Green Industrial Policy in Multilevel Governance: Low-Road and High-Road Strategies in Europe's Battery Rollout

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Europe's electric vehicle battery rollout promises to deliver climate neutrality, industrial competitiveness, and strategic autonomy. Political economy scholarship highlights how bundling these aims together can fasten decarbonization by broadening climate coalitions—but it can also dilute climate goals. This article introduces a typology of *minimalist* and *maximalist* paths to compare how countries navigate three core trade-offs in green industrial policy: fast clean-tech rollout vs. sustainable production; foreign-led expansion vs. domestic capabilities; and physical localization vs. geopolitical resilience. The analysis draws on a novel project-level dataset of planned and operational gigafactories and uses a revealed preferences approach to compare the pathways of five member states: Poland, Hungary, Germany, France and Sweden. Findings show that shallow compliance dominates—driven by fragmented EU governance structures that fail to enforce coherence.

Keywords: decarbonization, electric vehicles, green industrial policy

The European Union's strategy to build a domestic EV battery value chain has been cast as a Swiss army knife of industrial policy. It is expected to deliver on three high-stakes political projects at once: climate neutrality, industrial competitiveness, and strategic autonomy—central to decarbonization, to safeguarding Europe's automotive backbone, and to hedging against growing dependence on China. Political economy scholarship highlights how bundling climate and economic aims together can fasten decarbonization by broadening climate coalitions (Kupzok and Nahm 2024, 2025, Meckling et al. 2015). The promise of green industrial policy lies in its ability to align disparate objectives under a common banner. Yet these alignments are inherently unstable. First, climate, industry, and geopolitics can pull in different directions. Second, none of the three aims is a singular goal: each is a bundle of sub-goals, containing what this paper calls nested trade-offs. Rapid clean-tech rollout can undermine sustainable production; short-term job creation through loosely conditioned foreign investment can obstruct long-term upgrading; localized capacity can leave geopolitical dependence intact. As these internal divisions multiply in practice, apparent alignments quickly unravel.

The EU, like many complex multilevel polities prone to joint-decision traps (Scharpf 1988), has a tried-and-tested way to hold these aims together politically: strategic ambiguity. By leaving objectives vague and underdefined, Brussels can sustain broad coalitions, allowing governments and firms to claim progress on all three fronts even when their priorities diverge (Schmitz and Seidl 2023). But what happens once this ambiguity shifts the burden of resolution onto member states and firms? In practice, it produces fragmentation, as trade-offs are settled through expedient bargains that tilt the bloc toward low-road strategies.

This paper traces how these trade-offs unfold, and what they reveal about the political economy of green industrial policy in a multilevel governance system. It finds that the nested tensions generate two ideal-typical paths. Minimalist strategies privilege speed and visible returns, but at the expense of sustainability and sovereignty. Maximalist strategies seek upgrading and resilience, but struggle with fiscal and commercial viability in a volatile, capital-intensive sector—and are also undermined by others' minimalist strategies in the same single market.

The analysis draws on a newly compiled, project-level dataset of battery cell manufacturing capacities, tracking gigafactory investments across the EU. It includes information on company headquarters, project status, fiscal support, and an original assessment of risk profiles. Then, a more detailed qualitative inquiry zooms in on all five member states with online capacities as of 2024: Poland, Hungary, Germany, France, and Sweden. The paper investigates how these five countries navigate the nested trade-offs embedded in battery rollout—across three dimensions: climate integrity, industry development, and geopolitical resilience.

The analysis shows that the frontrunners of the battery industrial rollout, Poland and Hungary represent a "fast, fossil, foreign" rollout model, where manufacturing capacity expands rapidly, but at the cost of environmental degradation and limited domestic upgrading. Germany blends minimalist and maximalist elements, combining loosely conditioned foreign direct investment with domestic capability-building. France stands out as the most consistent case of a "slow, sustainable, sovereign" track, pursuing a more costly and risky strategy anchored in domestic firms and cleaner production. Sweden's Northvolt project initially embodied maximalist ambitions but has since collapsed, illustrating the fragility of that model. Across the board, foreign direct investment (FDI) dominates. Ironically, efforts to localize battery production and reduce China-dependence have triggered a surge of Chinese ownership in Europe's strategic battery sector, with little attention to securing domestic spillovers.

An analysis of project viability echoes Brett Christophers' warning—clean-tech industrial rollout hinges on sustained public subsidies and coordinated demand. In fact, the analysis finds that Europe's only battery champions still standing—Verkor, ACC, and PowerCo—are those backed by lead firms with strong state ties. But the 'European champion' model is fragile, especially as minimalist strategies continue to undercut them.

Subverted aims are not a bug: they are wired into an EU policy regime that does not clearly prioritize between its aims or operationalize them in binding ways. Hard trade-offs are not resolved at the center; they are displaced onto member states and firms who respond to their own incentives, eroding the coherence of bloc-wide ambitions.

The paper proceeds as follows. Section 1 situates the argument in the literature on green industrial policy; Section 2 outlines the analytical framework; Section 3 provides an overview of the EU's battery policy; Section 4 presents the dataset and maps the industry's rollout; Section 5 analyzes revealed preferences across five member states, tracing their minimalist and maximalist paths.

1. Battery Bargains over Climate, Development and Geopolitics

The battery industry sits at the crossroads of three major political projects: decarbonization, industrial renewal, and geopolitical resilience. It is a key enabling technology for reaching net-zero, crucial not only for electric vehicles, but also for stabilizing renewable-heavy energy systems (IEA 2024). At the same time, batteries represent a fast-growing high-tech sector with high innovation potential, deeply intertwined with the fate of legacy automotive industries, long the backbone of Europe's manufacturing base. Lastly, batteries have become a locus of geopolitical anxiety, as China's dominance across the value chain fuels fears over dependency, especially their chokehold over key minerals and their processing (Cheng *et al.* 2024). These overlapping stakes have made battery manufacturing into a proxy battlefield for climate, growth and geoeconomic ambitions, all at the same time.

These tensions are at the heart of a vibrant literature on green industrial policy. One influential strand explores how "decarbonizable" sectors became a key actor in propelling net-zero transitions forward (Kupzok and Nahm 2024, 2025, see also: Kelsey 2018, Fischer 2025), by fracturing the fossil coalition that has been blocking climate action (Aklin and Mildenberger

2020). Countries with large manufacturing industries can paradoxically become green leaders—leveraging existing manufacturing bases to build green industries (Nahm 2022). The idea of a "decarbonization bargain" captures this logic: industrial actors are offered fiscal incentives in exchange for decarbonizing. This creates incentives for factions of industrial capital to get on board with climate policies (or stop blocking them), creating "winning coalitions" (Meckling *et al.* 2015). But expanding the coalition comes at a price: the bargain often involves sacrificing stricter environmental aims, or entrenching existing power structures.

While the "bargain" frame highlights productive compromise, other scholars have emphasized the risk of leaving decarbonization to capital. Gabor and Braun (2025) or Wigger (2024), for instance, critique the "financial derisking" approach to green investment, arguing that it allows short-term market logics to dilute and slow down climate action. Extractivism scholarship (e.g. Riofrancos 2017, 2020, Jerez *et al.* 2021) has documented how green industrial expansion rests on sacrifice zones in the Global South: fuelling ecological degradation and social contestation. To put it simply: there seems to be a trade-off between advancing climate justice and local concerns of environmental justice. The cases of Poland and Hungary (as well as EU accession country Serbia) show that extractive dynamics—outsourced environmental damage, autocratic transgressions, limited local upgrading—are now recurring within Europe's internal peripheries, not only on the extractive frontier, but in green manufacturing (Polyák 2025).

The fast-growing, high-tech battery industry understandably captured the imaginations of economic policymakers as a source of innovation and growth (Allan and Meckling 2023). However, industry promotion has different stakes and entails different trade-offs based on industries' development levels (Meckling and Nahm 2019). Given the clear technological dominance of East Asian producers with a minimum two-decade lead, the EU now confronts many of the same challenges faced by late developers elsewhere: (whether and) how to foster ‘domestic champions’ in high-tech sectors dominated by foreign incumbents; how to ensure upgrading beyond low value-added tasks; and how to mobilize foreign capital without entrenching dependency. The literature on late industrialization offers critical insights here. While Amsden (1989) or Wade (2018) emphasized protection for early-stage industries, China charted a different path: conditional openness to foreign investment paired with enforced technology transfer—showing that FDI can serve domestic upgrading, but only with assertive conditionalities (Thun 2006; Sykes 2021). The global production network (GPN) approach argues that embedded FDI can support upgrading—through joint ventures and supplier relationships, local firms can absorb cutting edge technologies (Bridge and Faigen 2022, see also: Mackenzie and Sahay 2024). However, strong absorptive capacity and strategic governance are necessary conditions (Maggor 2021, Bulfone *et al.* 2025). Lacking these, FDI-led growth risks stalling at the assembly stage, and fiscal subsidies may devolve into “corporate welfare” (Bulfone *et al.* 2023).

This risk is not new in Europe’s political economy. Scholars of dependent development (e.g Nölke and Vliegenthart 2009) have long documented how Central and Eastern Europe was locked into a low value-added “workbench” role for the ‘German Manufacturing Complex’ (Ban and Adascalitei 2022). What is striking in the battery case is that this dynamic now stretches into the European core as well, with Korean and Chinese firms far ahead in key technologies. And there are further nested trade-offs involved. For instance, whose competitiveness is the aim—EV-makers’ or battery-makers’? While the EU promotes long-term value capture, the primary actors driving rollout are often legacy automakers—who seek reliable input at minimal cost, not long-term strategic control in the battery sector.

Finally, the geopolitics of the battery industry has attracted significant scholarly attention. Even in the EU, an unlikely case of geopolitical fervor, analysts note a shift away from neoliberal market-making toward (geo)politically infused strategies for securing supply chains and technological autonomy (McNamara 2023; Seidl and Schmitz 2023; Bauerle Danzman and Meunier 2024). But the battery rollout tempers these claims. Despite rhetoric of reducing China-dependence, Chinese FDI has surged. Despite friendshoring aspirations, the sector's frontrunner, Hungary, remains reliant on Russian gas. Despite localization aims, ownership and technological control remains external. In this context, strategic autonomy functions more as an empty buzzword than tangible reorientation.

