MIT CEEPR
Center for Energy and Environmental Policy Research

Research Commentary

Apples-to-Apples: Comparing Government Subsidies for Clean Manufacturing Reveals the Scale of China's Lead

Steven Berit and Robert Reese



NOVEMBER 2026

CEEPR RC 2026-10

Research Commentary Series.

Since 1977, the Center for Energy and Environmental Policy Research (CEEPR) has been a focal point for research on energy and environmental policy at MIT. CEEPR promotes rigorous, objective research for improved decision making in government and the private sector, and secures the relevance of its work through close cooperation with industry partners from around the globe. Drawing on the unparalleled resources available at MIT, affiliated faculty and research staff as well as international research associates contribute to the empirical study of a wide range of policy issues related to energy supply, energy demand, and the environment.

As a Research Commentary, views expressed within are solely those of the authors. Interested parties may contact the authors directly for further feedback on their Commentaries.

MIT CEEPR
Center for Energy and Environmental Policy Research

RC-2026-10
Commentary

Apples-to-Apples: Comparing Government Subsidies for Clean Manufacturing Reveals the Scale of China's Lead

Steven Berit and Robert Reese

Executive Summary

From 2018 through 2025, China provided an estimated $119.7 billion in subsidies to clean manufacturing, 2.6 times the $45.8 billion provided by the United States, Europe, Canada, and Australia combined. That disparity is difficult to see in headline figures, which combine grants, loans, and payment ceilings whose value to recipients differs widely.

This report compares the subsidy value of support—the part of government support that is effectively a gift—in the United States, Europe, Canada, Australia, and China. Getting below the headlines requires information on the instrument behind each award, its terms, whether it is binding, and how much has been paid. The globally expanded Clean Investment Monitor tracks that information and estimates the subsidy value of support on a common basis, making a comparison like this one possible.

The report uses those data to compare the scale and form of subsidies alongside operating and planned manufacturing capacity. Covered technologies include batteries, electric vehicles, rare earth elements, permanent magnets, and wind equipment, with amounts expressed in 2024 U.S. dollars. Four findings stand out.

- **China's lead is large and growing.** China increased its support every year, reaching $25.2 billion in 2025. The other four regions together provided $14.0 billion that year, just over half as much.
- **Subsidy values can reverse a headline comparison.** Australia has extended about $1.3 billion in rare earth financing, and Spain has awarded about $0.9 billion in battery grants. Because most of Australia's financing is expected to be repaid on terms close to commercial ones, it provides about $30 million in subsidy value. Spain's smaller headline amount delivered 30 times as much subsidy.
- **Support outside China has grown but remains concentrated.** Subsidies in the other four regions rose from less than $3 billion a year through 2022 to $15.3 billion in 2024 and $14.0 billion in 2025. U.S. battery subsidies, almost all provided through tax credits, account for about half of the total for the period.
- **In rare earths, billions in announced support translate into about $550 million in subsidies.** That amount is roughly one-seventh of the $3.85 billion China provided, in the supply chain where dependence on Chinese supply is greatest.

The other four regions are unlikely to match China's support dollar for dollar, which makes policy design particularly important for economies seeking to diversify supply. A smaller subsidy aimed at a specific barrier may enable investment and sustained production that a larger but poorly targeted award would not. Comparing the subsidy value and purpose of support helps inform those choices.

1. Introduction

Over the past decade, governments have expanded support for clean manufacturing to build domestic capacity and strengthen supply chains. Comparing that support on a common basis reveals a substantial disparity: from 2018 through 2025, China provided an estimated 2.6 times as much subsidy as the United States, Europe, Canada, and Australia combined.[1] Seeing that disparity requires looking beyond announced funding to the subsidy actually provided through grants, tax incentives, loans, equity investments, and production contracts.

Comparisons based on announced government funding often combine different measures of support. Some announcements describe grants that have been awarded. Others describe the most a government might pay if a factory meets its production targets, or financing that the government expects to be repaid. Adding those amounts together can substantially overstate the support being provided, and by different amounts in different countries.

Consider two commitments of similar scale. Since 2018, Australia has extended about $1.3 billion in loans and a convertible note to rare earth projects, chiefly Iluka Resources' Eneabba refinery and Arafura's Nolans project, and Spain has awarded about $0.9 billion in grants to battery plants.[2] On their face, Australia's is the larger program. Measured by subsidy value, however, the comparison runs the other way. Spain's grants provide a subsidy equal to their full value, or 100 cents per announced dollar. Australia's financing provides an estimated $30 million in subsidy, or about 2.3 cents per announced dollar, because most of it is expected to be repaid on terms close to those available commercially.[3]

In other words, Spain's smaller headline amount delivered 30 times as much subsidy.

The subsidy value of each announced dollar depends on the instrument and the terms of the award. Announced amounts alone reveal little about those differences, yet they are usually all that is visible. Measuring the subsidy value of each award puts government support on a common basis and allows policymakers to compare the resources devoted to different industries and countries. The Spain–Australia example shows why that distinction matters for assessing the scale of China's support relative to that of the other four regions.

This report draws on the Clean Investment Monitor, a joint project of Rhodium Group and MIT's Center for Energy and Environmental Policy Research.[4] No other public source analyzes, award by award, the instrument, terms, and payment status of government support for clean manufacturing in the United States, Europe, Canada, Australia, and China, or estimates the subsidy value of that support on a common basis. The award-level calculations underlying the data make

1 In this report, Europe comprises the 27 European Union member states, Norway, Switzerland, and the United Kingdom.

2 All dollar amounts are reported in 2024 U.S. dollars. Spain's grants were awarded mainly under its Strategic Project for Economic Recovery and Transformation of the Electric and Connected Vehicle (PERTE VEC).

3 Australia's figure comprises four rare earth financing commitments made between 2022 and 2025: three loan tranches to Iluka Resources' Eneabba refinery under Australia's Critical Minerals Facility, administered by Export Finance Australia (EFA), and a convertible note to Arafura Rare Earths from the National Reconstruction Fund Corporation (NRFC). The below-market element of the EFA loans (estimated at 1.1 percent of face value) is the "initial valuation adjustment" that EFA records in its audited financial statements when it lends on below-market terms (EFA Annual Report 2022–23, Notes 7–8). No government valuation exists for the NRFC note; we estimate its subsidy element at 13.4 percent of face value using the same fair-value approach applied to the MP Materials agreement in Deese, Khan, & Reese (2026).

4 This analysis uses cross-country subsidy estimates from the Clean Investment Monitor to compare levels of government support over time. For more information on coverage, valuation methods, and limitations, see the appendix to this report. The data can be viewed without an account on the Clean Investment Monitor website and downloaded from Rhodium Group's ClimateDeck.

this kind of cross-country comparison possible. We use them to examine the scale and form of clean manufacturing subsidies in those economies alongside operating and planned capacity.

