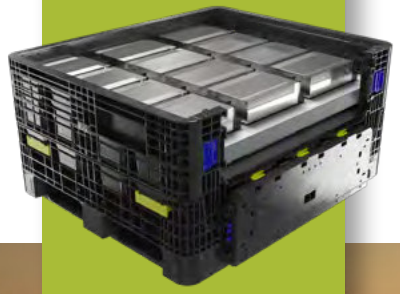

ORBIS®

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*INNOVATIVE*
*PACKAGING SOLUTIONS*
*FOR A SUSTAINABLE FUTURE*

# HOW TO TRANSPORT DANGEROUS GOODS

## Safe and Sustainable Battery Transportation with Reusable Packaging

Table of Contents



## WHAT'S IN THIS WHITEPAPER

With the growing number of electric vehicles on the streets, battery production in Europe is on the rise.

The automotive supply chain is becoming increasingly complex – including the need for secure packaging for transporting lithium-ion batteries.

Reusable plastic packaging can solve many of today's challenges. It not only meets the high standards required for transporting dangerous goods securely, it is also a sustainable alternative to conventional packaging solutions.

**This whitepaper examines various practical examples and highlights the development process.**

Batteries are a mainstay of the automotive market. They require **individual packaging solutions for storage and transport.**

# THE BATTERY MARKET IS EXPANDING

## EVS ON THE RISE

**350.000**
ELECTRIC
VEHICLES

**The European electric mobility market is booming:** according to the European Automobile Manufacturers' Association, or ACEA, the number of new electric vehicle (EV) registrations rose by 63 percent in 2021 as compared to the previous year. And the trend continues: experts forecast more than 8.7 million new EV registrations each year in Europe by 2030.

Germany is leading the way in Europe – in 2021, over 350,000 out of a total of 2.65 million new car registrations were electric vehicles.[1]

The growing number of electric cars on our streets, and the increased electrification in other industries, has significantly expanded the market for batteries. Experts predict that battery production capacities in Europe will **multiply by a factor of 20** by 2030.[2] There are already more than 100 projects in the pipeline to develop the European battery market. This includes the construction of gigafactories in Poland and the Czech Republic, in key automotive markets such as Germany and France, and in countries with low carbon footprints, such as Norway and Sweden. There is no doubt about it: **battery cell production now has an irrevocable place on the European market.**

[1] de.statista.com/statistik/daten/studie/429428/umfrage/anzahl-der-verkaeufe-von-elektroautos-nach-laendern-quartalszahlen/
[2] mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric

# HOW E-MOBILITY AFFECTS

## SUPPLY CHAINS

The rapid growth of battery production in Europe is reshaping the global automotive supply chain as we know it and affects supply chains in diverse ways. Lithium-ion batteries, or LIBs, are subject to strict **handling and safety requirements** for both storage and transportation.

It is essential that packaging be considered as early as possible in the process of reshaping or building supply chains. In addition, companies are looking for providers that support them through the entire supply chain process, **from consultation to return shipments.** After all, a growing number of electric cars means a growing number of used batteries that must be disposed of.

Packaging for battery transport is subject to strict regulations – it must meet **high government standards** and conform with customer needs at the same time.

**Companies are searching for:**

+ UN-certified
+ automation friendly
+ and customised packaging.

# LITHIUM-ION BATTERIES

## TRANSPORT PACKAGING CHALLENGES

Lithium-ion batteries have become the **preferred energy source** in this monumental shift in the automotive industry. The lithium-ion battery cells are combined into modules, and several modules are combined to create a battery pack.

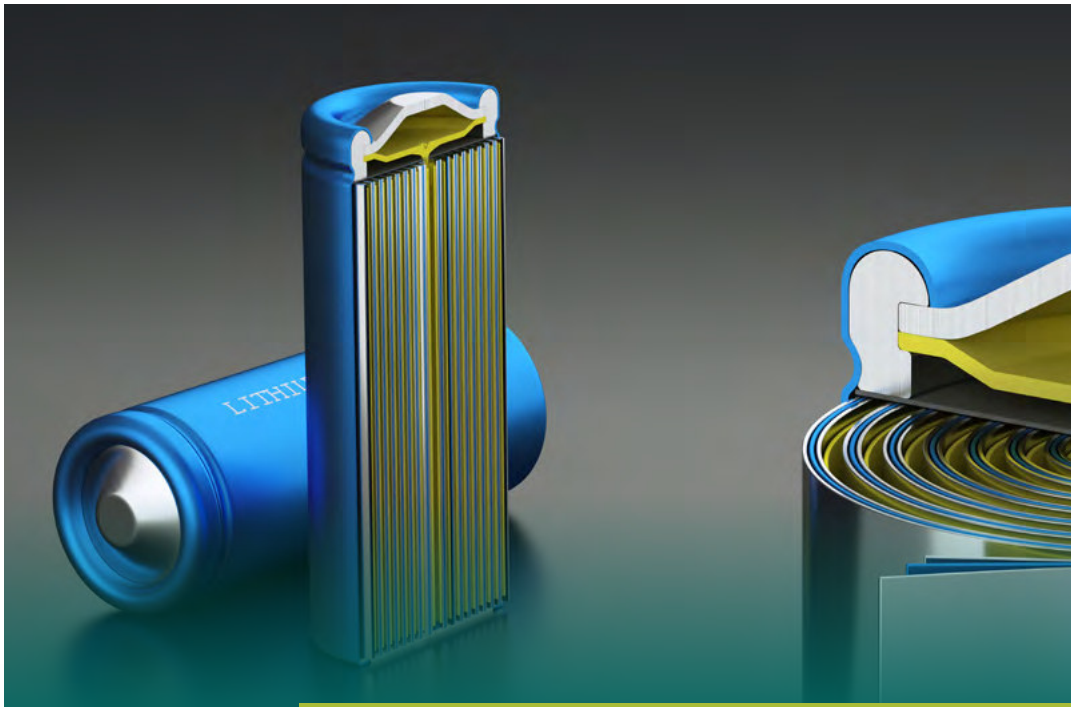
At the same time, batteries are at the forefront of the current supply chain challenges. Due to their high value, their complex regulations and the severe risk they pose during a thermal runaway, lithium-ion batteries are classified as Class 9 Dangerous Goods under RID / ADR / IMDG / IATA-DGR.

