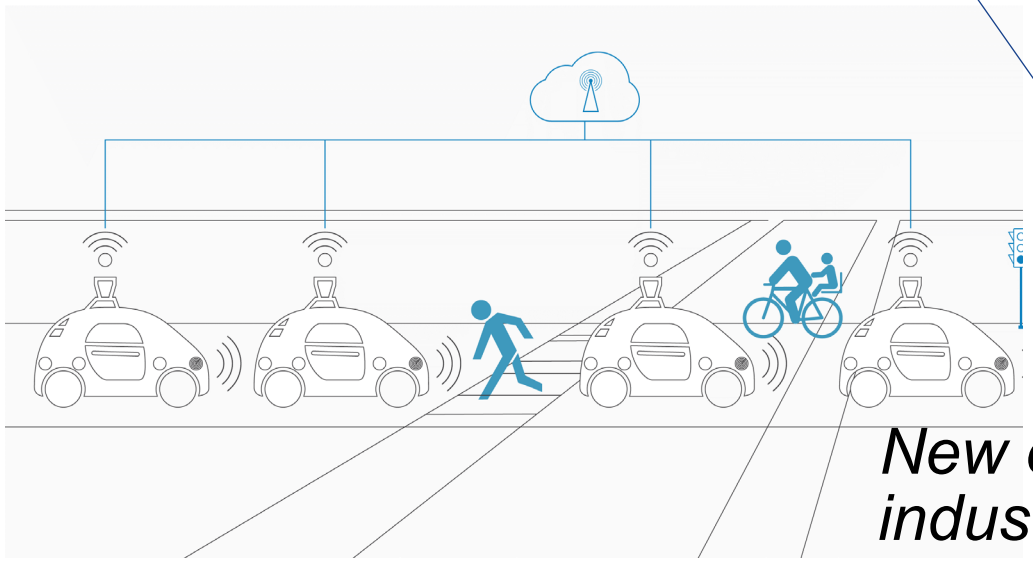
# PRITEX

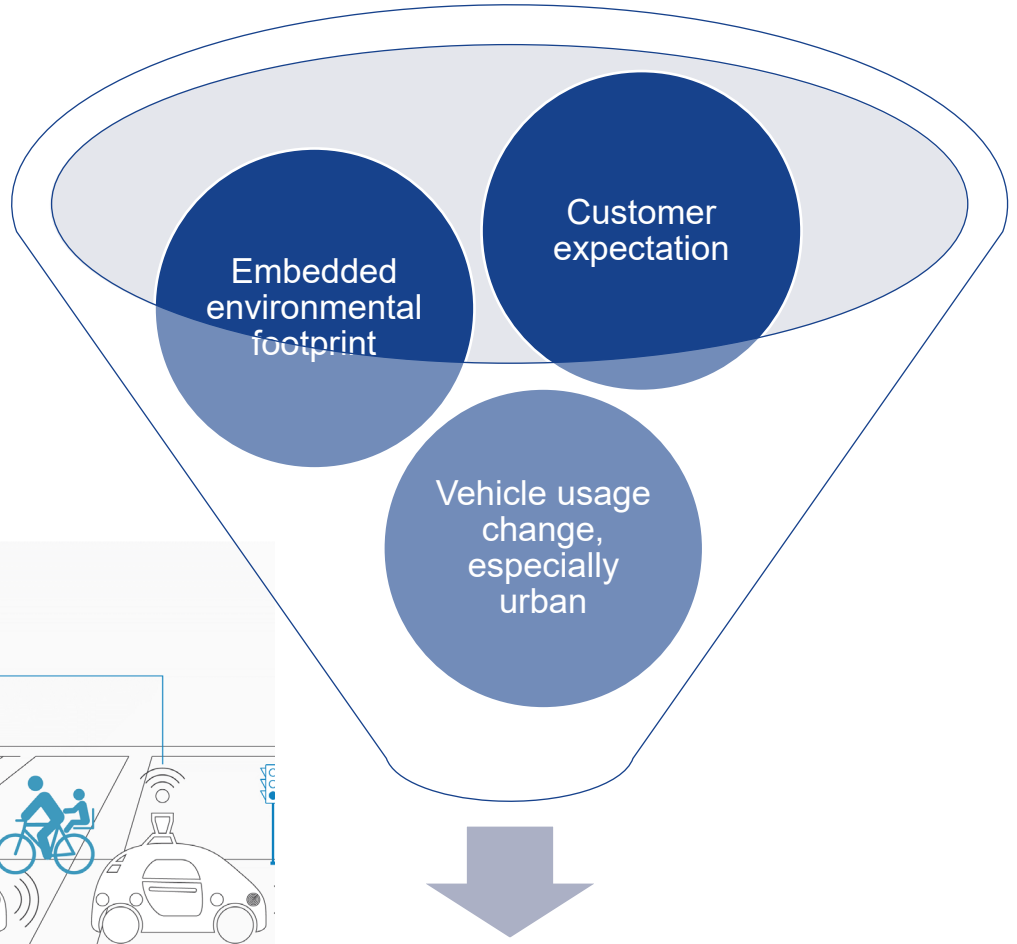
## The low carbon future and its effects on automotive acoustic design