2. Why Announced Amounts Differ from Subsidies

This report measures support by its subsidy value: the part of government support that is effectively a gift. Grants and tax credits count in full. For loans, loan guarantees, and equity investments, only the discount counts—the value of terms more favorable than the recipient could obtain from a private lender or investor. A $100 million grant therefore costs the government $100 million, whereas a $100 million loan at close to market rates costs it little, because the money is repaid with interest.

Each total also counts support at a specific point. Grants count when awarded, and financing counts when the agreement becomes binding. Tax credits count at their published or estimated cost. Contracts that pay only as a plant produces count at what had been paid through 2025. Announcements, preliminary selections, and conditional approvals are not counted.

On that basis, announced amounts can differ from subsidy value for three reasons.

Some support has no announced total. Grants generally specify an award amount. Production tax credits instead pay a set rate for each unit produced. For example, the advanced manufacturing production credit created by the Inflation Reduction Act provides $35 for each kilowatt-hour of battery cell capacity produced in the United States and sold.[5] Its cost depends on how much is produced, and governments do not always publish detailed accounts of what was claimed, so the total must be estimated.

Some headlines are ceilings, not commitments. Canada's 2023 agreements with Volkswagen's PowerCo and with NextStar Energy, the Stellantis–LG Energy Solution joint venture, are often cited as more than $20 billion in support.[6] In practice, the agreements work as follows:

> *What is promised.* A payment for every kilowatt-hour of batteries the two plants produce and sell over 10 years, up to that combined maximum.
>
> *What must happen for money to flow.* The plants must be built, start producing, and sell batteries. If output is low, payments will fall far short of the maximum.
>
> *What has been paid.* Through 2025, with both plants still ramping up, the agreements had paid about $30 million, less than 0.2 percent of the maximum.

This report counts the $30 million. That figure will grow as the plants produce, but the $20 billion headline describes how large the support could become, not what Canada has provided to date.

Some headlines are mostly money that will be repaid. For a loan, the subsidy value is the discount: the difference between the government's terms and those a private lender would offer, accounting for interest, maturity, repayment priority, and risk. Government equity works the same way: its subsidy value is the return the government forgoes relative to what a private investor would require for comparable risk.

---

5 See 26 U.S.C. § 45X for full details of the program's eligibility requirements and per-unit credit amounts for different products.

6 Innovation, Science and Economic Development Canada, "Canada and Ontario Establish An Auto Pact to Secure Stellantis-LGES and Volkswagen deals," statement, July 6, 2023, https://www.canada.ca/en/innovation-science-economic-development/news/2023/07/canada-and-ontario-establish-an-auto-pact-to-secure-stellantis-lges-and-volkswagen-deals.html.

That discount can be large or nearly zero. For example, Australia's published valuation of a $900 million loan to Iluka's rare earth refinery implies about 1 cent of subsidy per dollar lent. The European Investment Bank's $360 million loan to Verkor's battery factory in France, backed by the European Union's InvestEU program, carries an estimated $145 million in subsidy, or about 40 cents per dollar lent. The smaller loan therefore provides more than 10 times the subsidy of the larger one.

Why this matters for comparisons. Each country relies on a different mix of instruments, so these differences do not cancel out; they inflate some countries' headline figures far more than others'. A comparison of announced amounts can misstate both the scale of a country's support and how it ranks against other countries.

Therefore, any serious assessment of government support for these industries, or comparison of that support among countries, must start by putting every country's awards on the same basis.

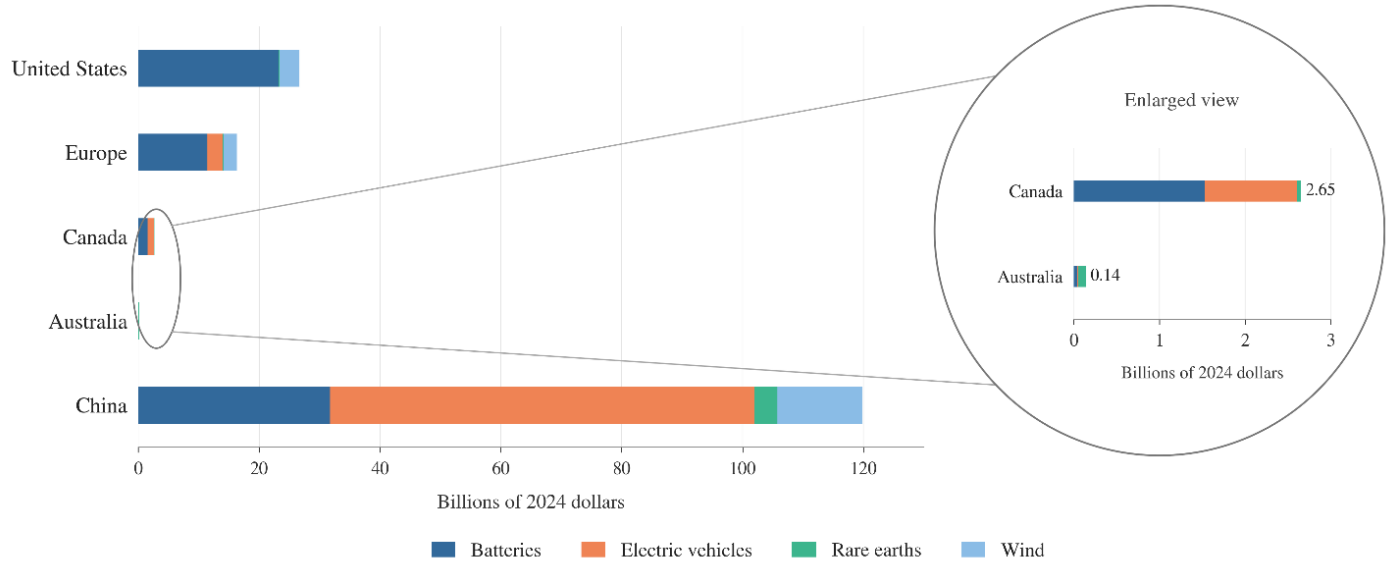
3. What Governments have Committed

Putting government support on a common basis shows four things: how much each region provided, through which instruments, how far headline figures overstate that support, and how it has changed since 2018.

Total subsidies. Support outside China is concentrated in one technology and one country. From 2018 through 2025, the United States, Europe, Canada, and Australia provided a combined $45.8 billion in manufacturing subsidies for batteries, electric vehicles, rare earths, and wind equipment. The United States committed $26.7 billion, Europe committed $16.3 billion, Canada $2.6 billion, and Australia about $0.1 billion. China provided $119.7 billion over the same period, about 2.6 times the combined total of the other four regions (see Figure 3.1).

