WEAKENING EUROPEAN ELECTRIC VEHICLE MARKET: CHALLENGES AND OPPORTUNITIES FOR THE BATTERY INDUSTRY

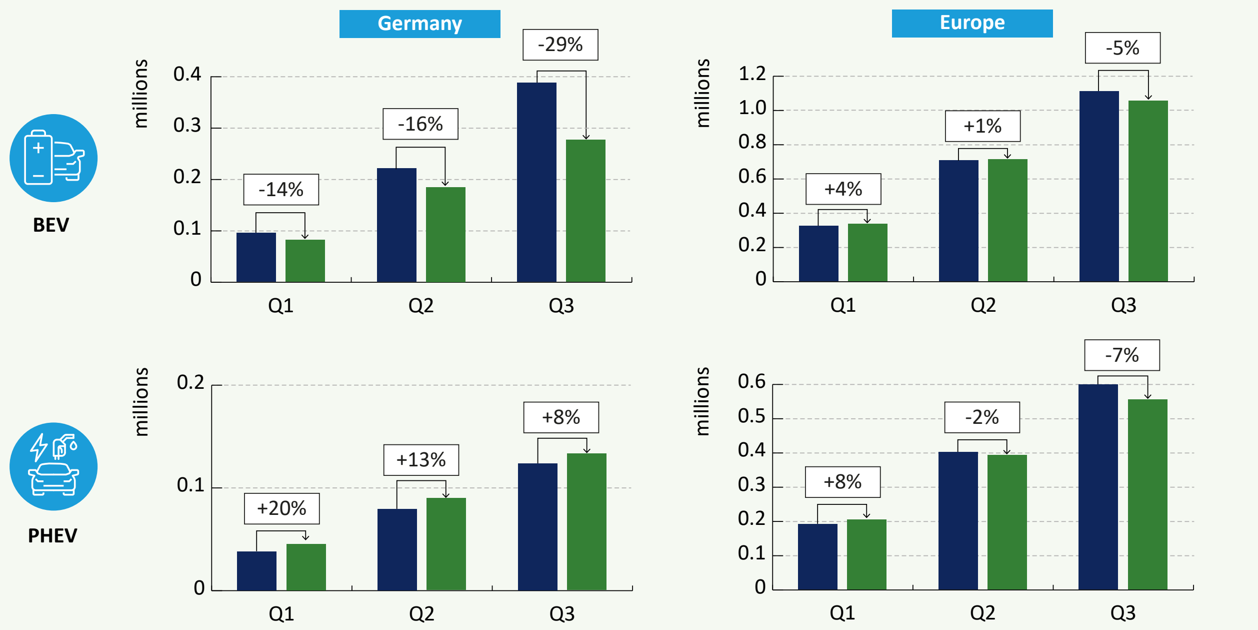
2024 has been a challenging year for the European battery industry. European electric vehicle registrations and thus the demand for battery cells in Europe have been on a downward trend so far. The weakening demand not only leads to underutilised European cell factories, but also has an impact on the entire European battery value chain. The challenges facing the European battery industry are illustrated using the example of cathode active material production. New impetus is needed to revitalise the faltering development of the European battery industry.

Weak electric vehicle market reduces demand for batteries

The automotive market remains the key growth driver for the global lithium-ion battery industry. In **Germany**, registrations of fully electric vehicles (BEV) have decreased compared to the previous year (Figure 1). While a good 385,000 BEVs were newly registered in the first three quarters of 2023, only around 275,000 BEVs were registered for 2024. In contrast, registrations of plug-in hybrid electric vehicles (PHEV) stabilised in 2024 and even showed slight increase. Compared to 2023, 8% more PHEVs were registered in the first three quarters.

