



mob-ion<sup>®</sup>

#BUILTTOLAST ELECTRONICS

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#BuiltToLast

A new approach  
to mobility and  
energy storage

## Foreword

# The life cycle of a product

**The environmental factors associated with equipment are the life cycle assessment (LCA) and the reparability index. LCA is a standardised assessment method (ISO 14040 and ISO 14044) to systematically assess the environmental effects of a product's life from start to finish, i.e. the incomings and outgoings (of materials or energy) of each stage of a product's life, from the extraction of raw materials to the eventual waste.**

LCAs depend on how a good is used. For example, a study\* published in November 2020 showed that the small electric vehicles in circulation in Paris alone emitted 13,000 tonnes of CO2 in one year. This is equivalent to the annual emissions of 16,000 French people. There are several reasons for this negative carbon footprint, starting with the materials used: the aluminium chassis and the lithium-ion battery. In addition, the vans with internal combustion engines, used for maintenance (collecting batteries, recharging them and dropping them off again in the city) also generate high emission levels.

The reparability index is a rating that must appear on certain types of appliances (smartphones, laptops, washing machines, televisions, etc.) at the time of purchase. This measure was introduced on 1st January 2021 as part of the anti-waste law enacted on 10th February 2020. The aim of this index is to make consumers aware of the need to repair products as soon as they are purchased by informing them of the reparability of their appliance.

The concept of #BuiltToLast championed by Mob-ion is inspired by these measures. By reusing and recycling the materials over and over again, we embrace the «cradle to cradle» concept and promote sustainability through two main areas:




**The design of our products.** In the spirit of #BuiltToLast, «design for disassembly» allows us to keep control of the quality of replacement parts, in order to maintain the longevity of our products, or to decide to recondition or recycle them.

We integrate the principles of the circular economy and industrial ecology: constant search for renewable, reusable, rebuildable and recyclable materials.



**Our preventive maintenance policy.** We have used our expertise in connected on-board electronics to develop a preventive maintenance system that makes it easy to change worn/damaged scooter parts at any time. This system further increases the longevity of our products and leads to 2 to 3 times longer warranties than others on the market.

*\* Journal of Cleaner Production*



*“ The concept of #BuiltToLast emerged when we realised that we had to escape the inevitable obsolescence resulting from the linear consumption economy, and develop an economy based on functionality. Our sales model, combined with our services, provides our customers with a continuous service while freeing up their time. This economy of functionality, synonymous with serenity and quality of life, is in reality an economy of reliability and sustainability\* ”*

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**Christian Bruere**

Co-founder and CEO of Mob-ion

\*expression borrowed from Arnaud Berger, Mob-ion's strategic manager, in July 2020 during an internal ENERGIGA seminar, a start-up specialising in stationary storage.

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## Part 01

# Mob-ion: Designer and manufacturer of integrated electronic systems using #BuiltToLast




- 1 Mob-ion designed and manufactured the retrofit (battery, BMS, controller) of a French buggy, E-CROSS. Project commissioned by the company Solutions VE for the Rallye des Gazelles.
- 2 The company Parinautes asked Mob-ion to convert its hacker craft into a hybrid vehicle..

**At Mob-ion, we believe there is a better alternative.** We believe in a system other than the linear economy of consumption, inevitable obsolescence and the fossil-fuelled energy network. **We are confident that it is possible to build a clean, fluid, transparent system that ties us together in a sustainable way.** This is the path we are taking today.

Our current economic system, born from the industrial revolution, is based on a continuous sequence of extraction, production, consumption and disposal. Based on the mass production and consumption of goods from the globalised linear economy, this model leads to levels of resource extraction and destruction and pollution emissions that have exceeded our system's capacity to adapt.





*“In a complete contrast to the current system of inevitable obsolescence, #BuiltToLast consists of designing products that are as sustainable as possible. For us, as a manufacturer of scooters and electric batteries, this approach offers us the opportunity to develop an economic model based on the optimisation of our resources and apply it to urban mobility.”*

—  
**Cyril Haenel**

Technical director

In addition to ecological problems, there is a crisis of confidence from consumers. New models based on sharing, reusing and collaborating are emerging. At the crossroads of these emerging economies, **Mob-ion is developing the concept of #BuiltToLast, a counterpoint to inevitable obsolescence, which puts sustainability at its core: from design, manufacture and maintenance of its products, to its logistical decisions.**

Today, our model and expertise are based on two key markets: electric mobility and energy storage. We offer plug-in electric scooters designed to last, manufactured and assembled in France. In addition, our expertise in battery design allows us to provide customised vehicle electrification and develop a stationary storage solution, contributing to the development of the Smart Grid.

