Rhodium Group

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# Global Clean Investment Monitor: Electric Vehicles and Batteries

Energy & Climate

# Introducing the Global Clean Investment Monitor

Many major economies see domestic manufacturing of clean energy and transportation technology as a powerful driver of economic growth, important to national security objectives, or necessary to sustained political support for related policies. Governments in the US, China, and Europe all provide fiscal or other policy support to spur both the manufacturing of those technologies and the demand needed to sustain domestic industries. This support improves the politics of clean energy and transportation policy domestically, expands clean technology production capacity globally, and accelerates the clean energy transition.

As these industries mature, new international trade and cross-border investment tensions between major economies will emerge. Governments are increasingly concerned about the security and resilience of clean energy supply chains and the need to counter the economic influence of their competitors through trade and overseas investment. Navigating these economic and security concerns while maintaining global climate cooperation and ensuring developing countries receive the support they need to decarbonize affordably will be critical to the success of the global clean energy transition.

For the past two years, the US Clean Investment Monitor (CIM)—a joint project of Rhodium Group and MIT's Center for Energy and Environmental Policy Research (CEEPR)—has provided a comprehensive, real-time source of information on investment in the manufacture and deployment of clean energy technologies in the US. The CIM provides timely insights into the state of the US clean energy transition and the impact of relevant policy on clean energy deployment and local economic development.

Rhodium and MIT-CEEPR are now developing a new **Global Clean Investment Monitor (GCIM)** to track global investment in the manufacturing and deployment of clean energy technologies. The GCIM will provide policymakers and investors with up-to-date information on the manufacturing and deployment of clean energy technologies, including data on manufacturing investments at various stages of completion, estimated annual production capacity by country, current and projected country-level demand, and public subsidies. This report marks the first phase of the GCIM's development. A forthcoming MIT-CEEPR report will build on this report with an in-depth analysis of government incentives and trade policies.

# Executive Summary

In this first edition of the Global Clean Investment Monitor series, we explore how—after decades of national policy support, primarily in the US, China, and Europe—electric vehicles (EVs) and batteries have been catapulted into mass commercialization. Demand for EVs and batteries has risen sharply as EVs reach cost competitiveness with combustion vehicles across many regions. In this report, we share insights from our tracking of 1,248 EV and battery manufacturing facilities around the world—including investment levels, project construction status, and EV and battery production capacity—providing real-time data for policymakers, investors, and other decision-makers seeking to understand if EV and battery demand can be met primarily through domestic production in the coming decade, and the extent to which excess capacity by foreign suppliers will compete for market share. We examine four key dynamics that will determine the future of the electric vehicle transition:

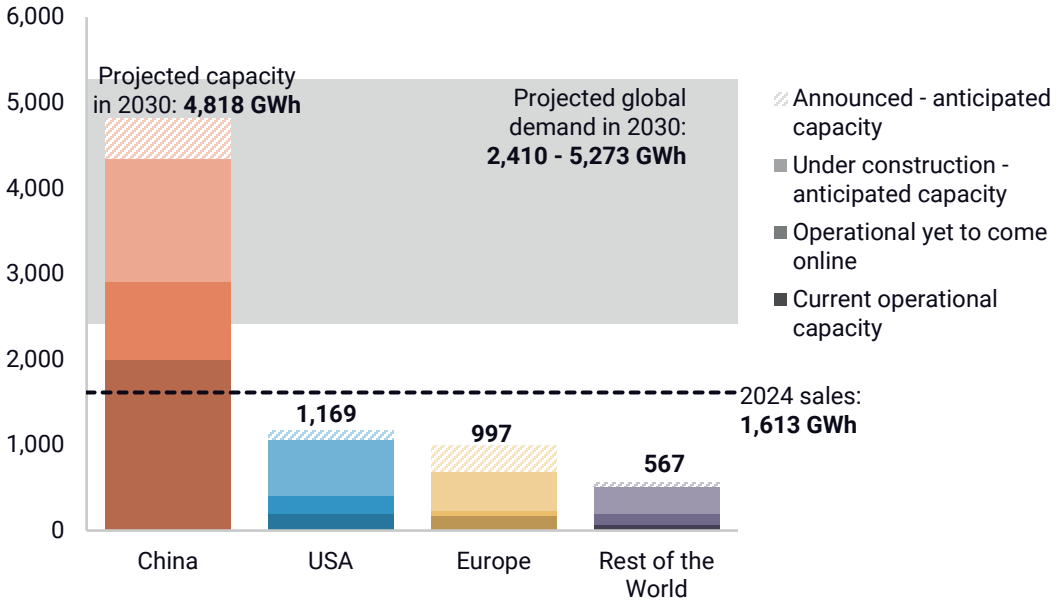
**How will China's automakers and the rest of the world react to China's massive overcapacity in batteries—and to a lesser extent EVs—over the coming years?**

