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Business Excellence in Battery Manufacturing.

The challenges of a rising industry in Europe

White Paper

Giving substance to a new reality.

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Management Summary

With the emergence of electric mobility, also the demand for automotive batteries is steeply increasing. By 2030, it's expected that more than 30 Gigafactories will be competing for market share and establishment of battery cell competence – only in Europe.

With continual growth of the European battery market, we expect that economies of scale will lead to a consolidation of battery companies from 2025 onwards. In order to survive in this competitive environment, new as well as long established players need to transform into reliable contributors to the automotive value-chain by building-up scalable organisations and ultimately run best practice operations. The current established battery players with strong technology expertise from consumer goods industries need to adapt to automotive standards & methodologies to fulfil the strict OEM expectations and governmental regulations of the automotive industry.

In addition, continuously tightened CO_2 regulations, shortage of raw materials and the aspect of sustainability have tremendous impact on future value-chains of automotive batteries. Therefore, a strategical approach towards a circular economy and emission neutral battery production must be developed.

This paper discusses the challenges of the European battery industry and highlights the following:

- the types of battery companies that are competing for market share
- how to prepare to survive the market consolidation ahead
- the strategic steps to establish best practice battery operations in order to stay

In past years, battery manufacturers have successfully improved the capacity and performance of battery cells. In order to become a competitive tier-1 supplier in the upcoming years, the focus needs to be directed towards improving operational performance and reliability.

To master the upcoming consolidation in the battery environment, it will be necessary to focus on more than just the product or the technology. Only those companies who combine cutting-edge technology, operational efficiency and a scalable organisation into a holistic operating system will prevail as a long-term partner of the OEMs.

European Battery Industry on the Rise

With the rise in demand for electric mobility solutions, the demand for battery cells is also increasing. After a reluctant start, European battery manufacturing is on the verge of becoming a leading industry in the European automotive environment. By 2025, the European battery industry is expected to reach market volumes of € 250 bn according to the objectives of the European Battery Alliance. As oversea shipping is not competitive, we expect this market to be located and served in Europe only.

30+

Gigafactories have been announced to be operational in Europe by 2030

As of today, more than 30 European Gigafactories for Li-Ion battery cells have been announced by battery cell companies by 2030. While in 2020 the European battery industry produced with 59 GWh only 10 % of the global battery supply, we expect the capacity to increase even up to 1125 GWh and 31 % by 2030.

When taking a closer look at the announced European Gigafactory landscape, we see three different types of battery manufacturing companies that will be competing for market share.

Established Players

Established and renowned battery companies (mostly from Asia) that expanded their battery production capacities and transferred their knowledge to the European market.

Volume Unicorns

European unicorn start-ups that have successfully developed a market-ready battery cell and are in the early stages of entering a series production for upcoming high-volume vehicle programs.

Small Scale Laggards

European start-ups, supported with liquidity by VCs, OEMs or regional governmental programmes that are still in the research and development phase and have not yet developed a market-ready battery cell.

European Battery Industry – Outlook

When comparing battery production capacities with forecasted market demands, we expect a mid-term overcapacity of at least 20 % on the European market between 2025 and 2030, resulting in a market consolidation. In this first decade of mass production, cell manufacturers will have to adapt to the required automotive standards through continuous transformation in order to achieve a reliable tier-1 supplier reputation. By adhering to the strenuous requirements, they can overcome the industry consolidation and gain market share.