**The transport packaging used must therefore meet specific safety requirements.** The type of packaging required, and the safety standards it must meet, depend amongst others on the type of battery and the means of transportation.

Dangerous goods regulations pertaining to transportation define the following different types of batteries*:

1. Prototype / untested – P910
2. Battery 38.3 certified – P903
3. Battery used – P909
4. Damaged, non-hazardous battery – P908
5. Damaged, hazardous battery – P911

*Transport in accordance with packaging regulations RID / ADR



The international regulations **RID** (Regulation concerning the International Carriage of Dangerous Goods by Rail) and **ADR** (Agreement concerning the International Carriage of Dangerous Goods) define different UN numbers for the types of batteries considered to be dangerous goods. **Lithium-ion batteries have been assigned the number UN3480.**

**IT IS THE PACKAGING INDUSTRY'S JOB TO PROTECT THE PRODUCT FROM THE ENVIRONMENT AND THE ENVIRONMENT FROM THE PRODUCT.**

*Christian Hemming, Technical Director EMEA*

In addition to **statutory requirements, individual needs** of car and battery manufacturers also have an important role to play when it comes to transporting batteries. Because battery design differs from manufacturer to manufacturer, there is a need for individual, customised solutions. In addition to battery size and weight, these solutions must take into account the means of transportation, as well as processes at the end customer: Are the batteries unloaded manually or using automation? How strict are anti-contamination requirements? At the same time, an additional supply chain is emerging. When returning used batteries to be recycled or used in energy storage systems, **even stricter transport packaging regulations apply.**

Battery manufacturers must be able to adjust **quickly to new circumstances and changes to the law.** This can be achieved by switching from traditional, linear manufacturing processes to a modular, flexible production model. Automation technology, such as robots, will necessarily have a greater role to play. This is particularly true for batteries, which are very heavy, and thus harder to handle manually. In fully automated production, **selecting the right packaging solution is essential to avoiding disruptions** – ideally, the packaging would be considered when selecting specific automation options. The uniform, consistent design of reusable plastic packaging solutions seamlessly interfaces with automated systems, therefore reducing system downtime.

Finding the proper packaging can be a fairly complex process. Therefore, it's important to involve a packaging supplier that has extensive knowledge of the regulations right from the start. **ORBIS Europe offers customised packaging solutions** that can support heavy weights as well as comprehensive expertise when it comes to dangerous goods regulations.

An automotive supplier reduced freight cost by **more than 70 %** by converting from a non-collapsible steel bin into a collapsible plastic bulk container.

# REUSABLE VS. SINGLE-USE

## DOES IT MAKE A DIFFERENCE?

While electric cars emit less carbon on the road than cars with combustion engines, almost 80 percent more $CO_2$ is emitted during the manufacturing process.[3] It is therefore extremely important that the **production and supply chains of these vehicles be as sustainable as possible.** Considering current events – raw materials shortages, a world-wide climate emergency, economic and social issues – sustainable packaging solutions are more important than ever.

For the most part, single-use packaging is still the norm for transporting batteries and other solid dangerous goods. These are produced and then disposed of after every single use. Because it takes large amounts of resources (water, for example) to recycle corrugated cardboard, re-using the packaging can be a more ecological and economical alternative. As a rule, **waste prevention should take priority over recycling.** ORBIS follows this approach and produces plastic packaging that is certified and can be used over the entire life cycle of one or even multiple vehicle generations.

While initial acquisition costs of reusable plastic packaging are generally higher compared to single-use solutions, the investment quickly pays off. The packaging has a significantly longer service life – of more than 10 years when handled properly and repaired as needed. Then, at end-of-life, packaging manufacturers offer to buy back the used packaging to recycle the raw materials and reprocess into new supply chain packaging. **Companies receive a credit for future purchases and save on disposal costs.**



[3] mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric

# REUSABLE INSTEAD OF ONE-WAY

## THE ADVANTAGES

**Reducing (transport) costs** – Savings are generated by both the lighter tare weight of the packaging as well as space-saving return transport in closed-loop supply chains because the packaging is collapsible. Due to the standardised dimensions and a return ratio of up to 2:1 (depending on inner packaging), more packaging fits in standard trucks to limit the number of trucks needed for a return trip. This leads to fewer trucks on the road, more cost savings and reduced emissions by up to 50 %.