Thanks to sustained state support for EV and battery manufacturing and deployment, as well as a massive domestic market, China has been home to two-thirds of global growth in EV sales and manufacturing capacity and over 80% of growth in battery manufacturing capacity over the last 15 years. Fierce competition among EV and battery manufacturers in China for state-based incentives has led to a sharp decline in EV and battery prices, helping scale deployment, but has led to massive overcapacity in batteries. Today, China's battery manufacturing capacity is 2x demand in China and 1.2x global demand.

FIGURE ES1

**China's battery overcapacity helps speed global EV transition but could undercut new entrants**

Projected battery manufacturing capacity in 2030 and expected global demand (GWh of cells)




Source: Global Clean Investment Monitor, Rhodium Group, EV Volumes. Note: Demand includes stationary storage capacity additions and EV sales.

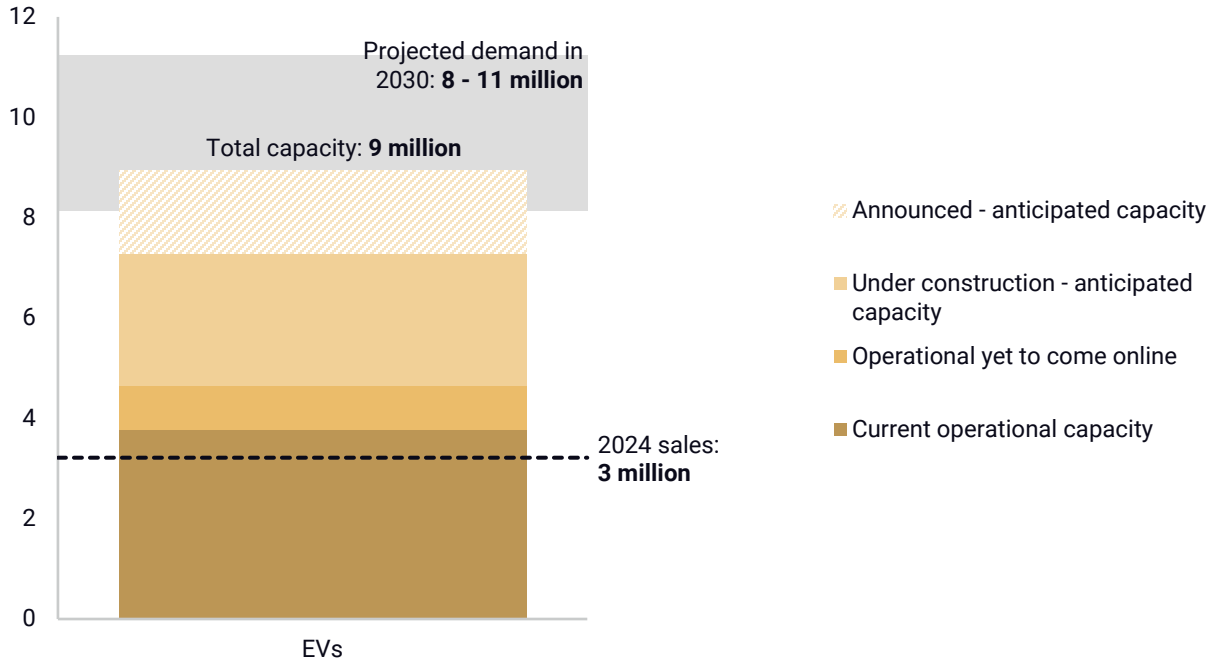
**How will Europe's near- and long-term zero-emission vehicle ambitions fare as European OEMs contend with the potential for a wave of cheap EV imports from China?**

After China, Europe is the world's second-largest EV market, and current and planned policies put the region on track to achieve 100% zero-emission vehicles in the coming decades. Unlike China where nearly all EV sales are produced domestically, almost a third of Europe's EVs are imported. In 2024, 15% of EVs sold in Europe were Chinese brands, most of which offer a significant cost advantage compared to European brands. Cost parity with ICE vehicles will be critical to achieving Europe's zero-emission vehicle ambitions, making cheap imports from China a boon to scaling EV deployment. Looking ahead, the big question for Europe is to what extent it will continue to open its doors to EV imports from China? What will cheap imports from China mean for the competitiveness of European OEMs and their willingness to go along with stringent zero-emission vehicle policy? How will policymakers balance the dual goals of maintaining domestic political support for the EV transition with the need to ensure access to cost-competitive EVs?