Batteries accounted for most of the support outside China, including $23.2 billion in the United States and $11.5 billion in Europe. U.S. battery subsidies alone represented about half of the combined support provided by the other four regions. Rare earth mining, processing, and magnet production received about $550 million, the smallest total among the technology groups examined here.

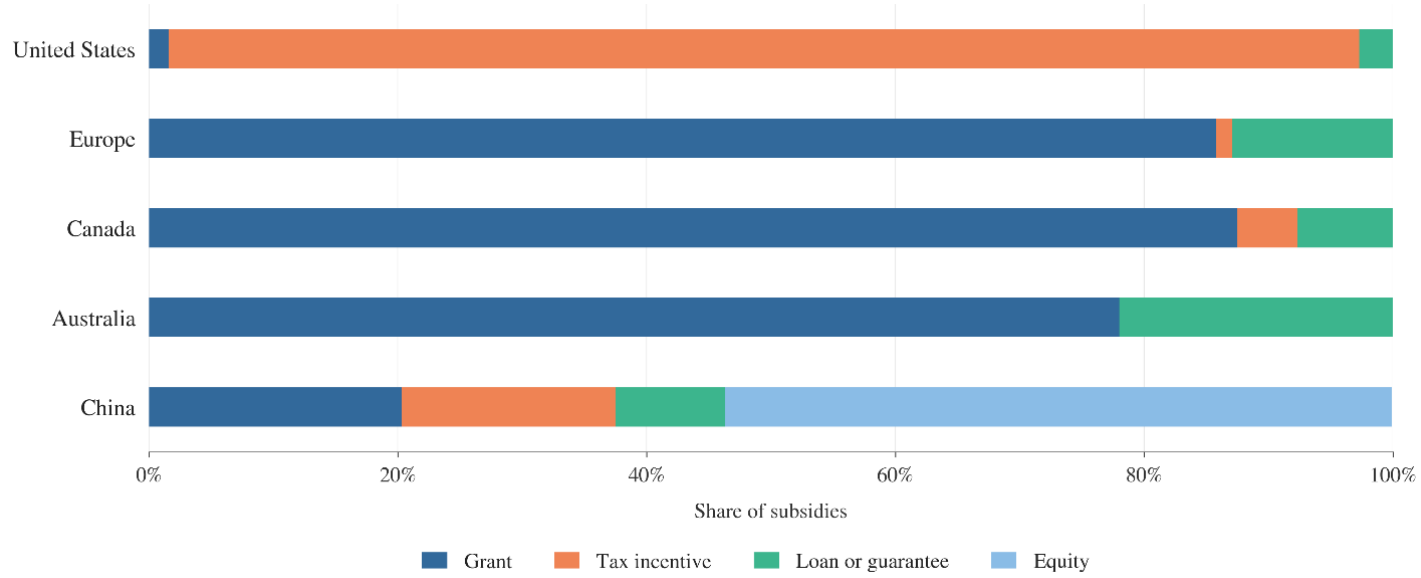
Figure 3.1: Manufacturing subsidies by region and technology, 2018–2025



Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

Forms of support. Tax credits accounted for 96 percent of U.S. subsidies, chiefly through the advanced manufacturing production credit described in Section 2 (see Figure 3.2). Grants accounted for 86 percent of European subsidies, including national awards under the Important Projects of Common European Interest framework—an EU framework for innovative projects that involve multiple member states. China used a broader mix of instruments. The subsidy value of government equity investments (the returns the state forgoes relative to what a private investor would require) accounted for the largest share, followed by grants, tax incentives, and loans.

Figure 3.2: Share of clean manufacturing subsidies provided through different funding instruments, 2018–2025

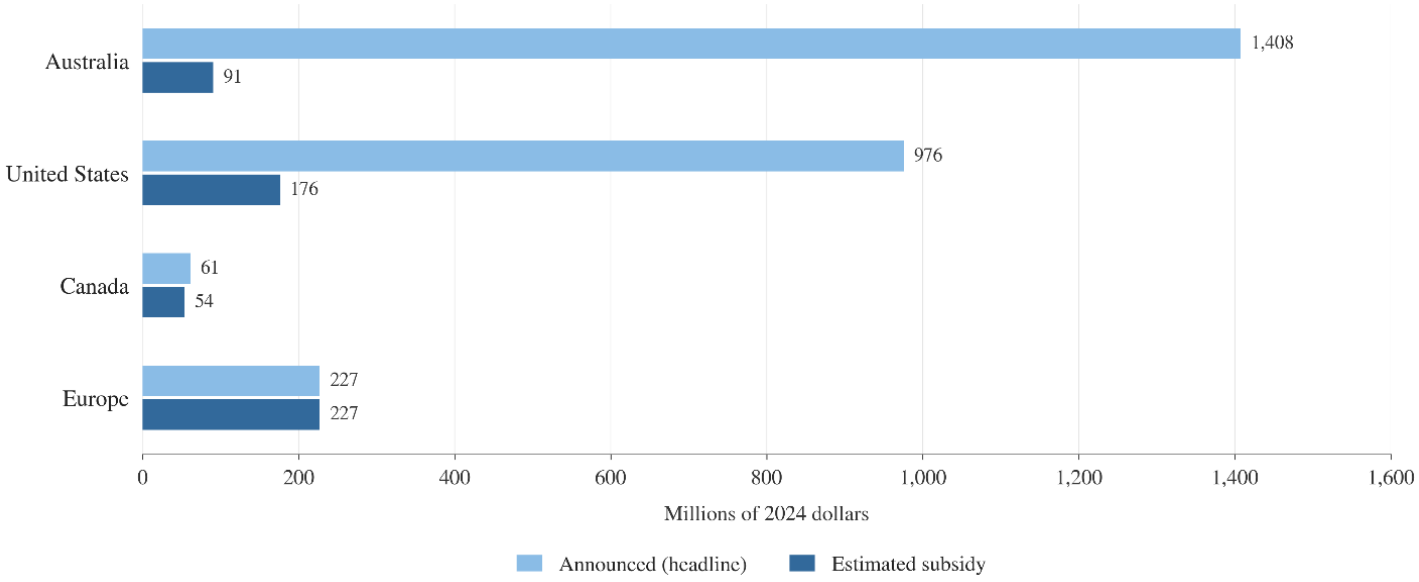


Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

Measuring subsidy value also changes the apparent composition of support in Canada and Australia. Their largest announcements include Canadian battery production contracts and Australian financing agreements. Yet grants accounted for 87 percent of Canada's subsidies and 78 percent of Australia's. Canada's production contracts had paid out only about $30 million through 2025, and by our estimates, Australia's loans generally carry subsidies much smaller than their face values.