What emerges across these literatures is a clear pattern: green industrial policy gains political traction by layering multiple goals, but this very layering produces structural ambiguity. In the absence of clear prioritization, binding standards, or institutional enforcement, the door is opened to what this paper terms the *minimalist path*—a strategy that fulfills headline goals on paper, but subverts them in practice.

2. Analytical Framework: The Architecture of Subverted Aims

It is tempting to see the battery industry as serving climate, industrial and geopolitical aims at once—yet the outcome of the industrial rollout can also hollow out, or outright undermine these: polluting gigafactories, foreign-dominated production, and deepening strategic exposure. The analytical framework begins from this puzzle.

2.1. From Trilemma to Nested Trade-Offs

The tensions between the three aims can be framed as a simple trilemma: if one wants a green industry that is competitive and geopolitically resilient (i.e. less dependent on China), something must give (do Prado *et al.* 2025). A decarbonized industry without Chinese involvement is costly, so competitiveness suffers. A sovereign and competitive industry likely requires compromising on green ambitions. And a competitive green rollout today relies on Chinese technological leadership. While policy trilemmas are catchy and fashionable, this stylized model obscures more than it reveals. In practice, each of these goals is itself composed of nested trade-offs—layered dilemmas and internal contradictions that multiply as they are operationalized. Rather than a triangle, we are dealing with a fractal geometry of compromises.

Take climate neutrality. It is not a singular aim, but a cluster of sub-goals: the aim is to decarbonize consumption by producing new clean-tech goods (such as EVs), while simultaneously decarbonizing the production of these goods and ensuring the ecological integrity of rapid industrial transformation. Trade-offs quickly emerge: fast clean-tech buildout (measured in rollout speed) can deliver batteries at scale, but often undermines ecological standards (in terms of the overall footprint of battery production). *Is the priority the fast scale-up of clean-tech, or to ensure that production uses low-carbon inputs and avoids local harm?*

Industrial competitiveness, too, is far from monolithic. Policymakers claim that Europe must secure domestic battery capacity to preserve its industrial strength. But whose competitiveness, and on what time horizon? For legacy carmakers, the immediate priority is securing battery supply to stay afloat in the global EV race. An important priority is safeguarding manufacturing employment and avoiding deindustrialization. A longer-term ambition is to capture high value-added segments of the battery value chain. These goals are not always aligned. Reliance on weakly conditioned FDI and assembly-heavy production does meet short-term job and output needs, but may undermine longer-term projects to foster domestic champions. *Is the priority immediate manufacturing employment and output or future value capture and innovation?*

Strategic autonomy—the most recent addition to the policy trinity—is perhaps the vaguest. Is it about reducing reliance on China? Securing less remote suppliers, regardless of ownership? Building technological sovereignty through domestic champions? Reducing geopolitical exposure? The ambiguity of the aim opens it to capture: this is how Chinese-owned gigafactories, powered by Russian gas in a geopolitically misaligned, autocratic member state can be rebranded as supply security. *Does producing in Europe suffice, or does ownership and geopolitical alignment also matter?*

Taken together, these nested trade-offs trace out different pathways of industrial rollout: a minimalist and a maximalist path (Table 1).

Aim	**Minimalist path** (Subversion risk)	**Maximalist path** (Viability risk)
Climate Neutrality	**Fast clean-tech rollout** Rapid rollout on fossil-heavy grids; attracts and sustains investment by weakened environmental standards	**Sustainable production** Ensures that production uses low-carbon inputs and avoids local harm
Industrial Competitiveness	**Jobs and output now (via FDI)** Jobs and output via weakly conditioned FDI in low value-added segments; automakers' short-term needs trump long-term technological sovereignty	**Long-term domestic capabilities** Secures future value capture and innovation by fostering 'domestic champions' and/or disciplined FDI

Strategic Autonomy	**Physically localized production** Secures more proximate suppliers, but disregards ownership and control; blind to the geopolitical risk of an autocratic member state	**Reduce geopolitical exposure** Prioritizes domestic ownership and geopolitical alignment

Table 1. Aims, nested trade-offs and rollout paths

2.2. Three Structural Drivers of Subversion

The subversion of policy aims in the EU's battery strategy is not accidental; it is structured by three interlocking features of the policy regime that shape how member states and firms respond to incentives.

First, the entire rollout is governed by a logic of urgency. Automakers must meet tightening emissions targets, gigafactory construction has long lead times, and climate goals loom large on the horizon. In this context, the overriding priority becomes deployment speed. Foreign firms with turnkey technologies and deep financial resources hold a structural advantage, as they can deliver capacity quickly. Conditionality, whether aimed at environmental performance or local value capture, is a barrier to rollout, especially in the onerous bureaucratic form the EU tends to do it (Schmitz *et al.* 2025).

Second, while the EU offers funding streams disbursed by Brussels, most subsidies are spent on the member state level, with minimal oversight in the post-COVID regime. This decentralization, in a highly competitive investment landscape, produces a race to the bottom. States also compete to attract battery projects by offering generous incentives and lax regulatory frameworks.

Peripheral member states often go furthest. Even well-intentioned EU instruments cannot compensate for this fragmentation in the absence of robust enforcement mechanisms.

Third, where environmental and strategic conditions do exist, they are often too vague, inconsistently applied, or lacking credible enforcement. The European Commission's ability and willingness to monitor and sanction non-compliance remains limited, especially in politically sensitive domains. This creates an institutional environment in which the rhetoric of industrial transformation is not matched by accountability. Firms can accept subsidies with few strings attached, and governments can circumvent EU-level environmental standards with few consequences.

In such a landscape of vaguely defined goals and layered trade-offs, the clearest way to discern policy priorities is through revealed preferences. When the objectives of climate integrity, geopolitical resilience, and industrial competitiveness collide, the first two are routinely sacrificed. Competitiveness—narrowly defined as job creation and the short-term interests of Europe's automotive sector—takes precedence.

3. Lacking Coherence: The EU's Real Existing Battery Strategy

While the EU has branded batteries as a cornerstone of its green industrial policy drive, there is no single, unified bloc-level strategy governing the sector. What exists is a layered regime: a patchwork of member state and firm strategies operating beneath a thinner EU-level framework that adds rules, incentives and funding streams, but fails to impose coherence.

The European Commission has long framed batteries as a strategic value chain, with the launch of the European Battery Alliance (EBA) in 2017 marking the first coordinated attempt to foster a domestic industry (Di Carlo and Schmitz 2023). At the time, automakers showed little interest in developing battery capacity themselves, viewing batteries as mere commodities. The Commission stepped in to "convene" stakeholders, with Commissioner and later Battery Tsar Maroš Šefčovič portraying the lack of investment as a market failure that demanded soft industrial policy: "getting the right people in the room" (Milne and Hall 2019). But while these early coordination efforts helped to shape a common narrative, member states and legacy automakers remained the central actors in shaping rollout.

How the EU drove battery industrialization forward was less through industrial policy, but the momentum of climate policy. The adoption of the European Green Deal in 2020 and the Fit for 55 package created a strong regulatory push: a legally binding 55% net emissions reduction target by 2030, and an EU-wide phaseout of internal combustion engine (ICE) vehicles by 2035. While conservative calls to walk back on the phase-out have been intensifying (e.g. Mathiesen *et al.* 2024), the target has gone a long way to anchor expectations and steer investment.

But as mentioned above, the climate objective also has nested trade-offs. How do EU-level interventions navigate the tension between fast rollout and clean production? There are important signs for a more maximalist orientation, notably the New Battery Regulation 2023/1542 (adopted in July 2023), which mandates traceability, recycling, and sustainability criteria for batteries sold in the EU. It has a promising mandate to disclose batteries' overall lifecycle carbon footprint, and introduce a carbon threshold, binding from 2028, to be determined by the Commission. But its effectiveness remains doubtful—the Commission, in its discretion, may be reluctant to set the threshold in a way that undermines EU industry. Through numerical targets, it is also difficult to capture ecological damage created by regulatory forbearance or increased water stress.

On the development side: do EU-level policy actions prioritize short-term employment and output or long-term value capture? EU officials' communications often conflate foreign firms' assembly lines with 'European' production. However, in actual policies, there is clear sensitivity towards meaningful value capture. The EU's flagship industrial policy instrument, the Important Projects of Common European Interest (IPCEI) framework explicitly targets R&D and high-value-added segments, and excludes mass production subsidies (Lopes-Valença 2024). Acknowledging the growing dominance of Chinese players, the Commission also announced that its new €1 billion funding stream for battery investments will include technology transfer requirements from foreign investors (Hancock *et al.* 2024); again suggesting that they are attuned to questions of domestic upgrading and aim for a more 'maximalist' understanding.

But maximalism in EU-level subsidy design is counteracted by another, far more consequential measure—the loosening of national state aid. Historically, strict competition rules prevented member states from subsidizing domestic industry. That changed in the wake of the COVID-19 crisis. As Di Carlo, Eisl, and Zurstrassen (2024) show, the level of state aid more than doubled after 2020, peaking at 2.2% of EU GDP. New guidelines issued in 2021 explicitly welcomed state support for the twin green and digital transitions. The two IPCEIs on batteries provided an amount of €6.1 billion to 12 member states' 74 individual projects (EPRS 2022). Various EU-level grants and loans provided an additional €1.6 billion for the entire bloc in the 2014-2020 period. But EU-level funding streams are dwarfed by member state level subsidies. To compare: aid by tiny Hungary amounted to around €1.5 billion support to its battery gigafactories—and that is only the tip of the iceberg, as it excludes subsidies to firms in the rest of the battery value chain (e.g. component manufacturers, recycling plants). Foreign players subsidized in Hungary will then compete with 'European champions' subsidized elsewhere—creating clear policy incoherence.

In sum, EU policy points toward an ambitious maximalist path in the climate and development domains—but it is shallow in enforcement. Member states remain free to choose a minimalist route: prioritizing speed and foreign investment over sustainability, value capture, or technological sovereignty. And nowhere is this asymmetry more visible than in the geopolitical dimension, where EU-level engagement is the weakest.

