BRIEFING - February 2025

Assembly plant or battery powerhouse?

Analysis of foreign battery investments in EU

T&E would like to thank the following external experts that kindly peer reviewed this work:
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- Bela Galgoczi, Senior Researcher, European Trade Union Institute

Summary

T&E's analysis finds that while hundreds of millions of subsidies are given to foreign battery factories and partnerships in Europe, precarious social conditions, some environmental breaches and - crucially - a lack of meaningful technology transfer persist.

Summary

Europe's ambition to build a world-leading battery industry is facing many headwinds. As local plans falter, over 90% electric car and storage batteries are produced by South Korean and Chinese companies in the EU. An additional 40% of announced battery gigafactories are from these companies, who are global leaders in the technology and more likely to succeed. Many European carmakers are entering partnerships with Chinese battery players to secure the supply.

But there are concerns about the environmental and social conditions under which some of these facilities, e.g. CATL battery plant in Hungary, are operating. Critically, as homegrown battery companies struggle, will the upcoming partnerships with foreign battery leaders enable the EU to gain the expertise we lack? Is it the road to becoming a battery powerhouse or an assembly plant?

T&E has commissioned a study to Carbone 4 and independent experts to find out. The study analysed the environmental and social conditions in the CATL battery plant in Hungary and the LG one in Poland, as well as the technology transfer provisions in the VW-Gotion and CATL-Stellantis battery partnerships. It finds that:

While hundreds of millions were given to these two factories alone, environmental and social risks persist

- Together, the two Asian factories analysed received at least EUR 900 mln in state aid subsidies from the Hungarian and Polish governments, often drawn from the European post-covid recovery fund. However, no environmental or social conditions were attached by the European Commission, or auditing performed.
- A clear breach of the EU's Industrial Emissions Directive on air pollution was found (but unclear if governments given derogation), as documents show that both factories exceed the EU limit for NMP, a toxic substance used in cathode manufacturing. In addition, poor water management plans and questions around the ability of the host countries, notably Hungary, to provide sufficient energy were raised.
- Precarious working and broader social conditions were also noted in Asian factories in Hungary. This is largely due to an insufficient local legal framework around temporary contract workers under which thousands of migrant workers in battery

factories are hired. A number of health & safety breaches have also been recorded and working and living conditions of migrant workers are described by some as “modern day slavery”.

Upcoming Chinese-EU battery ventures lack local knowledge sharing

The analysis, largely relying on external experts due to the lack of public data, also looked at decision making, technology/skills transfer and other key conditions in two recent partnerships. It finds that:

- No EU-wide (or national) requirements on technology transfer, local content or other conditions in joint ventures exist in Europe. This results in pure business to business (or member state to China) agreements focusing on short-term battery supply.
- While VW invested EUR 1.1 billion into Gotion and holds 26.47% of shares, it is said to have less significant say in battery operations. Experts point out that the partnership is more about securing LFP battery supplies to VW’s European operations, than comprehensive knowledge or IP transfer to Europe.
- Taking the form of a 50-50 JV, Stellantis and CATL were offered EUR 300mln in state aid for the planned LFP plant in Zaragoza, Spain. No conditions on technology or skills transfer were attached to this subsidy.
- Despite very little information available on the latter JV, expert after expert has pointed out that it is about supplies, not technology transfer: for Stellantis, the main goal appears to be access to the LFP battery technology to supply electric cars on the EU market.

Comparison of EU vs American joint ventures with Chinese companies

	VW + Gotion Partnership	Gotion + Inobat JV	Stellantis + CATL JV	Tesla + CATL (US)
Ownership structure	VW holds 26.47% in Gotion	Gotion: 80% | Inobat: 20%	Stellantis: 50% | CATL: 50%	100% owned by Tesla (incl. equipment)
IP or technology transfer provisions	"Limited"	Some	✗	✓
Local supply chain	✗	✗	✗	✗
Local workforce	Local R&D centre	Some, incl local schools	No known provisions	✓
Equal decision-making (e.g. voting rights) on battery side	✗	✗	✗	✓

Source: Carbonne4, expert interviews & T&E.

The overall conclusion is that Chinese-EU battery partnerships today lack any meaningful knowledge sharing or local benefits. This is because no rules or framework requiring technology/skills transfer or local content currently exists in Europe. This is in stark contrast to both China and the US (leading to a much better example of the Tesla-CATL licensing deal). A lack of a unified framework across the EU also allows a race to the bottom on environmental, social and other conditions.

EU leadership and measures are urgently needed

As it stands, Europe lacks technology or manufacturing expertise for a top cleantech technology, batteries. While this won't delay EV targets as plentiful global battery cell supply exists, this entails serious geopolitical, economic and security risks. Coupled with restrictions on technology transfer in China, and despite the many Asian plans to build battery factories to date, Europe risks becoming an assembly plant.

But it does not have to be this way.

Europe has power: its vast single market that's key to the growth strategy of many Asian companies, and it has the legal tools in areas of state aid, trade, procurement and foreign investment to require IP transfer and EU content. T&E estimates that filling the

under-utilised capacity of CATL alone (assuming available 2024 levels) can cover more than a third of the EU battery demand in 2025.

The EU needs to put in place a consistent vision and framework, incl.:

1. Make use of all instruments to assert more local control and local content. These include conditions to state aid, EU public funds and procurement, trade tools such as tariffs, and sustainability requirements, e.g. EV "ecobonus" or grid-based CO2 battery rules. All these can be used to require onshoring of battery manufacturing on terms set by the EU.
2. Define an EU-wide comprehensive framework on foreign FDI, including majority local ownership and decision-making rules (prioritising licensing deals e.g.), local workforce and supply chain provisions, and requirements on IP and manufacturing expertise.
3. Staying united as EU27 against foreign pressure to protect technology. A common definition of what constitutes "EU Made", "foreign" and "foreign of concern" can help streamline implementation across EU countries.

1. Introduction

As demand for electric vehicles (EVs), batteries, and the critical minerals required for their production continues to grow across Europe, significant investment is flowing into battery gigafactories and other key component facilities. These investments are pivotal to Europe's ambitious task of onshoring battery production and accelerating transport electrification. Achieving this requires not only technology and know-how, but operational expertise to scale manufacturing and a skilled workforce to compete globally.

Chinese companies today are global leaders in battery technology and adjacent supply chains. It is thus no surprise that a substantial share of battery investments across Europe is from Chinese companies - almost a third - with an even greater involvement in midstream activities such as cathode production.

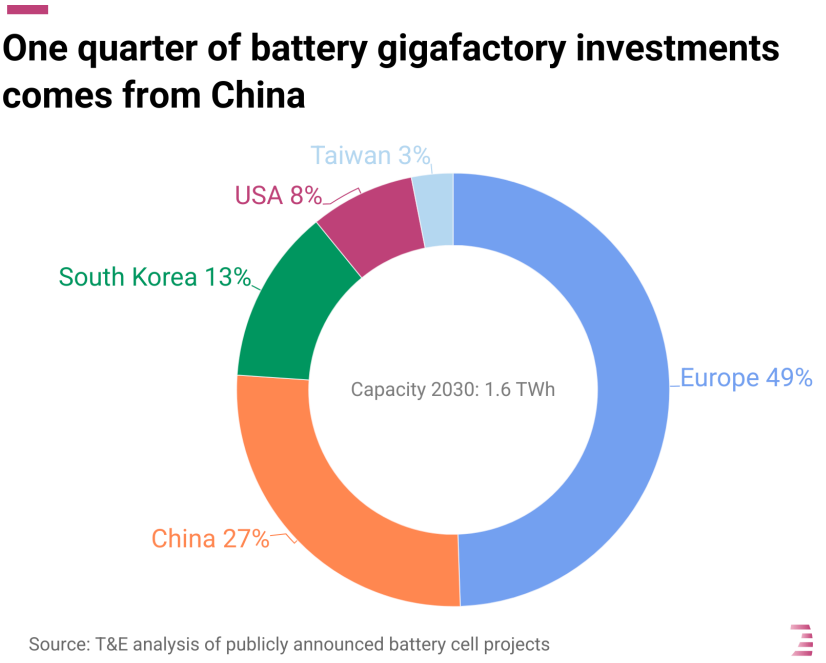

Figure 1: Announced gigafactory capacities in Europe by country of origin (January 2025)

Critically, while the pure share of EU-based plans is higher, these are the companies at highest risk of not going ahead or struggling, as they lack technology and operational expertise to scale manufacturing. In fact, Chinese and South Korean companies dominate +90% of the current lithium-ion battery production in Europe currently.