March 2023

SAINT-GOBAIN

# A FUTURE OF CHANGE






*New expectations from the industry of “Smart Mobility”*

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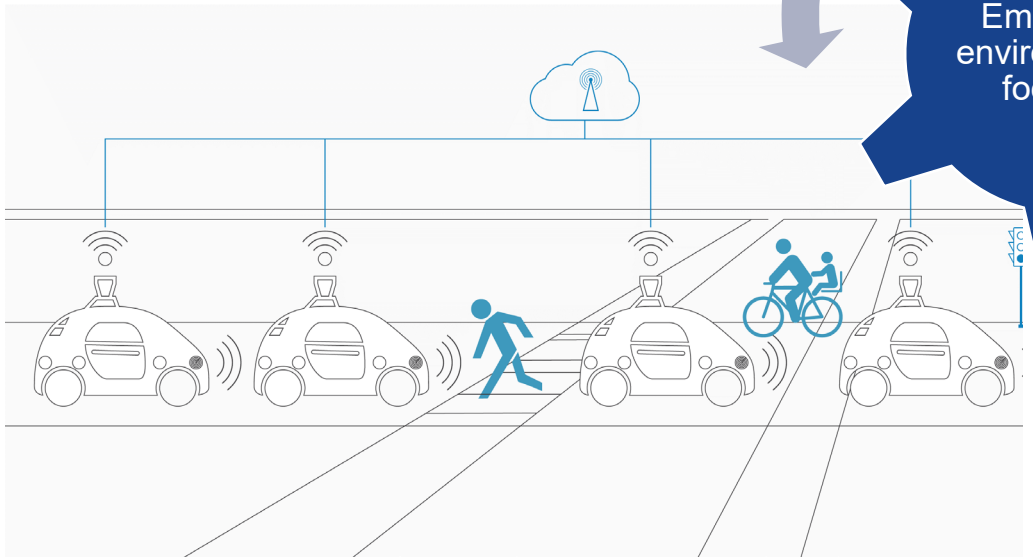
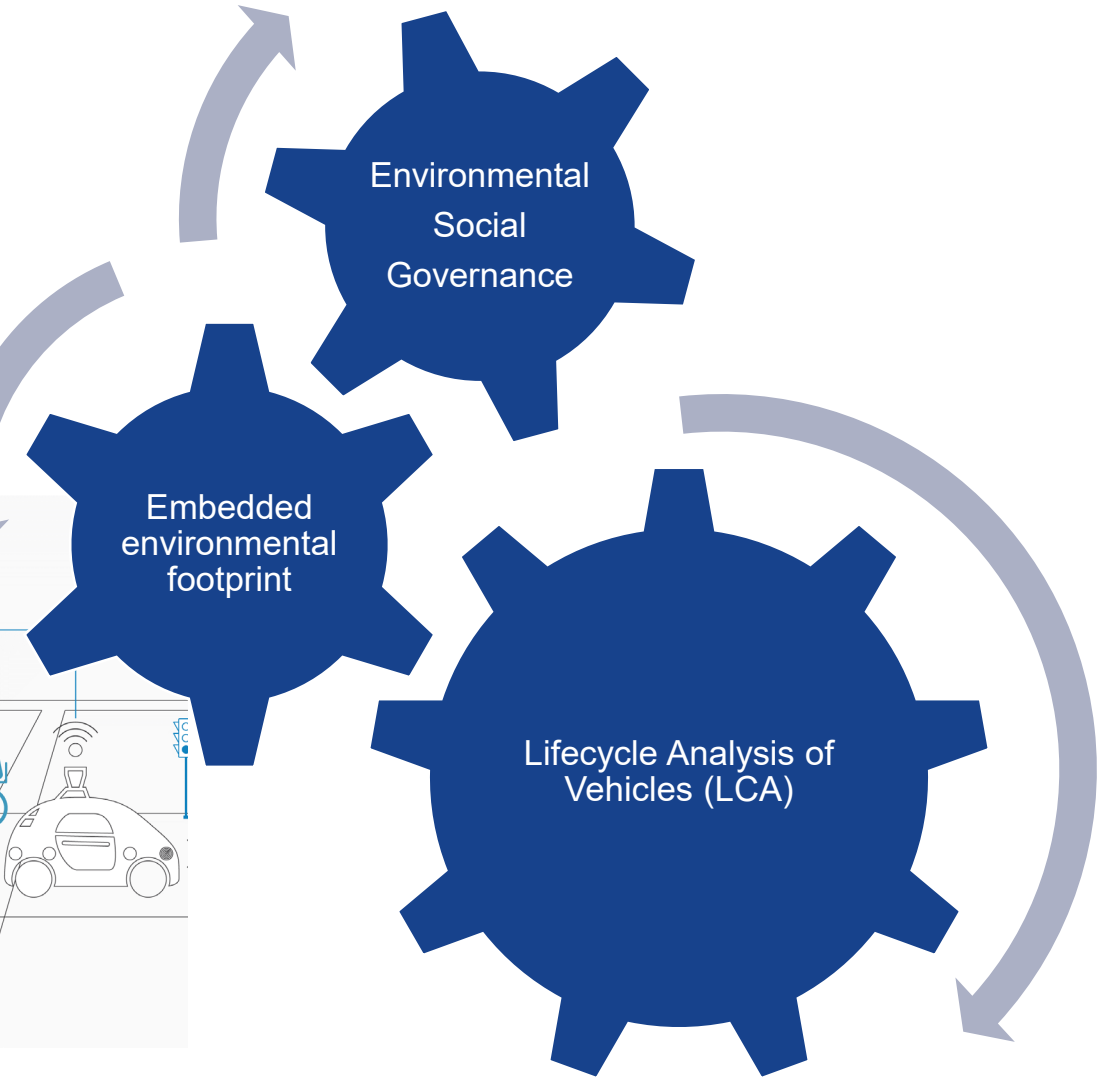
# EMBEDDED ENVIRONMENTAL FOOTPRINT



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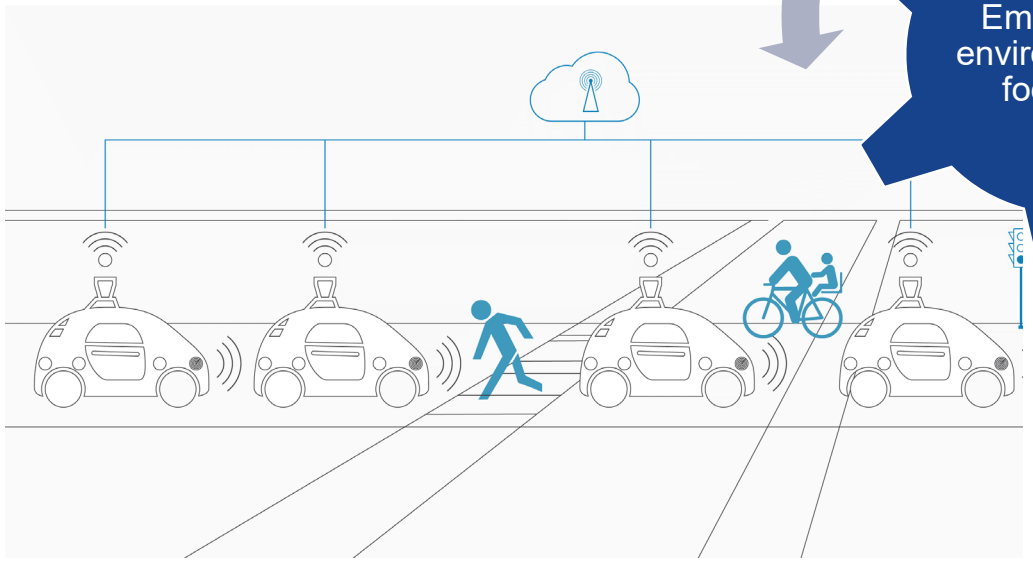