While academic and policy discourse increasingly invokes the idea of a "geopolitical turn," the EU's battery manufacturing rollout remains strikingly non-geopolitical in practice. Chinese firms are not only welcomed but actively subsidized across the bloc—not just in Hungary, but also in Germany, Portugal, and Spain (see section 4 below). In stark contrast to the United States, where *Foreign Entity of Concern* (FEOC) provisions exclude Chinese firms from federal subsidies and where political pushback spans from local activists to federal lawmakers (e.g. Zhou 2025), the EU has rejected this emerging "Cold War II" framing. This permissive stance persists despite the existence of an EU-level foreign investment screening mechanism, adopted in 2019 (Bauerle Danzman and Meunier 2024). While scrutiny has increased in sectors like semiconductors and critical infrastructure, battery investments appear to be an exception (Kratz *et al.* 2023). The EU's screening framework lacks centralized enforcement and leaves final decisions to member states—many of whom actively court Chinese firms. Although the Commission has begun retroactive enforcement under the new Foreign Subsidies Regulation, notably probing BYD's Hungarian plant (Bounds *et al.* 2025), these interventions are reactive and rare. In practice, a credible geopolitical steering of the battery rollout remains largely absent.

The next part of the paper delves into the revealed preferences analysis—sections 4 starts with a mapping of the headline numbers, section 5 then turns to the empirical markers of the minimalist and maximalist pathways.

4. Mapping Europe's Battery Buildout

Europe's battery cell manufacturing rollout is accelerating rapidly, but the patterns of investment, ownership, and project viability vary starkly. Drawing on a novel project-level database of operational, announced and cancelled gigafactory projects based on a monitoring of news media and firms' public communications, this section maps the current state of the sector in the EU. The analysis is limited to battery cell manufacturing projects with planned capacities of 2 GWh or more. While other segments of the value chain—such as component manufacturing, pack assembly and recycling—are also important, capital-intensive cell manufacturing gigafactories serve as anchor projects that structure local industrial ecosystems. Three dimensions are examined in turn: operational and planned capacity by member state and company headquarters; the status and risk profile of projects (online, low risk, high risk, cancelled) and fiscal support.[1] These empirical patterns reveal a fragmented landscape, and a clear lead for minimalist strategies.

4.1. Uneven Capacities – Who's Building What and Where?

By 2024, the EU hosted 209 GWh of nominal capacity in operation (Table 2). Korean-headquartered firms dominate the installed base. European firms account for only a

[1] The initial list of projects draws on data collected by VDI Innovation + Technik (Bünting and Giringer 2025), the Transatlantic Clean Investment Monitor by Bruegel (Jugé *et al.* 2025) and Transport & Environment (Racu 2023). Data on additional projects, company headquarters, project status and fiscal support is collected by a monitoring of companies public announcements, the news media and EU state aid databases. There is a risk that the monitoring did not capture all projects; the alignment with other analysts' work lowers this risk.

sliver of online production. Five member states have led the way in the rollout: Poland, Hungary, Germany, France and before Northvolt's collapse, Sweden.[2]

Looking toward 2030, total planned capacity is slated to increase more than fivefold, reaching over 1,125 GWh (Chart 1).[3] To put planned capacities in context of industry needs, using a rough back-of-the envelope calculation: in 2022, approximately 13 million cars were produced in the EU. If each of these vehicles were equipped with a large 80 kWh battery,[4] the total required battery capacity would be around 1,033 GWh. This suggests that the EU objective is to keep the automotive industry in its current size—as large as it is because of its strong export orientation.

Country	**Company**	**HQ**	**City**	**Capacity** (GWh)
Poland	LG Energy Solution	Korea	Wrocław	86
Hungary	Samsung SDI	Korea	Göd	40
	SK Innovation	Korea	Iváncsa	20
	SK Innovation	Korea	Komárom	18
France	ACC	Domestic	Douvrin	15
Germany	CATL	China	Erfurt	14
Sweden	Northvolt*	Domestic	Skellefteå	16
				209

Table 2. Battery cell manufacturing gigafactories in operation, nominal capacities, as of 2024.
*Production at Northvolt's Skellefteå site was discontinued on 31 June, 2025.

[2] France's AESC/ Envision, a Chinese-headquartered gigafactory with 10 GWh going online in June 2025. At the point of data collection, Sweden's Northvolt was operational with 16 GWh of capacity, about to be discontinued by mid-2025.

[3] The planned GWh numbers are maximum capacities, and firms can always choose to produce less.

[4] Average Battery Capacity (kWh) of Available BEV Models per Year. Data: European Commission (2025)

European firms, including ACC and Verkor (France), or PowerCo (Germany), are projected to make up roughly a third of this total—an improvement, but still leaving them behind Chinese companies, who claim the largest single share; either in standalone projects (CATL, AESC, EVE), or joint ventures (CATL/Stellantis, Gotion/InoBat). Korean and Taiwanese firms also remain major players. In aggregate, more than 65% of Europe's future battery supply is expected to be controlled by non-European firms.

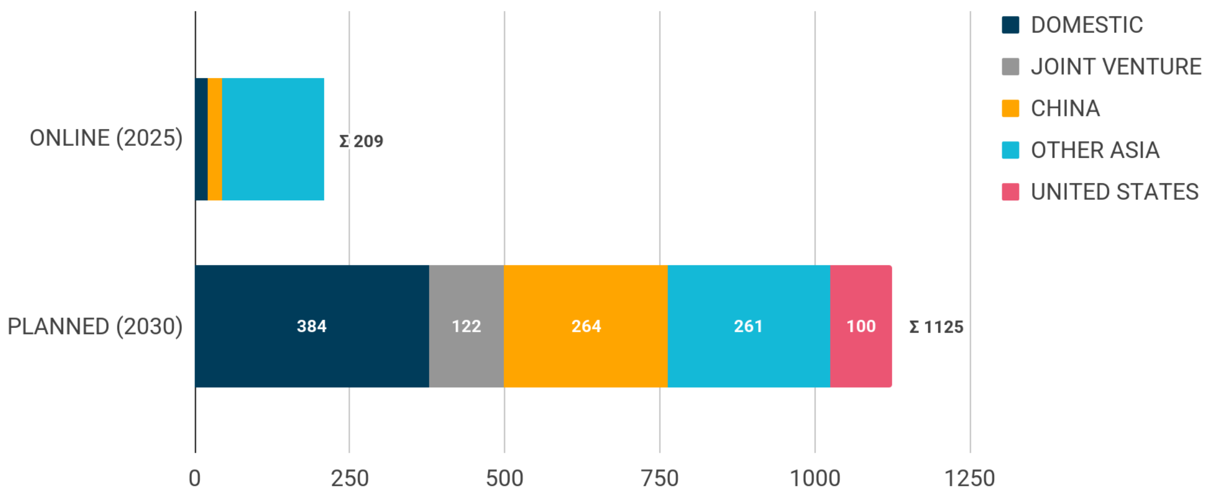

Chart 1. Planned battery manufacturing capacities in the European Union by company headquarters. Operational and planned gigafactory projects (GWh/a; planned: maximum capacities)

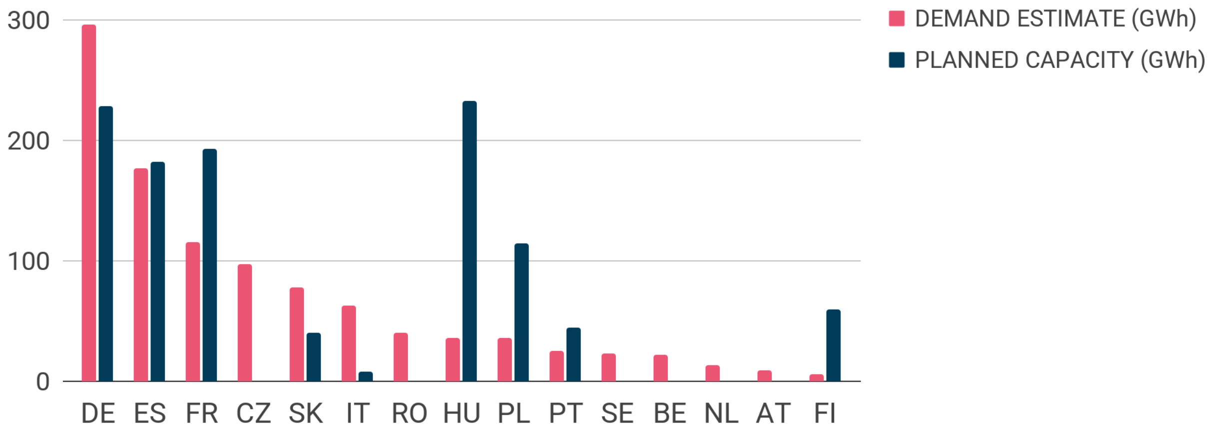

Chart 2. Planned capacities compared to demand estimates (Demand: capacity needed to cover 2022 vehicle production)

As shown in Chart 2, there is substantial variation between planned capacities across member states, and industry needs don't explain these patterns. Hungary and Germany plan the largest capacities in absolute terms – but while German plans are more or less in line with projected demand, Hungary is a class of its own with over 200 GWh more capacity than demand, implying a strongly export-oriented strategy.

Looking at the breakdown by member states and investor firms' company headquarters (Chart 3), one notable exception to the broader FDI-led pattern is France, which has pursued a strategy anchored by domestic champions. France has the highest planned *domestic* capacity in the EU, with projects led by Verkor, ACC, and BlueSolutions. These firms are embedded in supply relationships with Renault and Peugeot (Stellantis), both of which maintain institutional ties to the French state, enabling a longer-term industrial strategy.