**Protecting products** – As high-cost products and dangerous goods, batteries need special protection during transportation, specifically from external impacts such as shocks or jolts.

Plastic transport packaging is robust and, in combination with customised inner packaging, can protect the vulnerable dangerous goods

**Packaging sustainably** – Although cost is still the main driver of decisions, sustainability has moved up in importance to become key in the decision-making process. This emphasis on sustainability extends all the way through to packaging choices. Reusable transport packaging for dangerous goods is sustainable in a number of ways:

- It reduces greenhouse gas emissions.
- It lasts for many cycles through the supply chain.
- It is recovered, recycled and reprocessed into new packaging products
- It improves a company's image.

**WHEN COMPANIES USE REUSABLE PLASTIC PACKAGING TO TRANSPORT DANGEROUS GOODS, THEY ACT IN AN ENVIRONMENTALLY FRIENDLY, ECONOMIC MANNER – WHILE PROVIDING OPTIMAL PROTEC-TION FOR THEIR BATTERIES.**

*Jürgen Krahé, Senior Commercial Director EMEA*

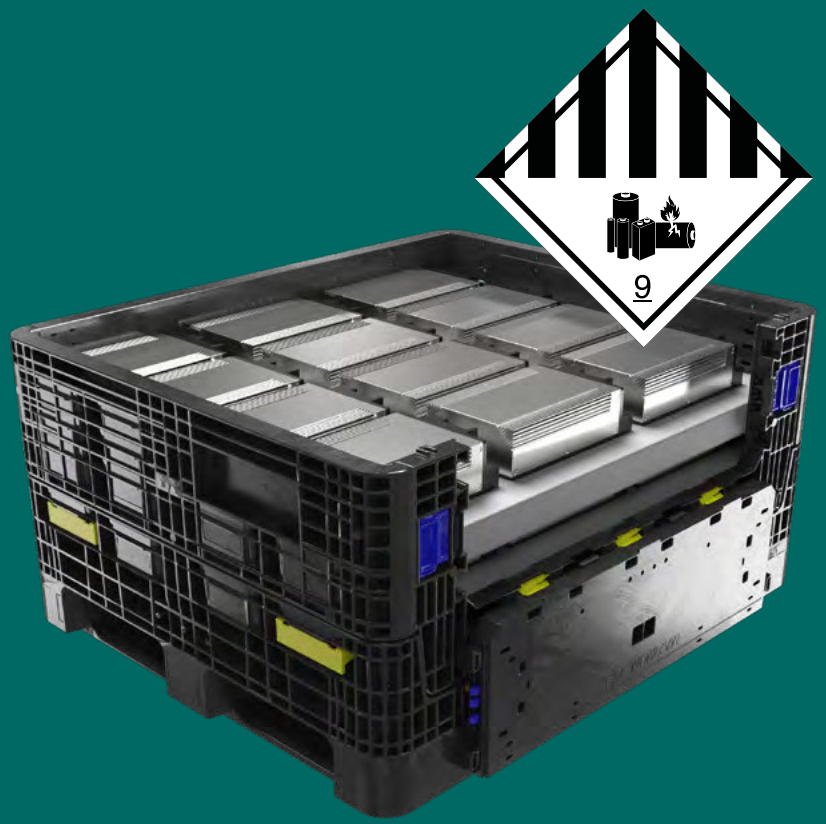
# A SUSTAINABLE PRODUCT LIFE CYCLE

## FOLLOWING THE CIRCULAR ECONOMY PRINCIPLE

ORBIS Europe offers customised, recyclable, and reusable packaging to support companies as they optimise their supply chains according to circular economy principles.

The packaging solutions are made up of up to 90 % recycled materials, saving around 60 kilograms of $CO_2$ per foldable large container – only during production.

**At the end of the service life, the recycling rate for the raw materials is 100 percent.**




Reusable-
Packaging
solution

# IONPAK®

## SAFELY TRANSPORTING SOLID DANGEROUS GOODS

Companies must meet requirements for safe dangerous goods transportation while simultaneously finding a solution that allows for a **sustainable, cost-efficient** supply chain.