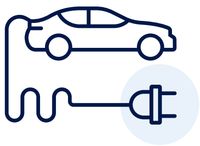
In the **European Union** (EU), BEV registrations declined less in the first three quarters compared to Germany. Lower registrations in Germany were at least partially offset by gains in other countries. However, with a 5% year-on-year decline in registrations, the European BEV market has also lost momentum. In the first three quarters of 2023, registrations rose by over 50% compared to the previous year. PHEV registrations have also declined in the EU. In 2023, growth in the first three quarters stagnated at 1% compared to the previous year while this year, registration figures decreased by 7%.

Figure 1: Summarised registration figures for battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) in Germany and the European Union



Source: KBA, EAFO

The weakening electric car market is having a direct impact on battery cell production and the upstream value chain. Samsung SDI reports falling demand in Europe in its latest quarterly report. According to media reports, the falling demand is also affecting capacity utilisation at LG Energy Solution's site in Wroclaw, Poland. In addition, LG Energy Solution is relocating production lines that previously produced cells for the North American market in Europe to North American plants. By diversifying its product range, LG Energy Solution aims to win new customers and utilise available production capacity. SK On also reacted to the falling demand for cells and postponed the start of production at the third plant in Hungary until the second quarter of 2024. The sluggish demand is affecting the entire value chain, right through to the extraction of raw materials. Terrafame, which mines nickel and cobalt in Finland and manufactures feedstock material to produce cathode active material, has announced that it will cut jobs and costs due the slump in demand.



In 2025, the European battery industry could receive new impetus from a recovery in the electric car market since stricter CO_2 emissions regulations will apply in the EU from 2025. In a recently published study, the International Council on Clean Transportation (ICCT) assumes that the market share of BEVs needs to increase by between 4 and 18 percentage points over the next two years to meet the CO_2 emission targets. This range can be explained by the fact that car manufacturers can choose different strategies to achieve the emission targets. Besides increasing the proportion of BEVs, PHEVs and hybrid electric vehicles (HEV), manufacturers can also achieve the CO_2 targets by pooling with other manufacturers.

If the emissions targets are not met, there is a risk of severe penalties. Manufacturers are thus already lowering the prices of their electric cars to boost registrations in 2025. Moreover, the variety of models available is continuously increasing and the range of vehicles in the under €25,000 segment is expanding. While non-governmental organisations (NGOs) such as the ICCT and Transport & Environment (T&E) are optimistic that the CO_2 targets can be achieved with the appropriate measures, the European Automobile Manufacturers' Association (ACEA) is concerned about the declining market share for electric cars and is calling for the target to be reviewed and adapted to current market conditions. Moreover, the ACEA believes that further measures, such as the expansion of the charging infrastructure, the provision of cheap and green energy as well as purchase and tax incentives, are essential to support the trend reversal.

Ultimately, the trend reversal depends heavily on consumer acceptance and their willingness to switch to electricmobility. According to the European Alternative Fuels Observatory's Consumer Monitor 2023, a third of non-electric car drivers are considering switching to an electric car within the next five years. The main obstacle remains the price. On average, Europeans are willing to spend €20,000 on an electric vehicle. Other challenges include limited public and private charging options and a limited range. 34% of participants desire a range of between 300 and 500 km, while 47% prefer a range of over 500 km.

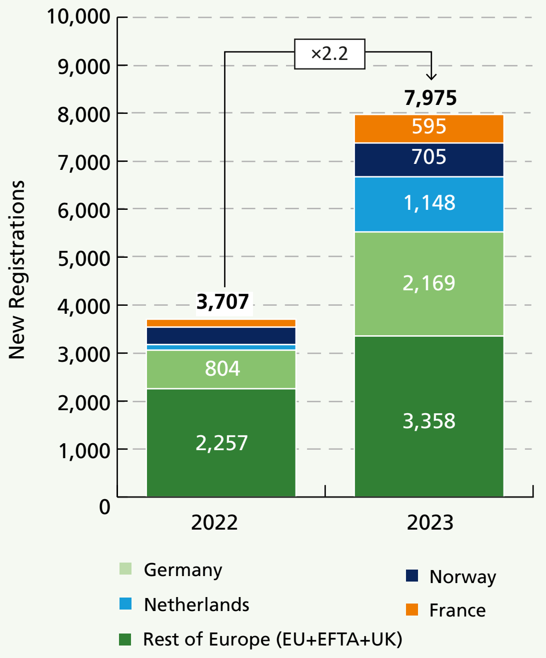
Electrification of heavy goods transport