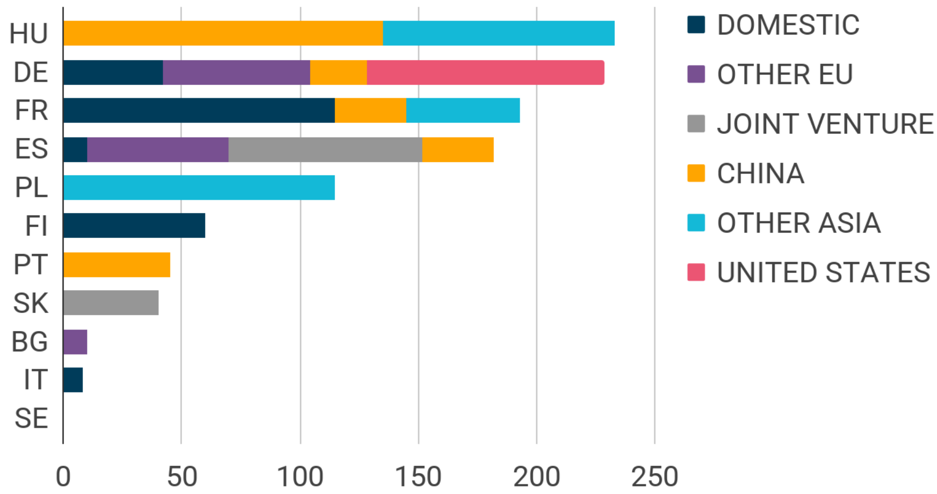

Chart 3. Planned battery manufacturing capacities in the European Union by member state and company headquarters (GWh/a, maximum capacities).

4.2. Volatile Pipelines and the Risk Gap

Planned capacities are very volatile—these are multi-year, capital-intensive projects, and planned capacities are getting announced, even break ground, then often getting downsized or cancelled. This volatility is partly driven by slower-than-expected customer uptake, with weak EV sales cascading down the whole value chain (Bünting *et al.* 2024). In this environment, the analysis of risk profiles shows a clear viability gap between domestic and foreign-led projects: while Chinese and Korean projects are online or advancing on schedule, European projects are faltering. The most high-profile cancellation was of course Northvolt. ACC, the consortium backed by Stellantis, TotalEnergies, and Mercedes-Benz, has also cancelled two major projects: one in Germany and another in Italy (Piovaccari 2024). Across the period under scrutiny, 356 GWh worth of projects were cancelled or abandoned—equivalent to a quarter of the EU's project pipeline. While online projects are overwhelmingly foreign (85%), cancelled projects are overwhelmingly domestic (86%) (see Chart 4).

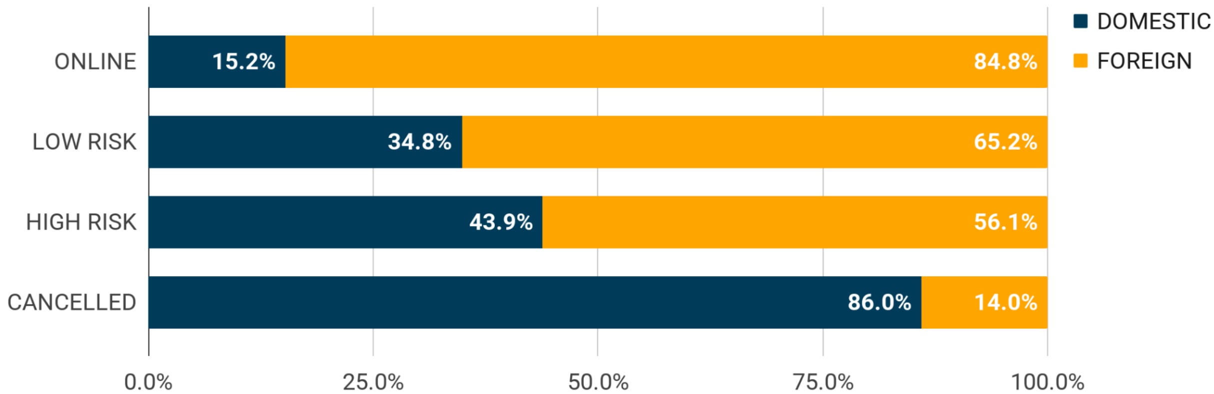

Chart 4. Operational and planned battery manufacturing capacities in the European Union by risk profile and headquarters (% of category total; as of 2024)

Around one third of the pipeline—342 GWh worth of projects—can be categorized as 'high risk,' either because of uncertain financing, repeatedly postponed timelines, or unresolved permitting and political hurdles. This includes projects such as Northvolt's German gigafactory in Heide, which is still officially underway despite the parent's insolvency; Tesla's expansion near Berlin, long stalled by local opposition; and projects with no confirmed construction schedules or investor commitments.[5] Out of the 342 GWh high risk capacity, 180 GWh is concentrated in Germany.

Public subsidies for battery gigafactories are substantial—amounting to €7.8 billion across the EU—and there is a clear connection between fiscal support and project viability, as anticipated by the literature (e.g. Christophers 2025, Driscoll and Blyth 2025). As Table 3 shows, average support is much lower for the cancelled projects (€67.3 million) compared to the online (€236 million) and low risk (€273.6 million) categories.

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[5] Five projects and two announced extensions are designated as high risk; the replication dataset includes detailed justifications.

	Total fiscal support (million €)	**Number of projects**	**Average fiscal support** (million €)
ONLINE	1,652. 3	7	**236.0**
LOW RISK	4,650.6	17	**273.6**
HIGH RISK	700.0	5	**140.0**
CANCELLED	807.0	12	**67.3**
	7809.9	**41**	

Table 3. Fiscal support to battery gigafactories by risk profile

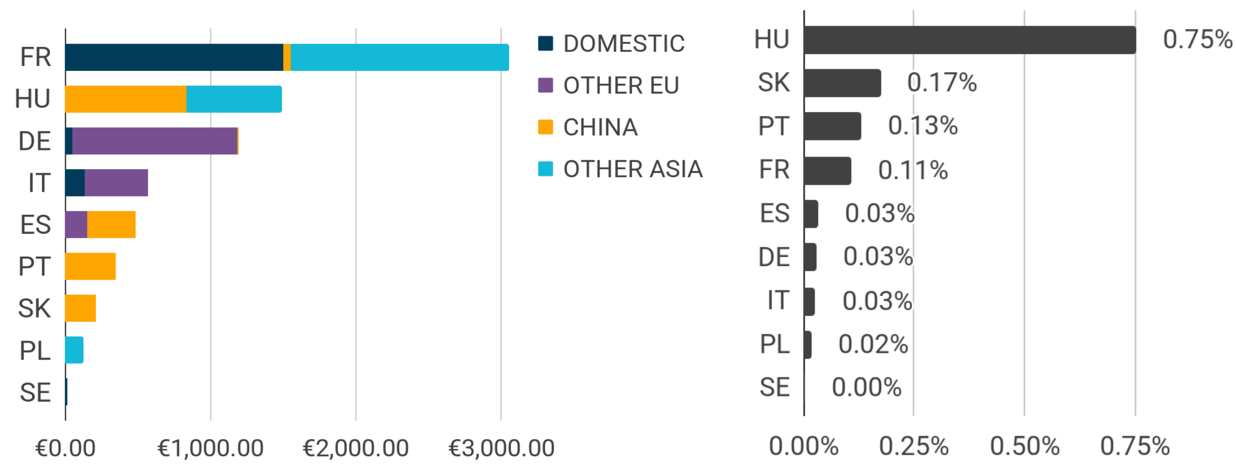

Chart 5. Left panel: Fiscal support to battery gigafactories by member state and receiving company headquarters (million euros). Right panel: fiscal support, % of national GDP.

In many cases, investors explicitly justify project cancellation because of a failed or rejected subsidy deal with the government; Belgian ABEE, for instance cancelled two potential sites (in Wallonia and Romania) citing this reason, and Chinese SVOLT bemoaned the "unevenly distributed subsidies" as it stopped two projects in Germany.

The distribution of subsidies also reveals sharp national differences (Chart 5). The variance is not explained by usual metrics of fiscal space or core-periphery status, rather showing diverging strategies and ideologies. Notoriously debt-laden France is the most generous spender in nominal terms: it has committed around €1.5 billion to domestic champions, and the same whopping amount to Taiwanese ProLogium. At the opposite end of the spectrum, Sweden has spent a meager €15 million—refusing to step in and bail out Northvolt. As a proportion of GDP, Hungary stands out as a clear outlier: while its entire project pipeline is foreign-led, it devotes 0.75% of GDP to gigafactory subsidies—over four times more than the next highest spender, Slovakia. Poland, by contrast, also hosts a 100% foreign-owned pipeline, but has kept subsidy levels modest, even while operating the EU's largest battery plant.

4.3. Power Brokers: How Europe's Top Automakers Shape the Battery Map

Another ingredient to project viability is whether or not the batterymaker has anchor contracts (long-term purchase agreements) with a lead OEM.[6] In fact, Europe's 'TOP5' legacy automakers are not passive recipients of government policy, but actively shaping the rollout and the fate of these projects.

Volkswagen follows an experimental, multi-pronged strategy. Through its battery subsidiary PowerCo, it originally planned six European gigafactories, but has scaled back to two (Salzgitter and Valencia). While pursuing the PowerCo project, VW also spread its bets: it held a 21% stake in Northvolt before writing it down, invested in U.S.-based QuantumScape, and acquired 26% of China's Gotion High-Tech—the first direct equity stake by a global automaker in a Chinese battery firm.

[6] OEM stands for Original Equipment Manufacturer, referring to carmakers at the top of the automotive value chain.

Stellantis has shifted from a domestic champion model toward a more pragmatic approach. It co-founded Automotive Cells Company (ACC) with TotalEnergies and Mercedes-Benz and initially committed to three sites in France, Germany, and Italy. But after cancelling the German and Italian projects, it pivoted to a €4.1 billion joint venture with China's CATL to build an LFP gigafactory in Zaragoza. The Douvrin site in France remains on track, slated to supply Peugeot and Opel EV models.

Mercedes-Benz, while a co-owner of ACC, has not anchored any domestic battery project itself. Instead, it has become a core customer of CATL. Its strategy reflects a classic outsourcing logic: secure supply through long-term contracts with globally competitive firms.

BMW initially backed Northvolt but chose to exit, cancelling a €2 billion supply contract in 2024 due to delays and quality issues—a major factor in the firm's collapse. It has since fully shifted to sourcing from Chinese suppliers CATL and Eve Power, located next to its future plant in Debrecen, Hungary. BMW's strategy prioritizes cost-performance and rollout speed, as opposed to a more patient strategy to foster domestic champions.

Renault is a strong case of strategic domestic anchoring with a diversified global sourcing strategy. It holds a 20% stake in Verkor and has secured a long-term supply contract for 12 GWh/year. The Verkor gigafactory in Dunkirk is backed by a €200 million investment from Renault. At the same time, Renault collaborates with multiple foreign firms (Envision, ProLogium), and also Gotion High-Tech near its Moroccan assembly plant.