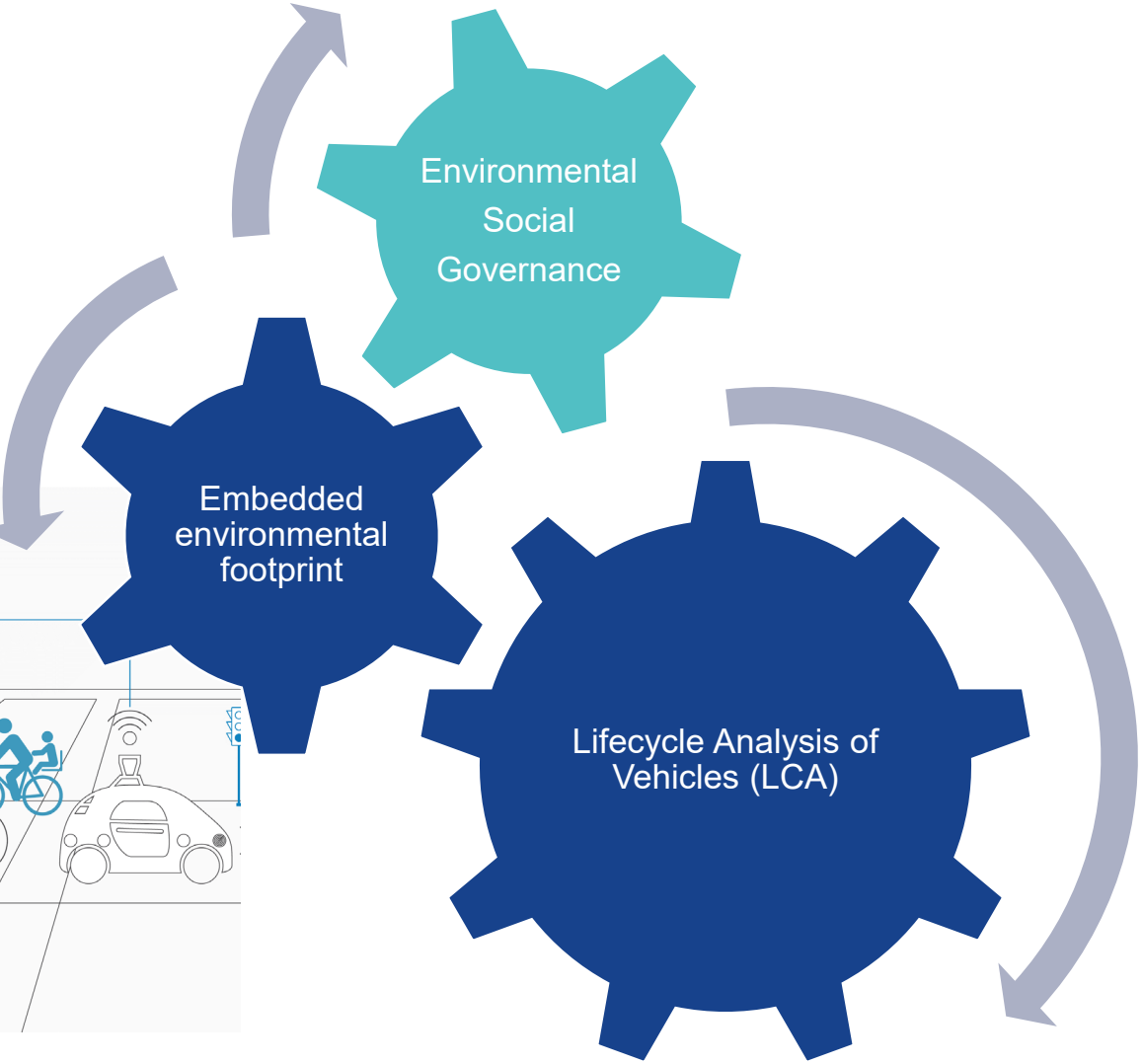


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# OUR COMMITMENT

## Environmental

*"We pledge to continually improve the environmental performance of our business and products, minimising our impact in the natural world"*

## Social

*"We are committed to ensure our activities, our employees and our partners are jointly involved in building a more sustainable and inclusive world"*

## Governance

*"To maintain a solid financial structure while being the leaders in sustainable acoustic solutions"*

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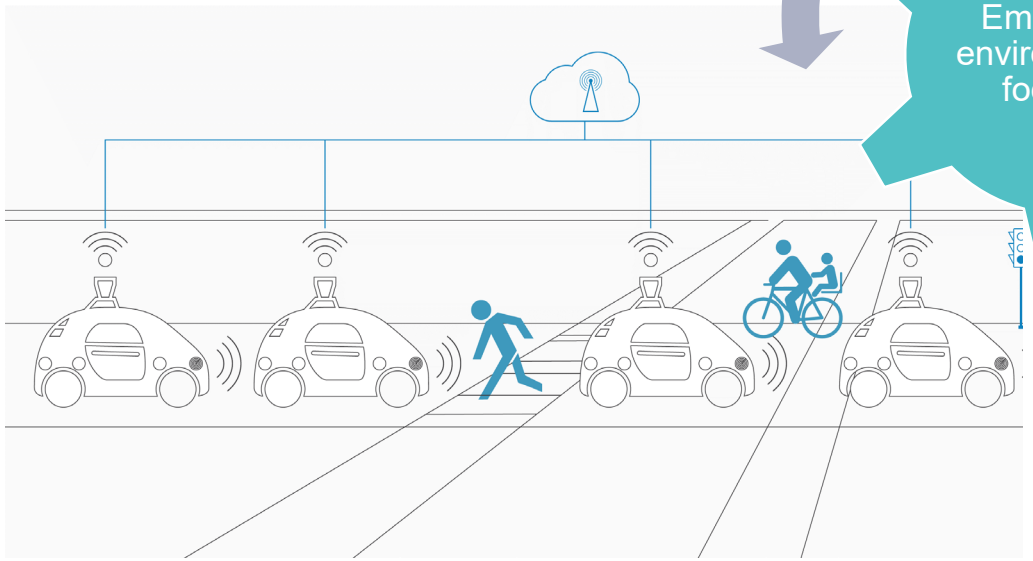

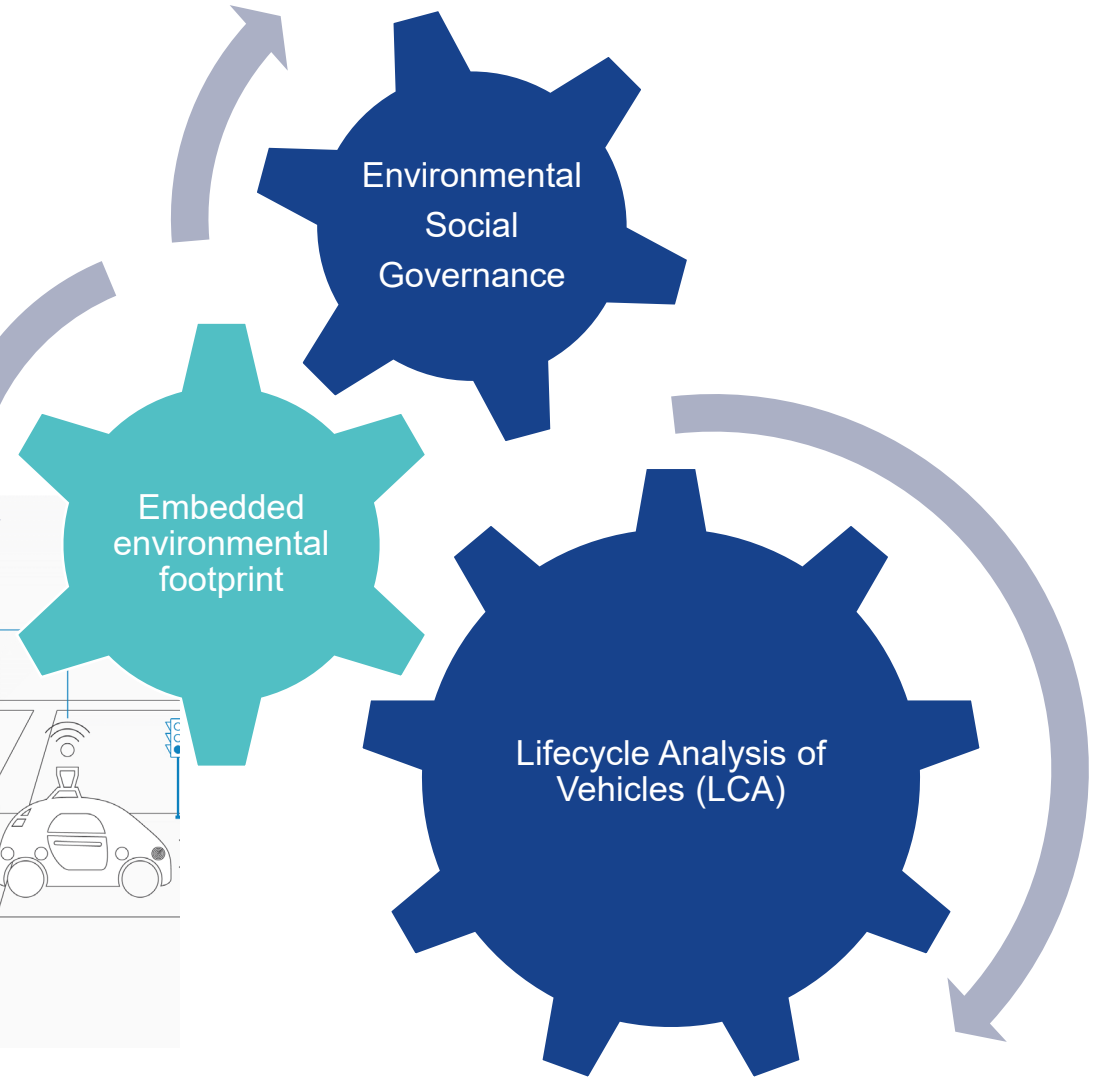


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# OUR COMMITMENT

## Environmental

**INVENT SUSTAINABLE MOBILITY**

| WATER | CO2 | WASTE | ENERGY | GAS |
|---|---|---|---|---|
| **TARGETS ACHIEVED 2022** | | | | |
| -34% WATER DISCHARGE | -48% SCOPE 1 & 2 | -39% WASTE TO LANDFILL | -31% ENERGY CONSUMPTION | -35% GAS CONSUMPTION BETWEEN 2021 AND 2022 |