In addition to the ongoing electrification of light vehicles, the transition to electrically powered lorries (e-trucks) in the heavy-duty sector is also taking shape. Batteries with a very large energy storage capacity are required, particularly for heavy trucks in the N3 class (> 12 t), which will influence battery demand in Europe in the long term. Towards the end of the decade, demand for electrically powered heavy-duty vehicles is expected to increase significantly. Stricter political emission reduction targets are forcing the switch to low-emission drive technologies in freight transport and motivating truck manufacturers to target high sales figures. EU emissions regulations stipulate a 43% reduction in emissions for sales of new medium and heavy-duty lorries by 2030 and a 90% reduction by 2040. In its 2030 climate protection program, the German government has formulated the target that one third of road freight transport mileage should be covered by electricity or electricity-based fuels by 2030.

European manufacturers expect to sell 48% (43,300 new registrations) of heavy-duty trucks (> 12 t) with battery-electric drive systems in Germany and 38% (124,700 new registrations) in Europe in 2030. In 2020, major truck manufacturers Scania, Daimler Truck, Volvo Trucks, MAN, DAF and Ford signed a declaration of intent agreeing that only commercial vehicles without fossil fuels will be offered from 2040.

New registrations of medium and heavy-duty e-trucks (> 3.5 t) are already showing a positive trend. In Europe (EU+EFTA+UK) new registrations totalled 7,975 vehicles in 2023, a 2.2-fold increase compared to 2022 (Figure 2). New registrations were mainly driven by Germany, the Netherlands, Norway and France. As a result, the share of e-trucks in total new registrations in 2023 rose to 2.3%, more than double the 1.1% from the previous year.

Figure 2: Comparison of new registrations of medium and heavy-duty electric trucks (> 3.5 t) between 2022 and 2023. New registrations in the four largest markets, namely Germany, the Netherlands, Norway and France, are highlighted.



Source: ACEA

Development of battery requirements for heavy-duty e-trucks (> 12 t) by 2030

The future cell demand for heavy-duty vehicles can be estimated from the forecast registration figures and the average battery size. Assuming an average battery size of 350 kWh, the current battery demand caused by the production of heavy goods vehicles is approximately 1.1 GWh.

The heavy-duty models from truck manufacturers available on the European market by 2025 are projected to achieve ranges of 250 to around 600 km. By 2030, the range could increase to up to 800 km. This increase in range will not be achieved disruptively, but through continuous technological development of the batteries. By 2030, e-trucks are expected to be equipped with batteries that can store between 300 and 800 kWh of energy. Regarding the battery demand expected from heavy-duty commercial vehicles in 2030, these two values are assumed for a minimum and maximum scenario in Europe:

- **Minimum scenario**: An average battery size of 300 kWh is assumed for 2030. With predicted new registrations of 124,700 heavy vehicles (> 12 t) in Europe, a battery demand of almost 40 GWh/a can be expected.

- **Maximum scenario**: An average battery size of 800 kWh is assumed for 2030. With predicted new registrations of 124,700 heavy vehicles (> 12 t) in Europe, a battery demand of 100 GWh/a can be expected.

In the last market update Q2 2024, the battery demand for the production of light vehicles was analysed in relation to the announced battery production capacities in Europe. In that update, it was assumed that in the realistic scenario battery demand in 2030 will be around 880 GWh/a. In the minimum scenario, demand would rise to 920 GWh/a due to heavy goods transport (see Figure 3) and in the maximum scenario, demand would rise to 980 GWh/a. Ultimately, cell demand from heavy-duty electric lorries should settle between these two values and could increase the demand arising from light vehicles by around 10 %. This would create additional sales opportunities for the European battery industry.