Across these divergent strategies, a pattern emerges: Europe's only major battery champions still standing—Verkor, ACC, and PowerCo—are all backed by automakers with direct state ownership or strong state links. The French state holds around 15% of Renault shares and through its investment bank Bpifrance, also retained a minority stake in Peugeot (now part of Stellantis). Volkswagen is part-owned by the German state of Lower Saxony. These institutional linkages appear to play a critical role in sustaining capital-intensive battery ventures through early volatility, enabling longer time horizons. By contrast, BMW and Mercedes-Benz are both without such ties (notably, the latter has two major Chinese firms among its top shareholders), and they have withdrawn from or bypassed European champions entirely, opting instead for Chinese suppliers. Confirming the argument developed by Hehenberger (2025), stable demand from a lead OEM appears decisive for successful clean-tech rollout; in this case, this demand is politically anchored.

5. Minimalists or maximalists? Revealed Preferences Analysis

After the overview of the rollout in the headline numbers, this section builds a typology of rollout pathways—by taking a closer qualitative look at country cases, and tracing how they navigated the nested trade-offs embedded in each of the aims: climate neutrality, industrial development, and geopolitical resilience. For each three aims, the analysis looks at revealed preferences through relevant empirical markers, and categorizes the path taken as either minimalist (shallow, expedient, loosely aligned with headline objectives) or maximalist (strategic, anchored, more substantively aligned with those aims). The focus is on all five member states with operational battery cell capacity as of 2024: Hungary, Poland, Germany, France, and Sweden.

5.1. Nested Climate Trade-Offs: Quick Rollout or Clean Production?

Climate neutrality bundles together multiple nested goals: scaling clean technologies, decarbonizing production processes, and safeguarding environmental integrity. These objectives can reinforce each other—but just as often, they collide. Paradoxically, there is a nested trade-off between climate policy, which prioritizes reducing greenhouse gas emissions at scale, and environmental policy, which seeks to protect ecosystems, water resources, air quality, and local populations from harm. The green transition is a rapid, unprecedented industrial transformation, governed by a logic of urgency. As such, it inevitably brings about local costs—including ecological damage, often concentrated in vulnerable, disenfranchised communities. In the absence of credibly enforced, binding bloc-wide standards, the door is opened to what this paper terms the *minimalist path*—a strategy that fulfills headline climate goals on paper (e.g. clean tech rollout), but subverts them in practice by allowing dirty production processes and localized ecological degradation. The key trade-off here is between fast clean-tech buildout and high-emission, ecologically damaging production processes. And across much of the EU, the balance has tilted sharply toward rollout speed.

The minimalist path is most visibly entrenched in Hungary and Poland—frontrunners in operational capacities. In both countries, fast rollout came at severe ecological costs. Researchers and environmental organizations have flagged that both countries had adopted national regulations on N-metil-2-pirrolidon (NMP)—a toxic solvent widely used in battery cell manufacturing—that violate existing EU air quality standards (Meunier and Ponsa Sala 2025). In Hungary, this is part of a broader pattern: as Éltető (2024) meticulously documents, the government has actively pursued a strategy of regulatory forbearance to fast-track these projects. Rollout speed was exceptional. In an industry where multi-year delays are the norm, Hungary's SK plants were the only ones starting production *ahead* of schedule. Investors were courted with promises of exemptions from environmental impact assessments, accelerated permitting, and permissive interpretations of environmental law. In Göd, where Samsung operates one of

Hungary's major battery plants, toxic chemicals were found in the groundwater—a civil society group had to organize the probe after both the company and authorities refused to act, and the designated monitoring well was later discovered to have been deliberately buried by Samsung (Bodnár 2023). Local residents have mobilized in response to pollution risks and water stress, but these protests have been either ignored or actively suppressed by the regime (Ricz and Éltető 2025).

Germany, though much slower in rollout, offers its own version of the trade-off. While its environmental standards remain more robust, its grid is still highly carbon-intensive. Environmental justice movements raised serious concerns about Tesla's gigafactory in the Berlin-Brandenburg area (Krantz 2024). Activists and experts rallied against the excessive water use of the factory, comparable to a city of 30,000 (Allyn 2022), and the fact that the plant is located in a water-scarce area (Leibniz Institute 2021), which already faces frequent droughts that will only exacerbate with climate change. In a similar dynamic to the Hungarian case, investments are challenged by local communities and climate activists.

Battery manufacturing is highly energy-intensive, so the overall ecological footprint also depends greatly on the source of energy. Chart 6 makes this tension tangible. It juxtaposes current operational capacity with the carbon intensity of national power sectors. Poland is leading the pack, with 86 GWh already online—while also having the dirtiest power sector in the bloc. Its electricity grid, still heavily reliant on coal, emits more than 615 gCO_2 per kWh. This figure is higher than that of China (560 gCO_2 per kWh), even though the European Commission justifies its battery onshoring efforts partly on the grounds that batteries in China are made "with environmental standards that lack our ambition" (von der Leyen 2021).

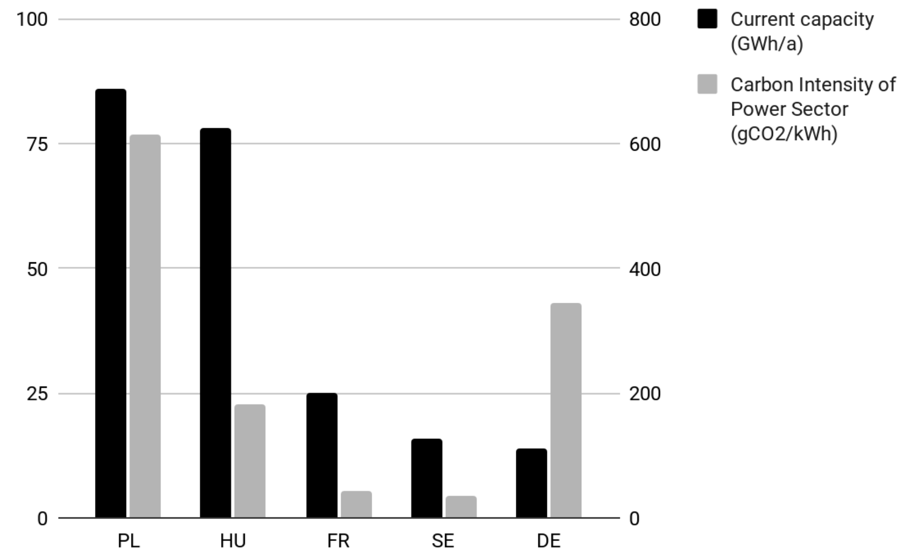

Chart 6. Current battery manufacturing capacity and carbon intensity of power sector (RHS) Data on carbon intensity: Eurostat

Hungary's grid is much cleaner by comparison, but still heavily gas-dependent, and this dependency is projected to grow. The industry is planned to be fueled by two new gas power plants, locking in fossil-dependence through new infrastructure, built explicitly to service the new industry (Orbán 2023). Germany breaks the pattern – with a high-emission power sector, but slow rollout. France's much cleaner grid, powered predominantly by nuclear energy, is coupled with modest rollout speed. Sweden's power sector is by far the cleanest among EU manufacturing sites. Its battery industry was slated to run on 100% renewables and benefiting from low water stress due to its colder climate (reducing cooling needs); promising the cleanest production profile in the bloc (Győrffy 2024). The collapse of this trajectory marked a significant setback in clean battery production.

It is implausible to assume a causal effect here; there is little evidence to suggest that fossil-heavy grids were a deliberate draw for battery investors, or that clean production contributed to Northvolt's downfall. In fact, industrial electricity prices are significantly lower in countries like Sweden and France, powered by renewables and nuclear, respectively. This suggests that the carbon intensity of battery production was simply not a decisive factor in firm location decisions—nor in public subsidy decisions. The aim of this exercise is to show that the EU fails to make clean production a meaningful criterion at all, and allows member states to pursue aggressive capacity expansion without addressing the climate integrity of production. This is the heart of the climate subversion risk.

Notably, there is no credible EU-level mechanism to reward cleaner production. The Carbon Border Adjustment Mechanism (CBAM) aims to equalize emissions costs between EU and non-EU producers, but within the single market, the EU tolerates these discrepancies. The new battery regulation (see Section 3), which foresees thresholds on carbon footprint and mandating recycling compliance, could potentially serve this function—but its details, including the enforcement mechanisms remain unclear, and it is not yet operational. Tellingly, the European Commission did conduct state aid probes into Hungarian subsidies for Samsung and SK, but green-lit the projects without addressing the environmental dimension at all, ignoring environmental dumping as an unfair competitive practice. Credible enforcement would go a long way to remedy these problems.

5.2. Nested Developmental Trade-Offs: Secure Jobs and Output (via FDI) or Foster Domestic Champions?

The promotion and protection of industry is clearly tied to Europe's climate ambitions. This becomes especially apparent if we draw up a hypothetical climate-only pathway. If climate neutrality was the sole goal, we would see a shrinking car industry and aggressive investment into trains or bicycle networks (at least on a comparable scale to battery factory subsidies)—to fundamentally reshape mobility systems to be less car-dependent. But even when it comes to EVs, a faster and cheaper decarbonization pathway could easily be importing batteries or even entire EVs from China and Korea, where production is more cost-effective and technologically advanced. Instead, the EU pursues decarbonization while simultaneously shielding domestic industry and manufacturing jobs—particularly in the automotive sector. When these aims conflict, it is typically industry that prevails. That said, the green industrial agenda is not reducible to industry promotion alone. If that were the case, the EU and its member states would simply drop the internal combustion engine phaseout and avoid decarbonization altogether.

Like climate neutrality, the goal of industrial development is not a single aim but a bundle of often conflicting sub-goals. What economic benefits does a localized battery industry really bring to Europe? Here, confusion is widespread. Policymakers often emphasize two headline facts: that the battery accounts for up to 40% of an electric vehicle's total value, and that the global battery market could reach an annual value of €250 billion. These figures—especially the latter—have taken on near-mythical status, even lending their name to the European Battery Alliance's flagship industrial development program, EBA250. Yet what is rarely acknowledged is that these figures will not be captured by the *minimalist path*—one that merely localizes the assembly of foreign-owned gigafactories, while the high value-added segments of the value chain, like R&D or design, still remain offshore.

