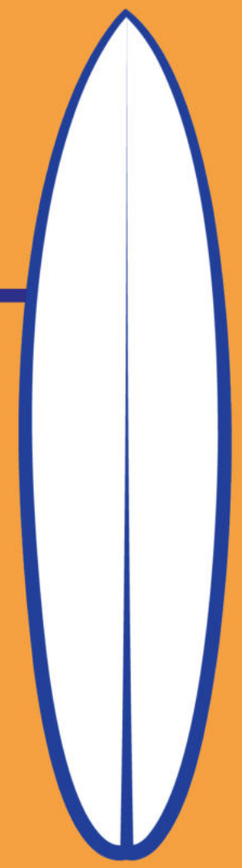
Whilst this report is not a formalised study, the entire team are extremely passionate about surfing and the environment, and wanted to ensure that the information represented here is accurate. Where possible, Australian data has been used. For instances where Australian data was not available or could not be found, internationally recognised data from industry bodies and emissions databases has been utilised. Examples of data include industry specific data to extract material densities, supply chain experts for transportation factors, certified emissions factors for materials and construction processes, and equipment specifications to determine power consumption. For labour and effort, surfing industry experts - including shapers and suppliers - have been consulted. For surfboard usage, some assumptions have been applied to account for the occasional to the avid daily user. A complete list of source information can be found within the appendix to this document.

04 SURFBOARD EMISSIONS

We've looked at four of the most common types of surfboards and calculated the carbon emissions of each board, expressed in kilograms of carbon dioxide or kg CO^2. Each calculation factors in the materials used and their embodied energy, the construction method, the distribution (packaging and transportation), the usage and lifetime maintenance, and finally the waste and disposal factors.

TYPICAL 6FT SHORTBOARD
(EPS BLANK + EPOXY RESIN)

=165 KG CO_2

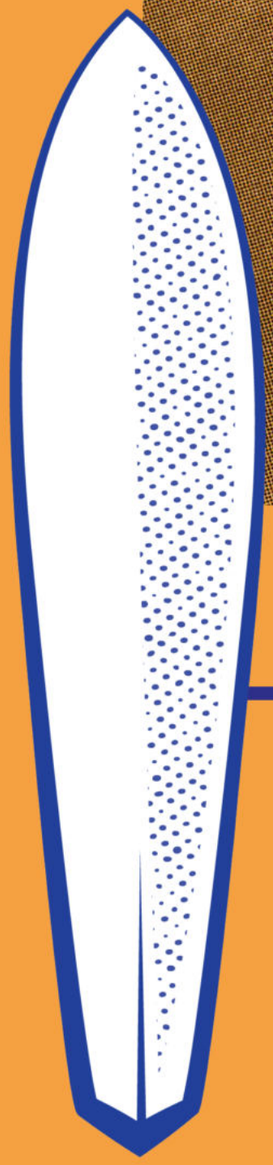


TYPICAL 7FT SOFT TOP
(EPS BLANK + EVA FOAM)

=167 KG CO_2

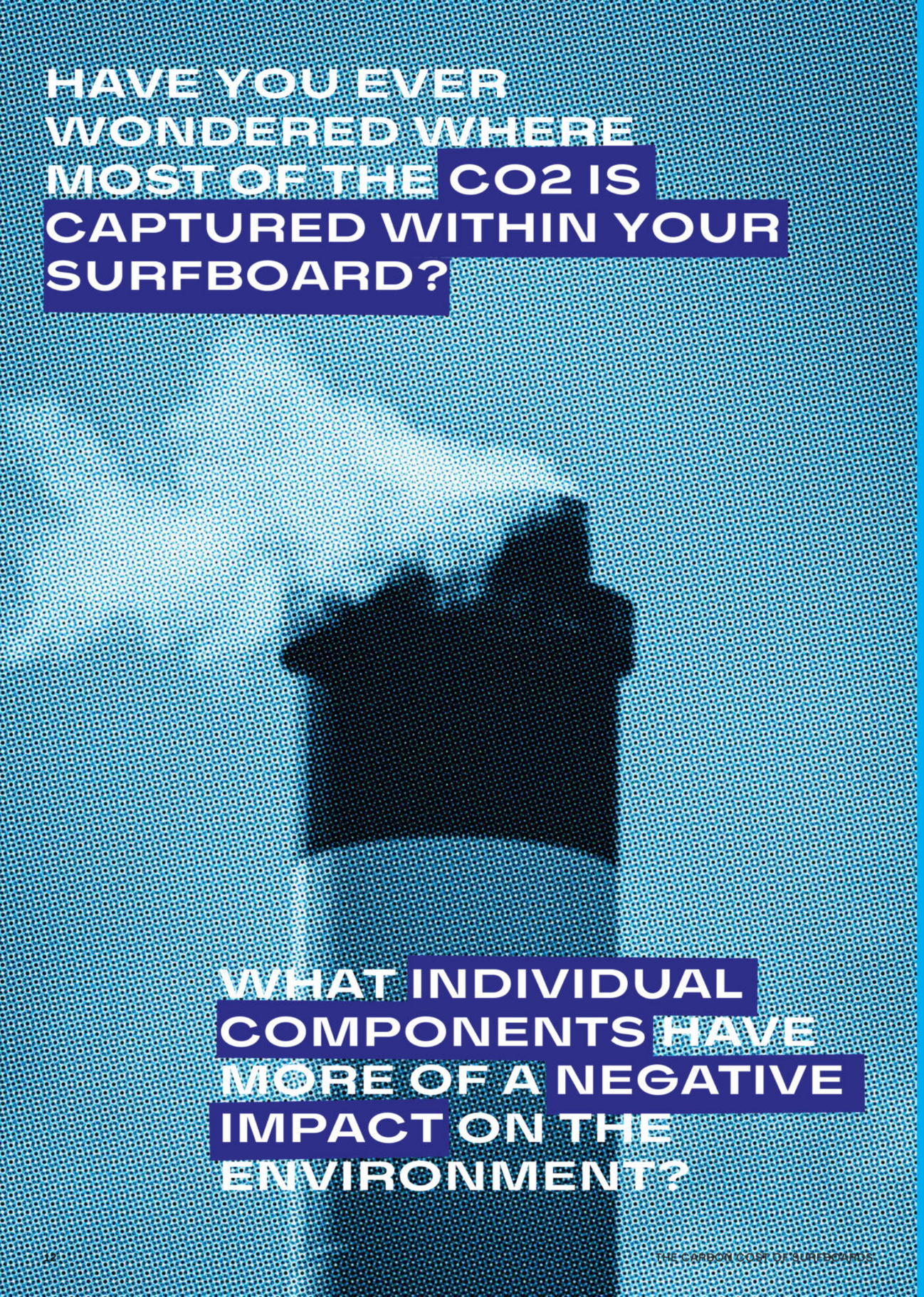
TYPICAL 8FT MINI MALIBU
(EPS BLANK + EPOXY RESIN)