## Part 02

3 core services:  
Electric scooter  
manufacture,  
electronic  
engineering  
and stationary  
storage

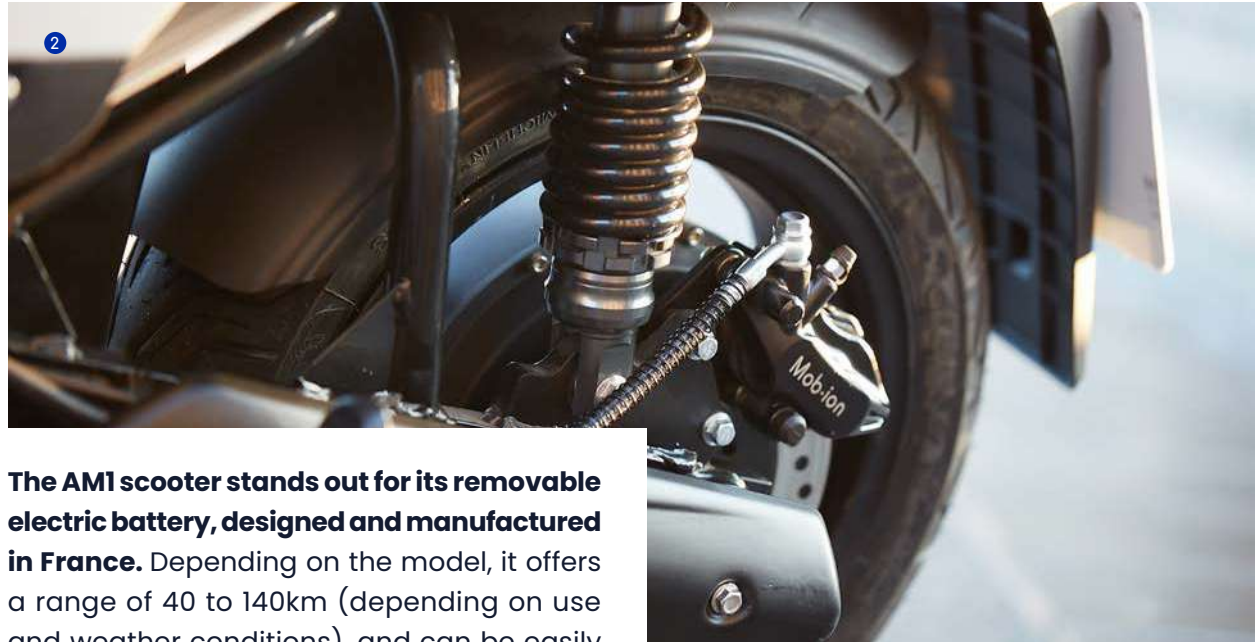
### Mob-ion AMI scooter

Our AMI Scooter was approved in May 2020 and is in process of being certified as having **Guaranteed French Origin**. This label guarantees that the selected product gets its main components in France and that at least 50% of its cost price is French. The local manufacture of the battery in Artigues-près-Bordeaux, in the Nouvelle-Aquitaine region,

and of the battery management electronics and the controller next to Nantes, in the Loire-Atlantique region, means that we are now able to reach 73% French cost price. This statistic should increase further in the coming years, thanks to our choice to produce locally and to develop our ecosystem.



The launch of our AM1 scooter marks the completion of a project that began in 2016. The result of several years of constant improvement based on feedback and analysis of data from intensive use of the scooter in the Delivered Catering sector. In total, 240 prototypes were tested over 5 million kilometres. The vehicles tested were domestic scooters, which were transformed into delivery scooters thanks to a box support system on the back to carry goods instead of a passenger. This trial paid off, as it enabled the teams to focus on the points of improvement and to be able to offer a scooter that stands out for its endurance and robustness.



**The AM1 scooter stands out for its removable electric battery, designed and manufactured in France.** Depending on the model, it offers a range of 40 to 140km (depending on use and weather conditions), and can be easily recharged with one or more portable chargers, taking between 2 hours 15 minutes and 4 hours 30 minutes, depending on the type of batteries and chargers used. The AM1 scooter can be fitted with 1 to 3 removable batteries depending on the needs of the customer. This is a considerable advantage for a vehicle intended for city-based businesses and workers who do not always have a garage, and in particular those involved in «free-floating» rental (self-service scooter rental), whose range is directly linked to their economic business model due to the cost of swapping their batteries.