FIGURE ES2

**Europe's planned EV production capacity may fall short of rapidly growing demand**

Europe's operating EV manufacturing capacity vs. European EV sales today (million vehicles)




Source: Bruegel European Clean Tech Tracker, Global Clean Investment Monitor, 2024 Rhodium Climate Outlook, EV Volumes.

**What is the outlook for the EV transition in the United States? Unlike China and Europe, where EVs have reached escape velocity, the potential for the US to follow suit is at risk as the Trump administration threatens to repeal policies that support EV sales and domestic manufacturing.**

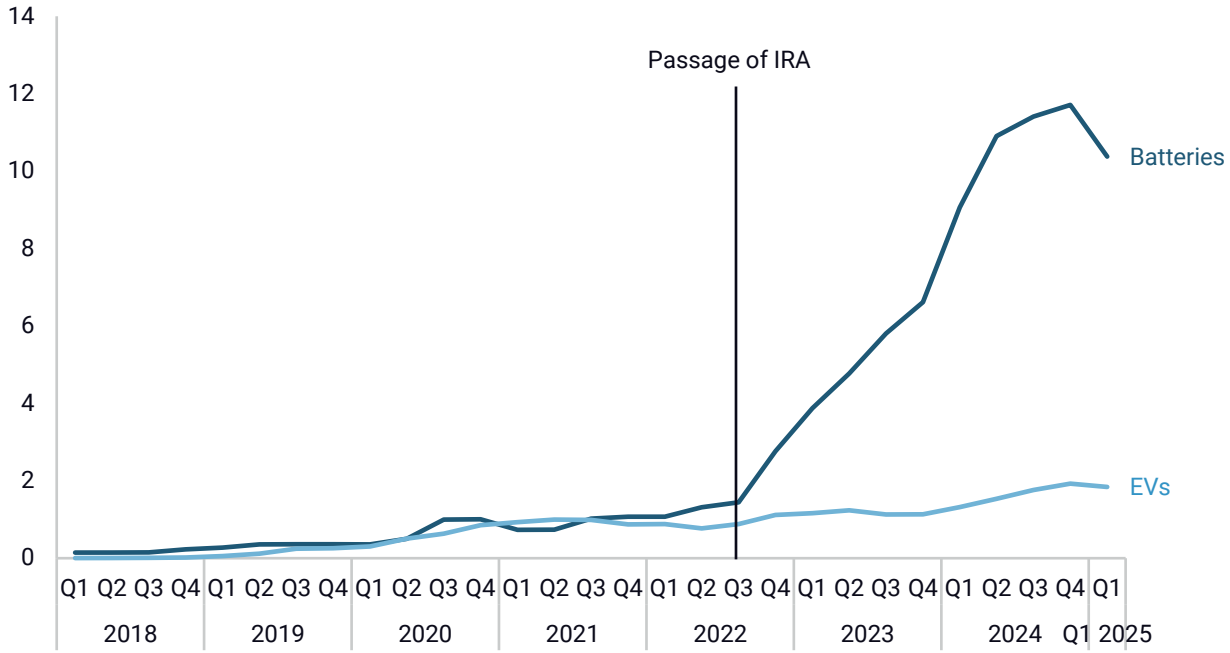
The passage of the Inflation Reduction Act (IRA) in the US in 2022 kicked off unprecedented investments in domestic EV supply chains by providing direct subsidies for domestic manufacturing of battery cells and EVs. These supply-side policies, coupled with

consumer EV tax credits tied to domestic content requirements and stricter tailpipe regulations, have spurred a wave of investment in domestic EV supply chains over the past few years.