### PRIORITIES

- Embed sustainability in new product and process development
- Increase our range of more sustainable products and processes
- Transparency of environmental impact (LCA)

### OBJECTIVES

- Closed loop AcuLite offer by 2025
- 100% LCA for all product ranges by 2030

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# ACULITE® (FIBROUS ACOUSTIC ABSORBER)

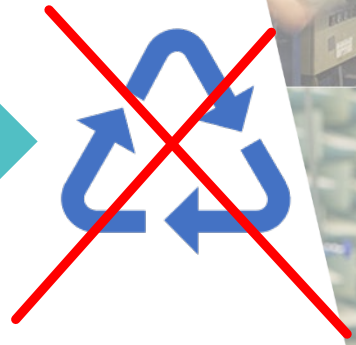
**Today's scenario : high recyclate content (up to 80%)**

RECYCLED PLASTIC BOTTLES

15million
/ yr used to make AcuLite Products

Birth

EOL



**A high recyclate content does not in itself confer the ability to recycle or repurpose at EOL**

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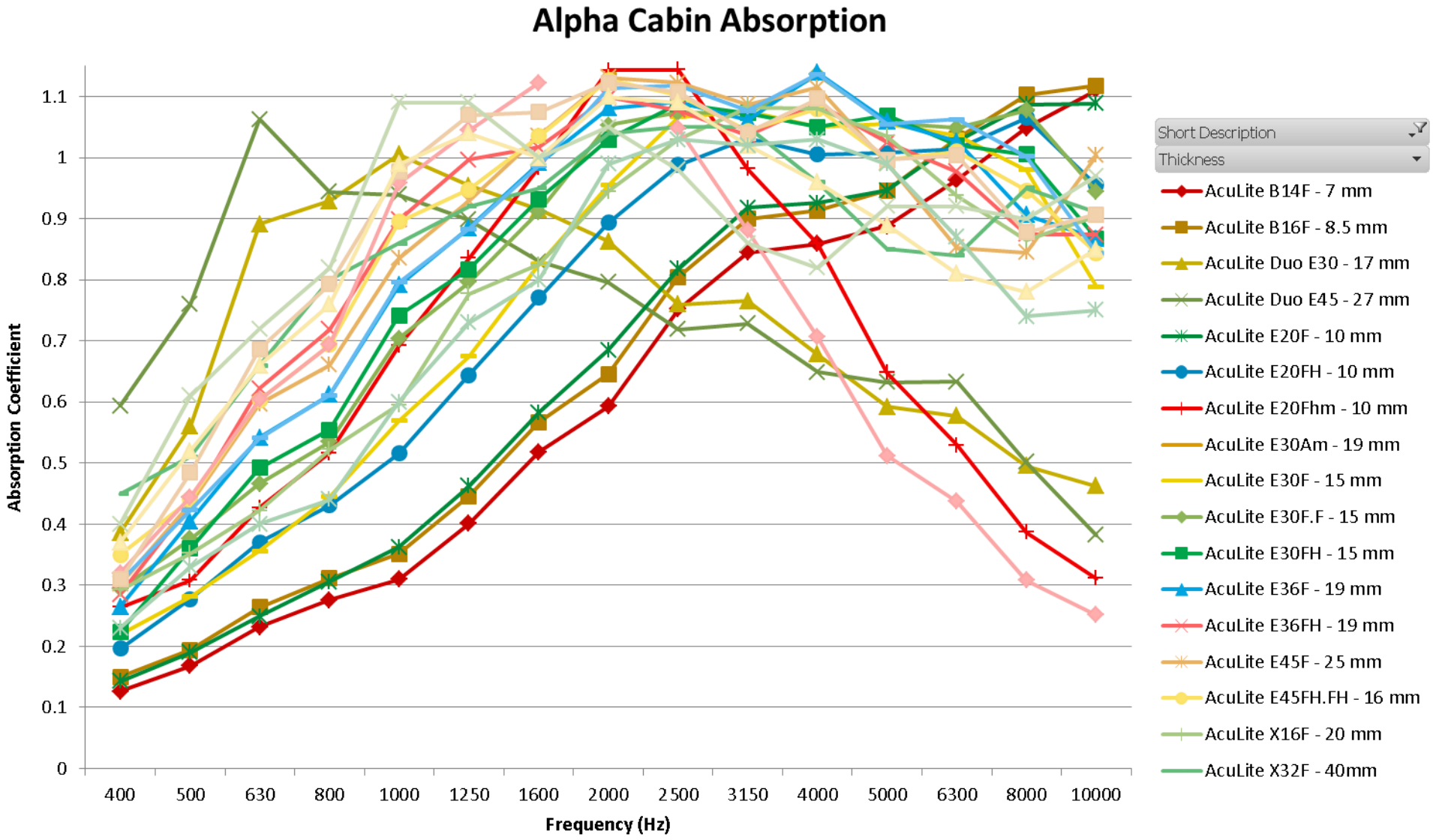
# OUR AMBITION: CLOSED LOOP ACULITE®