It is often unclear if the main objective is job creation or long-term industry development. Employment is certainly a key priority: the automotive sector remains the backbone of European manufacturing, directly and indirectly employing 13.8 million people (6.1% of the EU's workforce); protecting these jobs is understandably crucial. There are widespread fears that the continent will see its industrial base diminish, with jobs relocating to China in a new wave of deindustrialization driven by dominance in green technologies—a pattern German industry saw in the case of the photovoltaic sector (Ergen 2015). Jobs are also a key objective (if not *the* key objective) of both FDI-based and domestically anchored strategies. France's Battery Valley project was explicitly designed as a reindustrialization effort in an economically distressed region (and far-right stronghold), in a bid to address political discontent through place-based industrial renewal.

The distinction between the minimalist and maximalist paths diverge on the question of domestic upgrading. The nested trade-off is a difficult one: FDI is fast, visible, brings jobs and can be secured with fiscal incentives. Yet it risks reproducing the pitfalls of earlier waves of low-value-added manufacturing (and foreign capital is more footloose, risking the longevity of job-creation). Without securing innovation spillovers, the bulk of value added remains offshore. The maximalist path aims to address this, not by rejecting FDI, but by disciplining it. The empirical markers of this strategy are efforts to develop local industrial ecosystems, or tools like local content requirements or technology-sharing mandates.

The minimalist path logic is starkly visible in Hungary and to a lesser extent, Poland, where the battery boom has taken off through a foreign-led buildout. In Hungary, the subsidy rate is off the charts (see 4.2 above), but there are no technology transfer requirements or local ecosystem development (Meunier and Ponsa Sala 2025). Some Hungarian firms have reported being effectively shut out of supply chains: "they told us they have their suppliers from the Far East lined up for the next 17 years," one CEO complained (Lakatos cited by: Győrffy 2023). Local R&D activity is minimal, and the absence of a broader battery ecosystem is striking in the Hungarian case (with zero IPCEI-funded projects), but better in the Polish case (9 projects). In both countries, job numbers are impressive, but these are mostly low-skilled, three-shift assembly line positions. Jobs in Hungary's battery industry are notoriously prone to gross labor rights violations, including breaches of minimal safety standards (Merk *et al.* 2024)—a far cry from quality job creation, especially given the subsidy rate.

Germany offers a more mixed picture. While the country is home to substantial foreign capacity (CATL), it also hosts domestic players like VW's PowerCo and it has the most local firms involved in the EU's IPCEI funding framework (27 projects out of 56). This is a strong signal for domestic ecosystem depth, which is the best pathway for organic innovation spillovers and eventual value capture. Germany's strong industrial base, skills regime, and public R&D institutions offer an enabling environment for potential upgrading, but more explicit efforts for technology transfer are so far missing. A high-tech industrial region like Germany does not need to emulate Chinese levels of assertiveness in technology transfers, but a fully passive approach will also be unlikely to yield results.

France comes closest to embodying a conscious developmentalist strategy. It has three gigafactories—Verkor, ACC, and BlueSolutions—that are domestically headquartered, with strong ties to French automakers (Renault, Peugeot/Stellantis). The projects are backed by French state support and offtake guarantees, exemplifying a strategic effort to build local capacity with patient capital. This does not mean France will succeed where others failed; French battery production has not yet reached commercial viability. It is also a highly costly strategy for a fiscally constrained member state, often in the crosshairs of the European Commission's budget disciplinarians. But it is the clearest case of a maximalist strategy—subsidizing domestic firms, embedding them in OEM ecosystems (including anchor contracts), and attempting to control a larger share of the value chain.

France also offers the only case of explicit conditionalities for technology transfer in its subsidy design. ProLogium, the Taiwanese solid-state battery firm's €5.2 billion gigafactory project in Dunkirk received €1.5 billion in French public support—making it the most heavily subsidized battery plant in Europe (and showing just how costly the developmentalist path is). As part of its subsidy agreement, ProLogium committed to sharing technical results gained through the project (ProLogium 2023).

Finally, Sweden offers a cautionary tale of a defunct maximalist path. Northvolt was envisioned as Europe's domestically owned, R&D heavy battery champion. But the project collapsed after a series of delays, cost overruns, quality concerns, and shareholder exits. Unlike its EU peers, Sweden provided minimal fiscal support, letting the company fail. Sweden's battery strategy now looks hollowed out—leaving no large-scale capacity and no fallback domestic player. The only viable option now is to pivot toward a minimalist path, and draw in foreign capital to salvage the stranded assets. A low share of a viable foreign-led industry may be better than total exclusion. Sweden's experience underscores that ambitious transformational strategies can unravel without sustained public investment and political commitment.

5.3. Nested Geopolitical Trade-Offs: Less Remote or More Sovereign?

"Strategic autonomy" aims for more domestic control over critical supply chains, heeding Farrell and Newman's (2019) influential warnings on "weaponized interdependence". EU officials fully embraced this rhetoric, verging on the dramatic. As the EU Court of Auditors warned (2019): "The EU must not end up in the same dependent position with batteries as it did with natural gas; its economic sovereignty is at stake." Its report then went on to assess the rollout of manufacturing capacity located in the EU, without much attention to ownership or control of these projects. This misses the point: Europe's vulnerability in the case of Russian energy was not merely about imports—it was about *a hostile actor* owning and controlling those imports.

Like the previous two goals, geopolitical resilience involves nested trade-offs. One of the most important ones lies between securing more proximate suppliers and establishing political and technological control. The minimalist path can indeed deliver foreign-owned gigafactories located on EU soil, and help protect against supply chain disruptions like those seen during COVID-19 lockdowns or shipping crises on the Red Sea and Suez Canal. But it does little in the face of a broader geopolitical breakdown. If the concern is that China might restrict exports to Europe's automakers—say, in the event of a Taiwan conflict that prompts EU sanctions—then having the factory physically located in Europe offers limited protection. In theory, the host country could expropriate the facility. But that is far less likely if the host is Hungary, a close ally of China, or Germany, whose reluctance to seize Russian assets signaled the limits of such contingency planning.

Despite talk of a "geoeconomic turn," the battery industry's early developments reflect few signs of this. Automakers prefer proximate suppliers not for geopolitical reasons, but to reduce transport costs—especially for heavy and hazardous materials—and to stay close to design and engineering teams. In this context, "strategic autonomy" often serves more as well-sounding symbolic cover than guiding principle.

Nowhere is this clearer than in Hungary. The country not only welcomes record amounts of Chinese FDI but even Chinese police patrols in Budapest (Zgut-Przybylska 2024). Russian dependence is another factor. 95% of Hungary's natural gas imports and 100% of nuclear fuel came from Russia before the invasion of Ukraine. While other EU states sought to decouple, Budapest signed a new gas deal in September 2022 (Simeonova 2023). There are fresh efforts from the EU's side to enact a bloc-wide phase-out from 2028 onwards (European Commission 2025), this time, circumventing veto threats from opposing Hungary, Slovakia and Austria. But given the EU's track record in enforcement, the phase-out remains an uphill battle.

Concentrating one-fifth of the EU's planned battery manufacturing capacity in an autocratic member state is, in itself, a geopolitical liability. Hungary's centrality in a critical value chain gives Orbán potential leverage to deflect rule-of-law sanctions and shield his regime from censure—leverage he has previously shown a willingness to exploit. Indeed, chokepoint control may help explain Hungary's economically unreasonable, oversized bet on the battery industry. For over a decade, Orbán has treated alignment with German automotive firms as a pillar of regime stability. German FDI continued to flow even as Hungary dismantled democratic institutions and curtailed civil rights (Kelemen 2020, Bohle and Regan 2021). Now, by hosting a strategic input for German automakers, this political leverage only deepens.

Germany's own industrial logic shows a striking disregard for geopolitical risk—an aspect wildly underdiscussed amid narratives of Europe's geopolitical turn. Even after Russia's invasion of Ukraine, Germany clung to Russian gas imports until the bitter end. The ties weren't severed by choice, but by force: through the sabotage of the Nord Stream pipeline. German firms show similar indifference toward exposure to China. They remain deeply embedded in Chinese markets and supplier networks—and batteries are no exception. German governments have consistently lobbied for deepening EU–China trade and investment cooperation and opposed tariffs on Chinese EVs. The pattern is clear: Germany does not subscribe to a more cautious, geopolitical approach to Chinese industry and strictly rejects decoupling.

France, by contrast, reflects a more geopolitically conscious approach, with a project pipeline that is less concentrated and more domestically anchored. Their biggest planned foreign capacity is to be delivered by Taiwanese ProLogium, already signalling some hedging. However, China is also present through Envision/AESC. France has not rejected Chinese FDI, but made an effort to balance it out, especially long-term.

Sweden also attempted a maximalist model—with a domestically headquartered firm. Even so, Chinese involvement did exist, such as in the Northvolt-Volvo joint venture NOVO, where Volvo is owned by China's Geely.

Poland takes the most starkly "hawkish" approach. In cell manufacturing, it relies exclusively on LG, a Korean firm, even though Chinese firms have shown interest too. Earlier enthusiasm for Chinese capital—visible in port operations and telecom infrastructure—has waned in light of security concerns, often raised by the United States. A 2024 incident at the Hutchison terminal in Gdynia, where a NATO delivery was delayed, prompted reclassification of the port as critical infrastructure. (Nawrotkiewicz 2025). However, when it comes to the overall geopolitical resilience of Poland's battery value chain, domestic capacities remain elusive—and paradoxically, a U.S.-style rejection of Chinese FDI may hinder their development in the long run, compared to a more limited and strategically managed openness.

Ultimately, what emerges from this analysis is not a cohesive EU strategy for geopolitical resilience, but divergent national agendas. This is, in part, institutional: foreign policy remains a member state competence, and one that governments jealously guard (Orenstein and Kelemen 2017). Any serious strategy for geopolitical hedging would require a shared stance on China—yet here, the gap is stark. Hungary, the most extreme outlier, but its wider posture is shared by Germany. France, by contrast, has pursued a more strategic approach, while Poland has aligned closely with the China-skeptical U.S. posture. Against this backdrop, it is not surprising that "strategic autonomy" largely remains empty: a rhetorical tool masking irreconcilable positions.