FIGURE ES3

**IRA supercharges US battery manufacturing investment, but US EV future now in doubt**

Investment in EV supply chains in the US (billion 2023 USD)



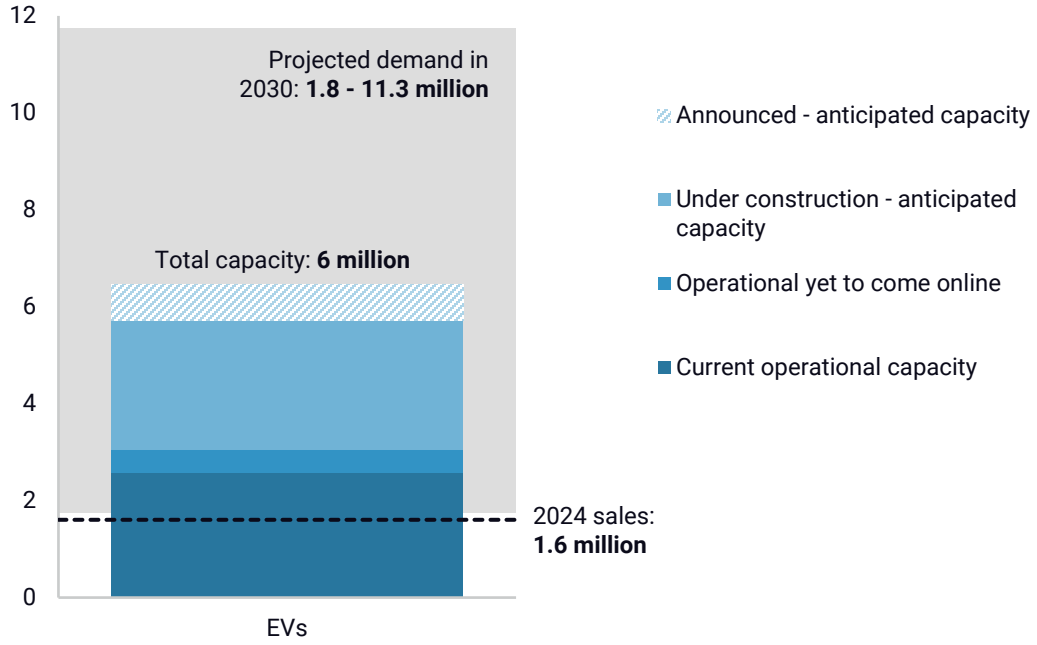

Source: Clean Investment Monitor

In contrast with Europe, the US has been on track to establish a competitive EV industry based on a largely domestic EV supply chain, but just as the EV transition is gaining steam, the EV and battery manufacturing sectors are now at risk of having core policy support revoked. President Trump's trade policy and signs of slowing demand cast further doubt on the outlook for EVs in the US. Going forward, key questions about the future of an electric vehicle transition in the US include: What happens to domestic production and sales if key policies, including the IRA tax credits and federal and state EV and GHG standards, are rolled back? How might trade policy, especially an escalation with China, reshape domestic manufacturing? If market conditions weaken, do planned manufacturing investments become redundant? In the absence of policy to encourage innovation, will US companies be able to compete in a world moving increasingly toward EVs? If not, what does that mean for the prospects of electrifying US transportation if major domestic automakers aren't producing the EVs of the future?

FIGURE ES4

**US policy uncertainty makes it difficult to plan for future EV demand**

Current and planned EV manufacturing capacity relative to current and 2030 demand (million vehicles)




Source: Global Clean Investment Monitor, Rhodium Group, EV Volumes.