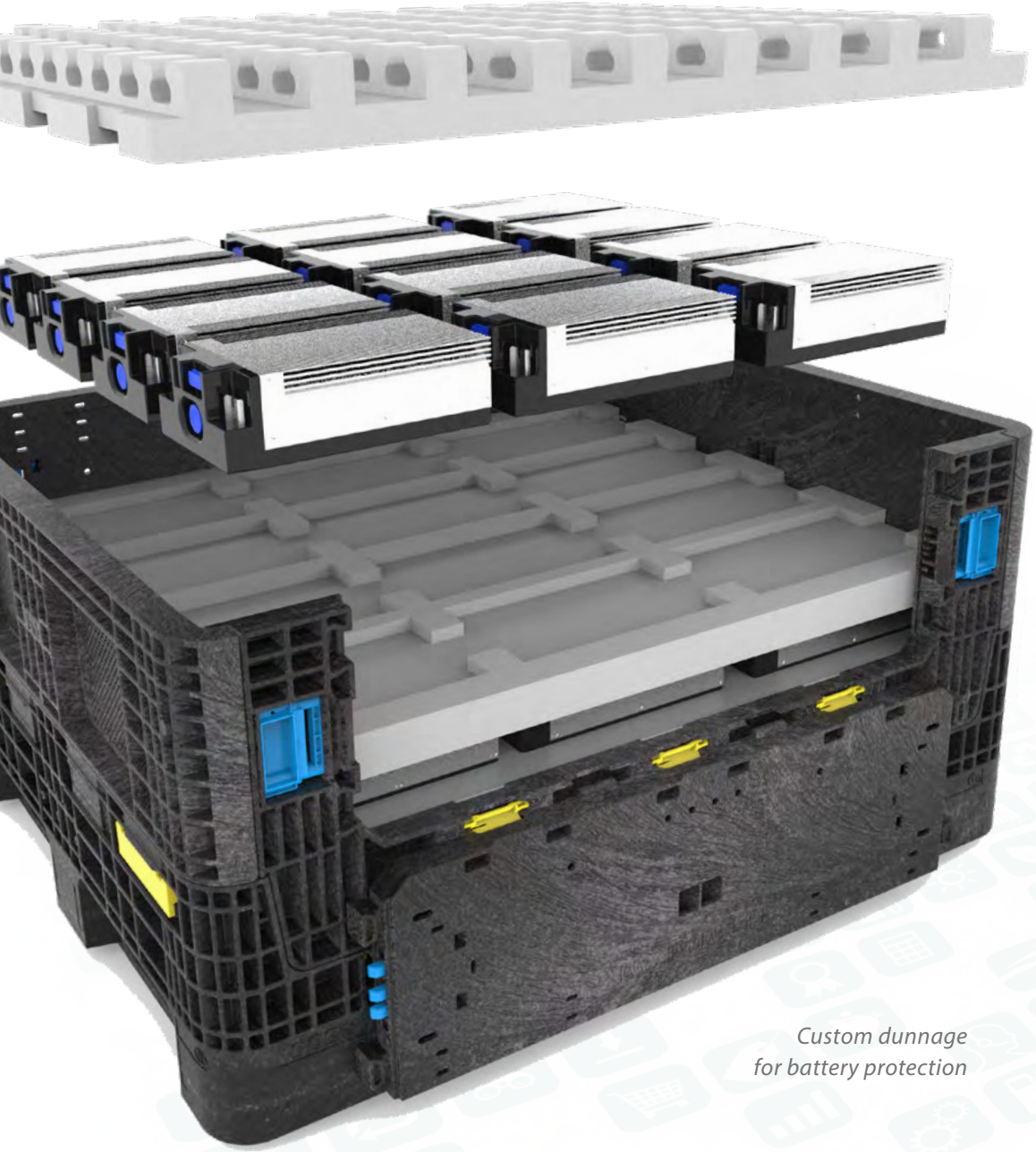
IonPak® is a reusable, foldable plastic packaging solution and represents an alternative to corrugated, steel or wood packaging.

The dangerous goods container is UN-approved to transport solid dangerous goods (Packing Group II) and, depending on the model, certified in accordance with RID/ADR (UN4H2/UN50H).

The customised packaging consists of a robust foldable large container with European standard footprints (1200 x 800 / 1200 x 1000 / 1600 x 1200 mm) and an inner packaging solution optimised to protect dangerous goods.

The lithium-ion battery shipping boxes are suitable for prototypes, battery cells, modules, small battery packs as well as end-of-life batteries (e.g. P903, P908, P909, P910).

Certified dangerous goods safety advisors provide guidance on possible applications and customisation options. **Rely on ORBIS for the entire process – from development to certification of your packaging solution.**



*Custom dunnage*
*for battery protection*

## IONPAK® FEATURES

AT A GLANCE:

- Stores and transports dangerous goods securely in several layers
- Is approved to transport solid dangerous goods in accordance with RID / ADR (Packing Group II)
- Helps companies to optimise space utilisation and save transport costs thanks to collapsible, stackable design
- Protects the product with a customised inner packaging solution
- Can be integrated seamlessly into existing manual or automated processes
- Is reusable and recyclable