- ① The Combined Break System (CBS) combines front and rear braking, significantly reducing braking distances and increasing driving comfort.
- ② The AM1 is equipped with Michelin dual-compound tyres produced in France. They provide optimum grip in both wet and dry conditions. This maximises cornering performance, resulting in safer driving and longer tyre life.



## Smart batteries

**In order to control the entire value chain, Mob-ion has specialised in the design of connected batteries.** We design and assemble our batteries in France. Today, we use cells based on lithium-ion technology (Panasonic), but we are looking for more suitable solutions via technologies that are less complex to supply. This is why **we have embarked on open innovation experimental research with Tiamat**, a French company specialising in cutting-edge research, which designs and produces battery cells in its laboratory in Amiens. Current research and testing is focused on sodium-ion technology, which is expected to lead to less environmentally damaging batteries, which are 3 times more durable, allowing 10 times faster recharge time.

**The main goal of this collaboration?** To co-develop French smart batteries, adapted to electric mobility and energy storage, to improve performance, range, recyclability and durability. Thanks to the production line located in Guise, in the Hauts-de-France region, this partnership reinforces Mob-ion's commitment to local production with French partners.

We have also developed a BMS (Battery Management System) with active communication functions called MLA (Machine Learning Appliance), in partnership with SAP. This technology aims to improve the battery's lifespan by continuously optimising its features and performance through dynamic weighting.

Our expertise in battery design has paved the way for collaborative engineering projects in vehicle electrification. Thanks to our design office, we are involved in many customised electrification projects on new vehicles (scooters, buggies, electric aircraft, jet-skis) and older vehicles (cars, boats)

## Stationary storage solutions



With the aim of giving new life to the cells used in our mobility projects, **we have extended our research, design and industrialisation services to the field of energy storage.**

We are developing storage cabinets made up of battery racks. This includes, in the long term, some of our reconditioned batteries first used in powering mobility solutions, in line with our commitment to the economy. These batteries are equipped with a communicating

BMS (Battery Management System) providing a 10-year guarantee.

Thanks to our vertical integration strategy, our expertise in battery design and our flexible working style (#CodeSocial approach), we have the capacity to design, produce and install standard or customised stationary storage solutions in France, for individuals and professionals alike. Granted, certain services require a continuous power supply, whether in hospitals, state administrations, companies or in remote rural areas. The installation of these battery storage systems would avoid the need to set up costly generators, support the grid during peaks in consumption and supply self-consumption energy systems.

Our latest major project is the design of batteries and controllers for a stationary self-consumption storage system for individuals wishing to live in complete self-sufficiency and store electricity generated by solar production.

Made to measure, the installation is made up of stackable and interlocking racks, with



dimensions larger than those required by industry standards, to maximise the reliability of the batteries.

1



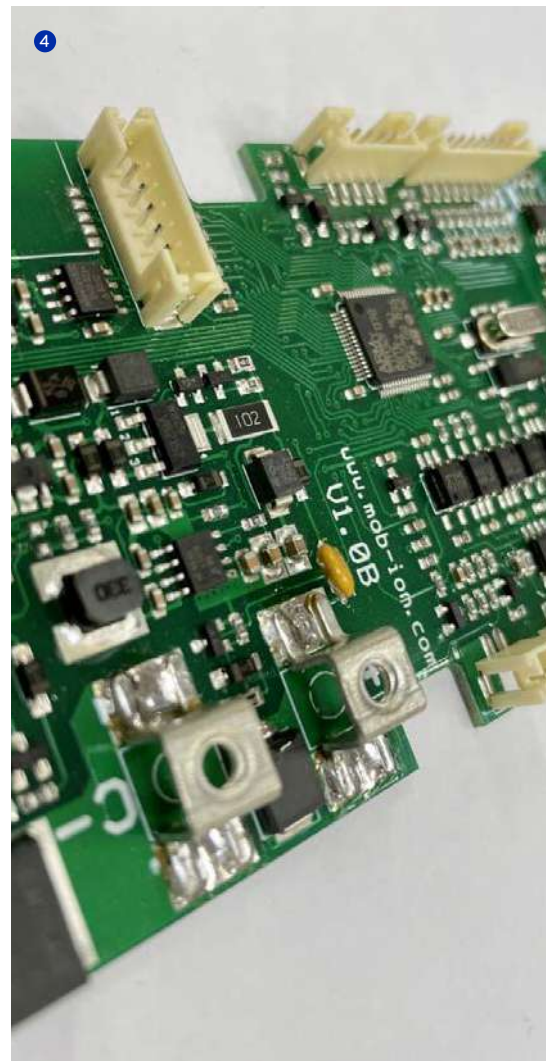
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3



4



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1 Robust retrofit controller designed and developed by Mob-ion.