=198 KG CO_2



TYPICAL 9FT LONGBOARD
(EPS BLANK + EPOXY RESIN)

=217 KG CO_2



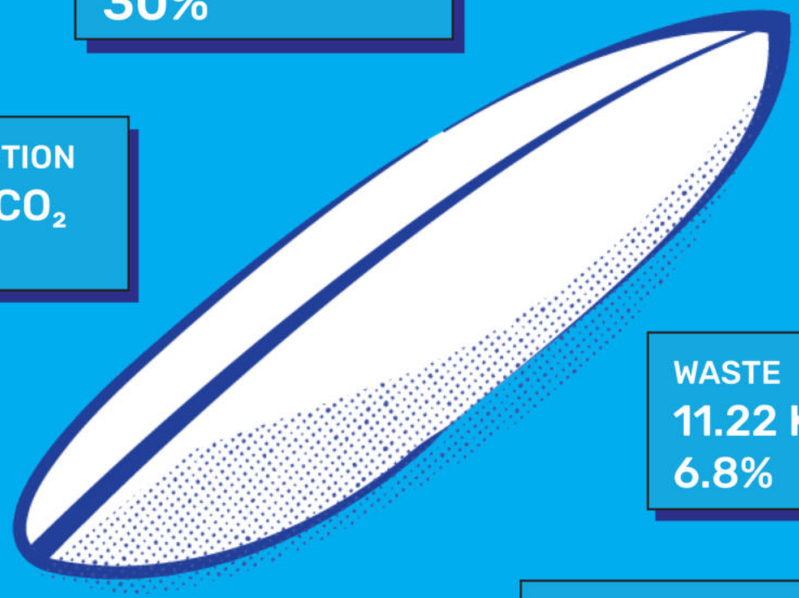
HAVE YOU EVER WONDERED WHERE MOST OF THE CO2 IS CAPTURED WITHIN YOUR SURFBOARD?

WHAT INDIVIDUAL COMPONENTS HAVE MORE OF A NEGATIVE IMPACT ON THE ENVIRONMENT?

BREAKDOWN OF EMISSIONS FOR A TYPICAL 6FT SHORTBOARD

MATERIALS
49.5 KG CO_2
30%

CONSTRUCTION
9.24 KG CO_2
5.6%



WASTE
11.22 KG CO_2
6.8%

+

DISTRIBUTION
5.94 KG CO_2
3.6%

USAGE & LIFETIME MAINTENANCE
89.1 KG CO_2
54%

= 165 KG CO_2 *

CONSTRUCTION PROCESS:

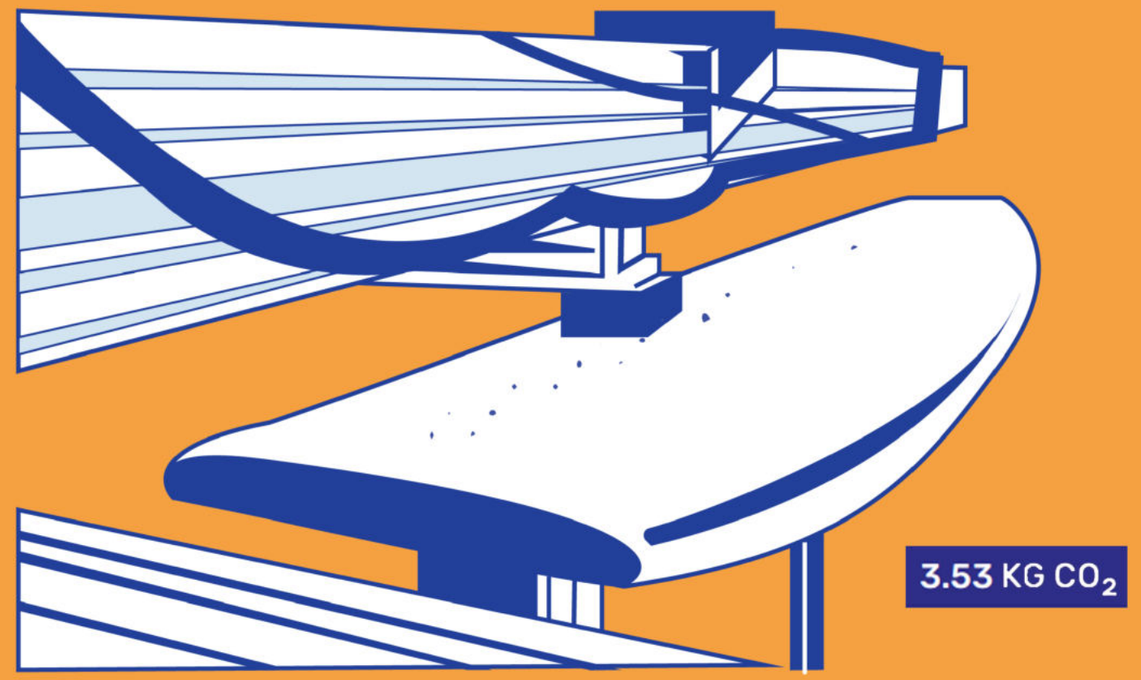
05 HAND SHAPED VS CNC MACHINE

STANDARD 6FT SHORTBOARD: CONSTRUCTION PROCESS BY HAND

4.93 KG CO_2

EMISSIONS FROM THE CONSTRUCTION OF SURFBOARDS (KG CO_2)