But the increasing presence of Asian companies has raised some environmental, social, and economic concerns, including from NGOs and local communities[1]. Like any industrial processes, battery production can be energy- and resource-intensive, including potential implications for water usage, local air quality and chemicals release.

Beyond some environmental concerns, a bigger topic within the industrial agenda in the EU is whether these investments will lead to longer term knowledge and technology transfer, including local skills and operational expertise. Or whether Europe will simply be turned into an assembly plant for Asian players seeking to avoid geopolitical tensions and trade restrictions.

To analyse all this, T&E has commissioned a study to Carbone 4, published alongside this briefing. The first part of the study assesses the key environmental and social conditions in two existing battery facilities: CATL battery gigafactory in Debrecen, Hungary, and the LG Energy Solution plant in Wroclaw, Poland. The focus is on whether these projects comply with relevant EU laws and regulations.

The second part of the study looks at the planned joint ventures (JV) between Chinese and European players, notably the VW-Gotion partnership and the newly confirmed Stellantis-CATL JV. The study looks at the structure of these collaborations, including technology transfer, decision-making and local skills provisions. With little information available in the public domain, the analysis is largely based on expert interviews with people familiar with companies and the negotiations.

[1] https://www.greenpeace.org/hungary/environmentally-speaking-what-is-wrong-with-battery-factories-appearing-in-hungary/

2. Environmental impact of battery factories

The first part of this assessment looks at two major Asian battery manufacturers - CATL and LG Energy Solution - with a focus on their compliance with EU environmental laws and their broader environmental impact.

It's important to note that the CATL gigafactory project in Debrecen, Hungary, represents the largest greenfield investment in the country's history with a total value of €7.34 billion, supported by €800 million in grants, tax incentives and infrastructure support from the Hungarian government. In addition to direct support, substantial resources have been allocated to develop the surrounding infrastructure, such as the €1.8 billion investment to prepare the Debrecen Industrial Park and modernise infrastructure.

Similarly, the LG Energy Solution gigafactory near Wroclaw, Poland, is the largest battery production facility in Europe, currently operating at 85 GWh per year capacity. Since its inception in 2017, the facility has benefited from significant financial support, including €95 million in state aid and €250 million in financing from the European Bank for Reconstruction and Development (EBRD).

This section summarises the key environmental aspects including energy use, water consumption and air quality, with more detail on all environmental and social parameters available in the report.

2.1 Energy

Lithium-ion battery production, like other industrial facilities, is energy-intensive, relying on electricity and heat. The Carbone 4 assessment shows that CATL's energy consumption at its Debrecen gigafactory is in line with similar projects across the EU, with no violations of EU law. Energy usage for the first phase is estimated at 1 640 GWh, translating into 41 kWh/kWh of battery cell capacity, comparable to French competitors ACC (62 kWh/kWh battery cell capacity) and Verkor (41 kWh/kWh battery cell capacity).

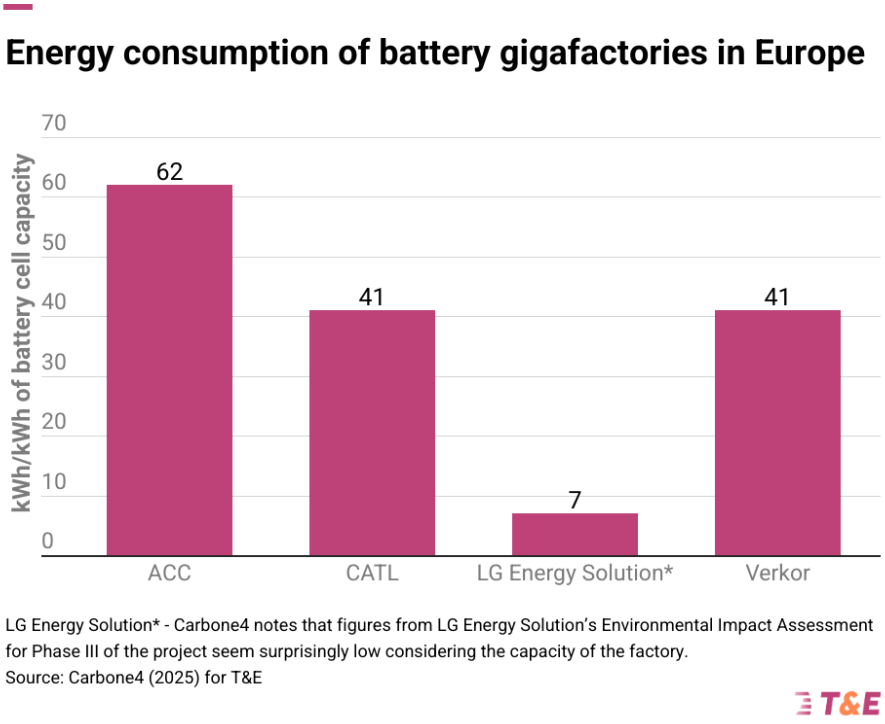

Figure 2: Energy consumption of battery gigafactories in Europe

Concerns have been raised around the energy demand of Hungary's broader battery manufacturing strategy, which aims for 300 GWh of battery production capacity in 2030. According to the study, this would require an estimated 12,500 GWh of energy capacity annually, equivalent to 20% of all industrial energy requirements under Hungary's climate neutrality scenario (and almost 5% of all Hungarian energy consumption in 2023).

While this might be challenging, it does not violate the EU's energy framework. A key issue that remains is that Hungary's renewable energy capacity is not growing fast enough to keep up with the growing energy demand of battery gigafactories. Although Hungary's National Battery Industry Strategy (NBIS) foresees supplying these facilities with solar energy, a gap persists between renewable energy production and the energy needs of the sector, realistically reinforcing the current gas supply.

The study highlights the energy supply challenges already evident in the case of SK Innovation and Samsung SDI, two existing gigafactories in Hungary. By 2030, these facilities are projected to reach a combined production capacity of 87.3 GWh, requiring approximately 3,600 GWh of energy annually (for both gas and electricity). This alone would consume half of the total solar power capacity Hungary plans to commission by 2030.

For LG Energy Solution's Wroclaw project, reported energy consumption figures appear underestimated. The natural gas usage of 633 000 MWh annually is about four times lower than CATL's comparable factory, and electricity consumption at full capacity (90 MWh/year) is significantly lower than CATL's 1 600 000 MWh/year. This discrepancy suggests reporting errors or incomplete data, but no breaches of EU law were identified.

2.2 Water

Water consumption in gigafactories primarily stems from cooling systems and industrial processes like slurry mixing and pollutant distillation. While levels vary across facilities, they are generally lower than other water-intensive industries, such as aluminum smelters.

The assessment reveals that CATL and LG Energy Solution's water usage aligns with other battery gigafactories and does not breach the EU's Water Framework Directive (2000/60/EC) or respective national regulations on water use management.