2 The stationary storage project for an individual who wants to live in complete self-sufficiency and store electricity generated by solar production. This stationary storage system has a capacity of over 110 kW.

3 Cassio1, a French hybrid electric aircraft designed by VoltAero and equipped with Mob-ion batteries and controllers. Successful first flight test phase for Safran's 45 Engine electric motor on the Cassio 1, with 25 hours of flight time in approximately 40 flights.

4 Circuit board developed by Mob-ion.

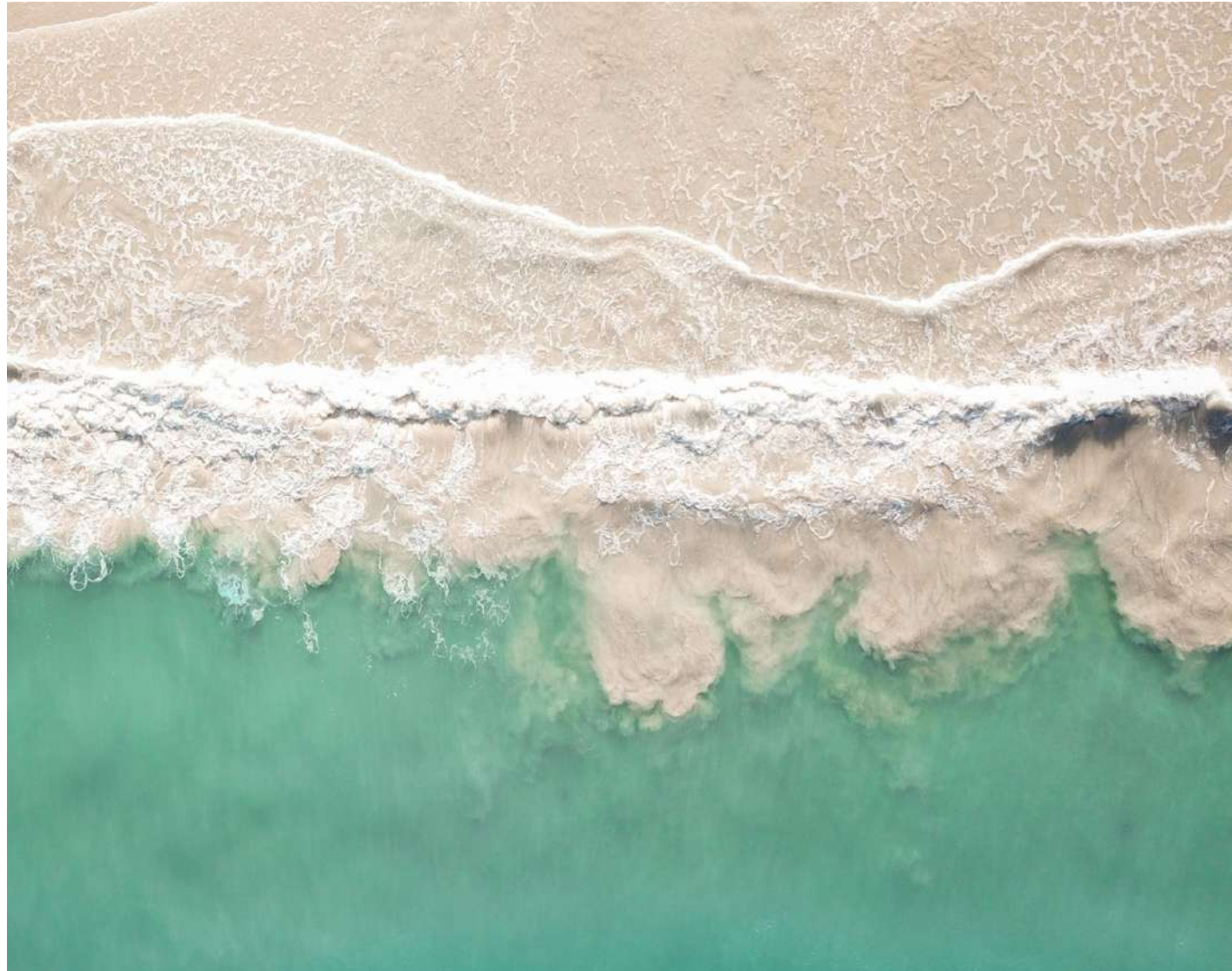
5 The Lupo is a hydrofoil designed by the Nantes-based company Bird-e-Marine, entirely handmade and limited to 250 units, combining an 100% electric motorisation of 4.5 kW and a foil device to reduce friction in the water. Mob-ion is the designer and the manufacturer of its battery.