	6FT	7FT	8FT	9FT
HAND SHAPE	4.93	7.40	12.34	19.74
MACHINE SHAPE	3.53	3.53	3.53	3.53
GLASS	4.27	5.33	6.40	7.47
HAND SHAPE & GLASS	9.20	12.73	18.74	27.20
MACHINE SHAPE & GLASS	7.80	8.86	9.93	11.00



3.53 KG CO_2

STANDARD 6FT SHORTBOARD: CONSTRUCTION PROCESS BY CNC MACHINE

STANDARD 6FT SHORTBOARD: GLASSING/LAMINATION PROCESS

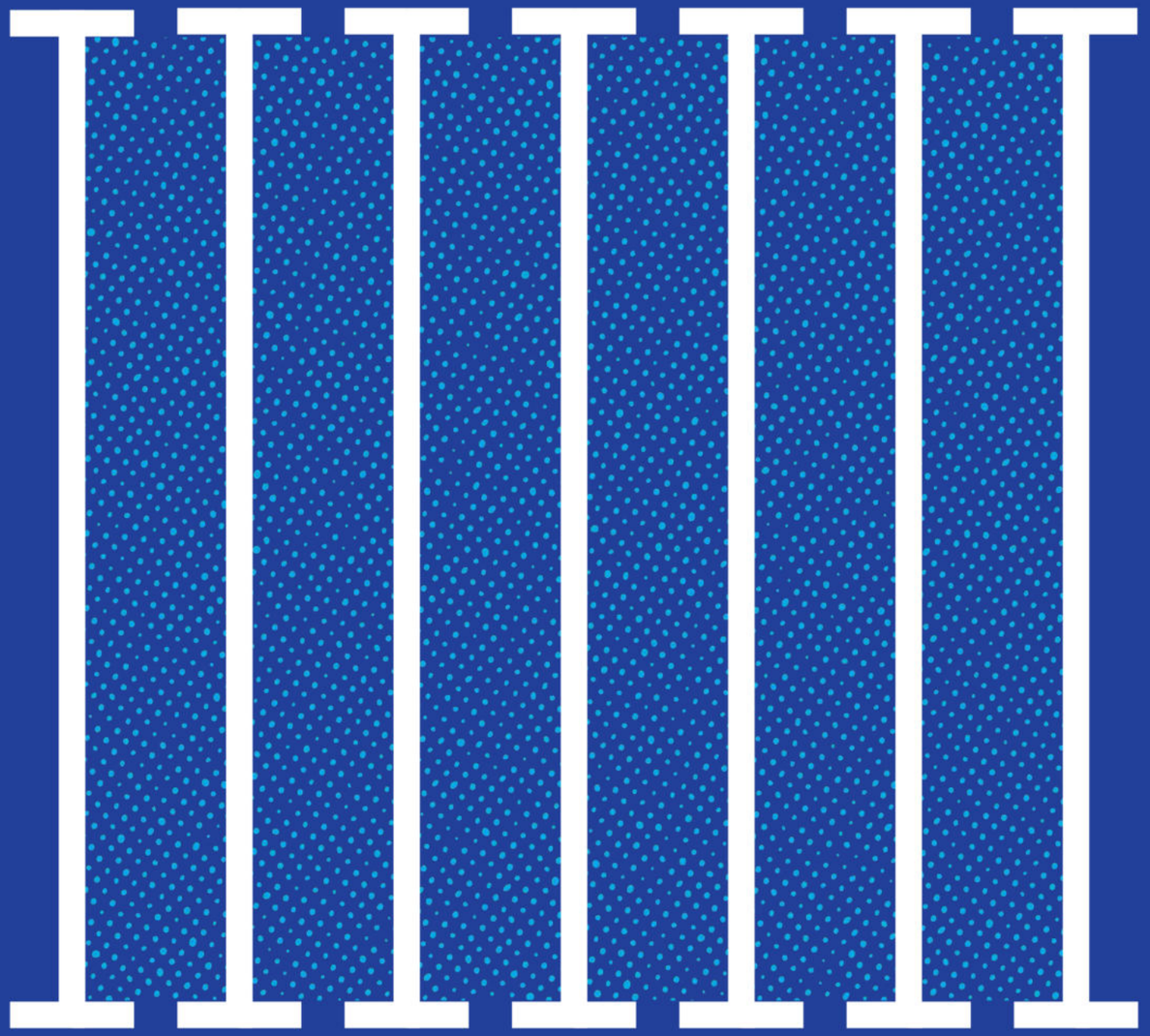
4.27 KG CO_2

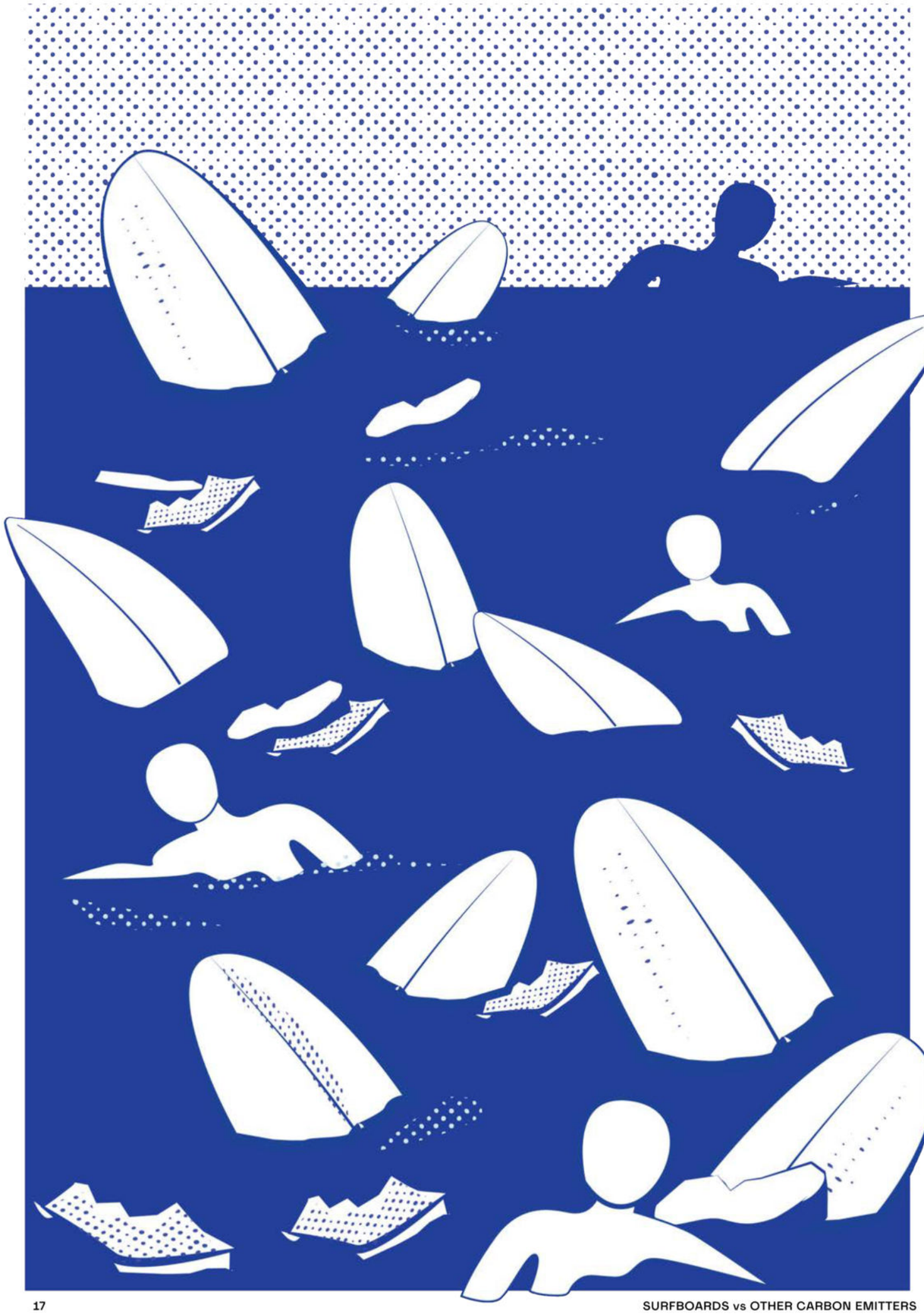
06 SURFBOARDS vs OTHER CARBON EMITTERS

YOU COULD FILL

7 X 50M

OLYMPIC SIZED SWIMMING POOLS WITH THE GLOBAL TOTAL OF EXPANDED POLYSTYRENE FOAM USED IN SURFBOARD MANUFACTURING, EACH YEAR.****





THE CARBON EMISSIONS FROM A TYPICAL 6FT SHORTBOARD*

(165 KG CO_2)

