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Transatlantic clean investment monitor 3: battery manufacturing

Battery manufacturing investment is rising fast on both sides of the Atlantic with the US outstripping Europe – for now

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This is the third of a series of Bruegel-Rhodium Group quarterly briefings to compare clean tech deployment and manufacturing trends in Europe and the United States.

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*Click here to access the **European clean tech tracker** dataset*

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Introduction[1]

Battery technology is a crucial component of the global energy transition. Batteries are needed for electric vehicles (EVs) and for stationary storage for electricity grids. The market for EV batteries significantly surpasses that for stationary storage, with EVs accounting for more than 80 percent of global demand for li-ion batteries[2]. EVs have grown to an important global market, accounting for 19 percent of automobile sales in 2024 worldwide (Figure 1). However, EV sales growth in the European Union market also stalled in 2024 as governments cut subsidies and companies delayed the launch of new EV models until 2025[3] to comply with stricter emission limits starting this year by promoting the sale of new EVs. Nevertheless, growth in EVs presents economic opportunities for companies and countries that can establish leadership in battery supply chains.

The US and European governments[4] have designed policies to try and attract battery manufacturing investment. In 2019[5] and in 2021[6], the EU approved two Important Project of Common European Interest (IPCEIs)[7] intended to support the development of a globally competitive battery value chain in Europe by funding R&D, innovation and deployment. In the US, the Inflation Reduction Act (IRA), passed in 2022, made available large subsidies for battery manufacturing, along with consumer EV subsidies paired with a domestic-content requirement.

Consequently, both Europe and the US have developed significant battery manufacturing capacities, and these are expanding. These predominantly focus on later stages of the value chain, while China dominates earlier critical inputs, such as lithium refining.

This analysis, based on data from the Bruegel European Clean Tech Tracker (Jugé *et al*, 2024) and the Rhodium Clean Investment Monitor (Rhodium Group-MIT CEEPR, 2024), assesses the scale of investment in battery manufacturing value chains and the resulting operational capacities, and compares this to demand in Europe and the US. We also look at trade data to understand the composition of imports. In combination, this comprehensive and granular data fills the gap in existing publicly available data and offers an insight into the impact of evolving policy and markets on a critical industry for the clean-energy transition.

Manufacturing investments and capacities

As the transition from combustion-engine to electric vehicles has progressed, along with the growing importance of stationary grid-connected batteries, investment in battery manufacturing has grown. While much of this investment has so far been in China, investment is significant and growing in Europe and the US.

The value chain for manufacturing a battery is long and complex[8]. The primary materials are chemical compounds formed from elements including lithium, nickel and cobalt, which must first be mined. Processing is then required to transform these minerals into compounds that are suitable for battery production. Battery cell fabrication involves the complex assembly of these prepared materials and is by far the most capital-intensive stage. The final step is the assembly of series of battery cells into modules and packs.

Most investment in battery manufacturing in the US and Europe has focused on battery cells and modules, while value chains remain highly reliant on inputs from China for the early stages of production. In 2020, investments in cell and module manufacturing were broadly similar in Europe and the US at around $500 million to $1 billion per quarter (Figure 2). In Europe, investment volumes have grown steadily over time, reaching just over $3.5 billion by the last quarter of 2024. Meanwhile, the US IRA drove a rapid expansion of investments in the US, starting in 2022. Since then, investment in the US has shot ahead of investment in Europe, reaching a record level of nearly $12 billion in the last quarter of 2024.

The IRA supercharged US activity in battery production, which accounted for more than 70 percent of US clean manufacturing investment in every quarter of 2024 (Rhodium Group-MIT CEEPR, 2025). While still largely centred on cells and modules, a growing share of investment is going to upstream steps, including critical minerals and electrodes.

Announced projects, an indicator of the investment pipeline, peaked in 2022 for both regions (Figure 3). This came on the heels of the IRA in the US and in response to the energy crisis in Europe (McWilliams *et al*, 2022). For both regions, investment announcements slowed in 2024 thanks to substantial previous investment, tempered EV demand growth and competition from Chinese producers. There was a spike in the last quarter of 2024 for Europe from a joint venture announced between Stellantis and the Chinese battery cell manufacturer CATL, for a project in Zaragoza, Spain[9].