## Part 03

# #BuiltToLast is at the heart of what we do

**The need to move away from the linear economy, where raw materials are extracted, used and then discarded, is becoming more and more evident. To combat this consumption pattern, the circular economy is establishing itself as a more responsible model.**

The concept was developed in an effort to combine the reduction of the human impact on the planet with the creation of added value which is essential to economic development. It takes the 3Rs principle (Reduce - Reuse - Recycle) one step further. It was developed in the 1970s, to promote the reduction of resource consumption, the reuse of products and the recycling of waste.



## #BuiltToLast rooted in the circular economy is an obvious solution for the functional economy

**Sustainability is the basis of the #BuiltToLast concept.** This is the opposite of planned obsolescence, which refers to where a manufacturer deliberately reduces the lifespan of a product in order to increase its replacement rate. The term 'planned obsolescence' first appeared in 1932 in the book *Ending the Depression Through Planned Obsolescence* by the American developer Bernard London, as a way of sustaining industry and growth in the midst of an economic crisis in post-crash America. Popularised in the 1950s, planned obsolescence remains a common practice in the electrical and electronic industry.

Conversely, #BuiltToLast is about designing the most sustainable products possible. For us, as a manufacturer of electric scooters and batteries, **this approach offers us the opportunity to implement an economic model based on the optimisation of our resources, applied to urban mobility.**

There are multiple benefits: longer life for our scooters and batteries, a reduced carbon footprint, and a lower Total Cost of Ownership (TCO) of operations. Also, the extension of the accounting depreciation period reduces the annual capital expenditure (CAPEX), and our preventive maintenance system and fixed prices for all spare parts support controlled and contractual operating expenses, creating a profitable cycle and an accounting advantage.

### **The more the product's durability is improved, the more profitable it's operation.**

Our model is based on several factors: the constant search for renewable, reusable and recyclable materials, the maximisation of the «repairability» of parts, as well as the reduction of industrial waste and effluent discharges, and the reconditioning of batteries to increase their life cycles. Thanks to the concept of Design for Disassembly, **all the parts that make up our scooter can be disassembled, repurposed and reassembled later.**

### **According to ADEME,**

*“The circular economy can be defined as an economic system of exchange and production, which aims to increase the efficiency of resource use and reduce the impact on the environment while increasing the well-being of individuals, at all stages of the product (goods and services) life cycle.”*

## #BuiltToLast, an initiative with an impact on human capital

**#BuiltToLast is a conscious industrial decision, taking into account the economy as a whole, but also environmental and social issues.**

Unlike the linear economy, where the necessary balances are at risk at each stage of production or manufacturing, the circular economy focuses on these values and places them at the heart of the model. The concept of #BuiltToLast is an example of this, to combat waste and the loss of energy or human resources.

**Based on a collaborative management model, Mob-ion's internal structure tends to be inspired by stigmergy**, which is a mode of indirect communication where individuals communicate with each other by changing their environment. The long-term goal is to base this structure on a system of indirect coordination between staff and their duties. Decisions are taken through an open innovation process usually involving trial and error.



The objective is to allow each person to choose their place in the company and to fully develop in their role.

### **A team of 52 staff**

Including 38 partners sharing a passion for sustainable mobility, integrated following a capital increase and free share allocations.

The company has a national presence with an office in Paris, a scooter assembly facility, a training and customer service workshop in Bezons, a battery prototyping workshop in Mérignac and a semi-automated production line in Guise.