## The challenge : a wide product portfolio!

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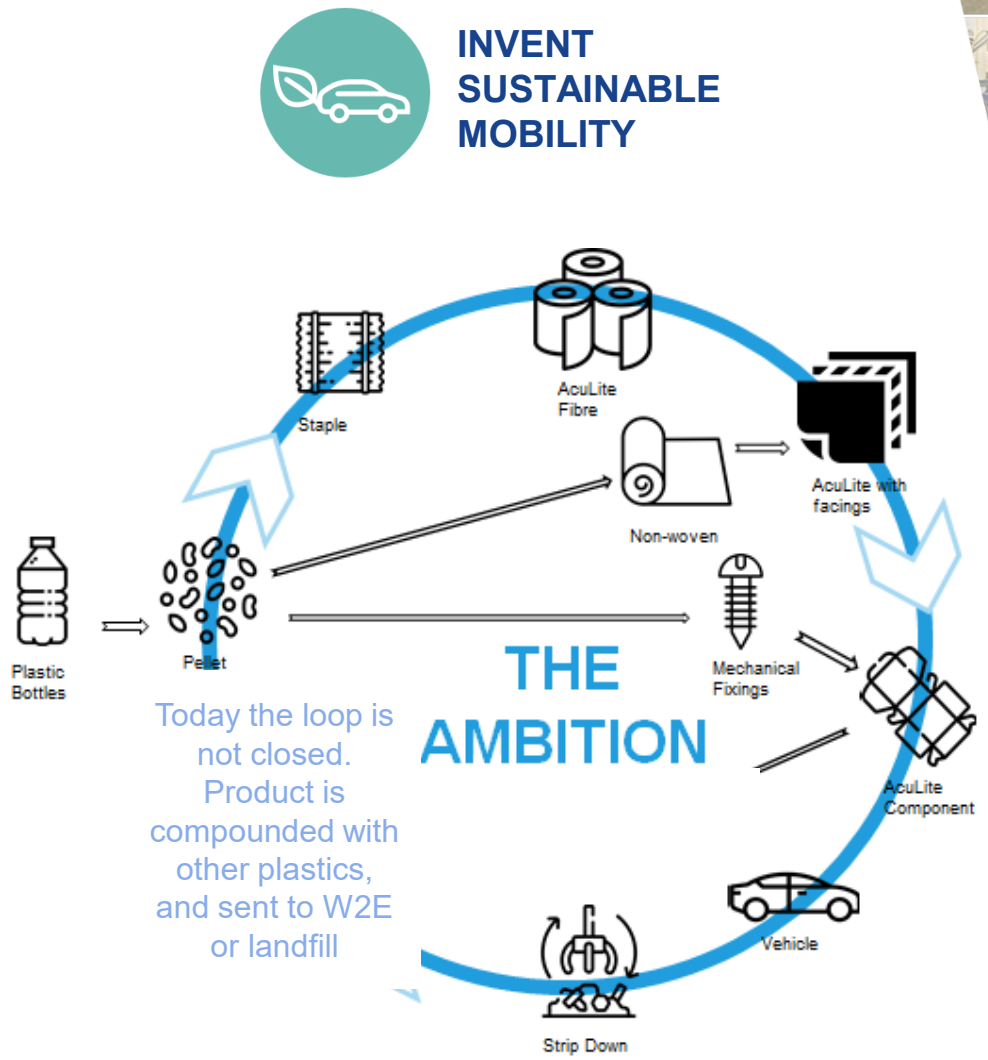
# OUR AMBITION: CLOSED LOOP ACULITE®

Today's case.

Input plastic material is not segregated and ends up as shredder "residual waste"

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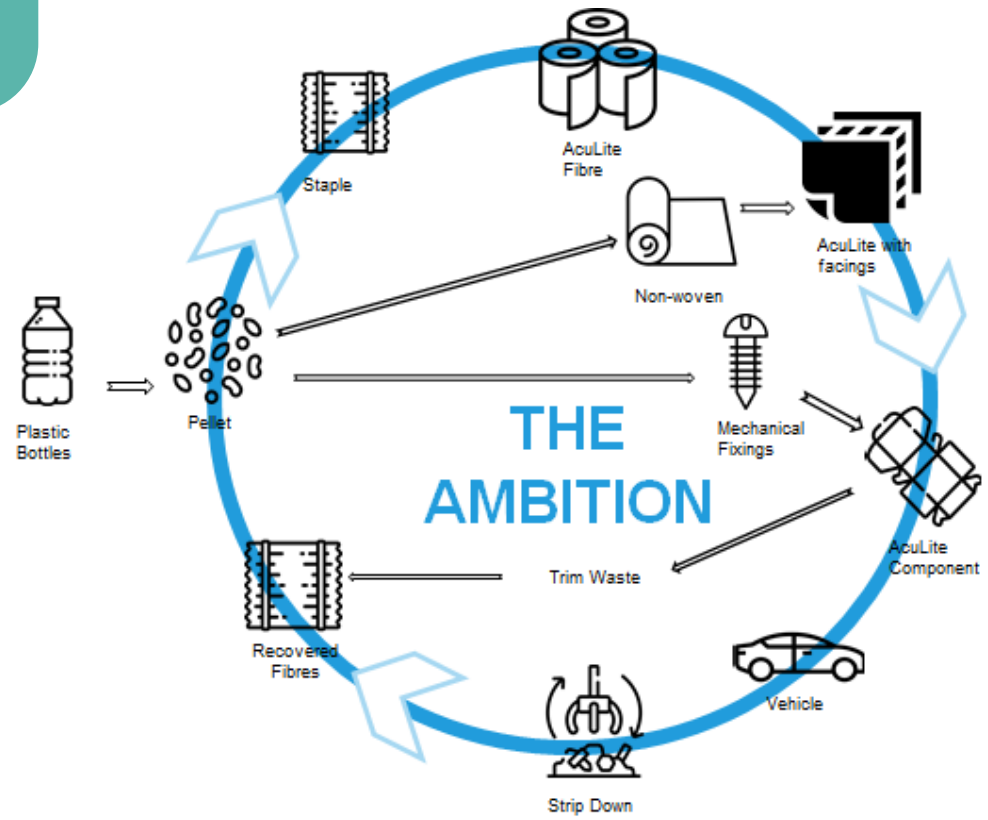
# OUR AMBITION: CLOSED LOOP ACULITE®

**Once your product has been re-engineered to be melt re-processable, focus has to be given to polymer degradation for its 2nd, 3rd .... lives**

**INVENT SUSTAINABLE MOBILITY**

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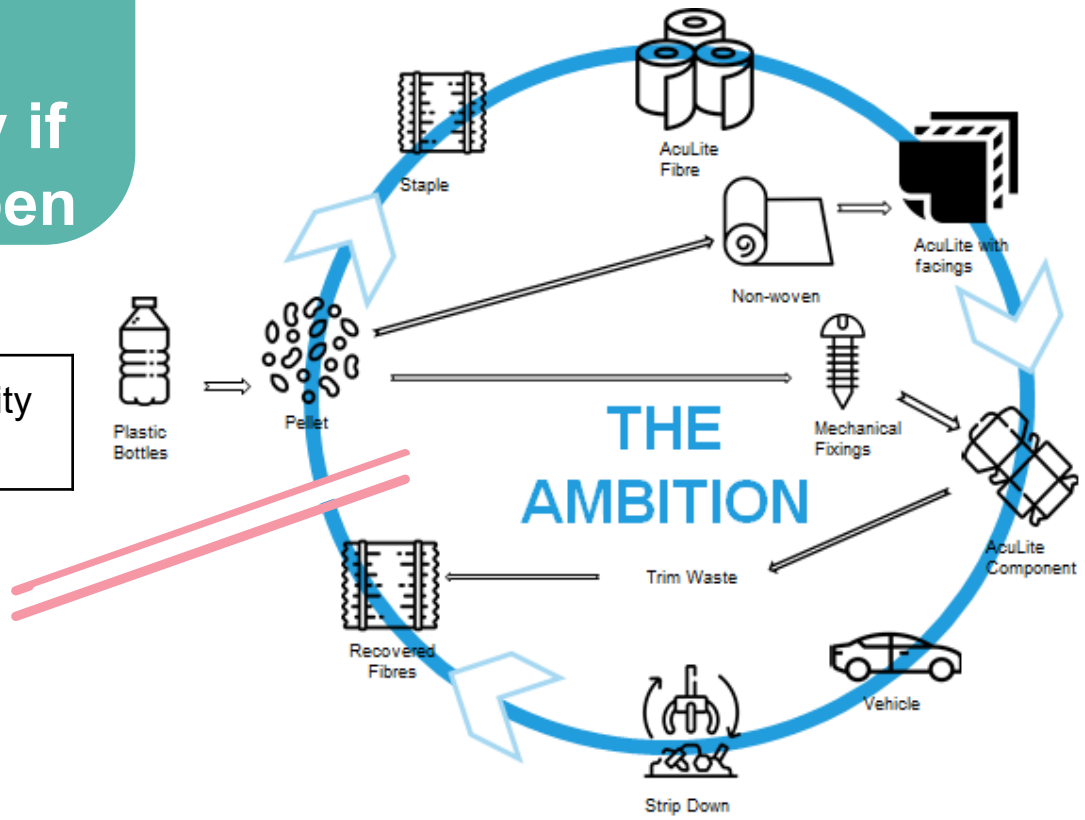
# OUR AMBITION: CLOSED LOOP ACULITE®