While investment volumes offer a market signal, it is the translation of these investments into operational manufacturing capacity that really matters. The US and Europe have similar manufacturing capacities (Figure 4). Both have around 200 gigawatt hours of operational battery cell capacity, or roughly equivalent to 3.3 million electric vehicles[10]. For module assembly, we estimate Europe has 190 GWh capacity while the US has 130 GWh.

However, the US is poised to overtake Europe in both cell and module capacity as IRA-driven investments break ground. If new facilities under construction are taken into account, together with operational plants that are still ramping up production, US cell manufacturing is expected to exceed 1,000 GWh. Europe has fewer projects in the pipeline and is on track to reach over 600 GWh cell capacity by the same metric. However, the fate of new builds in both regions is not guaranteed. Changing political priorities – in the US in particular – make ongoing monitoring of the sector critical.

Self-sufficiency and trade

Unable to compete with foreign-made traditional combustion vehicles, China's advantage in EVs arose from a risky government programme to build out a new industry (Wu *et al*, 2021). Now, battery manufacturing in the US and Europe is at a critical juncture as governments in both regions seek to shore up domestic supply chains while competing with China. Recent efforts have been reasonably successful in ramping up battery-cell manufacturing to meet growing demand. As of 2024, domestic battery-cell manufacturing in the US and to a lesser extent in Europe has sufficient capacity to meet most domestic demand (Figure 5).

Domestic battery cell manufacturing capacity, however, does not mean the US and Europe are nearing self-sufficient supply chains. For starters, both regions rely on China for upstream components. Even for cells and modules, rising manufacturing capacity obscures heavy European reliance on imports, while many batteries produced in Europe are shipped abroad. In 2023, Europe imported batteries worth $35 billion, and exported a quarter of that amount (Figure 6). Exports primarily go to North American facilities that largely serve the US EV market, while Europe imports cheap batteries from China to fill the domestic demand gap (Figures 7 and 8). This strategy has helped make lower-cost EVs available to European consumers, boosting EV deployment, but exposes the EV supply chain to trade conflicts.

The US also relies on imports, overwhelmingly from China. US policy under the Biden administration, including through the EV subsidy domestic content requirements, helped drive US demand for US-made batteries. This has helped keep batteries local; nearly half of US exports go to US-bound auto production in Mexico and Canada. Although China looms increasingly large, the US and Europe are also important trade partners for batteries, with Europe supplying 10 percent of US battery imports in recent years.

The domestic build-out of battery manufacturing capacity accompanies another trend: growing foreign investment in US and European plants. The overwhelming majority of operational European battery-cell manufacturing capacity comes from companies with headquarters abroad. The largest operational facilities belong to LG (South Korea), Samsung (South Korea), CATL (China) and SK (South Korea). One widely anticipated homegrown European battery producer, Northvolt, initiated bankruptcy proceedings in 2024 (Tagliapietra and Trasi, 2024).

In the US, more facilities are domestically owned, although foreign investment is increasing. South Korean firms have made substantial investments in US factories in recent years, including multi-billion-dollar investments from Samsung, Hyundai, SK and LG Chem. Chinese firms have made mostly mid-sized investments – in the millions, not billions – notably focused on the upstream components of battery manufacturing. These factories could help diversify in-country supply chains if completed, although most have not yet broken ground.

Perhaps the biggest threat to domestic manufacturing in both regions is policy uncertainty. In the US, President Trump wants to restrict battery and auto imports from China – broadening and intensifying tariffs enacted by his predecessor – and has sent mixed messages about openness to Chinese foreign investment in US factories, restricting such investment in 'sensitive areas' (such as energy, critical infrastructure and raw materials)[11] while signalling openness to Chinese companies building car plants in the US provided they hire locally[12]. The administration has frozen all grants and loans – many of which were awarded to clean manufacturing projects – and has threatened core provisions of the IRA. Tariffs or the threat of them aim to protect domestic producers. But a trade war would likely damage the burgeoning domestic battery industry, which still relies heavily on foreign supply chains. Pulling the plug on federal support for manufacturing and consumer subsidies would deal a major blow.