## Direct, indirect and induced employment

Or how Mob-ion's industrial eco-design model is becoming a driver of local economic value creation

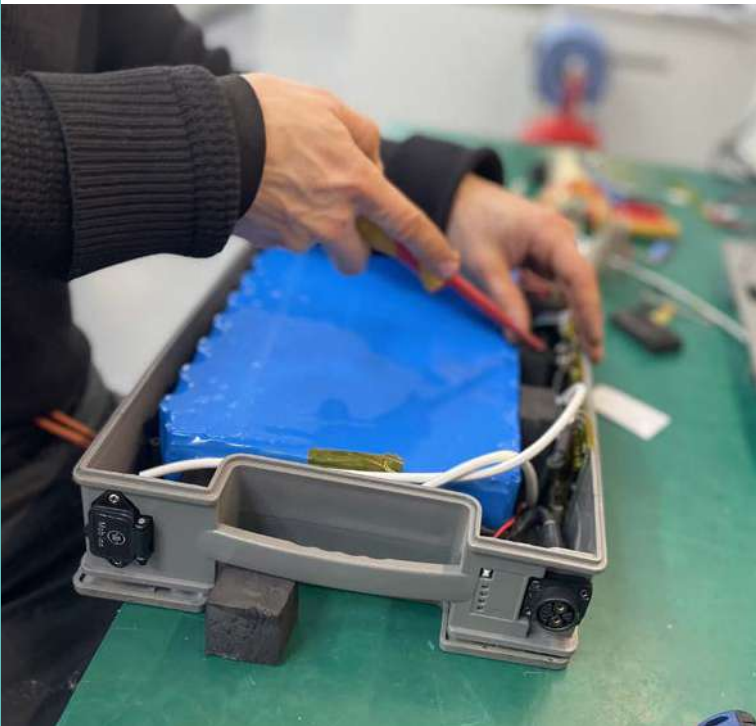
**Under the pretext that supporting ecology is at the expense of jobs, economic growth and the environment are constantly pitted against each other. Yet industrial eco-design proves the opposite, as shown by the development of a company like Mob-ion, a French manufacturer of batteries and electric scooters.**

Eco-design refers to the intention to design products that respect the principles of sustainable development and the environment (source Ademe). The aim is to use as many renewable resources as possible, or resources that are renewed in the form of by-products or secondary raw materials from manufacturing waste, allowing them to be reused, repaired and recycled, thereby generating a circular economy.

This logic challenges companies' commercial and accounting practices, traditionally based on the number of products sold and their respective margins. In this approach, the more quickly a product is obsolete, the better the company's business. With eco-design, the situation is reversed. The sale includes not only the product but also its reliability, an extended quality of service thanks to environmental awareness.

The difference is not only in the selling price but also in the management cost, as an eco-designed product consumes less energy and less repair costs. In effect, a lower sales margin on the eco-friendly product, due to optimised design costs, is compensated for by lower management costs. For us, a French manufacturer of electric scooters and batteries, this approach is a direct source of profit.

But the comparison does not end there. The sum of the reuse and maintenance aspects of a product, aimed at improving the sustainability of its use throughout its life cycle, significantly increases the economic value of the local ecosystem. For a given surrounding area, our business generates multiple beneficial economic impacts, including direct, indirect and induced employment.



## Direct, indirect and induced employment

- Direct jobs involve direct production of products specific to the industry.
- Indirect jobs are jobs involving suppliers of goods and services (intermediate consumption) linked to the direct production operations of the industry.
- Induced jobs are jobs that arise from the interaction of the industry with the rest of the economy with the rest of the economy: the knock-on effects of increased activity by the industry and its suppliers on macroeconomic growth via consumption, investment and the trade balance.

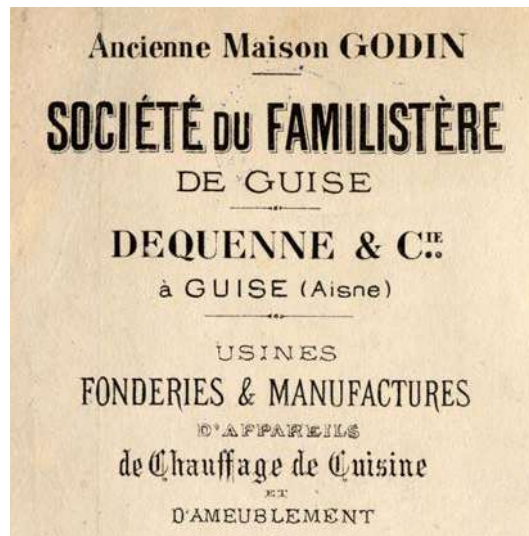
## The local ecosystem, a key factor in Mob-ion's development

Buying cheaper on another continent to maximise the profitability of invested capital is a widely accepted financial approach. However, it is not an approach which benefits the local industrial economy. The approach at the heart of our development strategy aims to adapt the profitability of invested capital in order to develop competitive commercial services with a high social and environmental impact.