**Melt processing alone reduces the intrinsic viscosity (IV) and changes the use case of the plastic**

**IV adjustment is necessary if infinite recycling is to happen**

| PET grade | Intrinsic Viscosity [dL/g] |
|---|---|
| Fiber grade | 0.40 – 0.70 |
| Film grade | 0.70 – 1.00 |
| Bottle grade | 0.70 – 0.78 |
| Water and soft drink bottle grade | 0.78 – 0.85 |

**INVENT SUSTAINABLE MOBILITY**

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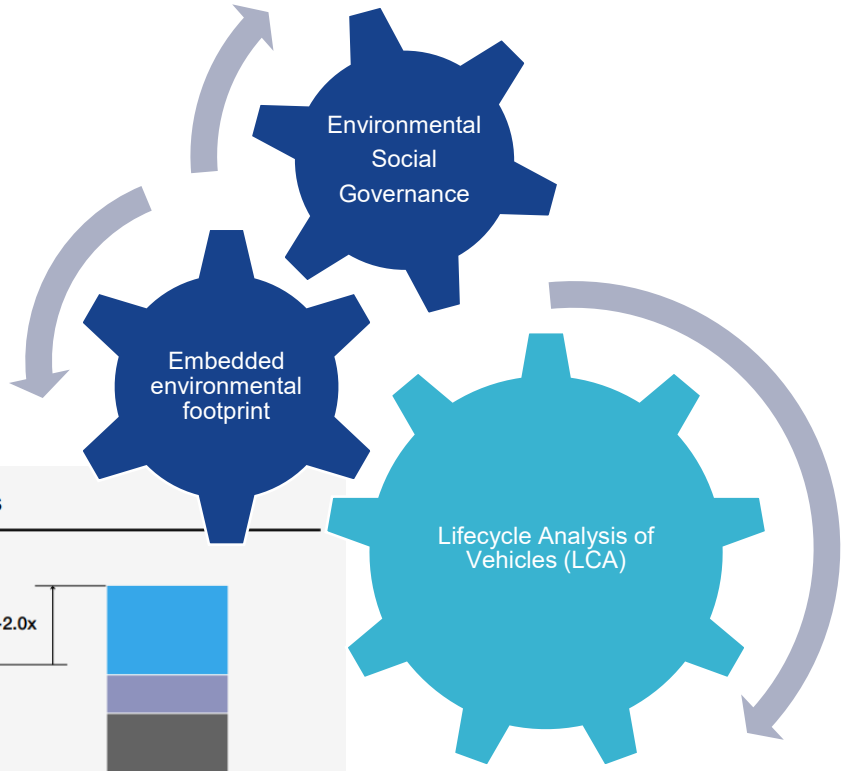
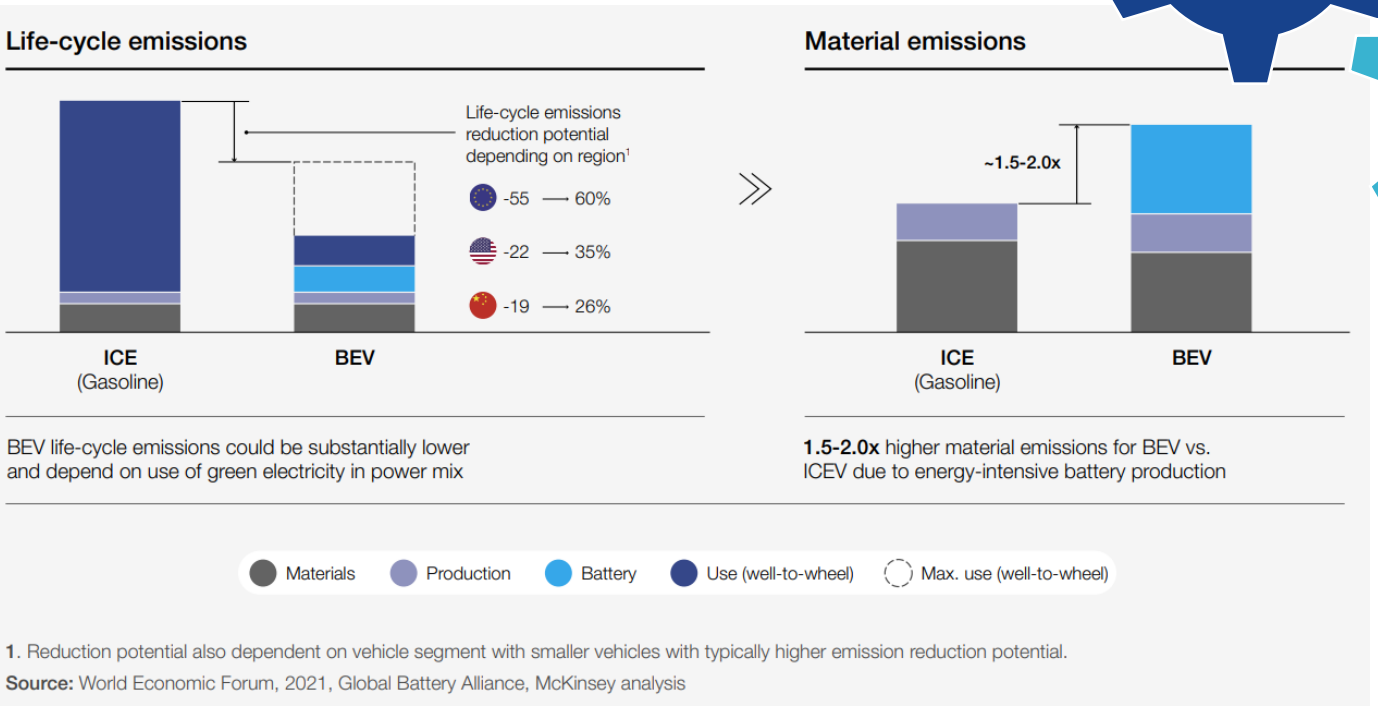
# EMBEDDED ENVIRONMENTAL FOOTPRINT : WHY LCA?

**Full life-cycle analysis of *embodied* $CO_2$ is vital as it becomes the dominant source of $CO_2$ in an electrified future**

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# THE CONSEQUENCES OF RE-PROCESSABLE MATERIALS

The pallet of all NVH materials will be changing.

To ensure optimal material re-use at end of life, dissimilar NVH materials will need to be disassembled from one another before entering the recycling streams.

This can require adaptions at the design stage

*How can this shifting landscape of design and materials be adequately understood at the early design stage, especially with new and novel NVH sound sources appearing in electric vehicles?*



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# ACOUSTIC TRENDS

The removal of ICE masking noise reveals other issues :

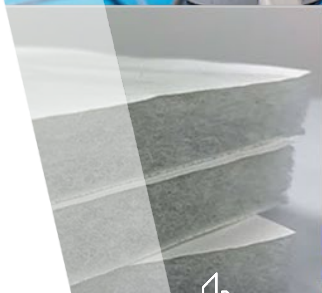
- Unexpected mechanical noises already present but previously masked

- The requirement to make silent new systems which are unrelated to the driving experience (e.g. Air Suspension Unit compressor, E-charger, E-AC, ESG).