# BEST PRACTICES

FROM THEORY TO PRACTICE

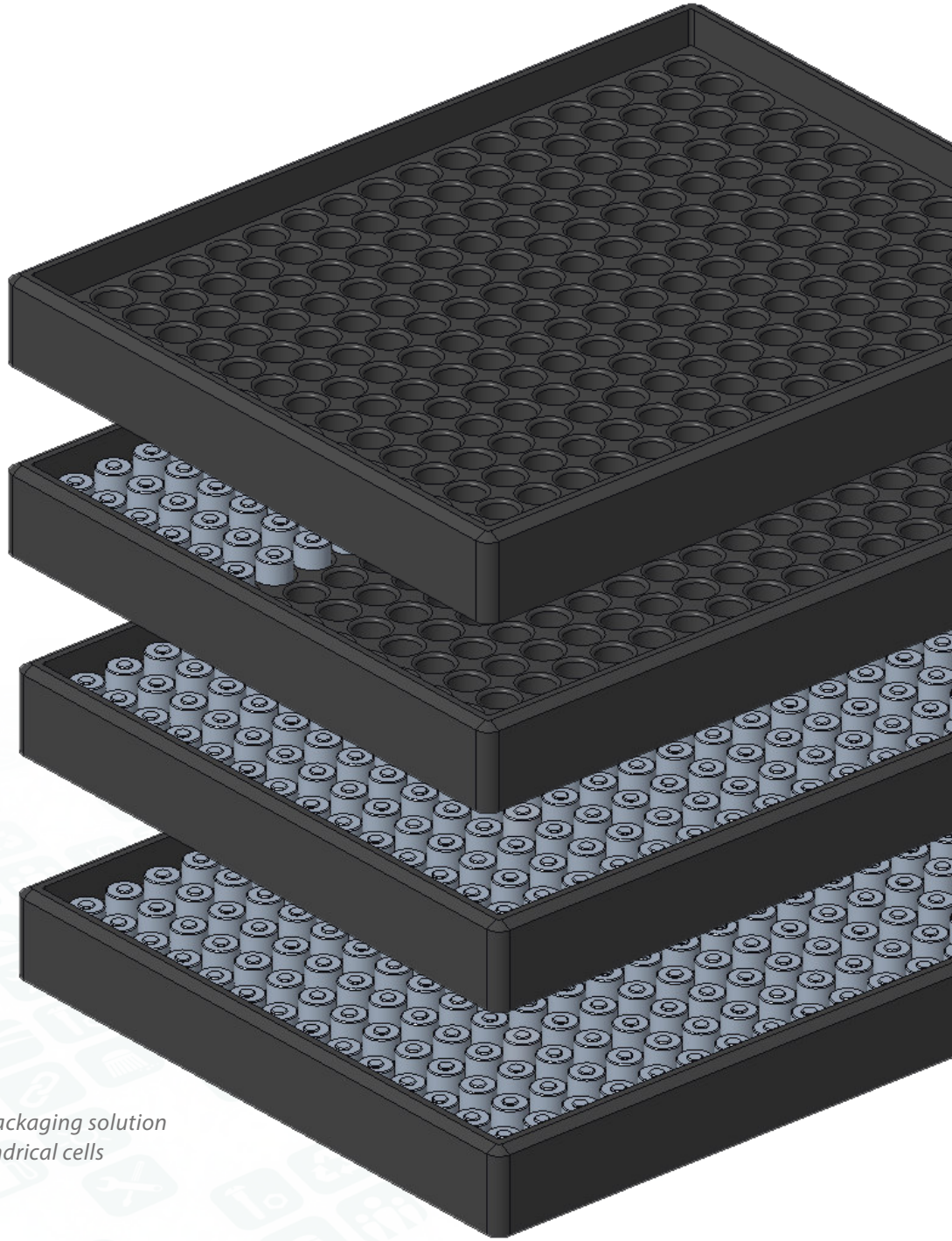
## **Case 1:** Packaging solution for cylindrical cells

**Solution:** ORBIS IonPak® – HDB1210
**Maximum weight according to RID / ADR:** 400 kilograms, net

The packaging solution consists of a foldable large container and an inner packaging solution with EPP foam trays. The foam trays are **shock resistant and protect the battery cells from contamination.**

The trays also ensure that the cells cannot touch or slip out of place. The packaging is optimised for semi-automated handling. It is opened manually or by machine, the batteries are then removed using a semi-automated gripper system tailored to the product.

The batteries can be removed **individually or in rows.** Once the batteries are removed, the empty trays are returned to the container and transported back to the battery manufacturer.