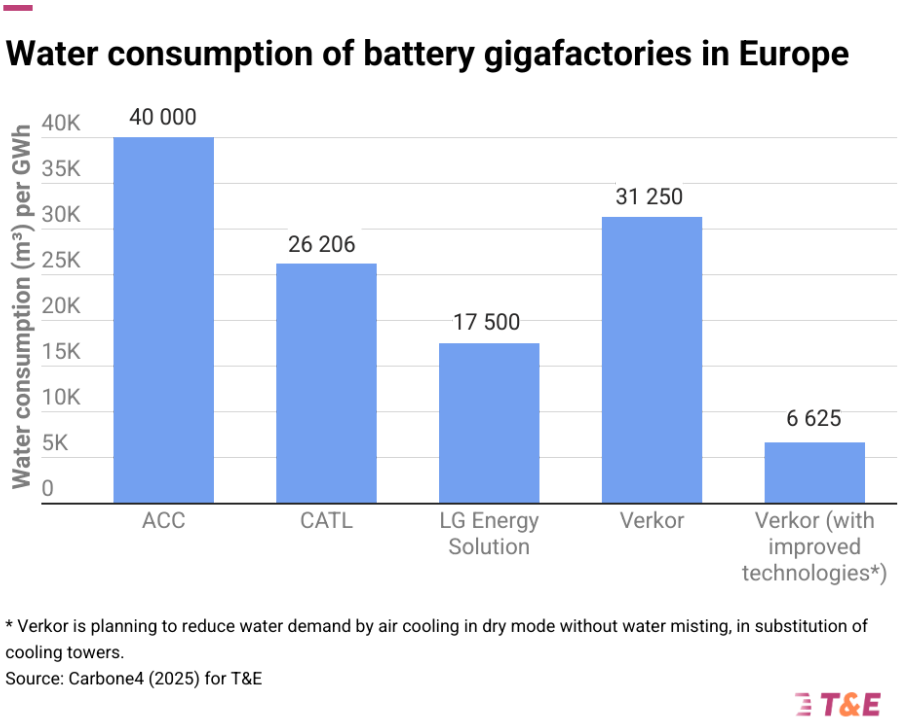

Figure 3: Water consumption of battery gigafactories in Europe

Although both consumption levels comply with EU law, adopting best practices across facilities should be prioritised as seen by Verkor reducing its consumption from 31 250 m³ to 6 625 m³ by implementing air cooling in dry mode as a substitute for cooling towers. Both CATL and LG ES can do more to use water more efficiently.

With regard to water pollution, N-Methyl-2-pyrrolidone (NMP) is used in cathode manufacturing and classified as toxic for reproduction, as well as a respiratory, skin, and eye irritant. Experts agree that NMP should not be present in wastewater, requiring separate treatment. Environmental permits, such as those from ACC and Verkor, demonstrate existing processes to prevent NMP discharge. The assessment by Carbone 4 shows that neither CATL nor LG Energy Solution adopt a similar precautionary approach regarding NMP management, as they do not mandate the absence of NMP traces in wastewater nor establish specific limit values for its discharge.

Both companies justify the lack of limits by the absence of regulations specifying such thresholds. This is true, as no current regulations set limits for NMP in effluents. Consequently, neither company's practices violate existing legislation on NMP management in wastewater.

Nevertheless, the way both companies are dealing with NMP in water is contradictory to both the EU's classification of NMP as a hazardous substance under the REACH regulation, and to broader EU environmental principles such as the Zero Emissions Principle for Hazardous Substances or the Precautionary Principle and Pollution Prevention.

2.3 Air

While no breaches were found for hazardous emissions such as hydrogen fluoride and electrolyte, at either CATL or LG Energy Solution, air pollution risks related to NMP treatment remain. While most of the NMP is recovered in special processes, some emissions can still occur. To control this, gases are

directed through filtration systems, but small amounts of NMP in the form of volatile organic compounds (VOC) may still be released.

At CATL's Hungarian plant, an NMP recovery system minimises solvent use, but emissions are still present. The plant has set three different emission limits for different sources: 1, 10, and 25 mg/Nm³. However, EU law and more recent Hungarian regulations set a VOC emissions limit of 2 mg/Nm³ for substances with reproductive toxicity. This suggests a breach of EU regulations and Hungarian law if the stricter limit is not met.[2] In Poland, LG's plant uses a similar system for NMP recovery. However, the emissions limit set by LG Energy Solution for NMP is 13.25 mg/m³, which exceeds the EU's 2 mg/Nm³ limit for VOCs, indicating non-compliance. It is important to note that although emission limits are set by the European Industrial Emissions Directive, Member States have the possibility to grant exemptions to domestic industries to emit more, eg on the basis of a cost-benefit analysis. It is not clear if Hungary and Poland gave derogations in this case as clear documentation is missing.

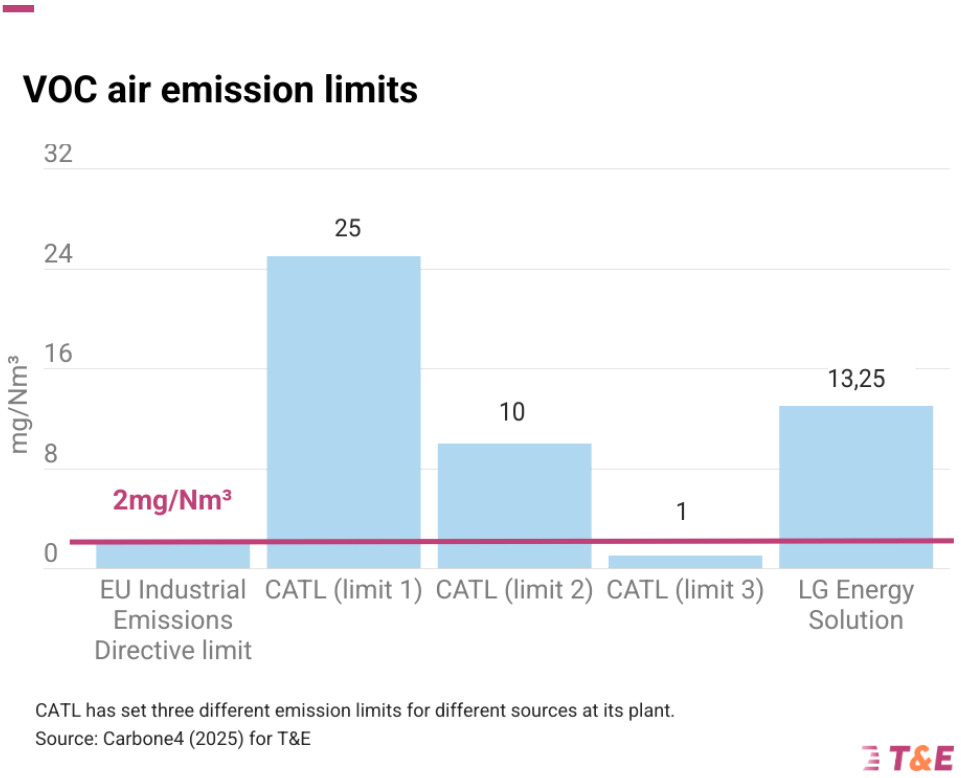

Figure 4: VOC air emission limits at CATL and LG Energy Solution

2.4 Social impacts

Carbone 4 did not focus on social impacts in detail, but their assessment does point out a number of challenges. In Hungary, there are concerns around the lack of industrial R&D and limited collaboration with local research institutions.

Carbone 4 points out that although companies often install high-tech and modern production capacity, there is virtually no industrial R&D activity in Hungary. Today, CATL has six R&D centres, one in Germany and five in China. In Hungary, CATL has agreed with the University of Debrecen to train professionals for

[2] In Hungary, NMP air emissions are governed by two decrees (VM Decree 4/2011 and 26/2014). Decree VM 4/2011 sets an emission limit value at 150 mg/Nm³ and would be in line with CATL's emission limit. However, this is non-compliant with the EU Industrial Emissions Directive limit. To be compliant with EU law, authorities need to apply decree 26/2014 instead which sets a VOC emission limit of 2 mg/Nm³.

the plant in e.g. engineering education, but so far no announcement has been made regarding the creation of a research centre. However, the establishment of research centres close to manufacturing plants would be considered best practice as it ensures that future batteries are not only manufactured but also developed in Hungary. The situation in Poland appears to be more favorable, as LG Energy Solution focuses more on technological transfer through initiatives like the Electromobility Research Center and internship programs. Despite challenges in retaining talent, LG ES remains a major regional employer.

However, separate reports and investigations have identified issues around precarious working conditions for both domestic and foreign workers in Asian-run Hungarian battery factories.