That said, the EU's overall project pipeline does reflect domestic capacity-building efforts, and if those projects remain viable, they can limit geopolitical risk. This points to an openness to Chinese FDI, but also efforts to avoid outright dominance. Given China's overwhelming lead in technology and its grip on upstream value chains, selective engagement may support Europe's long-term resilience—but without far more assertive measures to secure technology transfer, Europe's dependent position can be entrenched.

5.4. Varieties of EU Battery Rollout: Fast, Fossil, Foreign versus Slow, Sustainable, Sovereign

What does the EU's battery manufacturing rollout reveal about the priorities of member states pursuing it? The analysis reveals three broad strategic archetypes across the five studied cases: a minimalist "*fast, fossil, foreign*" model (Hungary and Poland), a maximalist "*slow, sustainable, sovereign*" one (France, and formerly, Sweden), and a "mixed" model (Germany). These typologies offer a lens into the bargains each state has made across ecological, industrial, and geopolitical trade-offs. While the minimalist path carries the risk of subversion, the maximalist path risks viability in a volatile, capital-intensive industry.

Hungary and Poland both pursue the minimalist path—rapid capacity buildup through foreign investment, with limited attention to domestic control and weakened environmental standards. Yet important differences remain. Hungary has committed 0.75% of its GDP in fiscal subsidies to battery investments, making it a clear outlier in Europe. It has also courted Chinese capital aggressively, with a geopolitical posture tightly aligned to both Beijing and Moscow. In contrast, Poland's fiscal support has been far more restrained (0.02% of GDP), and while Korean firms dominate its battery sector, Warsaw has grown increasingly wary of Chinese investment. In short, Poland is both geopolitically and fiscally hawkish; Hungary is the reverse.

On the other end of the spectrum, France and Sweden have both aimed for a much riskier maximalist path—anchored by domestic champions, lower emissions, and hedging geopolitical exposure. But their outcomes diverge. Sweden's Northvolt was once hailed as Europe's battery hope: R&D-heavy, domestically owned, and renewables-powered, yet the project collapsed. By contrast, France committed over €3 billion in public funds, and Verkor—its emerging battery firm—explicitly sought to avoid Northvolt's missteps: focusing on one product, one customer, one factory before scaling (Butler 2025). France's state-led industrialism has so far kept its ambition alive, but the viability still remains to be tested. The model is also by far the most costly one, in terms of fiscal resources.

Germany, with its mix of domestic and foreign capacities, and strong R&D and skills base, represents a hybrid model. The depth of its domestic industrial ecosystem bodes well for the chances of upgrading in Germany. According to the expectations of global production network theories, know-how from foreign firms can find its way to domestic players in a thick existing network. But the German model also has minimalist features: including its continued dependence on fossil power and its companies' over-exposure to China, which may undermine the assertiveness needed to incentivize (or force) knowledge transfer. A large chunk of Germany's new capacity will come from China's CATL with no explicit conditionalities, and German firms are also highly exposed to Hungary—geopolitical caution has taken a back seat to industrial expedience.

These divergent strategies produce systemic effects. In a single market, minimalist-path states lower the floor for everyone else. Competing for investment by relaxing environmental or labor standards (and doing so with impunity from EU authorities), or offering larger subsidies with fewer strings attached clearly undermine the EU's level playing field. This risks a structural race to the bottom—where the more strategic, long-term paths are made harder to sustain.

At its core, the EU's battery strategy is marked by incoherence. It claims to foster domestic champions and strategic autonomy, yet subsidizes foreign incumbents. It funds R&D and infant industries, while simultaneously empowering their rivals. These contradictions risk undercutting the transformative potential of green industrial policy.

Conclusion

Europe's battery strategy promises to deliver, simultaneously on climate neutrality, industrial renewal, and geopolitical resilience. But as this paper has shown, these objectives are often in direct tension. What emerges from a revealed-preferences analysis of early battery rollout is not a unified industrial strategy but a fragmented landscape of choices made by member states and legacy automakers, each navigating unresolved trade-offs in their own way. Some have opted for rapid rollout through foreign-led expansion, others have aimed higher, investing in domestic champions and cleaner production. Maximalist efforts have struggled with financial and operational viability, while the minimalist paths pose clear risks of entrenching dependency and undermining more aspirational pathways.

By analytically disaggregating the EU's green industrial agenda into three policy objectives—climate neutrality, industrial competitiveness, and strategic autonomy—and identifying nested trade-offs within each three, this paper has introduced a framework to make sense of the tensions shaping battery industrialization. The typology of minimalist versus maximalist development paths helps clarify the political economy logic behind member state trajectories, and highlights the structural incoherence that follows when these divergent pathways coexist within a single market. Minimalist approaches may deliver speed and industrial jobs, but risk locking the EU into low value-added and geopolitically fragile supply chains. Maximalist strategies promise longer-term autonomy and innovation, but face daunting financial and execution challenges—especially when undermined by generously subsidized foreign competitors within the same single market. An important conclusion by Brett Christophers (2025) is borne out in the EU's case: clean-tech industries depend on sustained public support and coordinated demand. Indeed, Europe's only battery champions still standing—Verkor, ACC, and PowerCo—are those backed by lead firms with direct state ownership or strong state ties.

Engaging with a vibrant literature on green industrial policy and EU governance, this paper takes its debates forward by offering a systematic framework for analyzing green industrial policy as a terrain of nested trade-offs across climate, industrial, and geopolitical aims. It operationalizes the vague policy objectives and traces how their internal tensions play out in practice. In doing so, the paper recasts the 'decarbonization bargain' as a series of bargains across these domains. It also brings into sharper focus how green manufacturing on Europe's periphery can reproduce the kinds of extractivist relationships typically associated with North–South asymmetries: where rapid rollout comes at the expense of ecology and democracy. By mapping out the minimalist and maximalist paths, the paper contributes a vocabulary for comparing national strategies and for diagnosing the structural incoherence of the EU's approach. It thus bridges literatures on the political economy of the green transition, late industrialization, and EU governance, while providing a template for future research on the political economy of green statecraft.

To avoid institutionalizing the minimalist path as default, EU policymakers must stop wishing away trade-offs and begin confronting them. On the climate front, the new battery regulation holds real potential to curb the race to the bottom in environmental compliance. But to do so, it must be credibly enforced—not just through lifecycle carbon thresholds, but also by monitoring water stress, land use, and local environmental impacts. On industrial development, it is incoherent to subsidize both domestic champions and their direct competitors. This tension cannot be managed indefinitely; collective subsidy governance at the EU level is the only durable resolution. On the geopolitical dimension, blanket rejection of Chinese FDI is neither feasible nor desirable. But openness without conditions invites strategic vulnerability. Technology transfers and local content requirements must be enforced—not simply incentivized—as deep-pocketed firms can afford to decline subsidies with strings attached. Trade-offs are inevitable in any transformative project. What matters is whether they are left to drift—or acknowledged and navigated with clarity.

Aklin, M. and Mildenberger, M., 2020. Prisoners of the Wrong Dilemma: Why Distributive Conflict, Not Collective Action, Characterizes the Politics of Climate Change. *Global Environmental Politics*, 20 (4), 4–27.

Allan, B.B. and Meckling, J.O., 2023. Creative learning and policy ideas: The global rise of green growth. *Perspectives on Politics*, 21 (2), 443–461.

Allyn, B., 2022. Tesla's first European factory needs more water to expand. Drought stands in its way. *NPR*, 3 Nov.

Ban, C. and Adascalitei, D., 2022. The FDI-led growth models of the East-Central and South-Eastern European periphery. *Diminishing returns: the new politics of growth and stagnation*, 189–211.

Bauerle Danzman, S. and Meunier, S., 2024. The EU's Geoeconomic Turn: From Policy Laggard to Institutional Innovator. *JCMS: Journal of Common Market Studies*, jcms.13599.

Bodnár Z., 2023. Pert nyertünk és kiderült: betemették a kutat, ami megmutatná, mérgezi-e a talajvizet a

gödi akkumulátorgyár. *atlatszo.hu*.
Bohle, D. and Regan, A., 2021. The Comparative Political Economy of Growth Models: Explaining the Continuity of FDI-Led Growth in Ireland and Hungary. *Politics & Society*, 49 (1), 75–106.
Bounds, A., Foy, H., and Dunai, M., 2025. EU Probes BYD Plant in Hungary over Unfair Chinese Subsidies. *Financial Times*.
Bridge, G. and Faigen, E., 2022. Towards the lithium-ion battery production network: Thinking beyond mineral supply chains. *Energy Research & Social Science*, 89, 102659.
Bulfone, F., Ergen, T., and Kalaitzake, M., 2023. No strings attached: Corporate welfare, state intervention, and the issue of conditionality. *Competition & Change*, 27 (2), 253–276.
Bulfone, F., Ergen, T., and Maggor, E., 2025. Regulating via Conditionality: The Instruments of the New Industrial Policy. *Regulation & Governance*, rego.70050.
Bünting, A. and Giringer, K., 2025. *Rising Electric Vehicle Registrations and New EU Measures: Is Europe's Battery Industry Thriving?* VDI Innovation + Technik, Market Update Q2 2025.
Bünting, A., Trunk, M., and Vogl, S., 2024. *Weakening European Electric Vehicle Market: Challenges and Opportunities for the Battery Industry*. VDI Innovation + Technik, Market Analysis Update Q4 2024.
Butler, E., 2025. France's Verkor Calls for 'Local for Local' after Northvolt Collapse. *Euronews*.
Cheng, A.L., Fuchs, E.R.H., Karplus, V.J., and Michalek, J.J., 2024. Electric vehicle battery chemistry affects supply chain disruption vulnerabilities. *Nature Communications*, 15 (1), 2143.
Christophers, B., 2025. *The price is wrong: Why capitalism won't save the planet*. Verso Books.
Di Carlo, D., Zurstrassen, D., and Eisl, A., 2024. Together we trade, divided we aid: Mapping the flexibilization of the EU state aid regime across GBER, IPCEIs and Temporary Frameworks. *Joint JDI-LUHNIP Policy Paper*, 307.
Driscoll, D. and Blyth, M., 2025. Decarbonising national growth models: derisking, 'hobbled states', and the decarbonisation possibility frontier. *Review of International Political Economy*, 32 (3), 617–642.
Éltető, A., 2023. Aspects of electric vehicle battery production in Hungary. *ELRN Centre for Economic and Regional Studies Institute of World Economics Working Paper*, 2023 (271).
Éltető, A., 2024. *Why Is It Different? Specific Characteristics of the Hungarian Battery Industry: Legal Background and Environmental Impacts*. Institute for World Economics - Centre for Economic and Regional Studies, IWE Working Papers No. 276.
EPRS, 2022. Important projects of common European interest: State of play. *European Parliamentary Research Service*.
Ergen, T., 2015. *Große Hoffnungen und brüchige Koalitionen: Industrie, Politik und die schwierige Durchsetzung der Photovoltaik*. Campus Verlag.
European Commission, 2025. Electric vehicle model statistics | European Alternative Fuels Observatory [online]. Available from: https://alternative-fuels-observatory.ec.europa.eu/policymakers-and-public-authorities/electric-vehicle-model-statistics [Accessed 5 Aug 2025].
European Commission, 2025. Commission Proposes Gradual Phase-Out of Russian Gas and Oil Imports into the EU.
European Parliament and Council, 2023. Regulation (EU) 2023/1542 of 12 July 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (Text with EEA relevance).
Fischer, J., 2025. Asset Specificity in Climate Politics: How Brown Industries Can Become Green.
Gabor, D. and Braun, B., 2025. Green macrofinancial regimes. *Review of International Political Economy*, 32 (3), 542–568.
Győrffy, D., 2023. Iparpolitika és akkumulátorgyártás Magyarországon és Svédországban. *Közgazdasági Szemle*, 70 (3), 245–273.
Győrffy, D., 2024. Liberal and illiberal industrial policy in the EU: the political economy of building the EV battery value chain in Sweden and Hungary. *Comparative European Politics*.