EQUALS THE SAME EMISSIONS AS CONTINUALLY DRIVING A PETROL VEHICLE FOR

700 KM (435 MILES)

OR A SINGLE PASSENGER FLYING NON-STOP FOR

650 KM (404 MILES)

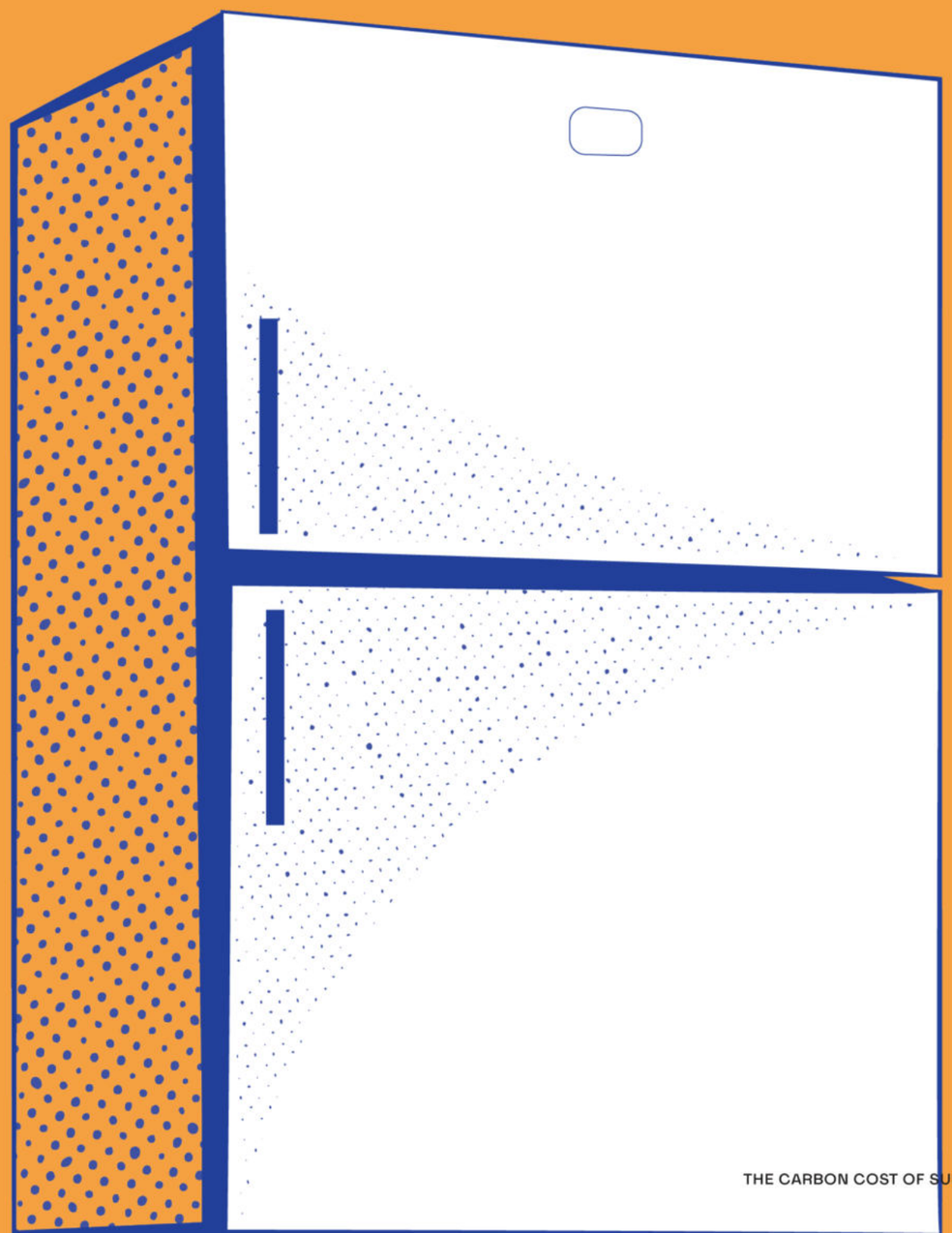
ON A SHORT-HAUL FLIGHT, OR

1,618KM (1,005 MILES)

ON A LONG-HAUL FLIGHT.**

THE GREENHOUSE GASES (GHG) FOR THE SAME 6FT SHORTBOARD

(165 KG CO_2)



IS THE EQUIVALENT OF CONTINUALLY RUNNING A HOUSEHOLD FRIDGE FOR

320 DAYS.***

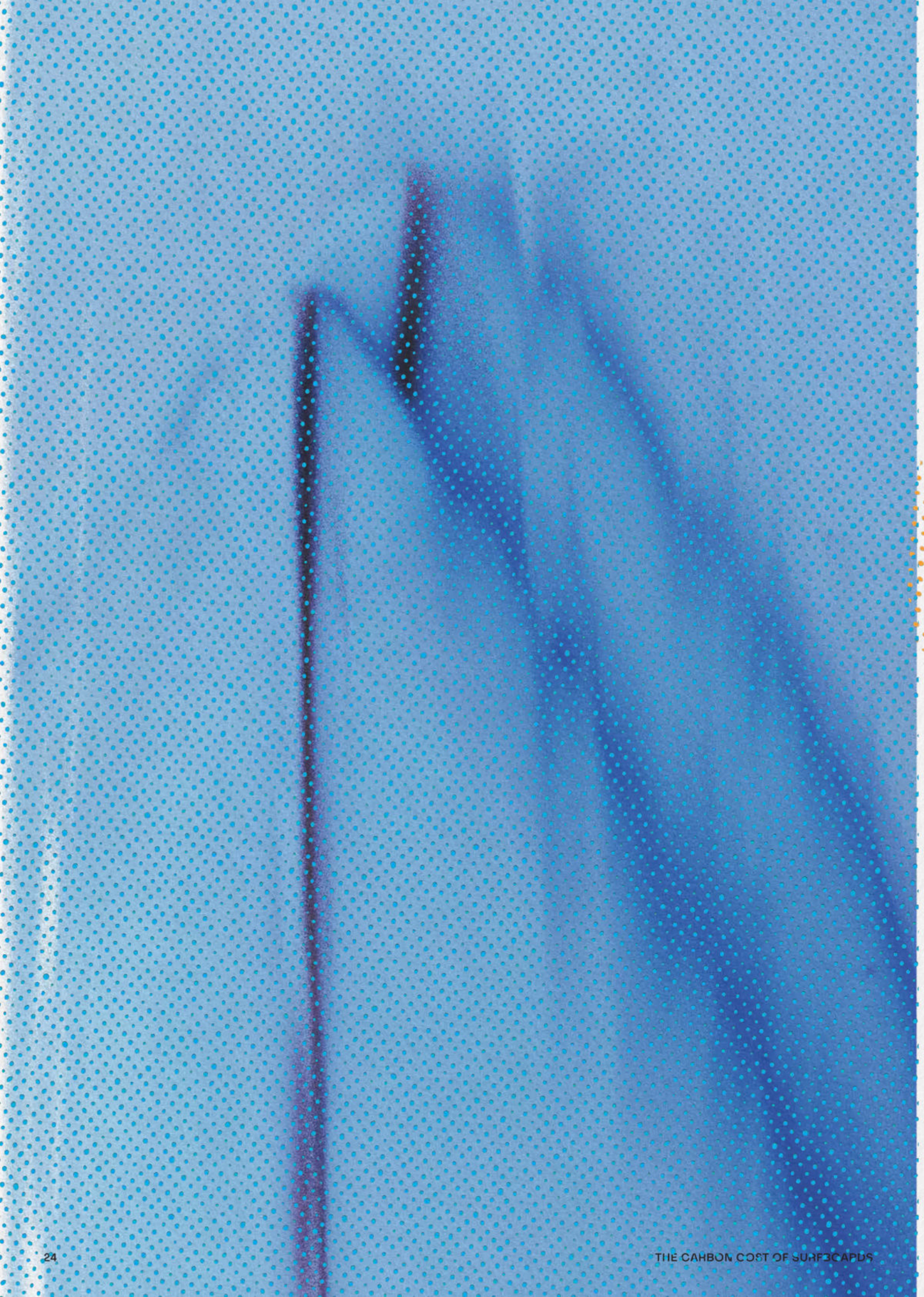
*TOTAL EMISSIONS FROM MATERIALS, CONSTRUCTION, DISTRIBUTION, LIFETIME USAGE + MAINTENANCE, AND WASTE.

**THE CARBON COST OF TRAVELLING ON LONG-HAUL FLIGHTS IS A LOWER FIGURE ON AVERAGE PER KILOMETRE BECAUSE OF THE HUGE AMOUNT OF EMISSIONS GIVEN OFF DURING TAKE-OFF AND LANDING.