**There are so many advantages to "Made in France".** We are developing our assembly lines at a site in Aisne, where we will also store our containers. This is an asset that will allow us to save on transport costs and optimise the whole production chain. Communicating and working in a common language strengthens mutual understanding, we benefit in both quality and speed of any decisions made. In addition, our employees' salaries, as well as the income of the service providers we work with, contributes to the wealth of the region. Through their participation in the local economy, they in turn create wealth. A virtuous circle is created, which ensures the good health of the local economy.

**A model like ours shows that eco-design is an important factor of economic growth and job creation,** provided that we have a diverse approach to value creation in the company. By respecting the natural rhythm of the earth, we prove that it is possible to find a sustainable partnership between economy and ecology. Independent and family-run SMEs are the perfect illustration of this and are emerging as models to follow in order to reindustrialise France.





## Our regional responsibility for employment

By setting up its main production site in Guise, Mob-ion aims to make its own contribution to the future of the industrial sector and has moved closer to the iconic Familistère site to make its mark on the development of a collaborative, connected and sustainable industry.

**#BuiltToLast** is not just a set of techniques. It is a global initiative that involves manufacturers, consumers, the public and stakeholders in equal measure. Deciding to manufacture in France in the industries of the future leads us to re-examine our systemic practices.

Our factory is next to the Familistère, a concrete industrial utopia created by Jean-Baptiste Godin to accommodate his workers. We have joined forces with the Familistère's union, which has a strong ambition, with the Campus of Alternatives, to give this structure back its original glory in line with the challenges of the 21st century.

Several projects are under consideration: the creation of a FabLab, an incubator for

connected and sustainable industrial projects, a professional training centre to support this transition towards an industry that integrates sharing, and the contribution of «wealth equivalents» through training and education in the ecological and industrial issues of the 21st century.

## Mob-ion's sustainability also depends on our ecosystem of committed partners



Historical partner of Mob-ion, **Just Eat** and its members have trusted us with over 5 million accumulated kilometres since 2017. Their feedback and the collected data have enabled the creation of a scooter addressing the specific needs of delivery professionals.

## STOR-H

Since the start of 2020, Mob-ion and **STOR-H Technologies** have been working together to develop a hydrogen version of the AMI scooter. We are working with Stor-H to develop an alternative version of our AMI electric scooter. Their «Powered by STOR-H» module, with a fuel cell and removable cartridges for solid storage of green hydrogen at very low pressure, is integrated into our scooter to bring a hydrogen scooter to the market, a true alternative to lithium battery scooters.

The goal? To move around freely with almost unlimited immediate access to energy while limiting its impact on the environment in a flexible and scalable infrastructure. This collaboration is also perfectly in line with STOR-H's strategy to revolutionise the relationship with energy, accompanied by leading players in the field of mobility, and Mob-ion's aim to offer innovative and robust «made in France» products. This «Powered by STOR-H» scooter was presented at the China International Import Expo in Shanghai from 5th to 10th November 2020.



TIAMAT

We are involved in open innovation R&D work alongside our partner **Tiamat**, a French company specializing in cutting-edge research which designs and manufactures sodium-ion cells for cleaner, more durable, faster charging batteries. We are also working with SAP on data collection and analysis models.



Our partnership with Tiamat led us to contact **SAP** to analyse the data from these new

sodium-ion cells. Once the data has been collected by our Jimini communication box, it will be processed by an analysis model designed by SAP.



Mob-ion is supported by **Ademe** through the Initiative PME scheme and winner of the Investissement d'Avenir IPME. We are also eligible to the

Young Innovative Company status and benefited in 2018 and 2019 from CIR and CII grants and BPI prospecting insurance subsidy which enabled our installation in Portugal.



Taking advantage of the multiple opportunities offered by artificial intelligence, Mob-ion approached **Adagos**, a Toulouse-based company specialising in economical AI software, to design a BMS-AIA (Battery Management System - Artificial Intelligence Appliance) and thus optimise the total cost of ownership (TCO).

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