*Inner packaging solution for cylindrical cells*

# BEST PRACTICES

FROM THEORY TO PRACTICE

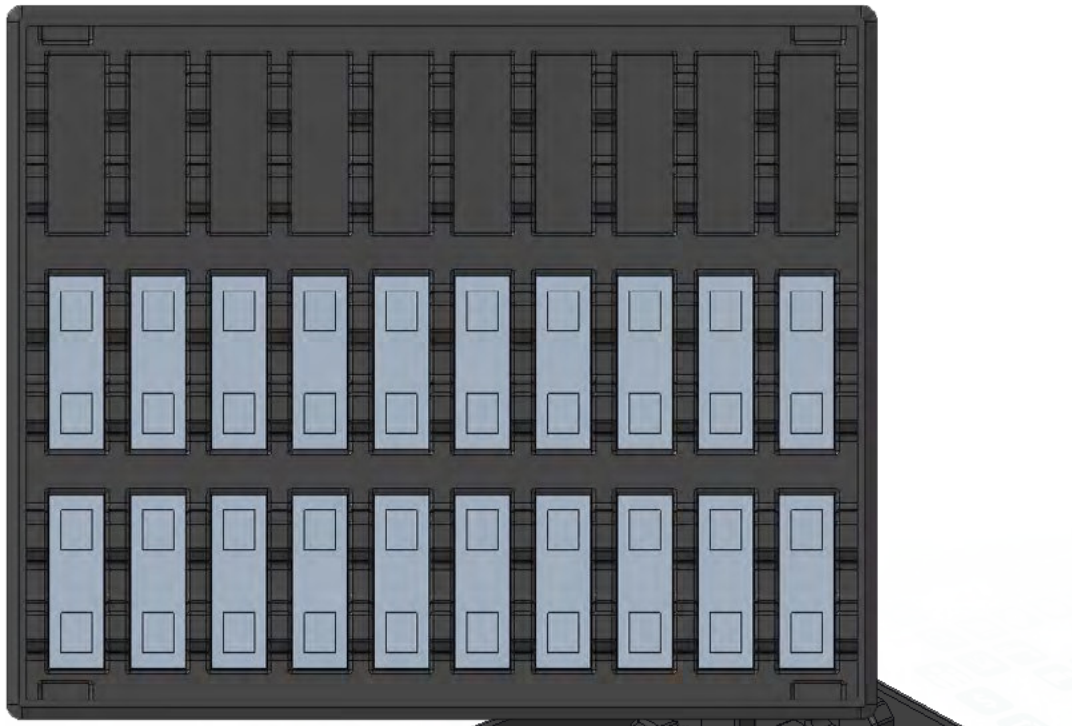
## **Case 2:** Packaging solution for prismatic cells

**Solution:** ORBIS IonPak® – HDB1210
**Maximum weight according to RID / ADR:** 400 kilograms, net

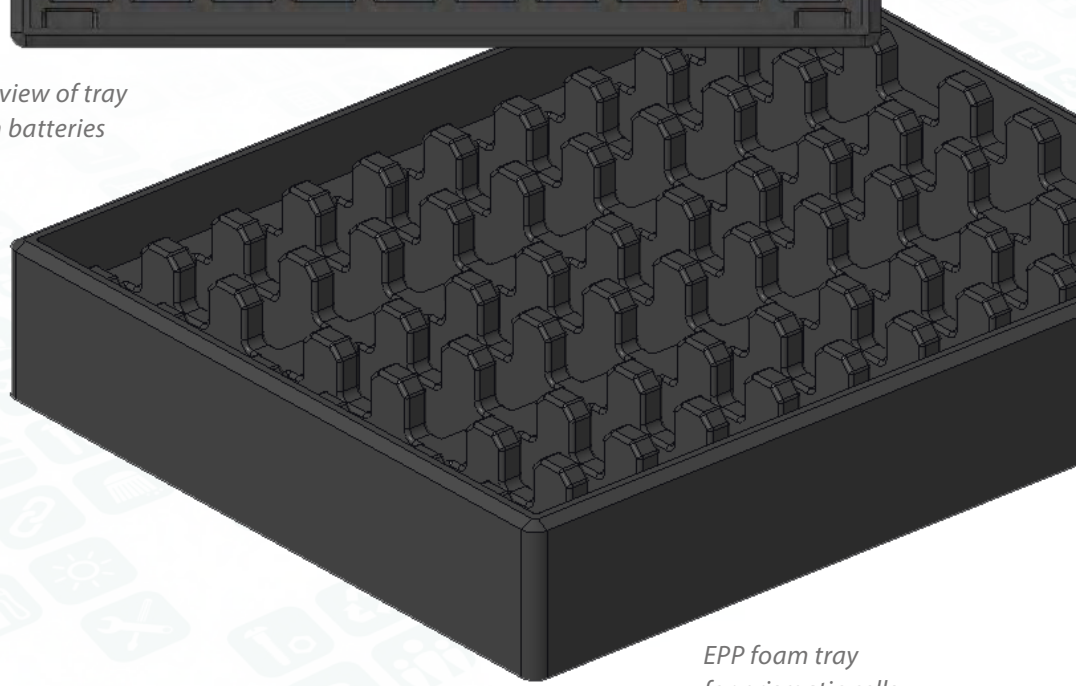
This packaging solution also consists of a foldable large container and EPP foam trays, which provide shock absorption and **protect the product from contamination and slippage.**

In this case, the cells are placed into the tray in rows at the point of manufacture. However, once they reach their destination they are removed individually, with a single gripper.

**ORBIS has optimised this solution** to ensure that the battery cells and trays can be removed via automation using the relevant gripper from the long or short side of the container.