***BASED ON TYPICAL 180W HOUSEHOLD FRIDGE RUNNING FOR 1500 HOURS (POWER VARIES DEPENDING ON FRIDGE BEING OPEN/CLOSED)

****BASED ON A TYPICAL SHORTBOARD CONTAINING 35 LITRES OF EPS FOAM. ONE OLYMPIC SWIMMING POOL = 2.5 MILLION LITRES

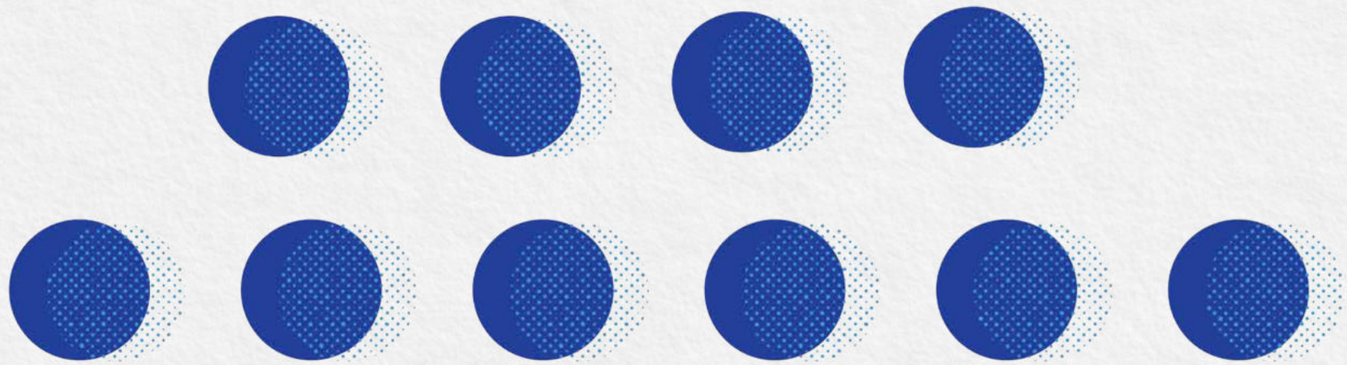
APPROXIMATELY 500,000 NEW SURFBOARDS ARE SOLD EACH YEAR AROUND THE GLOBE, WITH ROUGHLY HALF THAT NUMBER BEING SOLD IN THE USA



THE GLOBAL SURF INDUSTRY IS WORTH US $2.7 BILLION (AU$3.95 BILLION) FOR THE YEAR 2022

ESTIMATES FOR THE BREAKDOWN OF POLYSTYRENE (ONE OF THE MAIN TYPES OF FOAM USED IN SURFBOARD BLANKS) RANGE FROM 500 TO **1 MILLION YEARS.**

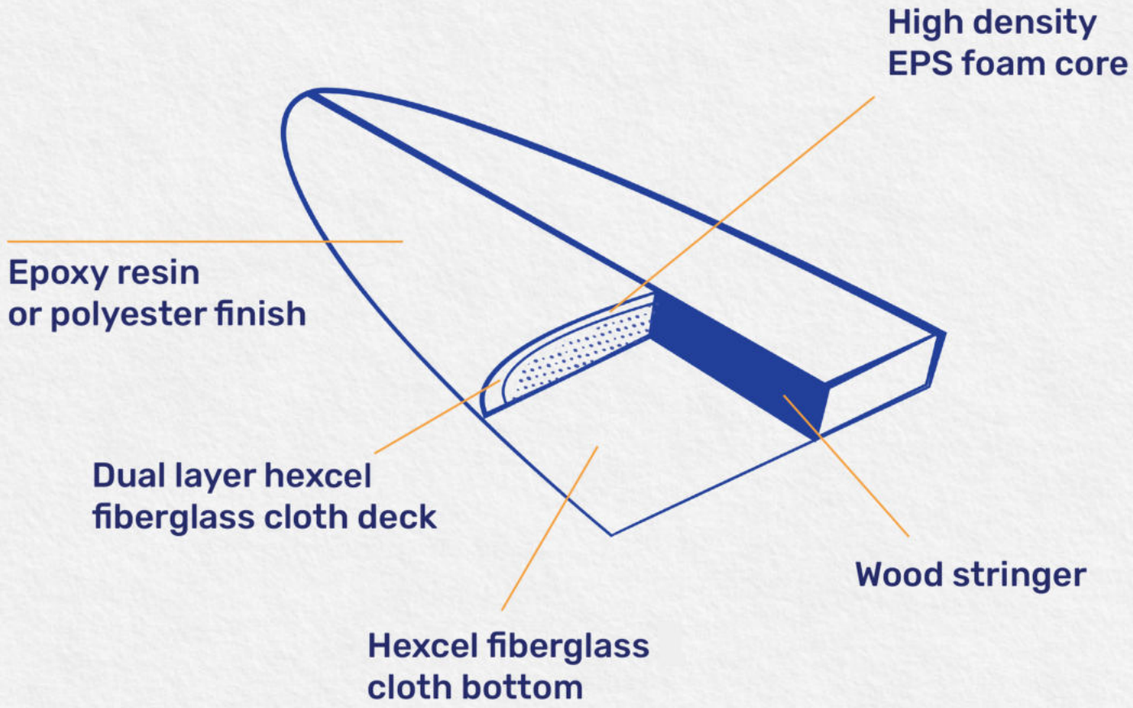
RATHER THAN DEGRADE, IT BREAKS INTO PIECES, WHICH IS OFTEN WORSE BECAUSE THOSE SMALL PIECES (OR MICROPLASTICS) WILL **SPREAD FAR AND WIDE.**



SURFBOARDS ARE NOTORIOUSLY DIFFICULT TO TAKE APART FOR RECYCLING.