Announced amounts and subsidy values. Where support comes mostly as financing, the headline figure mostly measures money that will be repaid. The distinction between announcements and subsidies is particularly pronounced in rare earths. Announced support outside China runs into the billions, led by Australia's financing for the Iluka refinery and Arafura's Nolans project. However, the subsidy value totaled only about $550 million: $227 million in Europe, $176 million in the United States, $91 million in Australia, and $54 million in Canada (see Figure 3.3).

Figure 3.3: Announced support and estimated subsidies for rare earth mining, processing, and magnet manufacturing in selected economies outside China, 2018–2025

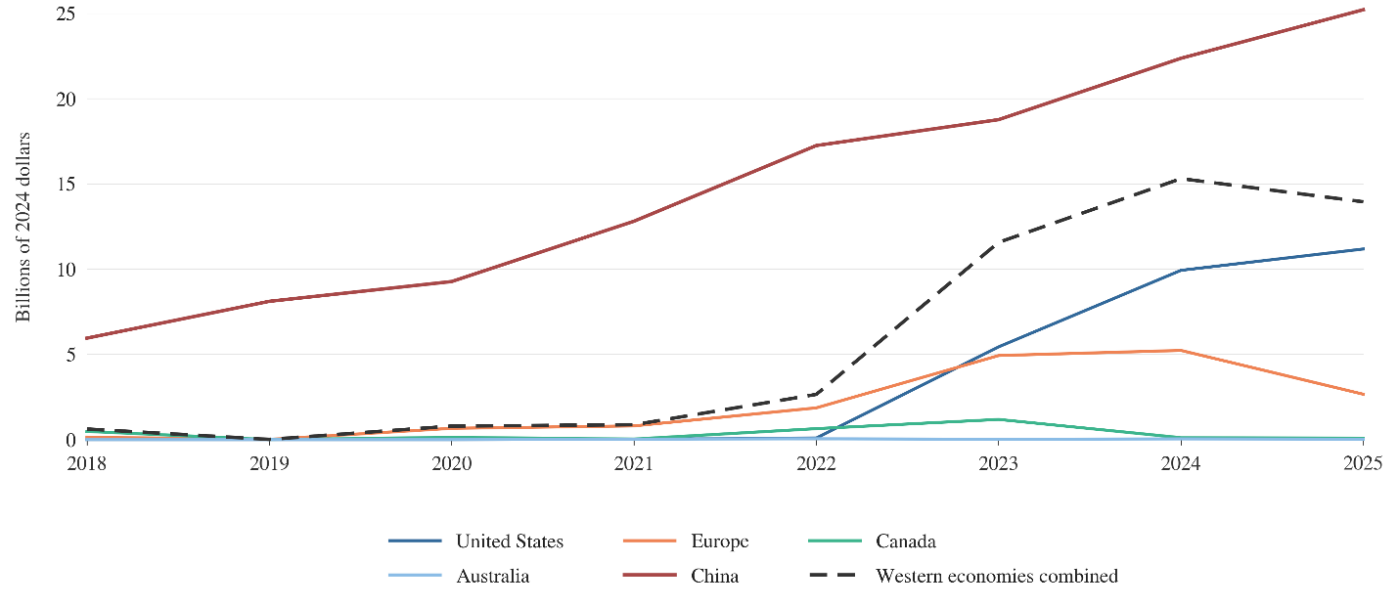


Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

Australia's announced financing was more than 10 times its subsidy value. We estimate that most of that financing is provided at rates close to market rates and can largely be expected to be recovered through repayments or financial returns. Counting its full value alongside grants would overstate Australia's support relative to that of economies providing more direct subsidies.

Changes over time. Support outside China surged after 2022, while China's support rose every year. Subsidies in the other four regions totaled less than $3 billion annually through 2022 (see Figure 3.4). They rose to $11.6 billion in 2023 and $15.3 billion in 2024 before declining to $14.0 billion in 2025. Much of that increase reflected the introduction of U.S. manufacturing production credits.

Figure 3.4: Annual subsidies by region, 2018–2025



Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

The combined trend masks different developments among regions. U.S. subsidies rose from $5.4 billion in 2023 to $11.2 billion in 2025, largely through credits tied to eligible production. European subsidies peaked at $5.2 billion in 2024 and fell to $2.7 billion in 2025; battery support peaked a year earlier, at $4.1 billion. Canadian subsidies were concentrated in 2022 and 2023, when awards totaled $1.8 billion.

Rare earths were an exception to the recent decline in European support. Europe committed $118 million in 2025, more than half of its total for the period. That increase was driven largely by the introduction of a French tax credit for production that supports green industry, for which rare earth processing and magnet manufacturing are eligible.[7] The United States also committed $139 million that year, nearly four-fifths of its period total. Those increases occurred in the same year that China imposed export controls on rare earths and magnets.

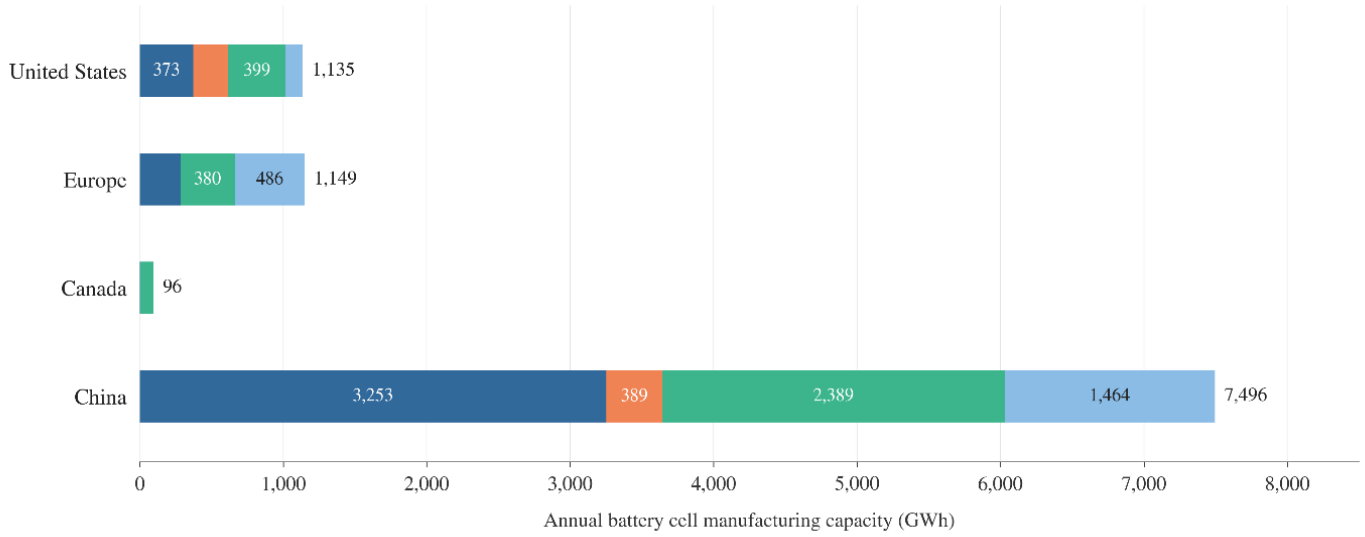
China's subsidies began at $5.9 billion in 2018, above Europe's subsequent annual peak. They increased each year, reaching $25.2 billion in 2025. Despite the expansion of U.S. tax credits and new awards elsewhere, the other four regions together provided $14.0 billion that year, just over half China's total.