**How will the rest of the world respond to these dynamics emerging among China, Europe, and the US?**

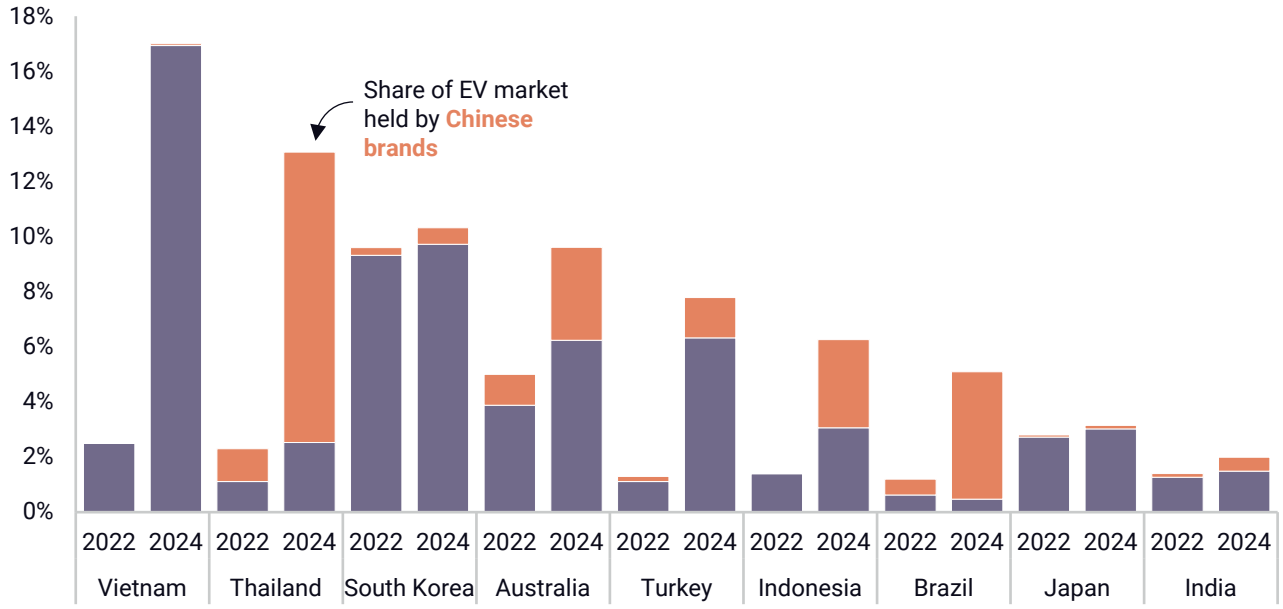
While China, Europe, and the US dominate EV markets today, sales in the rest of the world are rising rapidly. We project that by 2050, EV sales outside of China, Europe, and the US will grow from 10% to 30-40% of global EV sales. Just in the last few years, sales have surged in Turkey, Brazil, and many Southeast Asian countries, driven in large part by low-cost Chinese models. For consumers in emerging economies, EVs must be affordable to gain market share. Low-cost imports from China and foreign investment present opportunities for widespread adoption and local manufacturing, but risk crowding out domestic manufacturers (Figure ES5).

Investments in EV and battery manufacturing outside of China, Europe, and the US are ramping up rapidly (Figure ES6). As the rest of the world seeks to participate in and benefit from the EV transition, they will need to understand how they can position themselves in the global EV supply chain. How do EVs compete with traditional vehicles outside of China, Europe, and the US? Where are EV sales beginning to take off? Which countries are investing in domestic manufacturing? To what extent are both sales and manufacturing driven by Chinese imports and investment, versus domestic brands? What pressures do policymakers face to carve out market share for domestic manufacturers, versus allowing access to low-cost Chinese EVs?