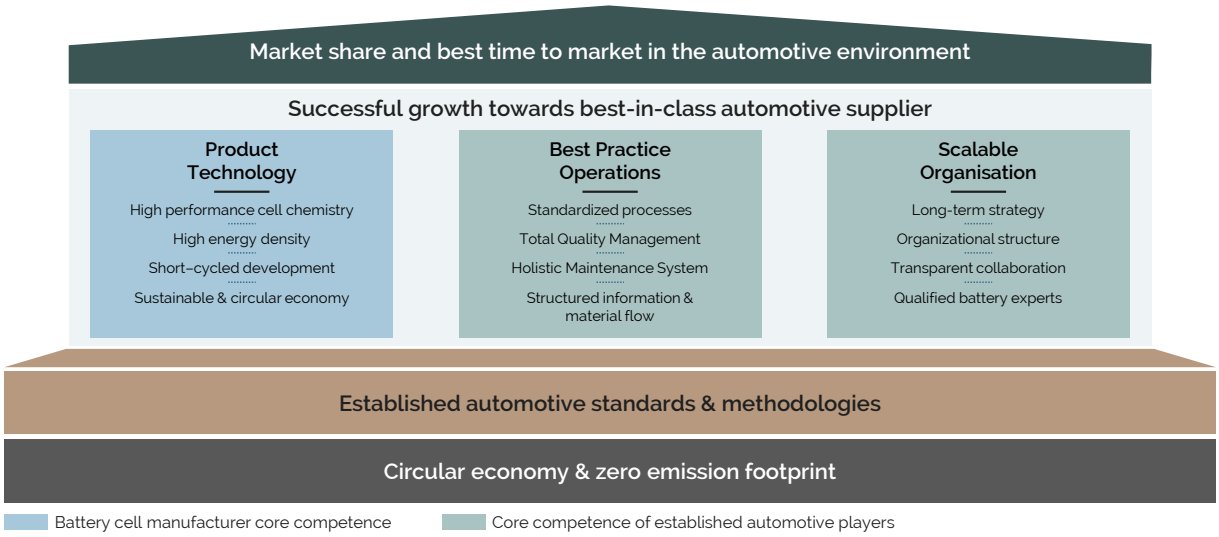

Figure 1: Preconditions for cell manufacturers to be successful in automotive environment

To strengthen the company during the process of market consolidation, we see the following preconditions to be fulfilled by cell manufacturers:

Successful growth towards a best-in-class automotive supplier

Automotive OEMs are producing millions of vehicles a year and expect battery manufacturers to be best-in-class series suppliers that deliver high quality battery cells, just in time. Battery manufacturers are relatively new to the automotive world, where high standards and expectations are set for tier-1 suppliers. To become a reliable series supplier and trusted partner, we see three main challenges that need to be mastered:

Product Technology
The core of success is the product itself and is regarded as the core competence of a battery cell manufacturer. Without a technology edge cell chemistry and innovative cell design, battery companies will not be successful. Therefore, the product performance &

characteristics in the product lifecycle need to be understood, both physically as well as data driven through intensive testing. Cell manufacturers have to establish industry leading and short-cycled product development processes to continuously fulfil the market demand towards high performance automotive battery cells and increasing variants.

Best Practice Operations
Even the best battery cell technology will not be successful on the market, with battery companies failing to manufacture cells at a high and stable quality. Battery companies are failing to establish best practice automotive manufacturing processes and operations. Traditionally, one of the core competences of best in class automotive suppliers is based on the ability to master operational excellence along the entire product life-cycle. Battery manufacturers need to maintain short improvement cycles in their value-added processes and their supporting infrastructure like quality, logistics and maintenance.

Scalable Organisation
A likely avoided field for battery companies is the continuous development and evolvement towards a scalable organisation. In today's battery companies, reoccurring issues such as time constraints, trouble shooting and high workload are on the daily agenda, whereas the development and foresight of the internal future organisation is neglected. In times where competition for talents is at its peak, deskilling of operations is no longer driven by cash-flow considerations but the response to lack of available top-talent. In our work with clients, every day we see decisions that increase the technical debt. The longer the wait, the deeper the cut in order to reorganise the gradually dysfunctional organisation eventually.

Automotive standards & methodologies

Battery companies are entering a mature industry that has developed best practice standards and methodologies over more than a hundred years. Just-in-Sequence, Zero-Defects and Continuous Improvement are just a few key requirements in the automotive world. Cell manufacturers have to apply proven automotive standards and methodologies to battery cell manufacturing processes. In addition to closing existing gaps, new industry trends like smart factories and digitalisation must be recognized and implemented.

Circular economy and zero emission footprint

The availability of raw materials will be one of the major challenges for European based Gigafactories, as most materials are not

sufficiently available in Europe. Battery cell manufacturers have to build-up a circular economy to guarantee sustainable supply of raw materials, by establishing recycling strategies to secure the required demand and attain a higher level of independency.
The emission free production of Li-Ion battery cells is highly dependent on the energy mix that is used for a Gigafactory. On average, a power consumption of ~160 kWh is required to manufacture 1 kWh of battery cell capacity. Gigafactories need to maintain green energy supply and focus on the improvement of energy consumption.

~160 kWh

energy is required to produce 1 kWh battery cell capacity

Mastering the Transformations of Battery Manufacturing

We see that battery companies are mostly focusing on the battery cell itself, yet underestimating the importance of operational and organisational excellence.

In times of sheer endless liquidity, battery companies are tending to neglect efficiency improvements, build-up unstructured Capex and increase avoidable OPEX. Funding might cover inefficiencies today, but will not in the foreseeable future where economies of scale will put pressure on cost efficiency. Scaling battery cell operations may fail due to missing standards, processes and methodologies. We expect that battery cell cost savings of up to 20 % will be possible through efficiency improvements in cell manufacturing.

20 %

battery cell cost can be saved through efficiency improvements in manufacturing

Battery companies have to follow four strategic steps to establish best practice battery operations with seamless integration into the underlying organisation.