4. How Support Relates to Manufacturing Capacity

China's subsidy lead accompanies a much larger manufacturing base, but the relationship between support and capacity differs among technologies. The comparisons below place subsidies recorded during 2018–2025 alongside operating capacity and project pipelines as of the second quarter of 2026. They describe the scale and focus of support, not the capacity caused by subsidies or the cost of establishing new production.

Batteries. As of June 2026, China had 3,253 gigawatt-hours (GWh) of operating battery cell capacity, about 80 percent of the global total. The United States had 373 GWh, or 9 percent, and Europe had 283 GWh, or 7 percent. Canada had only about 5 GWh (see Figure 4.1). Of the 373 GWh of current U.S. capacity, 90 percent has come online since enactment of the Inflation Reduction Act's advanced manufacturing tax credits in 2022.

Figure 4.1: Battery cell capacity by project stage (GWh, as of the second quarter of 2026)



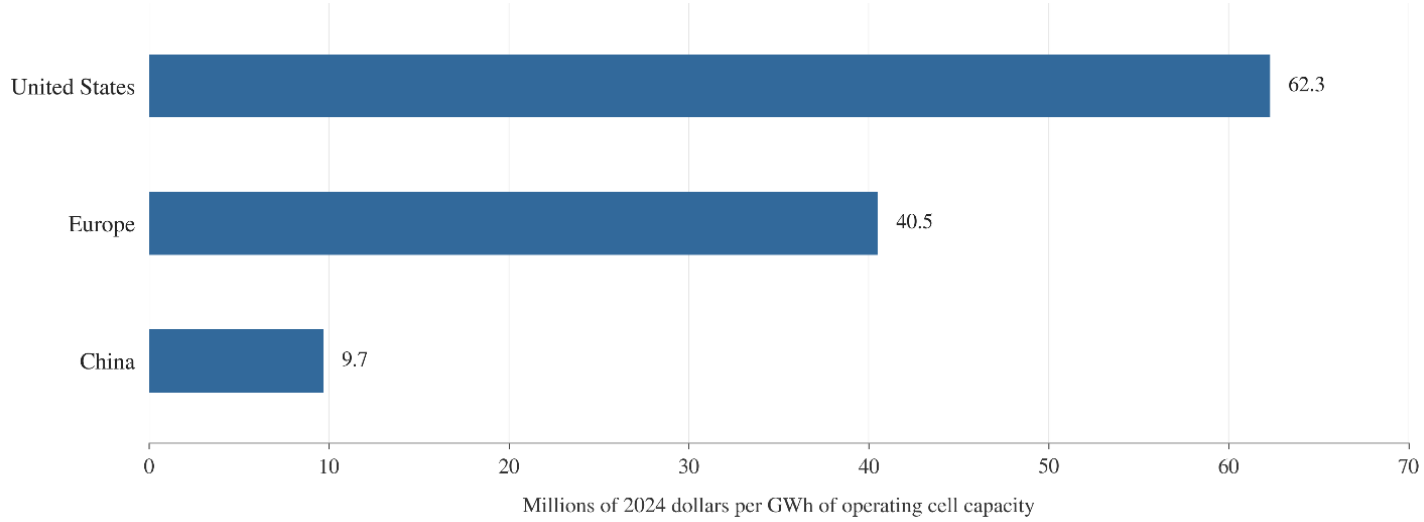
Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

7 France's tax credit for investment in green industry (C3IV) supports investment in selected clean technology supply chains. Its wind-sector eligibility rules include permanent magnet manufacturing and the extraction, production, processing, and recovery of rare earths. See Direction générale des Finances publiques, "Crédit d'impôt au titre des investissements dans l'industrie verte—Champ d'application," BOI-BIC-RICI-10-180-10, July 3, 2024, paragraphs 220–230.

Pipelines for expansion differ substantially among those regions. The United States had another 244 GWh ramping up, 399 GWh under construction, and 118 GWh announced. Together, those projects represent about twice its operating capacity. Europe had 380 GWh under construction and 486 GWh announced, roughly three times its operating capacity. Canada had 90 GWh under construction, 18 times its currently small operating base. These projects could expand alternative supply substantially, although completion and sustained production remain uncertain.

Cumulative battery subsidies amounted to about $62 million per GWh of operating cell capacity in the United States, $41 million in Europe, $10 million in China, and $306 million in Canada (see Figure 4.2).[8] Canada's high ratio reflects its small operating base and support for projects still under development. Canada's production-contingent agreements could provide additional support as output grows, but their maximum values are not included in subsidies recorded through 2025.

Figure 4.2: Battery subsidies for 2018–2025 per GWh of operating capacity as of the second quarter of 2026



Note: Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

The United States accounts for 42 percent of combined U.S. and China battery manufacturing subsidies between 2018 and 2025, but only 8 percent of the cell capacity the two added in that same time. In 2025 alone, the U.S. share was 59 percent of the subsidies and 10 percent of the new capacity.

Following the expansion of U.S. battery subsidies in 2023, annual support per GWh of newly added cell capacity rose each year, from $105 million in 2023 to $134 million in 2025. Over that same period, China's ratio declined from about $16 million per GWh added during 2018–2021 to $9 million during 2022–2025. These differences partly reflect the maturity of the two industries and the timing of support. China's longstanding subsidies accompany continued expansion of an already large manufacturing base. U.S. subsidies, by contrast, increased sharply as its smaller industry began to expand more rapidly.[9]

Electric vehicles. Vehicle manufacturing shows a different pattern from batteries. China had annual assembly capacity for 26.5 million zero-emission vehicles, compared with 5.7 million in Europe, 2.6 million in the United States, and about 230,000 in Canada. Recorded EV manufacturing subsidies over 2018–2025 were equivalent to about $2,650 per vehicle of annual capacity in China, $435 in Europe, $8 in the United States, and $4,700 in Canada.

8 These ratios divide support across the battery supply chain by cell capacity; they are not cell-specific subsidy rates.

9 Because support also benefits existing production, these ratios describe subsidies relative to capacity additions rather than the subsidy cost of establishing new capacity.

The differences reflect the scope and instruments of recorded support. U.S. manufacturing subsidies were concentrated in batteries, whereas U.S. support for EVs has focused more heavily on the demand side through consumer incentives.[10] In China, estimated benefits from below-market equity accounted for about $45.7 billion, or 65 percent, of EV subsidies. Those benefits were recorded throughout the period and support an established industry as well as expansion. The ratios therefore cannot be read as the cost of adding a vehicle of assembly capacity.