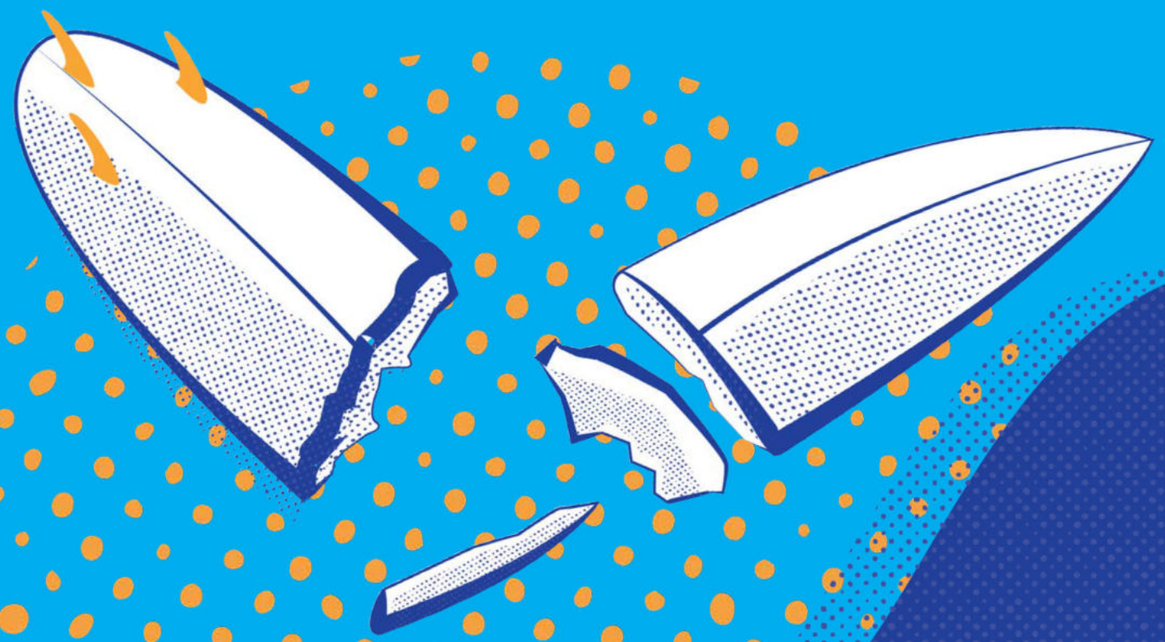
THE FOAM BLANK (OR CORE) OFTEN CONTAINS A CENTRAL TIMBER SUPPORT PIECE CALLED A STRINGER.

THE OUTER FINISH OF POLYESTER OR EPOXY RESIN HAS FIBREGLASS CLOTH SET WITHIN IT, AND A SURFBOARD TYPICALLY HAS FIN BOXES AND A LEASH PLUG FIXED WITH GLUE AND ALSO SET WITHIN THE RESIN.



ONCE BROKEN OPEN AND THEY BEGIN TO FALL APART, MODERN SURFBOARDS ARE AN ENVIRONMENTAL DISASTER DUE TO THE PETROLEUM-BASED MATERIALS AND SHEER VOLUME OF THEM.

EVEN SURF WAX, TYPICALLY PARAFFIN-BASED, IS HARMFUL ONCE IT ENTERS THE OCEAN AS IT CLOGS REEFS AND IS MISTAKENLY EATEN BY MARINE LIFE.



Going forward, if you're reading this and working in the surfing industry, here are some questions to ask yourself that could help reduce your emissions and overall carbon footprint.

1.0

Could you look to introduce locally sourced materials and even set-up (or share) an onshore/local manufacturing facility?

1.1

How about sourcing alternative materials that replace any existing petroleum-based, harmful substances. Natural materials such as paulownia, cork, bamboo, balsa wood, and even next-gen materials such as mycelium or algae. At the very least, look to include recycled content rather than using raw, virgin materials from non-renewable sources.

1.2

Can you reassess your product's packaging and look to reduce it or replace the harmful materials being used? Plastic can be replaced with cardboard, for example.

1.3

Is your product easy to recycle?
Can the number of parts and/or types of materials be reduced so that it avoids being a recycling nightmare? Some sports equipment, such as running shoes, are now being made with just one type of material. Adidas have developed a shoe made from only one type of Thermoplastic Polyurethane that can be recycled upon return.

1.4

Could you explore a leasing model, where users rent your product and return it once they've finished using it or when it breaks? The manufacturer can then reuse or recycle those materials, and in the worst case scenario, can dispose of them safely. The definition of a circular production facility.

1.5

This next one appeals to the users as well as the manufacturers. Can you look to reduce the carbon footprint of the lifetime usage and maintenance of your product? Fix your own surfboard, take care of it, and extend its life. Reduce the amount of toxic wax you use by buying cork traction panels. Reduce the frequency and distance of travel that's associated with surfing. Pass on unused/broken surfboards to those looking to learn to surf, or transform it into an art project, and do whatever it takes to avoid sending it to landfill.

1.6

For any unavoidable emissions, look to become carbon neutral with a provider such as Carbonhalo.
www.carbonhalo.com ↵
Offset your emissions with verified carbon credits that fund emissions reductions projects across the globe.

1.7

For more ideas and inspiration, visit www.wavechanger.org to access our learning resources; including podcast, blog and further research projects. Our mission is to lead the surf community to embrace sustainable solutions and reduce the environmental impact of surfing.