Hancock, A., Bounds, A., and Russell, A., 2024. EU to demand technology transfers from Chinese companies. *Financial Times*, 19 Nov.
Hehenberger, A., 2025. Green Vanguards and Dependent Followers: How Export-Led Economies Decarbonise. PhD dissertation. Max Planck Institute for the Study of Societies, Cologne.
Higgins, A., 2023. A Hungarian Town Seethes Over a Giant Chinese Battery Plant. *The New York Times*, 15 Mar.
IEA, 2024. Batteries and Secure Energy Transitions.
Jerez, B., Garcés, I., and Torres, R., 2021. Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility. *Political Geography*, 87, 102382.
Jugé, M., Keliauskaitė, U., Larsen, K., McClintock, C., McWilliams, B., Pitt, H., Tagliapietra, S., Tavarez, H., and Trasi, C., 2025. *Transatlantic Clean Investment Monitor 3: Battery Manufacturing*. Bruegel.
Kelemen, R.D., 2020. The European Union's authoritarian equilibrium. *Journal of European Public Policy*, 27 (3), 481–499.
Kelemen, R.D., 2024. Will the European Union escape its autocracy trap? *Journal of European Public Policy*, 1–24.
Kelemen, R.D. and Pavone, T., 2023. Where Have the Guardians Gone? Law Enforcement and the Politics of Supranational Forbearance in the European Union. *World Politics*, 75 (4), 779–825.
Kelsey, N., 2018. Industry type and environmental policy: Industry characteristics shape the potential for policymaking success in energy and the environment. *Business and Politics*, 20 (4), 615–642.
Krantz, P., 2024. Tesla EV factory drives latest climate justice struggle in Germany [online]. *Climate Home News*. Available from: https://www.climatechangenews.com/2024/03/15/tesla-ev-gigafactory-drives-germany-latest-climate-justice-struggle/ [Accessed 3 Jun 2024].
Kratz, A., Zenglein, M.J., Sebastian, G., and Witzke, M., 2023. *EV Battery Investments Cushion Drop to Decade Low: Chinese FDI in Europe 2022 Update*. Rhodium Group and MERICS, Report.
Kupzok, N. and Nahm, J., 2024. The decarbonization bargain: How the decarbonizable sector shapes climate politics. *Perspectives on Politics*, 22 (4), 1203–1223.
Kupzok, N. and Nahm, J., 2025. Green macrofinancial bargains: how economic interests enable and limit climate action. *Review of International Political Economy*, 32 (3), 569–592.
Leibniz Institute, 2021. The Berlin-Brandenburg region and the Tesla Gigafactory | IGB [online]. *Leibniz Institute of Freshwater Ecology and Inland Fisheries*. Available from: https://www.igb-berlin.de/en/news/berlin-brandenburg-region-and-tesla-gigafactory [Accessed 3 Jun 2024].
von der Leyen, U., 2021. Opening Speech by President von der Leyen at the EU Industry Days 2021.
Lopes-Valença, H., 2024. EU industrial policy and convergent development in EU peripheries: An assessment of the 'Important Project of Common European Interest'(IPCEI) template. *JCMS: Journal of Common Market Studies*.
Mackenzie, K. and Sahay, T., 2024. Great Green Wall of America | The Polycrisis. *Phenomenal World*.
Maggor, E., 2021. The Politics of Innovation Policy: Building Israel's "Neo-developmental" State. *Politics & Society*, 49 (4), 451–487.
Mathiesen, K., Weise, Z., and Guillot, L., 2024. A triumphant right's first post-election target: Overturning Green Deal car ban [online]. *POLITICO*. Available from: https://www.politico.eu/article/european-election-green-deal-rollback-europes-far-right-greenhouse-gas-pollution-global-warming/ [Accessed 3 Aug 2025].
McNamara, K.R., 2023. Transforming Europe? The EU's industrial policy and geopolitical turn. *Journal of European Public Policy*, 1–26.
Meckling, J., 2021. Making Industrial Policy Work for Decarbonization. *Global Environmental Politics*, 21 (4), 134–147.
Meckling, J., Kelsey, N., Biber, E., and Zysman, J., 2015. Winning Coalitions for Climate Policy. *Science*, 349 (6253), 1170–1171.

Meckling, J. and Nahm, J., 2019. The politics of technology bans: Industrial policy competition and green goals for the auto industry. *Energy Policy*, 126, 470–479.

Merk, J., González, A., and Czirfusz, M., 2024. Electric Dreams, Hard Realities.

Meunier, N. and Ponsa Sala, C., 2025. *A Study on Asian Electromobility Investments in the EU*. Transport & Environment.

Nahm, J., 2022. Green growth models. *Diminishing returns: The new politics of growth and stagnation*, 443.

Nawrotkiewicz, J., 2025. Ghosts of FDI Past: Rethinking Poland's China Strategy. *China Observers in Central and Eastern Europe (CHOICE)*.

Nölke, A. and Vliegenthart, A., 2009. Enlarging the varieties of capitalism: The emergence of dependent market economies in East Central Europe. *World politics*, 61 (4), 670–702.

Orbán, V., 2023. Nagy gázerőműveket építünk, hogy kiszolgáljuk az ipari központokat. *24.hu*.

Orenstein, M.A. and Kelemen, R.D., 2017. Trojan Horses in EU Foreign Policy. *JCMS: Journal of Common Market Studies*, 55 (1), 87–102.

Piovaccari, G., 2024. Stellantis-Backed Battery Maker ACC Pauses Plans for German, Italian Plants. *Reuters*.

Polyák, P., 2025. Sacrifice Zones: The Local Costs of the Electric Vehicle Investment Boom in Hungary and Serbia. *Conference paper. 2025 Annual Meeting of the Society for the Advancement of Socio-Economics*.

do Prado, V., Fabry, E., González Laya, A., Köhler-Suzuki, N., Lamy, P., and Praetorius, S., 2025. *The Road to a New European Automotive Strategy: Trade and Industrial Policy Options*. Jacques Delors Institute, Report No. 129.

ProLogium, 2023. ProLogium Welcomes the Green Light Given by the European Commission for Public Grant for Its Gigafactory Project in Dunkirk.

Racu, A., 2023. *How Not to Lose It All*. Transport & Environment.

Ricz, J. and Éltető, A., 2025. Paradoxes of Green Transition and Developmentalism: The Case of EV Battery Production in Hungary. *Problems of Post-Communism*, 1–15.

Riofrancos, T., 2020. *Resource radicals: From petro-nationalism to post-extractivism in Ecuador*. Duke University Press.

Riofrancos, T.N., 2017. Scaling democracy: Participation and resource extraction in Latin America. *Perspectives on Politics*, 15 (3), 678–696.

Scharpf, Fritz W. "The joint‐decision trap: Lessons from German federalism and European integration." *Public Administration* 66.3 (1988): 239-278.

Schmitz, L. and Seidl, T., 2023. As open as possible, as autonomous as necessary: Understanding the rise of open strategic autonomy in EU trade policy. *JCMS: Journal of Common Market Studies*, 61 (3), 834–852.

Schmitz, L., Seidl, T., and Wuttke, T., 2025. The costs of conditionality. IPCEIs and the constrained politics of EU industrial policy. *Competition & Change*, 0 (0).

Simeonova, E., 2023. The EU Is Much Less Dependent On Russian Gas But Still Isn't Ready To Give It Up. *Radio Free Europe/Radio Liberty*, 31 Dec.

Toplišek, A., 2024. Beyond Dependent Development? The Unlikely Emergence of an Upgrading Alliance in the Case of InoBat in Slovakia. *Studies in Comparative International Development*, 59 (4), 767–793.

Wigger, A., 2024. The new EU industrial policy: Opening up new frontiers for financial capital. *Politics and Governance*, 12.

Zgut-Przybylska, E., 2024. The worrying Chinese projects in Orban's Hungary [online]. *EUobserver*. Available from: https://euobserver.com/eu-and-the-world/araf881355 [Accessed 3 Jun 2024].

Zhou, V., 2025. How a Chinese battery factory sparked a political meltdown in a small Michigan town [online]. *Rest of World*. Available from: https://restofworld.org/2025/gotion-ev-battery-us-expansion-backlash-michigan/ [Accessed 12 May 2025].