The main issue is Hungary's shortage of local labour, especially for the skills needed in the battery manufacturing sector. This has led the government and Asian battery investors to rely on foreign workers, importing labour. Between 2019 and 2024, the Hungarian labor market saw a 92% increase in non-EU migrant workers.[3] By 2024, more than 78 000 non-EU workers were employed in Hungary, with the manufacturing sector employing 14 154 of them. These workers predominantly come from Ukraine (31.7%), India (8.2%), Vietnam (7.6%), Mongolia (7.3%), the Philippines (7%), and Kosovo (5.5%), with additional representation from South Korea (5%) and Serbia (4.7%).[4]

A significant portion (30%) of these foreign workers in Hungary is employed through temporary work agencies[5], which benefit from more lax Hungarian regulations - Act XC of 2023 or the so-called "new guest worker law" - allowing them to hire workers on temporary agency contracts without proper work permits.[6] This means that their work and residence permits are tied to specific employers and fixed-term contracts, denying them many structural labour rights. For instance, this set up makes it impossible to switch jobs or ask for family reunification, and limits the maximum length of stay to three years without the possibility to reapply for residence permits.[7] Trade union representatives have pointed out that the temporary agency work system is overused and should only be used to meet temporary needs as originally intended, rather than replacing a permanent practice to deal with labour shortages.[8]

Reports highlight significant gaps in occupational safety and health as well as accidents resulting from these in Hungary's battery manufacturing sector. In recent years, health and safety standards in Hungary have been increasingly weakened by deregulatory packages. For instance, today it is the responsibility of workers to get familiarised with health and safety measures and for employers it would be considered sufficient to send an e-mail with health and safety instructions or manuals.[9] At Korean Samsung SDI and SK Battery, inspectors identified multiple safety violations.[10] At SK Battery, workers were not informed they were handling carcinogenic substances, and adequate changing rooms to protect clothing from contaminants were not provided. Inspections at SK Battery's factory also found 18 unresolved safety deficiencies as of 2022 which had been previously reported to authorities but not addressed. Occupational safety and health education was also found to be lacking and cases of battery module fumes have been reported which lead to 14 people being hospitalised.[11]

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[3] https://library.fes.de/pdf-files/bueros/budapest/21810.pdf
[4] Idem. Some sources state that while there are over 100 000 foreign guest workers in Hungary, there is no information available about the main companies employing them https://www.portfolio.hu/gazdasag/20231125/elkepesztoen-gyorsan-no-a-kulfoldi-dolgozok-szama-magyarorszagon-653763
[5] https://library.fes.de/pdf-files/bueros/budapest/21810.pdf
[6] Idem.
[7] Idem.
[8] https://library.fes.de/pdf-files/bueros/budapest/21810.pdf
[9] https://cms-lawnow.com/en/ealerts/2024/02/hungary-makes-changes-to-labour-law-occupational-health-and-safety-at-work
[10] https://vgi.krtk.hu/wp-content/uploads/2024/11/Elteto_WP_278.pdf
[11] Idem.

Similarly, at Samsung SDI, machine safety interlocks were missing on some units, and signs on control switches were in English, despite the workforce being predominantly Hungarian and Ukrainian.[12] Further, the Samsung SDI plant experienced a series of incidents between 2021 and 2023, including - among other incidents - a fire in which 36 battery modules caught fire, and the death of a 27-year-old Hungarian maintenance worker. In the case of the battery module fire, reports found that firefighters were unable to disconnect the power because the investor had not installed the main switch, which significantly delayed the firefighting.[13] The building's fire safety compliance and staff fire training could not be certified and fire extinguishers were not working.

Notably, remuneration and working conditions in the Hungarian battery sector remain precarious. Amendments to the Hungarian labour code in 2018 (often referred to as the 'slave law') have introduced generous overtime provisions, allowing companies to demand up to 400 extra hours per year.[14] This is further aggravated by wage structures heavily relying on bonuses and allowances, with base salaries low. For example, advertised net monthly incomes of €1000 often includes a base salary of just €600, supplemented by various bonuses such as a shift supplement bonus (12-hour shifts with a bonus for night work), attendance bonus (receiving bonuses for not missing shifts) or a production bonus (tied to productivity).[15]

Foreign workers employed by agencies are also not entitled to join the same union as directly employed staff in the same factories. This restricts their ability to be represented and advocate for better conditions.

More broadly, reports highlight that foreign workers in Hungary face systemic challenges, such as language barriers, insufficient access to information and unfamiliarity with local institutions, fear of sanctions or retaliation, coupled with financial burdens, inadequate housing and poor mental health, making them particularly vulnerable to exploitation.[16] Trade unionists have pointed out that while foreign workers, e.g., from the Philippines, were initially motivated, they were increasingly leaving after about two years due to health problems.[17]

Existing challenges in Hungary's battery manufacturing sector exemplify the risks of rapid industrial growth without sufficient regulatory oversight and social safeguards. The reliance on migrant labour and temporary contracts, precarious wage structures and limited union representation are some of the main problems faced. These challenges are exacerbated by the fact that many management positions in these battery gigafactories are filled by expatriates from South Korea or China,[18] limiting opportunities for local workforce development and knowledge transfer. Reports suggest that management's openness to cooperation and engagement with workers varies, with some companies perceived as more cooperative by trade union leaders eg allowing unions[19] whereas others obstruct union formation, such as Samsung's SDI's factory in Göd.[20]

To avoid a race to the bottom in countries like Hungary - given the large state aid given often stemming from EU funds such as the EU Recovery and Resilience Facility (RRF) - funding given to foreign investors

[12] Idem.
[13] Idem.
[14] https://www.somo.nl/electric-dreams-hard-realities/
[15] Idem.
[16] https://library.fes.de/pdf-files/bueros/budapest/21810.pdf
[17] Idem.
[18] https://vgi.krtk.hu/wp-content/uploads/2024/11/Elteto_WP_278.pdf / https://www.somo.nl/electric-dreams-hard-realities/
[19] https://library.fes.de/pdf-files/bueros/budapest/21458.pdf
[20] https://library.fes.de/pdf-files/bueros/budapest/20101.pdf

should be subject to more scrutiny.[21] Conditions around this should be added to the reformed state aid guidelines.

2.5 Summary of impacts

The Carbone 4 analysis points out that while there are concerns about the environmental and social impacts, no actual breaches of key EU water, waste and other environmental legislation have been found. However, one violation around air emissions of NMP was found, which exceeded the EU Industrial Emissions Directive's limits (though it is unclear if national derogation was given). But continuous concerns remain about the increased gas supply in Hungary, as renewable energy production is unlikely to keep pace with new factories. Both CATL and LG Energy Solution should in particular use improved technologies to reduce water consumption and bring their waste water management into line with best practice to avoid dangerous levels of NMP.

With regard to concerns around labour and workers, some serious issues remain in Hungary: precarious working conditions due to flexible national rules on overtime, wages and foreign contract workers, as well as a long record of occupational safety risks and accidents found in Korean battery factories. For foreign workers, the situation is further complicated by strict migration rules that restrict workers' rights, such as the right to unionise.

Summary of CATL and LG Energy Solution's compliance with EU regulations

	CATL in Debrecen, Hungary	LG Energy Solution in Wroclaw, Poland
Energy consumption	✓	✓
Water demand	✓	✓
Water emissions	✓	✓
Air emissions	✗	✗
Scrap & waste management	✓	✓
Land occupation	✓	✓

Source: Carbone4 (2025) for T&E

Figure 5: Summary of key findings from Carbone 4

[21] See CSO letter calling for public support to be linked to social and environmental conditions

3. Joint ventures and knowledge sharing

Given overcapacity at home, and high tariffs and other restrictions in many markets from the US to India to Brazil, Chinese battery producers are looking at opportunities to localise part of their production abroad. In fact, Chinese players alone produced more battery capacity that the world needed in 2023. According to the International Energy Agency, China used less than 40% of its maximum battery cell output in 2023. Similarly, the installed capacity of cathode and anode active material was 4 and 9 times greater (respectively) than the global EV battery cell demand that year.