The battery is still the biggest cost factor in the switch to electric commercial vehicles

The battery is still the biggest cost factor in an e-truck, accounting for 84% of the drive train costs and around 60% of the total vehicle costs. The battery therefore plays a crucial role in the development and sale of e-trucks. To compensate for the additional weight of the battery, zero-emission trucks in the EU are allowed to weigh 2 t more than conventional trucks. Sufficient energy density is required to reduce the weight and volume restrictions imposed by the battery while still guaranteeing a sufficient driving range. Lithium nickel manganese cobalt oxide (NMC) and lithium iron phosphate (LFP) are the two main cathode active materials (CAM) used on the market to fulfill the relevant requirements. While NMC offers a higher energy density, LFP provides a longer service life, a good price-performance ratio and better safety properties. In the medium to long term, lithium manganese iron phosphate (LMFP), which offers a higher energy density than LFP, may become relevant for the heavy-duty sector.

While the majority of all trucks in China are powered by LFP-based batteries, the European truck manufacturers Scania, MAN and Volvo use nickel-containing cathode material (e.g. NMC, NCA). As LFP-based batteries are more cost-effective alternatives and promise a longer service life, they will play a greater role on the European market in the future. Battery cells to produce e-trucks in Europe are largely purchased from third parties. Traton has so far focused on the production of modules and packs. MAN, part of the Traton Group, operates a production facility in Nuremberg with an annual capacity of 15,000 to 25,000 trucks, depending on the configuration. From 2025, the production of commercial vehicle batteries will also gradually ramp up, aiming to equip around 20,000 e-trucks with batteries in the long term. It was announced in the summer that Traton is considering the construction of a third battery assembly plant. The manufacturer Daimler Truck purchases its LFP cells from CATL. The newly installed pilot line for the production of battery packs in Mannheim lays the foundation for future series production.

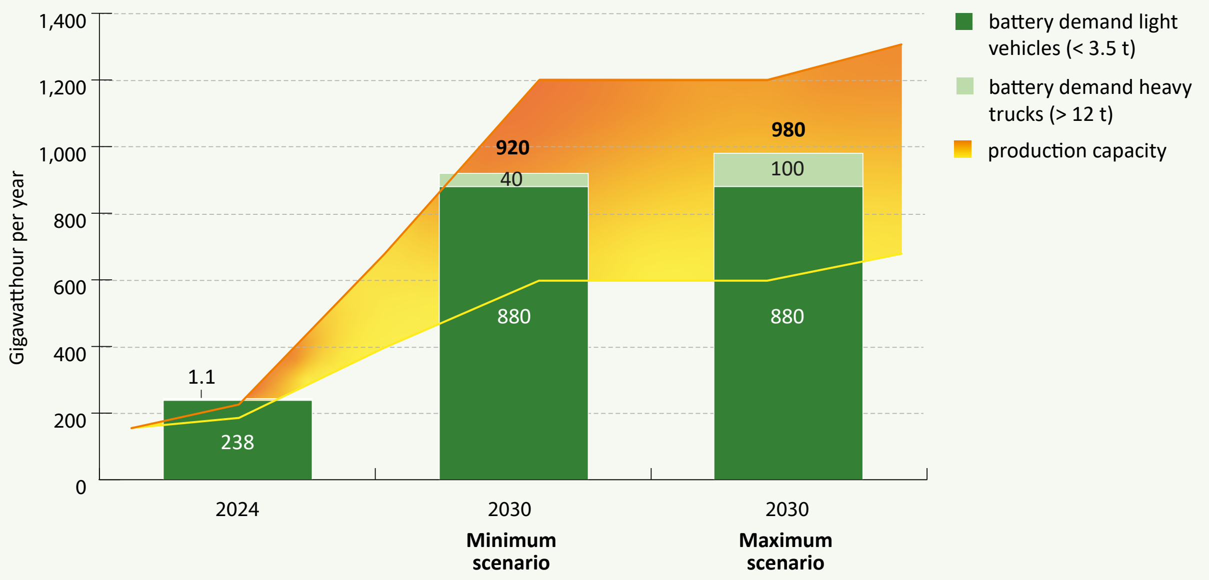
Charging infrastructure and battery storage

In addition to the still high investment costs for the purchase of the e-trucks themselves, the expansion of charging infrastructure is cited as another hurdle for the ramp-up of e-trucks. The acceptance of e-trucks will grow depending on the expansion of the necessary heavy-duty charging infrastructure, thus increasing the corresponding demand.