- Noises associated with electric primary drives (EDU)

*How can this shifting landscape of design and materials be adequately understood at the early design stage, especially with new and novel NVH sound sources appearing in electric vehicles?*

# WORKING WITH OUR CUSTOMERS ON THE NEW CHALLENGES



BIOT parameterisation on the core acoustic media to enable SEA modelling of the generic vehicle level performance

- interaction of vehicle battery pack provides a useful boost in floor system performance

- What about the new electro-motive sound sources?,

e.g. eAC, primary drive



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# THE ELECTRIC ENGINE

Newly conceived electrically driven rotating machines with exceptionally high energy densities and low mass, are providing unique acoustic challenges with new and distinct radiation patterns.

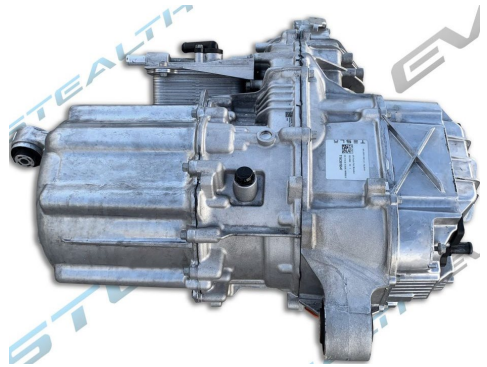
Example

Industrial Motor, **300hp**

Typical Mass 1500 – 2000Kg

Model S Motor, **300hp**

Mass **45Kg**





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# 2 STAGES OF APPROACH

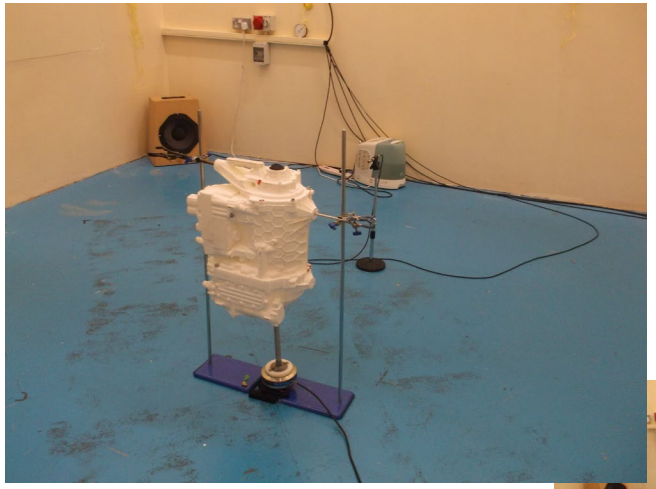
Firstly, at the earliest opportunity use 3D printing to develop a 1:1 physical representation of the sound source in question.

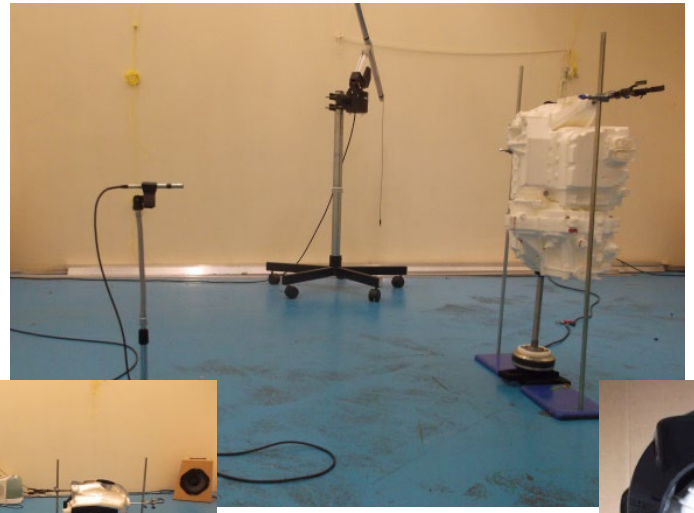
This can the be developed into a representation of the sound source in application through the controlled injection of acoustic energy into the structure.

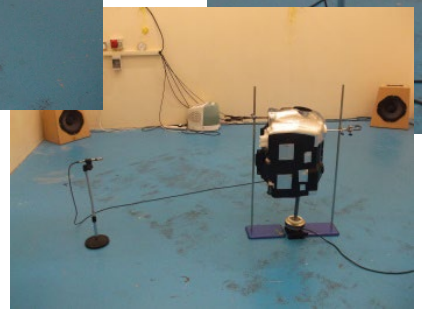
Secondly prototyped acoustic countermeasures can then be fitted and trialled

# ACOUSTIC SUB SYSTEM EVALUATION

Make the 3D printed sound source







Fit the jacket (or acoustic countermeasure) and assess change in radiated sound power



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# WHY DO WE DO THIS?

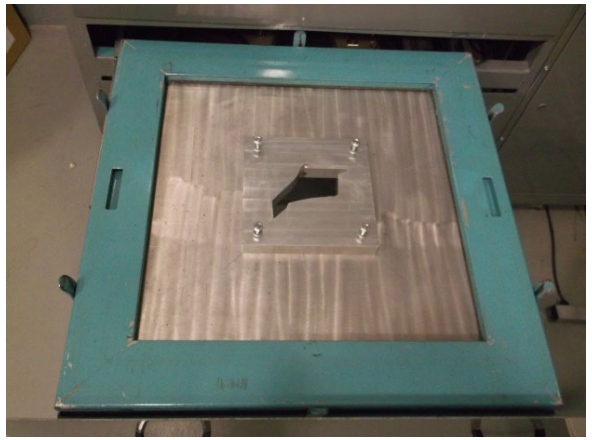
Often the geometry is complex, and obtaining an intimate fit for acoustics can be challenging

The noise sources contain high energy high frequency content (>5KHz) and sealing, grommets and interfaces have to be qualified in the context of the mating geometries

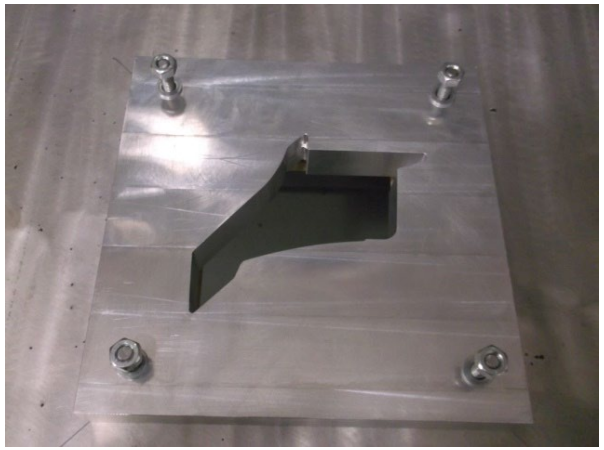
The separate qualification of these mating and sealing elements can then be separately qualified to help build more robust acoustic models

# CHARACTERISATION OF INSTALLATION, SUBCOMPONENTS

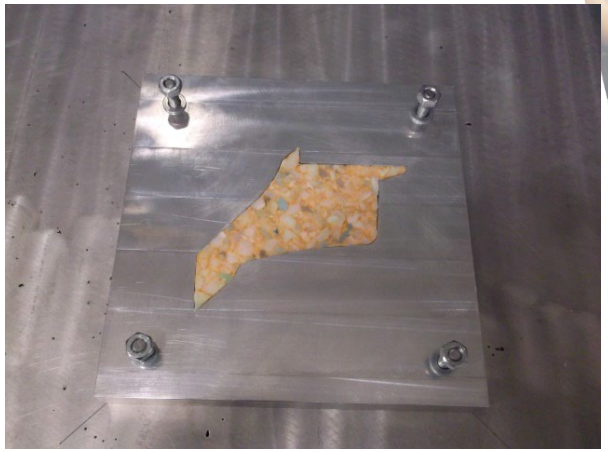
Important to qualify the interfacing / bounding elements of an acoustic containment measure