Driven to seek new growth opportunities beyond China, CATL, BYD and Gotion – which account for nearly 50% of the Chinese domestic capacity - are all developing partnerships and strategies to invest in or close to Europe. The second part of the report looks into the two of those partnerships - Gotion and CATL - in detail.

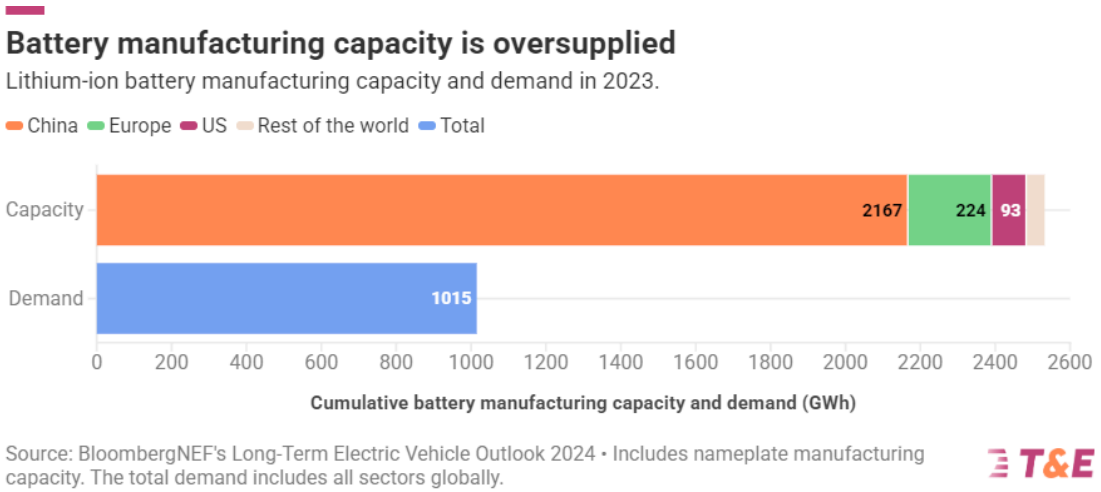

Figure 6: Battery manufacturing capacities

There are a number of ways in which Chinese companies can invest into and integrate themselves into the EU market, including:

- Creating a local subsidiary in an EU country
- Acquiring a local battery (or other) company
- Entering an alliance or partnership with a European partner (by taking a stake in the EU counterpart or offering a stake in its own capital)
- Entering a joint venture with a local battery or auto maker, or
- Signing a licensing agreement that gives technology and UP to a local player.

The choice depends on many factors beyond pure business considerations, including the local policy in Europe (or a lack thereof), market access conditions or the guidelines issued by the Chinese government. Experts interviewed for the report point out that there is currently a strong pressure from Beijing not to take capital or technology out of China. In fact, the Chinese authorities want their companies to export knock-down kits to their foreign facilities as much as possible, meaning final assembly.

More recently, e.g., China announced restrictions on the export of technologies related to lithium processing and best in class LFP cathode active material[22]. Given that China controls 99% of LFP CAM production globally, critical to affordable EVs, this poses a serious challenge to EU's efforts to onshore this expertise.

But no coherent framework to address such moves by China exists in Europe. E.g., beyond a few provisions in the Foreign Subsidy Regulation. There are no EU-wide (or national) requirements or conditions on joint ventures or greenfield battery investments. Neither the state aid framework (EU's largest subsidy scheme), nor other EU funds or regulations, such as the EU Foreign Subsidy Regulation, stipulate any conditions, social, industrial or otherwise.

The report supports this, by highlighting the long-standing difference between the investment conditions for European companies in China vs Chinese companies in Europe. Due to the EU's commitment to "fair treatment", Chinese companies investing in the EU and benefiting from state aid support have no conditions as to their stake or role in joint ventures. The opposite is true in China (and following the US IRA's "Foreign Entity of Concern" now also in the US) where local companies often hold majority stakes in their joint ventures with rules on IP and technology transfer, as well as local staff and R&D.

With no political framework or EU's involvement present, below is the summary of the situation in two of the larger Chinese-EU battery partnerships in Europe to date.

3.1 VW - Gotion partnership

The first case study the researchers analysed is the partnership between the Volkswagen Group and Gotion High-Tech Co., Ltd, who. entered a strategic cooperation framework based on a substantial shareholding agreement in May 2020. Based on the available information, VW invested around EUR 1.1 billion and holds 26.47% shares in Gotion (but gave up some of its voting rights).

Gotion High-Tech appears to also have become the overall LFP battery technology partner for VW, including for its planned battery cell factory in Salzgitter, where Gotion is expected to design and manage the factory's layout, machinery and production processes (and even recycling capabilities).

The information as to the technology, IP or skills transfer within this partnership is summarised in the report and remains scarce. It appears, e.g., that some worker training has been promised by Gotion, but no detail on what types and and at what company functions is available.

Based on extensive interviews with experts familiar with the matter, it appears that:

- The partnership between Volkswagen and Gotion is more about "securing LFP battery supplies" to VW's European operations, rather than knowledge or IP transfer. While Gotion will provide operational expertise and support to VW's PowerCo, whether or not this will result in local workforce expertise beyond Gotion remains uncertain.

[22] Benchmark Minerals Intelligence, https://source.benchmarkminerals.com/article/china-proposes-restrictions-on-lithium-and-cathode-technology-exports?utm_campaign=Customer+Email+-+Source+Weekly+Update&utm_medium=email&_hsenc=p2ANqtz-_qLVAyeYAHwtGIlnkLU0fAY40ruaViTkM7gawxUYjVX50nOIWxMfiZUWISeTM8jR_BHhYw7qC5uf6pYv3y6vutKL86_cnPWTckqRS6VwCmf8mwyGW0HkYIyBT4ax44sDUKu_yQ&_hsmi=102231460&utm_content=102231460&utm_source=hs_email

- Some experts pointed out that “Volkswagen was somewhat at the mercy of Gotion during the talks”, since the Chinese group had “other options” while VW needed a battery technology partner. This is why experts point out limited provisions on technology transfer.

Another separate joint venture between Innobat and Gotion in Slovakia appears to have more provisions on technology transfer and local value and skills, but it is 80% owned by Gotion making it clear where the final decision-making power lies. The project - with a total investment of EUR 1.2 billion[23] - has received EUR 214 million from the Slovak government, including a subsidy of EUR 150 million and a tax relief of EUR 64 million.

3.2 Stellantis - CATL JV

The second case study in the report looks at the recently confirmed joint venture between Stellantis and CATL, world’s largest battery manufacturer. Taking the form of a 50-50 JV, the aim is to build an LFP battery gigafactory near Stellantis’ Spanish site in Zaragoza, targeting to produce up to 50 GWh of battery capacity.

While the final approval of this JV from the Beijing government is unclear, the Spanish government did offer a total of EUR 300mln[24] in aid from its PERTE VEC III plan. No conditions on technology or skills transfer were attached to this subsidy, so it was left to Stellantis and CATL to negotiate. The overall project is said to be worth around EUR 4bln.

Despite very little information available on this JV, expert after expert has pointed out that this is about supplies, not technology transfer:

- For Stellantis, the main goal appears to be access to the LFP battery technology to supply electric cars on the EU market. While they can buy batteries from any Chinese company on the market, this JV secures the supply at agreed prices and volumes.
- Stellantis appears to be a pure financial shareholder in this arrangement, with the know-how and IP remaining in CATL hands.

Once again, there appear to be no clear provisions on any technology transfer or local talent.

When it comes to skills, a vocational training programme for battery manufacturing has been announced by the Spanish government and Stellantis[25], no concrete provisions within the JV with CATL are known. In addition, the government has already exempted the initial factory phase from any environmental permits[26], giving a worrying indication of a lack of proper oversight.