The EU put up fewer barriers to imports from China until October 2024[13], when EU countries approved countervailing duties on Chinese EVs following a substantial rise in imports. Europe's auto sector is integrated with China; in addition to relying on Chinese battery imports, many European companies have joint ventures with production in China[14], and cars manufactured in China account for nearly a quarter of EV sales in Europe. It remains to be seen how EU duties will balance protecting local industry with averting an escalation with China that could slow the EV transition.

The Trump administration is another wild card for European battery production. President Trump's threat to impose tariffs on the EU could slow Europe's substantial exports to the US. However, if the US pulls back from the global EV race, there will be opportunities for others – including Europe – to fill the gap.

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Endnotes

1 This analysis is the third in a series of quarterly briefings comparing clean technology deployment and manufacturing trends in Europe and the United States as part of a collaboration between Bruegel and Rhodium Group. For the previous briefings, see Delgado et al (2024a, 2024b). The Transatlantic clean investment monitor brings together data from the Clean Investment Monitor, a joint project of Rhodium Group and MIT's Center for Energy and Environmental Policy Research (Rhodium Group-MIT CEEPR, 2024), which tracks public and private investment in the manufacturing and deployment of clean technologies in the US, and Bruegel's European Clean Tech Tracker (Jugé et al, 2024), which provides an overview of the main clean-technology manufacturing and deployment trends in Europe.

2 Colin McKerracher, 'Battery Makers Counteract EV Slowdown With Energy Storage Boom', Bloomberg, 14 August 2024, https://www.bloomberg.com/news/newsletters/2024-08-14/battery-makers-co….

3 Kana Inagaki and Ian Johnston, 'European carmakers braced for tough 2025 despite 'firework' of launches', Financial Times, 25 January 2025, https://www.ft.com/content/c6423ebf-3b26-4445-aef0-1ed9d25ddb99. Note that in 2025, EU EV sales are expected to grow.

4 For our purposes, Europe refers to the EU, Norway, Switzerland and the United Kingdom.

5 See European Commission press release of 9 December 2019, 'State aid: Commission approves €3.2 billion public support by seven Member States for a pan-European research and innovation project in all segments of the battery value chain', https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6705

6 See European Commission press release of 26 January 2021, 'State aid: Commission approves €2.9 billion public support by twelve Member States for a second pan-European research and innovation project along the entire battery value chain', https://ec.europa.eu/commission/presscorner/detail/en/ip_21_226.

7 IPCEIs are EU-backed industrial initiatives that allow EU countries to provide state aid for large-scale, cross-border projects in strategic sectors with positive spillover effects to the whole EU.

8 The description of the manufacturing process is accurate for the most common type of batteries, including lithium-ion. Advances in sodium-ion chemistries or solid-state

cells are exciting but, for simplicity, are not covered.

9 See Stellantis press release of 10 December 2024, 'Stellantis and CATL to Invest Up to €4.1 Billion in Joint Venture for Large-Scale LFP Battery Plant in Spain', https://www.stellantis.com/en/news/press-releases/2024/december/stellan….

10 Assuming a battery pack size of 60 kWh.

11 See The White House Presidential Action of 21 February 2025, 'America First Investment Policy', https://www.whitehouse.gov/presidential-actions/2025/02/america-first-i….

12 Ana Swanson, 'Trump's New Crackdown on China Is Just Beginning', The New York Times, 26 February 2025, https://www.nytimes.com/2025/02/26/us/politics/trump-china-crackdown.ht….

13 See European Commission press release of 29 October 2024, 'EU imposes duties on unfairly subsidised electric vehicles from China while discussions on price undertakings continue', https://ec.europa.eu/commission/presscorner/detail/en/ip_24_5589.

14 Examples include Smart, the joint venture between Germany's Mercedes-Benz and China's Geely, FAW-Volkswagen between China and Germany, and Sweden's Volvo and Polestar, assembling models at a Geely plant in China.

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