The start of the tendering process for the fast-charging network for truck along German motorways has laid the first foundation stone for a nationwide public heavy-duty charging infrastructure in Germany. Charging Infrastructure operators specialising in the fast charging of large commercial vehicle batteries are increasingly including battery energy storage systems in the charging infrastructure. These storage systems can store low-cost electricity from renewable sources and retrieve it when needed. Increasingly high charging capacities for heavy vehicles lead to high peak loads during peak times, which can be buffered by battery storage systems. One prominent example of such a concept is charging infrastructure operator Milence.

This example shows that with the ramp-up of electromobility in the heavy commercial vehicle sector, there may also be a need for storage systems for the corresponding charging infrastructure. The more electrification progresses, the more important the system integration of battery storage systems becomes at different levels.

Figure 3: Comparison of the projected battery demand (green) for European automotive production, including the demand for heavy vehicles (> 12 tonnes) (light green) in 2030, with the expected battery cell production capacities (orange).



CAM production in Europe: New factories and strategic developments

A key element of a lithium-ion battery (LIB) is the cathode active material (CAM). As with cell production, China, South Korea and Japan are among the leading countries in the field of CAM production. However, there are also CAM producers in Europe which can supply the LIB battery cell industry based in Europe with cathode active material (Figure 4). The two largest CAM factories are operated by Umicore in Poland and BASF in Germany, each having a production capacity of 20 GWh_{eq}/a in the first expansion stage, with Umicore already announcing at the opening that it would increase capacity to 40 GWh_{eq}/a by 2024. Both factories produce nickel-containing CAM (NMC), which is currently mainly used on the European market.