Rare earths. Nearly 90 percent of subsidies outside China supported processing and magnet production, the stages where dependence on Chinese supply is greatest. China provided $3.85 billion in subsidies during 2018–2025, about seven times the combined total for the other four regions.

Alternative supply has begun to grow. China's share of global rare earth refining declined by more than 5 percentage points between 2023 and 2025, as new U.S. projects and increased Malaysian production expanded alternative supply. China nevertheless remained the dominant supplier, still producing about 85 percent of refined rare earths in 2025.[11]

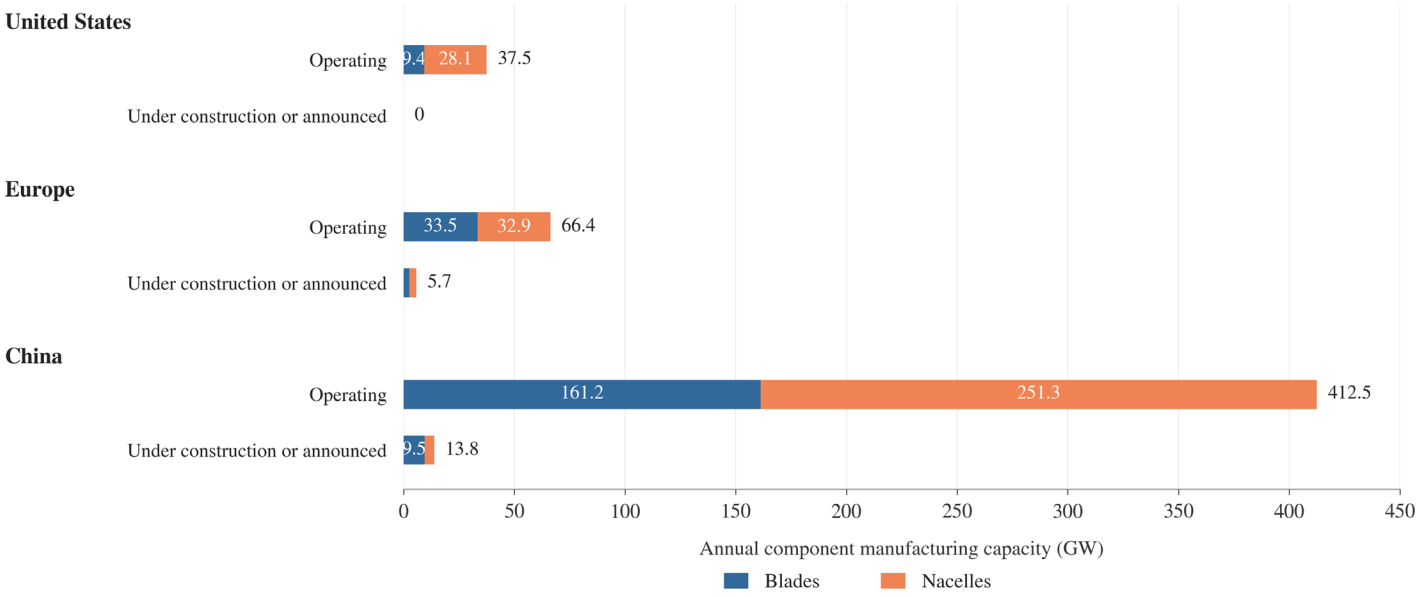
The increases in U.S. and European awards in 2025 mark a greater commitment to alternative sources of supply. Yet the subsidy value of the recent announcements in the United States and Australia, where large financing announcements translated into much smaller subsidies, remains modest compared with the support China provides to its industry. Thus, the new suppliers receiving this support in the United States and Australia continue to compete with a dominant, more heavily subsidized producer. However, these programs illustrate how a relatively small subsidy can support a much larger financing commitment. Australia's loans provide upfront capital for mining and processing projects, while recent U.S. equity investments, loans, and long-term price commitments address both financing needs and the risk of falling prices, which China's large market share allows it to influence.

Wind equipment. Europe and the United States have some established wind manufacturing capacity and relatively little additional capacity under development (see Figure 4.3). Europe has annual capacity to manufacture about 33 GW of nacelles and 33 GW of blades, with roughly 6 GW of additional capacity under construction or announced. The United States has about 28 GW of nacelle capacity and 9 GW of blade capacity, with less than 1 GW of additional capacity in development. China accounts for roughly three-quarters of global nacelle capacity and 70 percent of blade capacity.

10 Between 2018 and 2025, the United States provided varying levels of support for electric vehicle purchases through tax credits for new and used vehicles. Although demand-side subsidies are excluded from this report, estimates of the value of those tax credits over the 2018–2025 period are included in the published CIM data.

11 International Energy Agency, "Supply concentration, export restrictions and declining investment put critical mineral security at risk," July 16, 2026, https://www.iea.org/news/supply-concentration-export-restrictions-and-declining-investment-put-critical-mineral-security-at-risk.

Figure 4.3: Operating wind component manufacturing capacity, second quarter of 2026

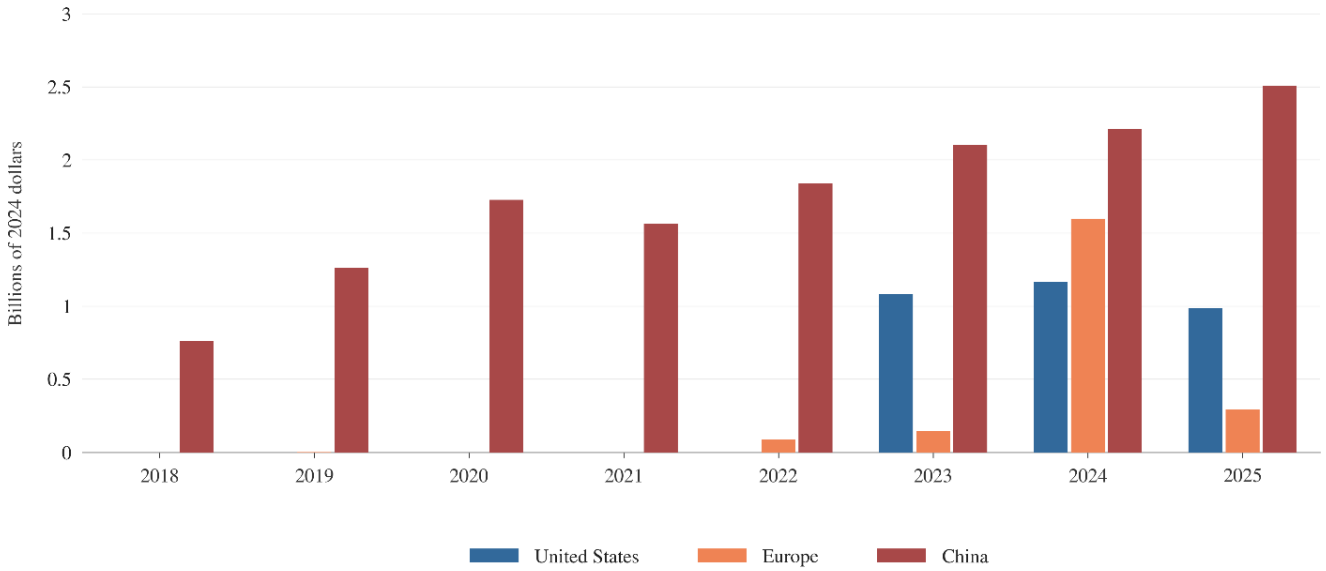


Note: The stacked totals combine the two manufacturing stages and do not measure completed turbine capacity. Europe includes the 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