09 APPENDIX

All EF not stated below	The Integrated Carbon Metrics (ICM) Embodied Carbon Life Cycle Inventory Database, "Wiedmann, T., Teh, S. H. and Yu, M. (2019) ICM Database - Integrated Carbon Metrics Embodied Carbon Life Cycle Inventory Database"
Fibreglass Layers	https://www.boardcave.com.au/information/surfboard-glass
Resin Chart	https://cdn.shopify.com/s/files/1/0689/1441/files/Surfboard__Glassing_Resin_Amounts_Per_Board_Length.pdf?7799691258 253686780
Catalyst Chart	https://cdn.shopify.com/s/files/1/0689/1441/files/Surfboard__Glassing_Resin_Amounts_Per_Board_Length.pdf?7799691258 253686780
PU foam density	https://cdn.shopify.com/s/files/1/2994/9530/files/Surfblanks__Density_Chart_2014.pdf?2360690609765356245
PU resin density	https://allnexproductseu.blob.core.windows.net/products/40/ 2d3d7a859f5d4316887b-3350b821e5b0/2021-08-25/POLYPLE X-SURFBOARD-LAMINATING-RESIN_EN_A4.pdf
PU rubber cord density	https://www.gteek.com/Polyurethane-rubber-cord
Epoxy Resin density	https://shapers.com.au/content/Kinetix%20R110X%20surfboa rd.pdf
MEKP density	https://www.amcsupplies.com.au/wp-content/uploads/MEKP -Catalyst-SDS-1.pdf
PVC density	https://www.vynova-group.com/hubfs/02_Website_Pages/Pr oducts/PVC/Documents/vynova_polyvinylchloride_GB_rev010 0_2015-830.pdf?hsCtaTracking=1b4e11ef-1379-48c1-af73-2e07fcedcab6%7C53beaf85-8f40-4c2c-bbcb-71dd2f-9547bc
Fibreglass Fin layers	https://greenlightsurfsupply.com/pages/i-wan-to-make-fins-d o-you-know-how-make-layers-of-fiberglass-cloth-are-required- to-get-the-right-thickness-so-the-base-will-be-thick-enough-to -go-into-a-normal-fin-single-fin-base-also-how-much-resin

Surfboard Construction	https://greenlightsurfsupply.com/pages/green-light-surfboard- building-guide-page-3
Fin Data	https://www.surffcs.com.au/pages/fcs-fin-data
Carbon Fiber Density	https://www.opchealth.com.au/Content/Images/uploaded/P DFs/Carbon%20Fibre%20MSDS.pdf
EPS and XPS density	https://www.sanded.com.au/pages/core-basics
Stringer Size	https://surfblanksaustralia.com/pages/an-introduction-to-surf blanks-stringer-products
IXPE foam density	https://www.foamsales.com.au/products/polyethylene-roll
EVA foam density	https://www.foamsales.com.au/collections/polyethylene/pro ducts/eva-foam-sheets-sky-blue-colour
Epoxy Resin EF (search for epoxide resin)	https://www.carbonfootprint.com/factors.aspx
PVC EF	https://www.carbonfootprint.com/factors.aspx
EVA EF	https://www.alcas.asn.au/auslci-emissions-factors
Carbon Fiber EF	Suzuki, T., & Takahashi, J. (2005, November). Prediction of energy intensity of carbon fiber reinforced plastics for mass-produced passenger cars. In Proceedings of 9th Japan International SAMPE Symposium (pp. 14-19).
Neoprene density	https://www.landscapepros.com/wp-content/uploads/2021/0 1/Neoprene-SDS.pdf

Hypalon density	https://irp-cdn.multiscreensite.com/d4974b4a/files/uploaded /Chang%20Rubber%20-%20MSDS%20Hypalon%20Rubber%20 Sheet%20THHPL135665.pdf
Fibreglass waste EF	https://www.climatiq.io/explorer
Balsa Density	https://www.woodsolutions.com.au/wood-species/hardwood /balsa#:~:text=Balsa%20wood%20is%20the%20lightest.Baltic %20pine%20(Pinus%20sylvestris)
Plywood Density	https://www.australply.com.au/technical/characteristics#:~:te xt=Density%20and%20species%20of%20timber.-The%20densi ty%20of&text=The%20density%20of%20pine%20plywood.500 %20%2D%20650%20kg%2Fm3.
Nylon Waste EF (assumed as textiles)	https://www.alcas.asn.au/auslci-emissions-factors
Steel Waste EF	https://www.climatiq.io/explorer
Cardboard Emissions	https://www.climatiq.io/explorer
Cardboard Box Sizing	https://fefcobox.site/
Avg. Feight dist in Aus	https://www.freightaustralia.gov.au/sites/default/files/docum ents/commodity-report--vehicles.pdf
Road Freight EF	https://www.climatiq.io/explorer
Sea Freight EF	https://www.webcargo.co/knowledge-base/tools/freight-co2-emissions-calculator/
Cardboard Size Calc	https://fefcobox.site/

Appliance EF	https://www.digitaltechnologieshub.edu.au/media/huppewx4 /home-energy-use_calculating-ghg-emissions_electricial-appli ances.pdf
Surfboard repair quantity	https://citeseerx.ist.psu.edu/viewdoc/download?-doi=10.1.1.6 05.1046&rep=rep1&type=pdf
Surfwax EF	https://espace.library.uq.edu.au/data/UQ_28c5949/UQ28c59 49_OA.pdf?Expires=1661177871&Key-Pair-Id=APKAJKNBJ4MJBJNC6NLQ&Signature=UQ3BjFiT0rhVqVN5tiuI-QH4fRQMV0LN RyqSTwEExFcz4EaoL3fOR2UN-R2lGg3rbfLoWttZTlXqkBJp9Ia4P0 XYaYC2khxqjaz-tyP71QJSL~zsXVYloiiJaegi-j7GFqdVMP8nosGQ2lulZrXAmkoI8OfjTHyLeOocpdTOXf~IvCWK6mxVLd-fwnKD00~5Z PR7FR04z6IKsUPMnSC-K2kXQ9M-Rrekq-G0vsnK1GQwxtAxaJ88 a2XRDh77ahFa-Mo~0hSWrKFASgIT0s4QSeoqaFlwCYD4AIe4hv3 7kiKjmQIMobiGmMPTA1bbClpE3j2n080kb1Z3yNVaL-paCFMPV 5HfQ__
Car EF	https://www.ntc.gov.au/transport-reform/light-vehicle-emissi ons

IT'S ONLY RECENTLY WE'RE SEEING THAT THE TIDE IS CHANGING TO PAUSE, EVALUATE AND ASK – WHAT IS THE REAL COST OF SURFING?

COST BEYOND ECONOMICS, THAT CONSIDERS THE COST TO OUR LANDFILL SITES, COASTLINES, MARINE-LIFE AND AN INESCAPABLE SOCIAL RESPONSIBILITY OF THE SURFING INDUSTRY AND EVERY SURFER.

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