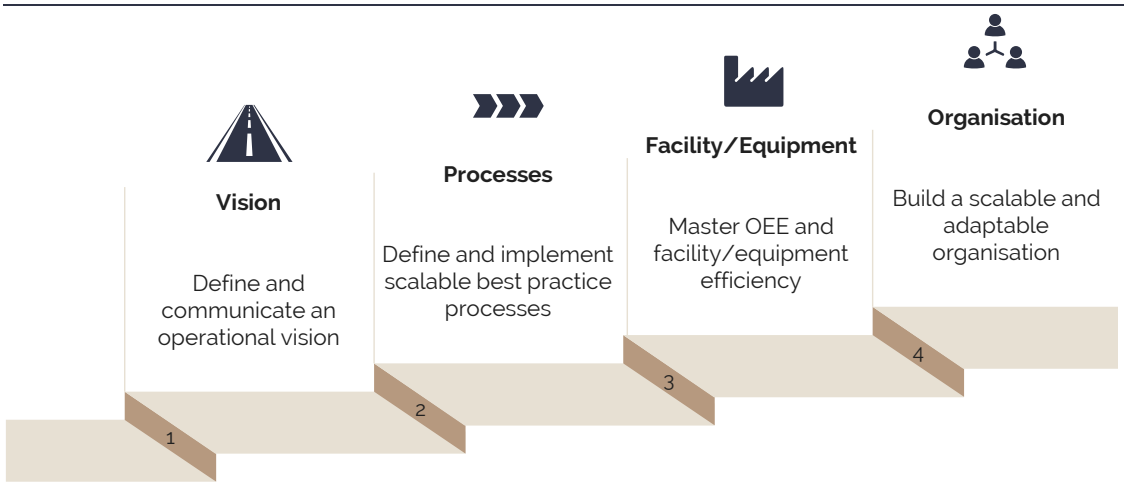

Figure 2: Strategic steps to establish best practice battery operations

Define and communicate an operational vision

As a first step, a clear and leading operational vision needs to be defined and communicated within the organisation. Without following a defined vision, unstructured and non-sustainable decisions will be taken that do not support the overall objectives of the company. In addition, battery companies need to strategically define, which elements of the value-chain are core competences and have to be kept inhouse.

Define and implement scalable best practice processes

As a second step, scalable best practice processes need to be established. As battery companies grow, previous work practices that used to work due to individual performance will not work in a more complex environment or a larger organisation. All processes need to be thoroughly defined, centrally aligned, connected with existing interdependencies, modular to ensure scalability and under constant review for necessary updates. Battery companies have to define a clear path for scaling with predefined transformation steps and become masters of transformation and change.

Master OEE and facility/equipment efficiency

30 %-50 %

OEE as current operational maturity of battery cell manufacturers

As a third step, cell manufacturers need to master the effectiveness and efficiency of the operated equipment. Scaling immature operations and processes will not be successful, as long as Overall Equipment Effectiveness (OEE) and the efficiency of the supporting facility are not mastered. Today, we see renown cell manufacturers operating at an OEE between 30 %-50 %, which is way below an intended automotive standard of ~90 %. Unplanned downtime is lowering availability, unstructured processes are turning down performance and unstable equipment is causing quality issues.

Build a scalable and adaptable organisation

As a fourth step, a scalable and adaptable organisation needs to be built around a set of defined processes. Clear roles and responsibilities, structured skill requirements, balance between stability and agility, lean hierarchical structures and the ability to establish an intercultural work environment are required. The cell manufacturing organisation needs to promote transparent bi-directional communication and a toolset for structured escalation and quick decision making. Organisational development is a major challenge for battery companies which must be strategically planned and implemented with centralized governance.

Call for Action

Europe is in the early stages of establishing battery competence, securing market share and increasing production capacities for battery cells. The automotive industry contains challenges but offers promising opportunities for battery companies.

Companies that will be able to adapt and transform from a chemistry and technology focused cell manufacturer to a holistic, mature and reliable automotive supplier will survive the consolidation ahead. Improving standards, a zero-defect culture, easy to apply and straightforward processes, reliable equipment and tools will be necessary to manufacture high quality automotive batteries that will meet the existing and future requirements of OEMs.

According to our calculations, if battery manufacturer keep the current progression rate of efficiency improvement, they will emerge at the end of the decade with an average OEE of 78% (compare to ~90% automotive standard), making CAPEX investments of €13 billion euros necessary to make up for performance shortfalls. We think circularity would be the better investment case.

~13 bn €

CAPEX investment necessary due to lack of efficiency in battery production by 2030

Don't let sustainability become the industry's blind-spot. To fulfil the increasing requirements and expectations towards sustainability and encounter the necessity of a circular economy for battery cells, a strategical approach needs to be developed.

The battery industry offers significant opportunities, but does not yet show it at full scale. Today's surplus of liquidity and governmental support are limiting progress and improvements, which the established automotive suppliers have shown in the past. Batteries are already today the key technology of the new automotive era and the biggest chance towards circular economy and emission free production.

To master the challenges ahead, today's battery companies need to establish strong inhouse transformation and process competence. The need for transformation and change will not stop when battery companies have achieved to be a series automotive supplier and trusted partner to the OEMs.

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About us

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