FIGURE ES5

**EV market share has surged with Chinese brands playing a major role in many markets**

EV sales share and fraction from Chinese brands

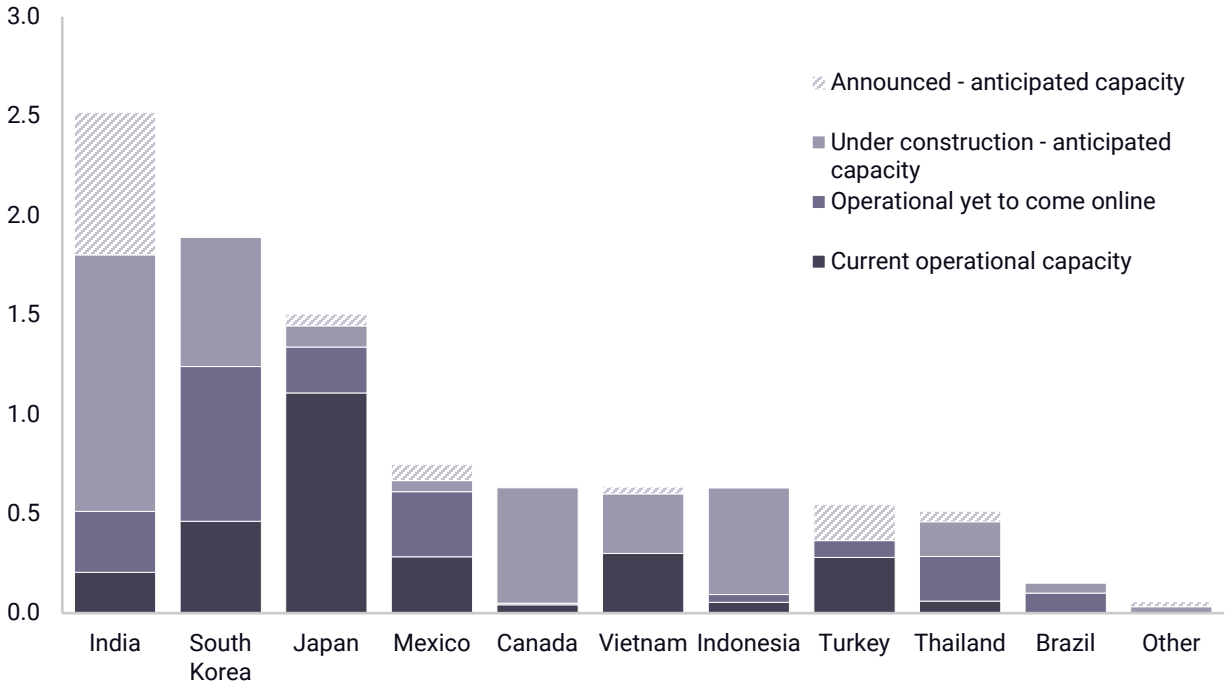



Source: EV Volumes

FIGURE ES6

**The pipeline of EV manufacturing shows a shifting landscape for capacity**

EV current and planned capacity in 2030 (million vehicles)




Source: Global Clean Investment Monitor

The world is at a critical inflection point when it comes to global auto manufacturing. The global transition to electric mobility has finally achieved escape velocity as EVs reach cost

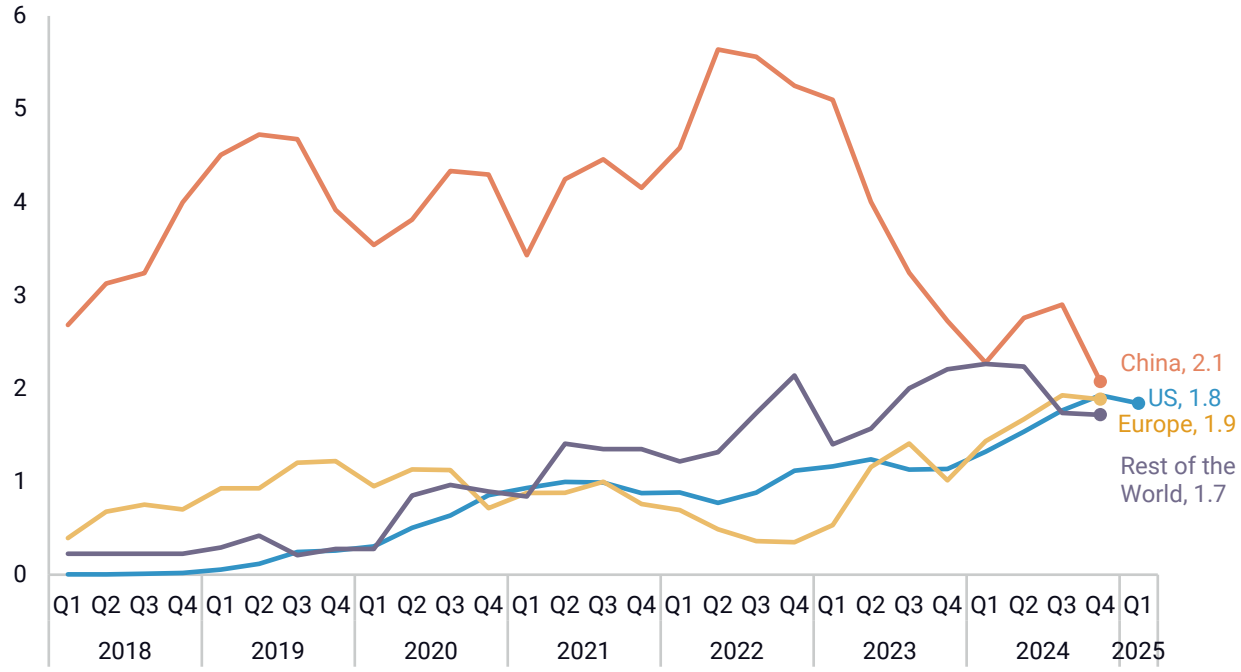
parity with internal combustion engine vehicles. In fact, even absent an acceleration in clean transportation policy, the Rhodium Climate Outlook projects that passenger EVs will *very likely* (greater than 95% probability) make up at least half and as much as 80% of global sales by mid-century. While the Big Three—China, the US, and Europe—will represent the majority of sales for the next decade or so, demand growth in the rest of the world is set to accelerate sharply.