*Top view of tray with batteries*



*EPP foam tray for prismatic cells*

# BEST PRACTICES

FROM THEORY TO PRACTICE

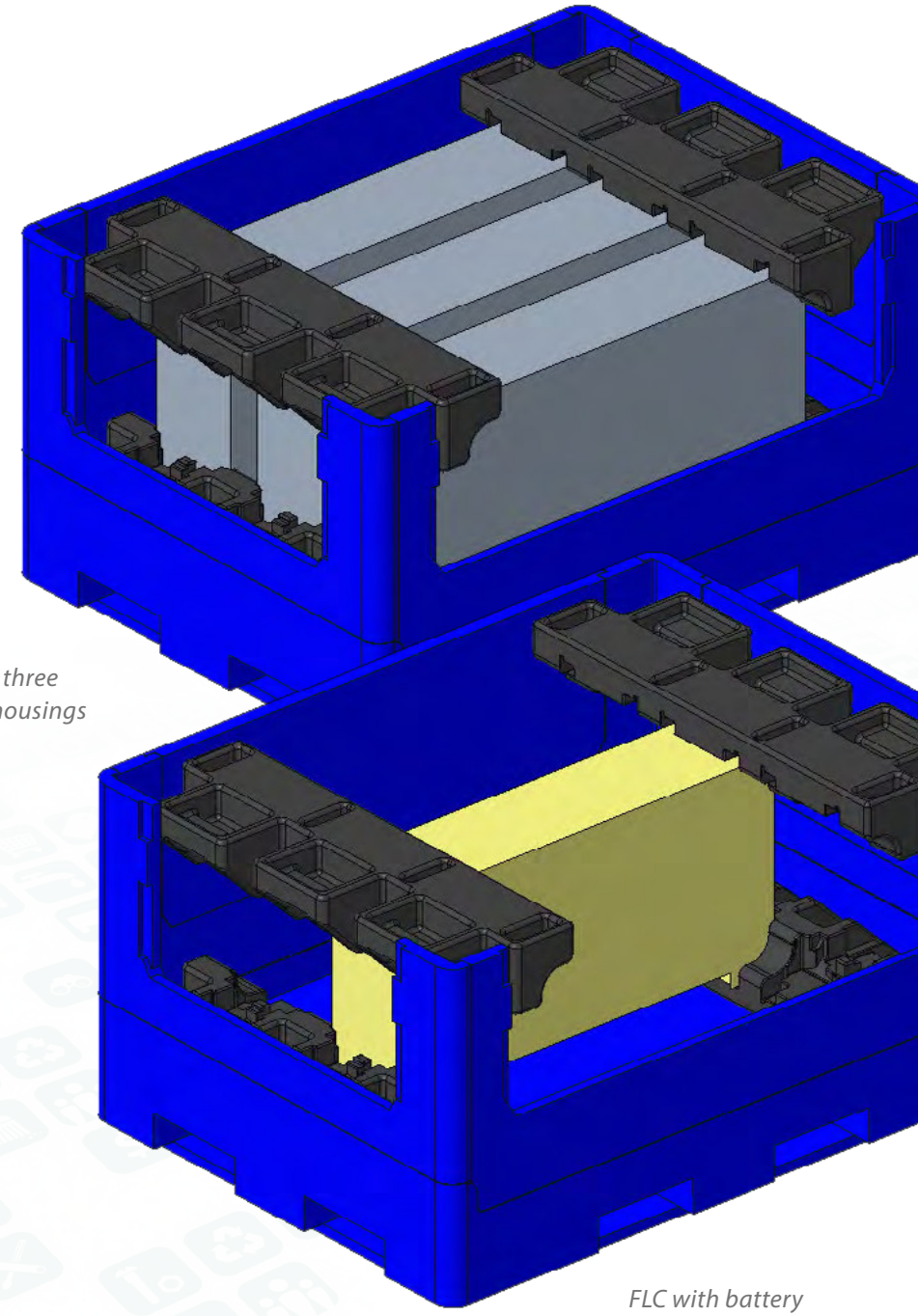
## **Case 3:** Packaging solution for batteries and housings

**Solution:** ORBIS HDR6548-34 with UN50H- and UN4H2 certification
**Maximum weight according to RID / ADR:** 915 kilograms, gross (UN50H)

In location A, three aluminium housings are placed in each foldable large container (FLC) and then transported to location B to complete the batteries. There is no UN-certification required for this first stage.

Once the batteries are completed, they must be transported to the end customer, in location C. A UN-certified packaging solution is needed. As each individual battery weighs over 400 kilograms, only **one battery may be transported per package** in accordance with RID/ADR.

The padding is **reusable** and inhibits flames in the event of a fire. Once the batteries have reached their destination, the plastic containers are collapsed and returned to the housing supplier or battery manufacturer for reuse. The packaging solution, **suitable for all individual shipments,** can thus be used along the entire supply chain.



*FLC with three battery housings*

*FLC with battery > 400 kg*

Are you interested in our packaging solutions? Talk to one of our experts today! Simply get in touch at **europe@orbiscorporation.com.**

The ORBIS Europe team will be happy to help.

# ORBIS EUROPE

## YOUR ONE-STOP SHOP

As battery production continues to expand, it's important to work with a packaging provider that can help your operation transition to meet the automotive supply chain's changing needs. The team at ORBIS Europe provides support and expertise through the entire packaging process, from development to certification of your packaging solution. We offer innovative, durable and sustainable packaging solutions for transporting lithium-ion batteries.