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[23] https://www.mhsr.sk/en/press/the-second-highest-investment-in-the-history-of-country-is-coming-to-slovakia-it-is-worth-eur-12-billion-and-it-focuses-on-battery-production#:~:text=A%20joint%20undertaking%20of%20the,investment%20of%20EUR%201.2%20billion

[24] La Moncloa, 2025 https://www.lamoncloa.gob.es/lang/en/gobierno/news/Paginas/2025/20250117-stellantis-catl-gigafactory.aspx

[25] Heraldo, 2025, https://www.heraldo.es/noticias/aragon/2025/01/17/pilar-alegria-anuncia-en-stellantis-zaragoza-nueva-fp-superior-sobre-produccion-baterias-litio-1792730.html

[26] Heraldo, 2025, https://www.heraldo.es/noticias/aragon/2025/01/17/gigafactoria-stellantis-figueruelas-zaragoza-evaluacion-ambiental-1792609.html

3.3 Summary of JV findings

Overall, no comprehensive technology, local content or talent transfer appears to be happening in the current Chinese-EU partnerships based on the expert interviews and consultant research. Many experts familiar with the matter mostly point out that this is because there is no single framework in Europe on the scope of technology or skills transfer. Neither the European Commission, nor national governments require or enforce such provisions today (compared to clear rules on this in both China and the US).

There are a number of parameters that are needed to establish effective knowledge sharing, including:

- The ownership structure of the JV, whereby the majority stake should be with the local company so they can take key decisions on product, operations, etc. Having a licensing deal is preferable as it gives a complete ownership, whereas in the JV both sides contribute capital.
- The actual provisions around technology and IP. This is not only about the knowhow and ability to produce the technology, but scale that process over time to good yields and quality.
- Use of local workforce and local supply chains. Skilling local workforce, including at all levels of management and engineering is important to ensure local expertise is developed and over-reliance on foreign workers long-term avoided. In the case of supply chain, having provisions to use local components or raw materials can help the entire ecosystem develop in Europe as smaller new companies often struggle to secure offtake (when importing components is cheaper from elsewhere).

Based on the study accompanying this paper and numerous interviews with experts, the following summary of the key parameters around EU-China investments can be derived. The Tesla-CATL JV in the US is added as a comparative example.

Comparison of EU vs American joint ventures with Chinese companies

	VW + Gotion Partnership	Gotion + Inobat JV	Stellantis + CATL JV	Tesla + CATL (US)
Ownership structure	VW holds 26.47% in Gotion	Gotion: 80% | Inobat: 20%	Stellantis: 50% | CATL: 50%	100% owned by Tesla (incl. equipment)
IP or technology transfer provisions	"Limited"	Some	✗	✓
Local supply chain	✗	✗	✗	✗
Local workforce	Local R&D centre	Some, incl local schools	No known provisions	✓
Equal decision-making (e.g. voting rights) on battery side	✗	✗	✗	✓

Source: Carbonne4, expert interviews & T&E.

Figure 7: Comparison between Joint Ventures in the EU and the US

It is worth pointing out that both VW and Stellantis have plans of their own to produce battery cells, so do not view them purely as commodities. In the case of VW, the PowerCo subsidiary has confirmed at least 2 battery gigafactories in Germany and France. Whereas Stellantis is invested into ACC, which has recently put some of its plans for review but is nonetheless building one battery cell factory in France. While some links between PowerCo and Gotion exist in VW's case, a lack of more comprehensive technology transfer provisions (including manufacturing expertise) is nonetheless worrying given their own plans to develop batteries.

A particular example that was brought up is the funding support that Polish and Spanish governments give as part of the EU RRF. Whether for the Stellantis-CATL JV or EV suppliers in Poland, no questions are being asked on how or where the money is spent beyond the final product, often benefiting suppliers and equipment manufacturers in China (who have lower costs).

Such an EU-wide framework is also necessary to avoid Chinese and other companies going to places in or around the EU with lower restrictions and/or higher aid. This creates a race to the bottom when it comes to social, environmental and other conditions.

In addition, despite a number of R&D centres announced or opened by Chinese companies in collaboration with Europeans across the EU, experts interviewed for this report point out that in reality a lot of those provide technology transfer from EU academia back to China. In many cases - beyond the minimum to qualify as being present - a lot of those are in due course being closed or reduced, with key research and development teams and functions related to EVs or batteries happening back in mainland China.

Verifiable publicly available information is very scarce, so the comparison below of the VW-Gotion and Stellantis-CATL JVs is based on the expert interviews with ex-employees and people familiar with the JV negotiations conducted for the study, as well as T&E's own research and intelligence. The consultants interviewed 10 experts from Germany, Slovakia, France, Spain, Poland and Belgium. A US ex-Tesla insider was also interviewed to understand the details of the Tesla-CATL deal.

4. Conclusion & policy implications

The first conclusion from the analysis undertaken on the two Asian battery factories in Hungary and Poland is that - while some legitimate concerns on their environmental and social impact exist - not many infringements of EU water, waste and other environmental legislation has been found. One exception is air emissions where levels of NMP exceed the limit in the EU Industrial Emissions Directive.

In addition, the management of NMP in water by both companies is contradictory both to the EU's classification of NMP as a hazardous substance under the REACH Regulation and to broader EU environmental principles such as the precautionary principle and pollution prevention. Both companies should adopt better practices in this regard to prevent any discharge of NMP. It remains paramount for the EU to put pressure on both Polish and, above all, Hungarian governments to make sure no trade offs are allowed.

But the second conclusion is a lot more glaring. While Chinese companies are leaders in battery technology, innovation, operational expertise and global volumes of battery cell capacity installed, their current investments and partnerships in Europe do not seem to bring genuine technology transfer or local knowledge.

This is in stark contrast to how the Chinese government treats foreign companies at home. Chinese companies acquired much of traditional automotive expertise via forced JVs (>51% Chinese ownership) since the early 2000s[27]. Strict requirements on technology transfer, local research and development and performance requirements often benefiting local companies are in place in China. The government often imposes more favourable conditions on local companies: e.g. via negative lists or "catalogues" which classify foreign investments as "encouraged", "restricted" or "prohibited"[28].

The lack of technology transfer will not necessarily undermine Europe's EV goals, as plentiful supply of battery cells exists globally (in fact, the market is over-supplied). However, the lack of comprehensive technology transfer, local content or control provisions in the EU undermines the effort to gain a foothold in one of the energy transition's key technologies, for at least two reasons:

[27] European Commission, https://policy.trade.ec.europa.eu/enforcement-and-protection/dispute-settlement/wto-dispute-settlement/wto-disputes-cases-involving-eu/wtds549-china-certain-measures-transfer-technology_en

[28] Idem.

1. From the (until recently) healthy EU battery cell project pipeline, the homegrown players such as Northvolt and ACC are struggling to scale and deliver. At least 100 GWh of the planned EU-led capacity was cancelled last autumn alone, including Northvolt and ACC plans[29]. This underlines the difficulty in acquiring local battery expertise and production, which is unlikely to happen quick enough (if at all) without external support.
2. At the same time, the majority of the "likely to happen" battery investment in Europe is by Asian companies, with around 440 GWh announced by Chinese companies (mainly CATL and Gotion) vs around 200 GWh by South Korean players. Without the framework for comprehensive knowledge transfer, local long-term benefits of these will be non-existent. This also poses geopolitical risks in case of trade tensions or political conflict.