Who will produce the vehicles driving the future of mobility? China's head start and massive domestic market have given it a leg up, but policy-driven upticks in US and European investment in recent years have tightened the race, and the rest of the world is investing rapidly to serve the Big Three and their own growing domestic markets.

FIGURE ES7

**China's lead on EV manufacturing investments has narrowed as the US and Europe ramp up**

Quarterly EV manufacturing investment by region (billion 2023 USD)




Source: Global Clean Investment Monitor

The auto sector's outsized role in economic, political, and, increasingly, national security dynamics will create significant trade-offs for policymakers in the coming decades. To what extent will countries look to secure largely domestic or friend-shored supply chains, and what will that mean for EV affordability and the ultimate pace of EV adoption? To arm these policymakers with real-time information to inform them as they navigate this critical inflection point, in the coming months and years the Global Clean Investment Monitor will track quarterly investments in EV and battery manufacturing, capacity additions by project status, EV sales, and trade flows to provide a real-time window into how these dynamics are at play across the world.

The full report is available here.

# Access all Global Clean Investment Monitor data from Rhodium's ClimateDeck

All data from this report are available through the **ClimateDeck** data platform—a partnership of Rhodium Group and Breakthrough Energy. The ClimateDeck offers global and US 50-state greenhouse gas (GHG) emissions inventories and projections, energy market outlooks, clean investment tracking, and analysis of energy and climate policy developments. The platform equips users with comprehensive datasets, dynamic insights, and a robust set of tools for tracking pathways to climate targets and understanding the implications of major developments at the international, national, and state levels. The ClimateDeck data platform includes filters that enable users to customize datasets by region, technology, or policy scenario—helping to tailor insights to meet specific use cases. All data is accessible and free to explore, download, and analyze offline, and users can export graphics for presentations and reports.

Beyond data, the ClimateDeck provides access to Rhodium's library of research, including featured analysis and key insights from our flagship publications. This report features data and analysis from several of those Rhodium publications, all of which are available in full from the ClimateDeck. They include:

## Rhodium Climate Outlook

The annual Rhodium Climate Outlook provides insights into what climate future the world is on track for, by integrating probabilistic energy and GHG emissions outcomes with a climate model to generate probabilistic temperature rise estimates incorporating climate system uncertainty. Based on Rhodium's Global Energy Model (RHG-GEM), the RCO considers a wide range of uncertainties underpinning the global energy system, providing a robust and systematic exploration of the main drivers of regional energy demand, technology deployment, and resulting greenhouse gas emissions.

## US Taking Stock

Each year, Rhodium releases Taking Stock, our projections of US GHG emissions under current federal and state policy, to provide a baseline against which to assess additional potential policy action. Based on Rhodium's flagship US economy-wide emissions model (RHG-NEMS), projects energy supply, demand, and emissions under physical, economic, and policy constraints. The model also estimates non-energy-related emissions, providing full accounting for all six categories of GHGs, and state-level results for key metrics.

## US Clean Investment Monitor

The Clean Investment Monitor (CIM), a joint project of Rhodium Group and MIT's Center for Energy and Environmental Policy Research (CEEPR), tracks public and private investments in the manufacturing and deployment of the full landscape of climate technologies in the US. Through this data and analysis, the CIM provides insights into investment trends, the effects of federal and state policies, and on-the-ground progress in the US towards net-zero GHG emissions, plus a comprehensive catalog of project announcements and investments.

# About Rhodium Group

Rhodium Group is an independent research provider with deep expertise in policy and economic analysis. We help decision-makers in both the public and private sectors navigate global challenges through objective, original, and data-driven research and insights. Our key areas of expertise are China's economy and policy dynamics, and global climate change and energy systems. More information is available at www.rhg.com.

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## Disclosures

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