For wind, the main distinction is the constraint being addressed: U.S. credits subsidize production, while much of Europe's recent support eases the financing of equipment orders. Both support established manufacturers facing a much larger Chinese industry. China provided $14.0 billion over the period, more than two and a half times the combined U.S. and European total (see Figure 4.4).

The United States accounts for about 60 percent of combined U.S. and European wind manufacturing subsidies, but 46 percent of their combined nacelle capacity and 22 percent of their blade capacity. Those comparisons indicate the scale of U.S. support relative to the two manufacturing bases; they do not allocate subsidies to individual components. U.S. support comes through credits for eligible production and sales. With little additional capacity in development, that support is primarily tied to output from the existing manufacturing base.

Figure 4.4: Annual wind manufacturing subsidies, 2018–2025



Note: 27 European Union member states, Norway, Switzerland, and the United Kingdom.
Source: Clean Investment Monitor.

Europe provided $2.1 billion in wind manufacturing subsidies over the 2018–2025 period, with $1.6 billion recorded in 2024. Of that year's total, an estimated $1.3 billion came from the subsidy value of the European Investment Bank's wind power package. The package uses guarantees to help banks provide the financial assurances manufacturers need to accept and fulfill equipment orders.[12] Its main purpose is to ease constraints on manufacturers' ability to supply wind projects, rather than to subsidize factory construction directly.

5. Implications for Designing Support

Manufacturers of clean technologies outside China compete with Chinese industries that have both a large manufacturing base and substantial, continuing government support. Governments seeking to expand alternative sources of supply are unlikely to match China's subsidies dollar for dollar, and they may not need to. The aggregate gap says little about how much support a particular project needs. If a project is held back by a specific barrier, a modest subsidy that addresses it can matter more than a larger award that leaves it in place.

The programs examined in this report illustrate that point. Financing such as Australia's rare earth loans, European Investment Bank loans backed by InvestEU, and the bank's wind guarantees can help projects raise capital and manufacturers fulfill orders, even though its subsidy value is small relative to the amount made available. U.S. production credits and Canada's production agreements instead offset higher production costs, and their cost rises only as output does. Long-term price commitments, such as those the United States has recently made for rare earths, can make future revenues more predictable where the risk of falling prices is holding back investment. In each case, the value of the support depends less on its size than on whether it addresses the barrier that would otherwise keep a project from going ahead.

Comparing the subsidy value of support among instruments and countries provides a basis for those judgments. It shows the scale and form of support competitors receive and where existing policies concentrate resources. That common basis is a starting point for identifying which barriers additional support should address, and which instruments are best suited to doing so.

Acknowledgments

The authors thank Brian Deese, Alejandra Gutierrez, Conor Hand, Zehra Khan, and Lauren Sidner for their review and helpful comments on earlier drafts.

12 European Investment Bank, "Germany: EIB and Deutsche Bank to boost Europe's wind energy manufacturers," July 31, 2024, https://www.eib.org/en/press/all/2024-308-eib-and-deutsche-bank-to-boost-europe-s-wind-manufacturers.

Appendix. Data and Methodology

Scope and coverage

For this analysis, we use data from the Clean Investment Monitor (CIM) to compare government subsidies for clean manufacturing in China, Europe, the United States, Canada, and Australia from 2018 through 2025. Europe comprises the 27 European Union member states, the United Kingdom, Norway, and Switzerland. The analysis covers battery manufacturing, electric vehicle manufacturing, rare earth mining and processing, permanent magnet manufacturing, and wind energy equipment manufacturing. Consumer purchase incentives and other industry decarbonization subsidies included in the broader CIM database are excluded for the purposes of this report.

Battery manufacturing includes electrode active materials, cells, modules, and packs. Raw-material extraction and general mineral processing are excluded from the battery category. Recycling is included when its output is an eligible manufactured product, such as active material. Rare earth coverage extends from mine to magnet, including mining and concentration, oxide separation, metal refining, alloying, and the manufacture of finished permanent magnets. Wind coverage includes nacelles and blades.

Support for pilot and demonstration facilities is included only when those facilities are meant to manufacture commercially viable products. We exclude nontargeted subsidies, subsidies for research and development activities, and below-market support for which we could not develop a justifiable benchmark—for example, subsidized land transfers in China. The analysis also does not quantify the effects of nonfiscal policies, such as disincentives to the production of conventional technologies like internal combustion engine vehicles.

Amounts are expressed in 2024 U.S. dollars. Local-currency amounts are converted using annual average exchange rates from the International Monetary Fund. Manufacturing subsidies are then adjusted using the Bureau of Economic Analysis's nonresidential fixed investment price deflator, obtained through the Federal Reserve Bank of St. Louis. Annual deflators are calculated from quarterly averages and rebased to 2024.

Recording and valuing support

The analysis measures the subsidy value of government support. Grants and tax benefits are recorded at their full value. For loans, guarantees, and equity investments, only the estimated benefit of terms more favorable than comparable commercial financing is counted. Government equity investments priced at or above market terms are excluded. Wherever possible, support is recorded when a government makes a final award or binding commitment. General announcements, appropriations without identifiable commitments, preliminary selections, and conditional approvals are excluded. Grants are generally assigned to the award decision year; financing agreements are recorded when they become binding. The latest published amendment governs the amount, and canceled awards are removed. Fiscal-year figures are assigned to calendar years using award dates where available; where they are not, we use assumptions to map government fiscal years to calendar years.

For contracts whose payments depend on production, we record payments through 2025 rather than the potential maximum. Tax benefits are taken from published government accounting or are estimated using information on eligible private-sector activity and applicable program terms.

We aim to include award-specific subsidy amounts published by governments for included loan and equity investments wherever possible. When such award-specific information is unavailable, we use published or derived agency portfolio ratios to estimate cohort-level subsidy shares, followed by bespoke estimates based on the agreement's terms. Portfolio ratios are proxies for individual transactions and may reflect different accounting treatments among government agencies. We retain the source and valuation basis for all estimates we include.