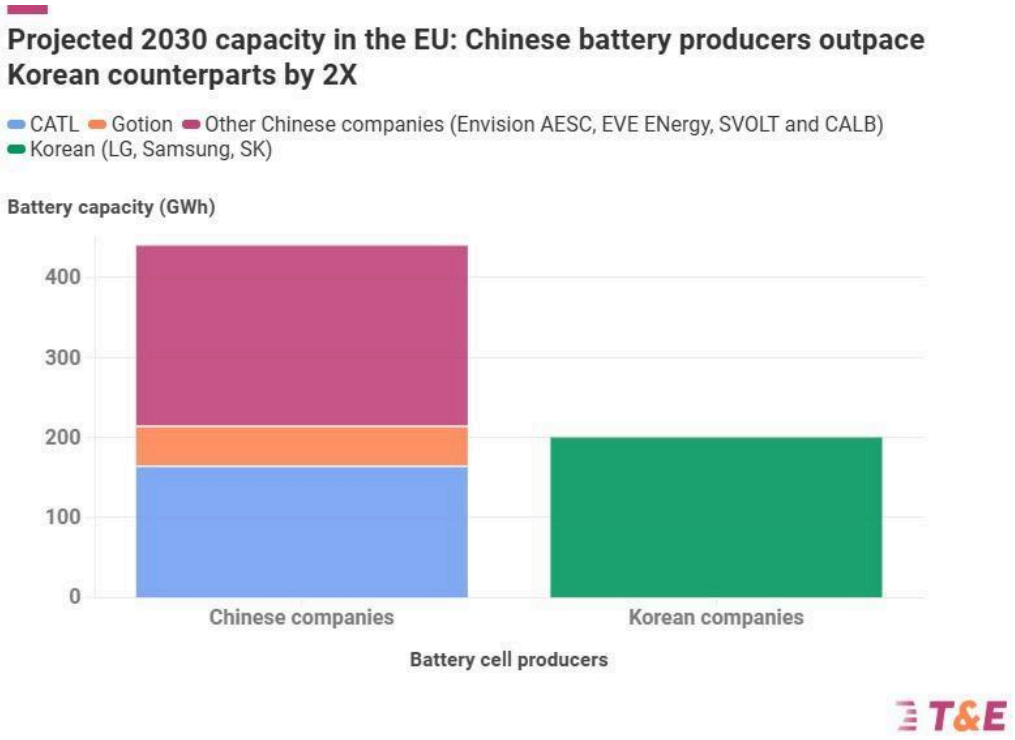


Figure 8: Projected battery production capacities

The conclusion from the analysis of the two current Chinese-EU partnerships is not just that such comprehensive knowledge and skills transfer is not happening, but that - as opposed to China and the US - European decision-makers lack political guidance or measures to ensure this. In fact one of the main reasons for no local technology or IP transfer is that this is not required by either the European Commission or national governments. Similarly, no local content requirements currently exist in any of EU funding or legal frameworks.

If no comprehensive framework is put in place, Chinese battery and supply chain companies will find it easier to import knock-down kits (whereby key components are manufactured locally in China and set to Europe for final assembly). This is because it is cheaper and because the Chinese government clearly has a preference for this approach. This would deprive Europe of the technology, skills and operational expertise in one of climate's core technologies.

Given the criticality of batteries to both energy and transport decarbonisation, not having any local expertise poses large geopolitical and security risks.

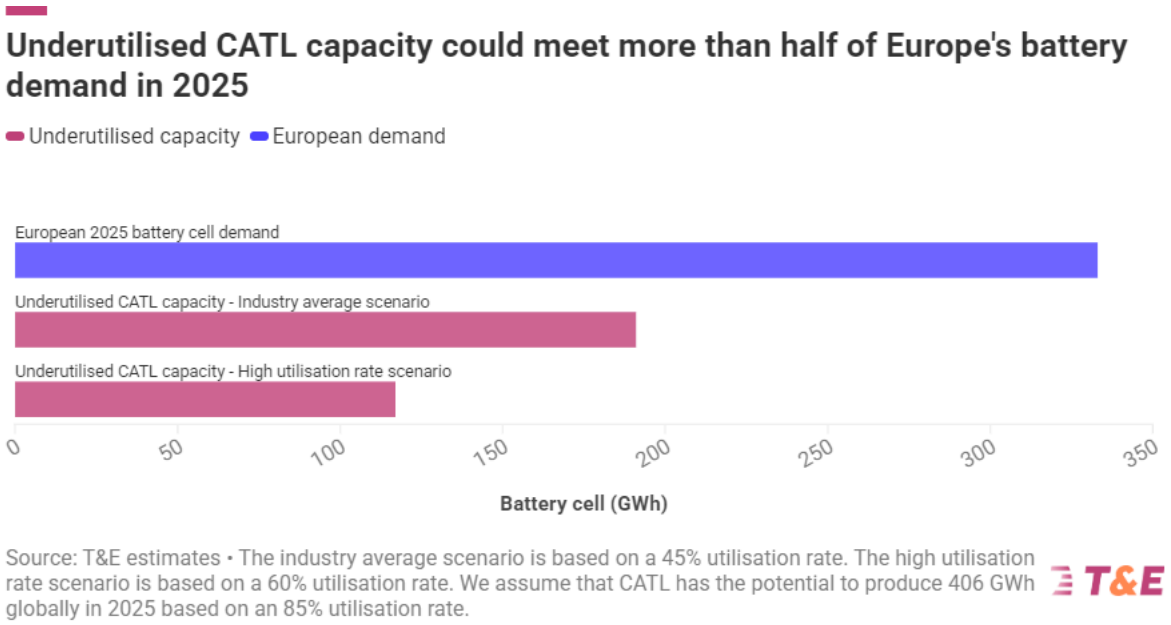
[29] T&E, 2024, https://www.transportenvironment.org/articles/batteries-the-next-frontier-in-trade-defence

But it does not have to be this way.

Europe has power: its vast single market.

It also has leverage vis-a-vis China. With the US closed to most Chinese companies, and huge overcapacity amidst a sluggish domestic market in China, the EU market is critical to the global growth strategy of many Chinese auto and battery companies.

T&E has taken CATL and its reported utilisation rates in H1 2024 (as well as overall industry projections for 2025) to illustrate this. Covering the difference between the currently reported utilisation of around 60%[30] to the desired industry standard of 85% is equivalent to around 117 GWh of battery cell capacity. This is equivalent to 35% of the expected EU battery cell demand in 2025. If CATL's utilisation rate dropped further to the industry average of 45%, then the under-utilised capacity would increase to 191 GWh, representing 57% of the EU's 2025 demand. With the US market largely closed due to EV tax credit rules, the EU is the only other major market that can cover such a big capacity excess.



This is why the EU should act quickly. The new EU leadership, the upcoming Clean Industrial Deal and a new trade and state aid reform agenda all offer a huge opportunity.

This is how EU's knowledge transfer strategy should look

The EU should define conditions for access to its market, its key leverage to make the case for local investment and to influence foreign direct investment (FDI). As a minimum, EU's toolbox for this includes:

- Trade defence, such as tariffs, to limit the access of imported goods to its market and agree onshoring conditions to avoid those tariffs;
- Conditionality in state aid and EU funds (and procurement) to require more local content, i.e. local IP transfer, local skills and local supply chain to benefit from various subsidies.

[30] Ainvest, https://www.ainvest.com/news/china-catl-s-shares-dip-revenue-fall-and-slowing-profit-growth-signal-market-concerns-25011010934337a202a4ae51/

- Sustainability tools to define what products can access the market, provided these are set simply (e.g. based on EU vs foreign grid) without complex provisions that are open to misuse. One example is to agree grid-based CO2 threshold for batteries as soon as possible, that would de facto limit batteries made on higher carbon grids abroad.

1. Use trade & investment tools to make the economic case for local battery manufacturing.

The European Commission should launch an anti-subsidy investigation into the Chinese battery supply chain - including battery packs, cells, cathodes and anodes - similar to the one done on EVs. The investigation can also be used as a dialogue with China to agree onshoring and local content conditions (see point 2) as a pre-condition for Chinese companies to avoid higher tariffs. Given the push by Beijing to limit foreign investment to assembly kits, this is an important part of the EU's battery industry plans.

Alternatively, local content provisions including batteries can also be put in place as part of the anti-countervailing measures under the *ongoing* anti-subsidy EV tariffs decision. This can set a minimum local content for Chinese EV makers to avoid tariffs, 50%, which would ensure they locally battery and other component manufacturing. This has already been done in the case of e-bikes, with the minimum local content (of 40%) set as a condition to avoid tariffs.

The evidence base for significant subsidisation - from direct subsidies to export loans and support in upstream supply chains - is clear. The current anti-subsidy EV investigation notice provides a detailed overview of various direct and indirect subsidy programmes in China[31], including some evidence on battery companies.