**What we offer:**

| | |
|---|---|
| 1 | **Initial contact including questionnaire, supply chain analysis and consultation** (e.g. turnaround times, weights, material flow amounts, transport routes and means, determining battery type) |
| 2 | **Development phase** |
| 3 | **Design freeze and approval** |
| 4 | **Pre-series production** |
| 5 | **Tests and UN-certification** (e.g. UN4H2/UN50H) |
| 6 | **Final approval and serial production** |

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ORBIS®

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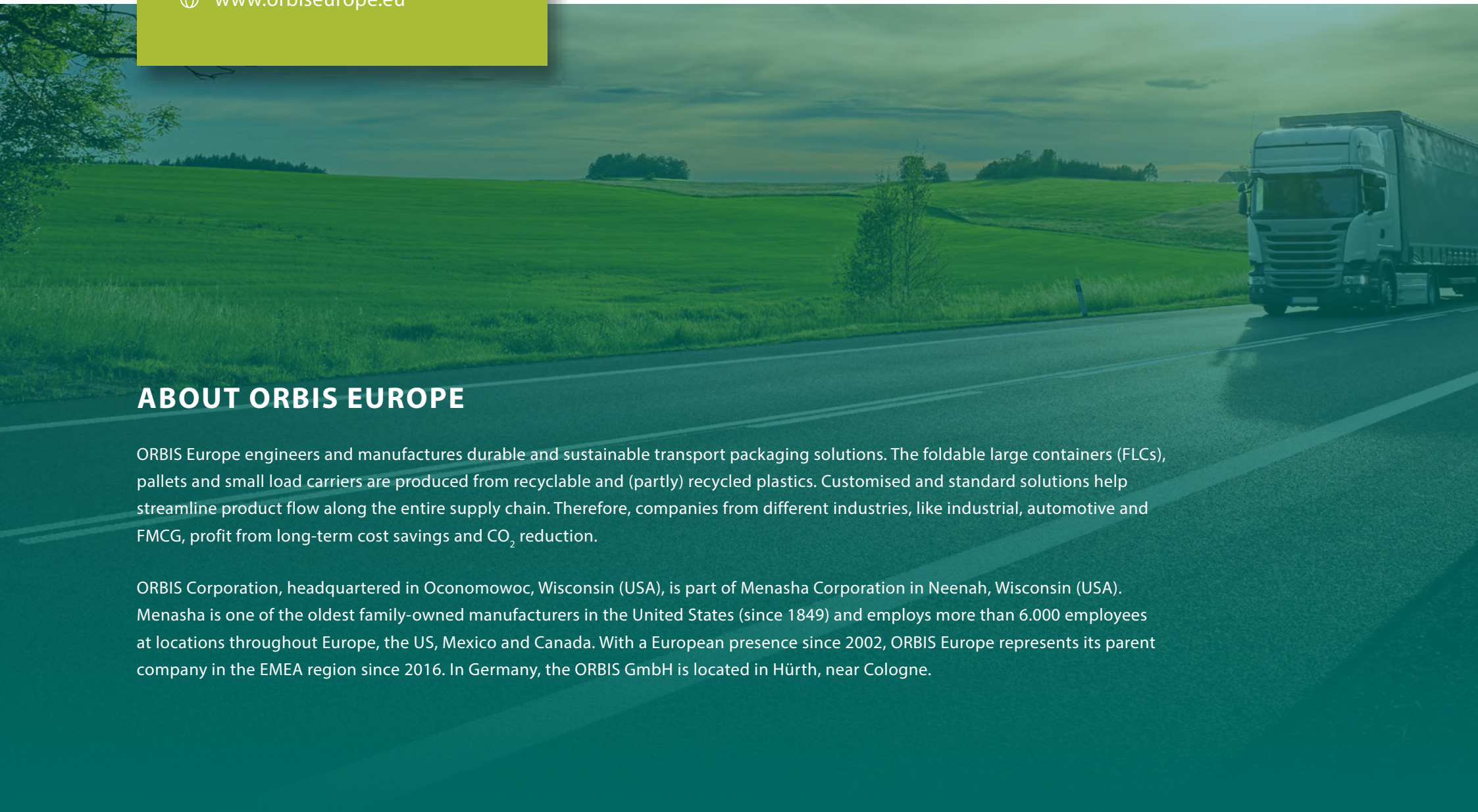
*INNOVATIVE PACKAGING SOLUTIONS FOR A SUSTAINABLE FUTURE*



## ABOUT ORBIS EUROPE

ORBIS Europe engineers and manufactures durable and sustainable transport packaging solutions. The foldable large containers (FLCs), pallets and small load carriers are produced from recyclable and (partly) recycled plastics. Customised and standard solutions help streamline product flow along the entire supply chain. Therefore, companies from different industries, like industrial, automotive and FMCG, profit from long-term cost savings and $CO_2$ reduction.

ORBIS Corporation, headquartered in Oconomowoc, Wisconsin (USA), is part of Menasha Corporation in Neenah, Wisconsin (USA). Menasha is one of the oldest family-owned manufacturers in the United States (since 1849) and employs more than 6.000 employees at locations throughout Europe, the US, Mexico and Canada. With a European presence since 2002, ORBIS Europe represents its parent company in the EMEA region since 2016. In Germany, the ORBIS GmbH is located in Hürth, near Cologne.