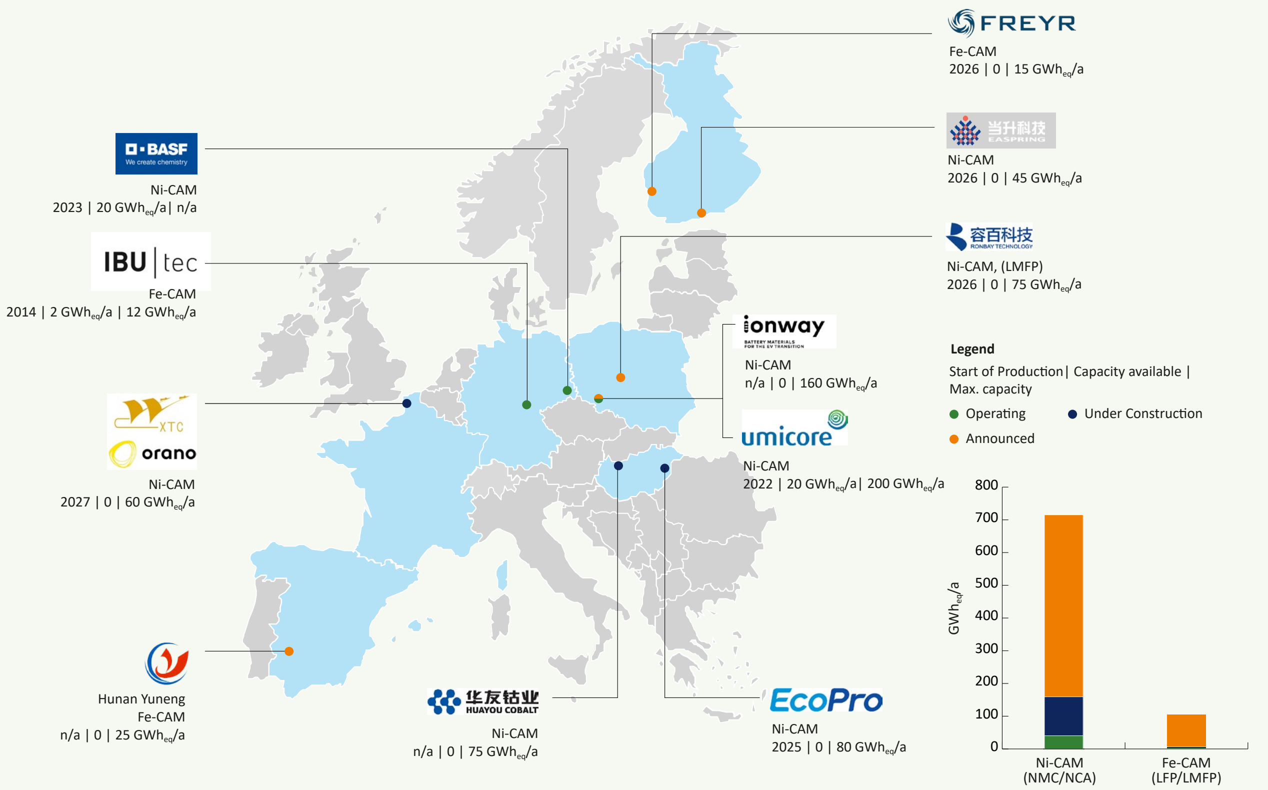
In the future, however, iron-based CAM (LFP/LMFP) could play a greater role, as it is cheaper than nickel-containing CAM, thus contributing to cost reduction. LFP has so far been produced on a smaller scale in Europe. According to IBU-tec, it is the only LFP manufacturer in Europe and has a production capacity of around 4 kt/a of LFP in Germany, equivalent to approximately 2 GWh/a. Production capacity is set to increase to 25 kt/a (approx. 12 GWh_{eq}) by 2026.

In addition to the existing plants, two further plants are currently under construction. In Debrecen, Hungary, EcoPro is building a factory with a capacity of up to 108 kt/a (approx. 80 GWh_{eq}/a). Nickel-containing CAM (NCA) is set to be produced there, supplying Samsung SDI's cell factory in Göd, among others. Production is scheduled to start in 2025. Also in Hungary, Huayou Cobalt is building a factory for nickel-containing CAM with a production capacity of up to 100 kt/a (approx. 75 GWh_{eq}/a). The factory is being constructed in Ács and is expected to have a capacity of around 25 kt/a (approx. 19 GWh_{eq}/a) in the first phase.

In addition to the plants already in production and under construction, there are numerous other production facilities that have been announced. In Finland, for example, Easpring Materials is planning an NMC production facility with a capacity of 60 kt/a (approx. 45 GWh_{eq}/a) together with the Finnish Minerals Group. The factory is set to be built in Kotka with production starting in 2026. In the immediate vicinity in Hamina, CNGR plans to construct a factory for precursor CAM (pCAM[1]), which also has a capacity of 60 kt/a and could supply the neighbouring factory in Kotka with the required precursor material. Moreover, Freyr has also announced CAM production of 30 kt/a (approx. 15 GWh_{eq}/a) LFP in Vaasa.

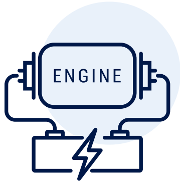
In France, a joint venture between Axens and Hunan Changyuan Lico is planning to build a CAM factory in the north of France. Production could start in 2027, although information on the planned production capacity and exact location is not yet available. A second joint venture between Orano and XTC New Energy is planning a factory for nickel-containing CAM and pCAM production, also in France. The CAM factory is scheduled to start production

Figure 4: CAM production in Europe. In addition to production facilities that are already in operation, locations that are under construction, announced or paused are also considered. Announced capacities show the potential, but actual realisation depends on market developments.