Region-specific information

Europe. European data primarily come from the European Commission's State Aid Transparency Award Module, national award registries, government funding decisions, and government budget or agency reports. These sources are supplemented by project records from the European Investment Bank and grant agreements administered by European Union (EU) institutions.

Awards are reviewed individually to identify eligible technologies, activities, instruments, and amounts. For funding that covers several technologies or activities and is not reported in enough detail, we estimate the relevant share using available supporting government documentation.

The compilation includes national and EU support but excludes awards funded by subnational governments. EU awards are identified separately from national awards to avoid double counting. National programs financed through the EU's Recovery and Resilience Facility remain classified as national commitments because they are reported by EU member states and the share reimbursed by the EU is not reported.

Published aid-equivalent amounts are used for loans where available. For European Investment Bank loans backed by the InvestEU program, we estimate the subsidy as 40 percent of the signed loan amount, using the program's statutory provisioning rate as a proxy for a portfolio-wide concessionality average.

Australia. Australian data primarily come from GrantConnect, the government's federal grants registry, supplemented by the Australian Renewable Energy Agency's project records and the various public financing agencies' financial statements. State-level support is excluded. Awards are classified by project activity and stage, and amendments are reconciled using the registry's award identifiers.

Loan and equity subsidies use published government valuations where available. For loans provided by Export Finance Australia, we apply a subsidy ratio of approximately 1.1 percent, derived from the agency's reported initial valuation adjustments. For financing under the Northern Australia Infrastructure Facility, we use an 18 percent ratio derived from reported concessional discounts and contractual commitments.

Where no published valuation exists, financing is estimated from its terms. For example, we estimate a subsidy of 13.4 percent of face value for the National Reconstruction Fund Corporation's convertible note using the below-market valuation method developed in Deese, Khan, and Reese (2026).

Canada. Canadian data primarily come from the federal proactive-disclosure registry, Public Accounts of Canada, departmental financial statements, and the Report on Federal Tax Expenditures. Provincial and local awards are excluded. We reviewed registry descriptions to distinguish nonrepayable, unconditionally repayable, and conditionally repayable contributions.

Nonrepayable contributions are counted at full value. Unconditionally repayable contributions are valued using departmental accounting measures of concessionality. For Innovation, Science and Economic Development Canada, we apply a 15.5 percent ratio derived from reported discounts relative to the gross repayable portfolio. For other agencies, we use their respective published or derived ratios.

Conditionally repayable contributions require an additional assumption because recoveries depend on project outcomes. We use an assumed recovery parameter of 50 percent, informed by historical Technology Partnerships Canada repayments.

Battery contracts contingent on future production levels are recorded at disbursements through 2025, not their maximum contractual amounts. Tax expenditures use published federal estimates, with estimated shares applied to programs that extend beyond the technologies covered by CIM. Refundable investment credits are counted at full value.

China. For China's manufacturing estimates, we use company financial disclosures, supplemented by government reporting and adjusted for overlap. Because of company-specific data limitations, we include documented amounts from the largest firms operating in a relevant technology and estimate support to the remaining market using the covered firms' subsidies as a share of their production and the share of the market not captured by the largest firms.

Government grants and disclosed tax benefits are recorded as reported. Benefits from preferential tax rates are estimated from the applicable rates and financial statement items. Below-market loan benefits are estimated by comparing reported borrowing costs with benchmark costs for comparable firms.

Below-market equity estimates identify firms with substantial government-backed ownership and compare their returns on capital with an estimated global sector benchmark. The shortfall attributed to government investors' acceptance of below-market returns is recorded as the subsidy.

United States. U.S. estimates draw primarily on the U.S. CIM and its supporting government sources. Grants are recorded at committed amounts, and financing is included at its estimated subsidy value. Manufacturing tax credits use government reporting where available or estimates based on eligible investment, production, or sales and the applicable credit rates. For production credits, the total subsidy depends on eligible activity rather than an announced program amount.

Verification and limitations

The Europe, Australia, and Canada compilation combined automated collection and AI-assisted classification with researcher review. Classifications were based on project descriptions and supporting source text. Researchers established the scope and valuation rules, reviewed flagged cases, and checked samples of excluded records. We used mechanical checks to identify duplicate awards, inconsistent units, missing classifications, and superseded amounts. Our records retain the sources, estimation assumptions, and revision history for all included award-level and program-level subsidy observations.

The estimates provide a common measure of subsidy support, but source coverage and valuation methods differ among economies. In particular, China's company disclosures can include support from multiple levels of government, whereas subnational awards are excluded for the United States, Europe, Australia, and Canada.

About the Authors



Steven Berit serves as Policy Advisor for CleanEcon and MIT Innovation Fellow Brian Deese. Prior to this role, he worked for the White House Council of Economic Advisers, focusing on climate, industrial strategy, and energy markets. Steven is a proud graduate of the University of Maryland, College Park, where he studied government and politics and computer science.



Robert Reese is a Program Manager for CleanEcon and is the Lead Data Analyst and Manager of Public Sector Research for MIT Innovation Fellow Brian Deese. He works on climate change and industrial policy projects, including the Clean Investment Monitor. Before joining MIT, Robert served as Chief of the Natural and Physical Resources Cost Estimates Unit at the Congressional Budget Office. There he oversaw the production of cost estimates for bills related to agriculture, energy, environment, transportation, and natural resources policy. Before being promoted to the chief role, Robert was a principal analyst in the same unit for over seven years where he worked on surface transportation and housing policy. He received both his B.A. and M.P.P. from the University of Virginia.

About the Center for Energy and Environmental Policy Research (CEEPR)

Since 1977, CEEPR has been a focal point for research on energy and environmental policy at MIT. CEEPR promotes rigorous, objective research for improved decision making in government and the private sector, and secures the relevance of its work through close cooperation with industry partners from around the globe. CEEPR is jointly sponsored at MIT by the MIT Energy Initiative (MITEI), the Department of Economics, and the Sloan School of Management.

Contact.

The MIT CEEPR Research Commentary Series is published by the MIT Center for Energy and Environmental Policy Research from submissions by affiliated researchers.

For inquiries and/or for permission to reproduce material in this commentary, please contact:

General inquiries: ceepr@mit.edu

Media inquiries: ceepr-media@mit.edu

Copyright © 2026
Massachusetts Institute of Technology



MIT CEEPR

Center for Energy and
Environmental Policy Research

MIT Center for Energy and
Environmental Policy Research
Massachusetts Institute of Technology
77 Massachusetts Avenue, E19-411
Cambridge, MA 02139-4307
USA

ceepr.mit.edu

MASSACHUSETTS INSTITUTE OF TECHNOLOGY