Apamat with machined fixture for acoustics



Fixture detail



With part fitted

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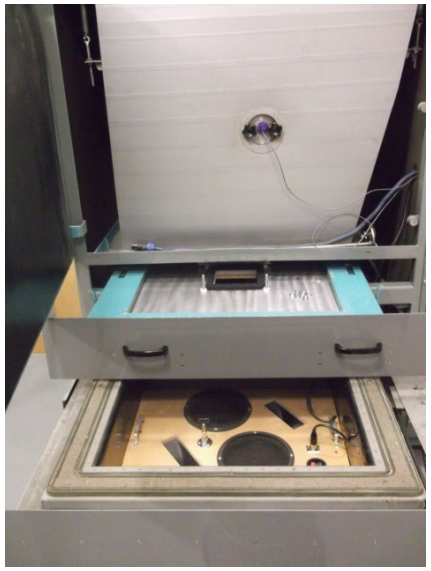
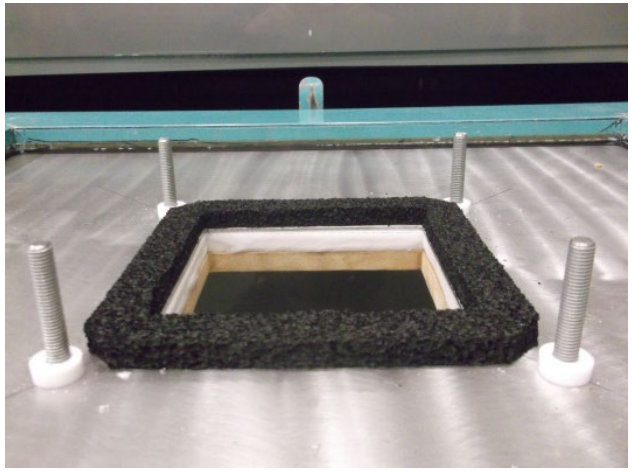
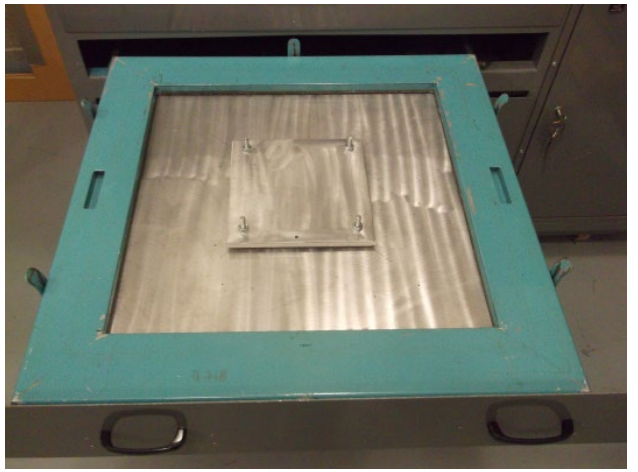


Apamat Machine



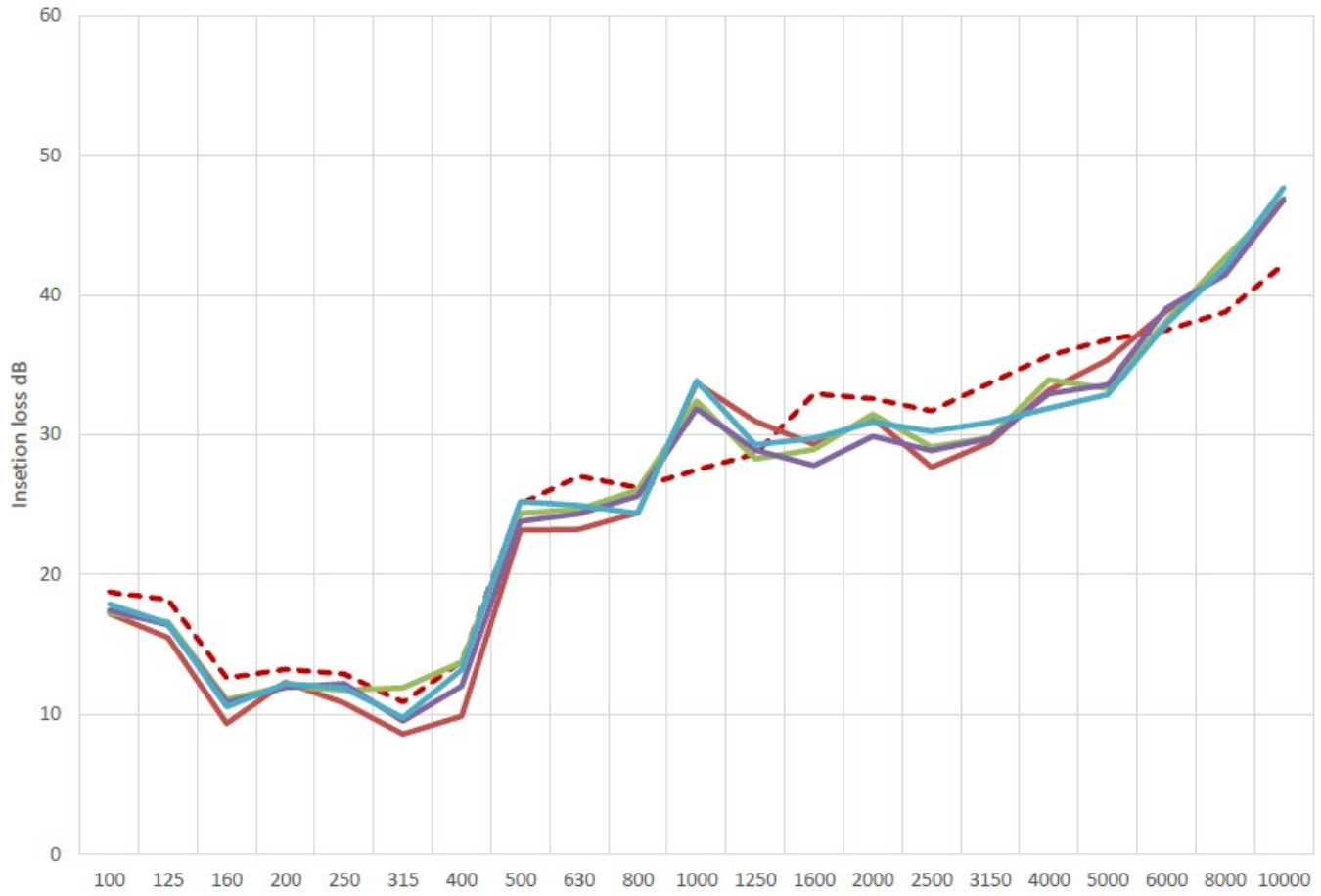
Seal Fitted



Top Cap

# CHARACTERISATION OF INSTALLATION, SUBCOMPONENTS

Example data of traditional seal (dotted line) and different configurations of a recyclable alternative




# SUMMARY

The requirements for novel acoustic solutions for EVs has evolved in an industry which is simultaneously committed to a sustainable future

The NVH pallet, and design considerations connected to it, is changing

*With customer expectations of refinement every increasing, it is going to be a very busy time in our industry!*

*Thankyou*



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