1 pCAM is a primary material that is required for the production of nickel-containing CAM. Some pCAM production takes place in independent factories, while some is also carried out at CAM production sites.

in 2026. Production capacity is to be increased to up to 80 kt/a (approx. 60 GWh_{eq}/a) by 2030. pCAM production is scheduled to start in 2027 and reach a production capacity of 80 kt/a by 2032. Both factories will be in the port of Dunkirk. In Sandouville, France, Sibanye Stillwater is currently examining whether an existing nickel refinery can be converted into pCAM production. The refinery was taken over by Eramet in 2022. A feasibility study on the production of pCAM is currently being carried out. If feasible, production could start in 2027.



A similar project is being pursued in Germany. Pure Battery Technologies wants to expand an existing nickel refinery in Hagen and convert it into a pCAM production facility with a capacity of up to 15 kt/a pCAM.

Ionway, a joint venture between Umicore and PowerCo, has announced a plant to produce CAM in Poland. The plant is to be built in the immediate vicinity of Umicore's existing plant in Nysa and will produce up to 160 GWh_{eq}/a of CAM in 2030. In addition, Shanghai Metals Market (SMM) has reported that Ronbay Technologies has taken over the CAM plant originally planned by Johnson Matthey in Konin, Poland. Johnson Matthey announced its withdrawal from the battery materials business in 2021 and as a result stopped the construction of the CAM production plant in Poland. Ronbay plans to start production in 2026 and aims to achieve a capacity of 20 kt/a NMC (approx. 15 GWh_{eq}/a) in the first production phase. In the future, this could be increased to 100 kt/a (approx. 75 GWh_{eq}/a), and LFP or LMFP could also be produced there.

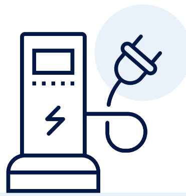
Another site could be built in Spain. Hunan Yuneng, one of the leading Chinese LFP producers, has announced in a letter of intent with the Junta de Extremadura that it is planning an LFP factory with a capacity of 50 kt/a (approx. 25 GWh_{eq}/a).

The locations mentioned so far make it clear that the focus in Europe has been on nickel-containing CAM. Europe currently has a production capacity of around 40 GWh_{eq}/a NMC and only 2 GWh_{eq}/a LFP. Taking into account the announced production sites, nickel-containing CAM could reach a production capacity of over 700 GWh_{eq}/a while ferrous CAM is projected to have a production capacity of around 100 GWh_{eq}/a.

However, the expansion of CAM production capacities and the realisation of announced projects and expansion targets is heavily dependent on demand from European cell manufacturers. For example, Umicore has announced that it will adjust further investments in Nysa so that they match the growth rate of the customer base. This is impaired by the fact that LFP/LMFP is increasingly becoming the focus of car manufacturers due to its cost advantage. Accordingly, CAM demand could shift more towards LFP/LMFP, which could lead to less NMC/NCA production capacity being required than currently announced.

As IBU-tec and Hunan Yuneng show, production sites for LFP/LFMP might be established in Europe. Alternatively, LFP/LMFP producers could supply the European market from other countries. Morocco stands out here, as it has seen numerous direct investments in the development of a battery value chain in recent years. For example, Huayou Cobalt and LG Chem have announced plans to build an LFP plant in Morocco. According to media reports, this plant will primarily supply the planned LG Energy Solution plant in the USA, but it is quite conceivable that the Polish LG Energy Solution plant will also be supplied. Finally, there is the possibility of importing part of the required LFP/LMFP directly from China, where the leading producers and the largest capacities are located.

The still young CAM industry in Europe is facing its first challenge. In addition to the difficult market situation, which is leading to a delay in the expansion of production capacities, further development will also depend on the extent to which LFP/LMFP is demanded by the European market. Despite the current challenges, however, it remains to be said that demand will increase in the medium and long term and that this will also create opportunities in Europe to further strengthen and consolidate the growing CAM industry.



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