Notably, figures by the Centre for Strategic and International Studies cited in the report indicate that if one includes various subsidisation categories - buyer's rebates, sales tax exemptions, infrastructure financing, research & development funding and government procurement - then in 2023 alone the Chinese state granted over over USD 45.3 bln in subsidies to its EV sector, including battery companies. CATL specifically is one of the largest recipients of government subsidies.

2. Set a comprehensive framework on knowledge sharing, e.g. instruments such as joint ventures (JVs) and licensing deals.

Technology and skills transfer, as well as operational expertise, can only be acquired if EU governments consistently require this as a pre-condition to access the EU market. While tariffs or sustainability rules such as carbon footprint thresholds can be used to limit the access, a common set of criteria of what constitutes an effective "knowledge sharing" also needs to be agreed.

For example, the US does it via its US IRA. Its 45X credit (or the EV tax credit for consumers) defines local content that's required to get it. This is followed by detailed implementation requirements, including the Foreign Entity of Concern (FEOC) definition and rules around direct, indirect and effective control by those FEOC. The latter includes the control of production, supply chains, or maintenance and operation of critical equipment. While privately owned Chinese firms can still invest in the US - and overall EVs with Chinese content can be sold but without a subsidy making them more expensive - these

[31] European Commission, 2024, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401866

provisions have led to the CATL - Tesla and CATL-Ford LFP battery licensing deals[32]. Those deals can be seen as best practice the EU can build on.

Add on shipping licensing deals?

While it is true that WTO rules make some of this difficult (unless justified on national security grounds), given that China, the US and other countries already have such rules in place, the EU should simply reciprocate and mirrour what's happening globally.

This is what the European technology transfer framework should include:

- Clearly define what constitutes as "Made in EU", "foreign" and "foreign of concern". Different technology transfer requirements should apply to foreign vs foreign of concern.
- Ensure majority control for EU-based companies within a JV, with preference for 100% locally owned licensing deals. Majority control should apply to all key aspects of governance, including decision-making, voting rights and product strategy.
- For foreign investment of concern, full technology transfer, including IP rights, on the specific battery technology built as part of the JV/joint project should be given to the European company. Some technology transfer rules should apply to all foreign investments.
- Technology transfer provisions should include support with operational expertise, notably manufacturing scale and yield, as well as equipment operation. E.g. CATL engineers helped Tesla build the LFP factory in the US and were on site to train local workers to operate it (due to restrictions under the US IRA 45X credit/FEOC definition).
- Separate guidance should be included on training and hiring local workforce at all seniority levels of the company, including technical experts and management. Provisions on local education and upskilling are key, both within the company and in the area more broadly (e.g. via education or R&D centres).
- Additional requirements to use local suppliers, including cathodes, anodes, and processed (locally recycled) materials for those. This can be set as a lower threshold initially and grow over time, as EU capacity increases. The EU has a vibrant landscape of smaller scale-ups developing innovative and clean alternatives to the current mid and upstream processes, which struggle to secure offtake with battery companies. The EU should use its powers to support this local ecosystem.

Technology transfer is important but only part of the success. This needs to be coupled with an investment framework that supports local manufacturing, a reskilling and training policy to have qualified workforce, strong research and innovation support, as well as wider regulation to shift the market towards electrification and create the market, such as the EU vehicle CO2 standards.

3. Support "Make Europe" via a reformed state aid framework.

Contrary to China and the US, the EU does not directly support manufacturing scale-up (as opposed to R&D or pilots). But a lot of subsidies are given to companies, including battery manufacturers, by

[32] Bloomberg, 2024, https://www.bloomberg.com/news/articles/2024-01-31/tesla-to-open-new-us-battery-plant-with-equipment-from-catl?sref=M2YKkTZ6 AND https://eu.freep.com/story/money/cars/ford/2025/01/07/ford-chinese-ev-batteries-catl-marshall-megasite/77519832007/

national governments as state aid. This is based on an outdated framework which is in dire need of reform. T&E will soon issue detailed recommendations on this in its upcoming report.

At the core of the reform should be doing away with the intransparent black-box thinking behind national subsidies today, without any conditions for local control or content. Lack of any visibility of possible support makes it impossible to build a strong business or investment case for cleantech players in Europe.

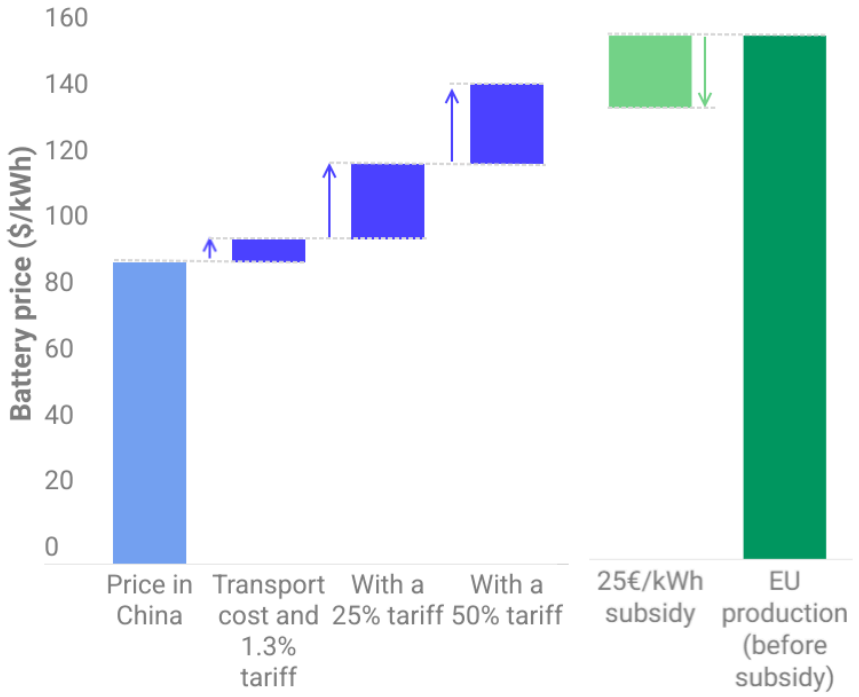
Instead of project-based funding, future state aid subsidies should be set ex ante in a transparent manner and be output-based. E.g. all EU member states should be allowed to give up to €25/kWh for battery cells (including CAPEX and OPEX) without cumbersome approval processes or per-project haggling.

In addition, the output-based subsidies should be tied to local control and increasingly stringent local content rules, so that there is a strong incentive to develop EU supply chains for batteries.

In addition, such local content and control rules should be included into broader EU funds, including the Innovation Fund, InvestEU and the EIB programmes. Products manufactured in the EU or using EU-made materials should be equally prioritised in procurement bids ('Buy Europe'). Some progress into this direction has been made in the new EU Battery Fund call, whereby 15 points are awarded to projects for "Security of supply and countering dependency", e.g. in case of diversification away from Chinese cathodes.

Overall, a combination of tariffs and state aid support can help bridge the average cost gap between China-made and EU-made lithium-ion batteries. E.g. as seen below, an output based state aid of up to EUR 25 per KWh of battery cells coupled with the 25% battery cell/pack tariff would reduce the average cost gap sufficiently to make local manufacturing attractive. The cost gap does not have to be zero, since many benefits of onshoring exist including resilience, closeness to market and less risk from transport hurdles or geopolitical tensions.

Comparison of made-in-China and made-in-Europe battery price



Source: T&E analysis of BloombergNEF's battery price survey 2023 and 2024

Other examples of "Buy Europe" measures include the use of the battery CO2 footprint to set maximum CO2 threshold to access the EU market, and a wider "ecoscore" methodology for cars to prioritise those with lower embedded CO2 via the use of green/local steel, aluminium and batteries.

Moving quickly and putting in place a framework to secure local battery expertise by leveraging its market power via tariffs, agreeing a common >51% JV framework vis-a-vis China and reforming its subsidy framework is what Europe needs.

Further information

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