

Energy Transition Investment Trends 2024

Tracking global investment in the low-carbon transition

January 30, 2024

Abridged version



BloombergNEF

Executive summary

Global investment in the energy transition hit a record \$1.8 trillion in 2023, climbing 17% from a year earlier. Electrified transport was the main driver of this spending on the rollout of clean technologies, leapfrogging renewable energy and accounting for more than a third of the investment total. China was once again the largest market, although Europe saw the fastest growth.

- This report is BloombergNEF's annual review of global investment in the low-carbon energy transition. In addition to 'energy transition investment', which is focused on the deployment of clean technologies such as renewable energy projects, electric vehicles, power grids and hydrogen, it also covers investment in the clean energy supply chain, venture capital, private equity and public markets investment in climate-tech companies, and for the first time, debt issuance for energy transition purposes.
- Electrified transport overtook renewable energy to be the largest driver of spending in 2023 at \$634 billion, up 36% year-on-year. Renewable energy saw more modest momentum, rising 8% to \$623 billion. There was also strong growth in emerging areas, with investment in hydrogen tripling year-on-year, carbon capture and storage nearly doubling, and energy storage jumping 76%.
- China remains the largest contributor to energy transition investment, comprising 38% of the global total at \$676 billion. But the US posted strong growth to narrow the gap, spending \$303 billion, while the 27 members of the European Union saw a combined \$340 billion in investment.
- Investment in the global clean energy supply chain, including equipment factories and battery metals production, hit a new record at \$135 billion, and is set to surge further over the next two years.
- Climate-tech companies raised \$84 billion in private and public equity in 2023, down 34% year-on-year in a second straight year of contraction. Public markets led the fall, with private investment also slightly down.
- The issuance of debt for energy transition purposes rose 4% to \$824 billion. Issuances had fallen by 10% a year earlier and the rebound has come off the back of stabilizing or falling interest rates.

\$1.77 trillion

Global energy transition investment in 2023

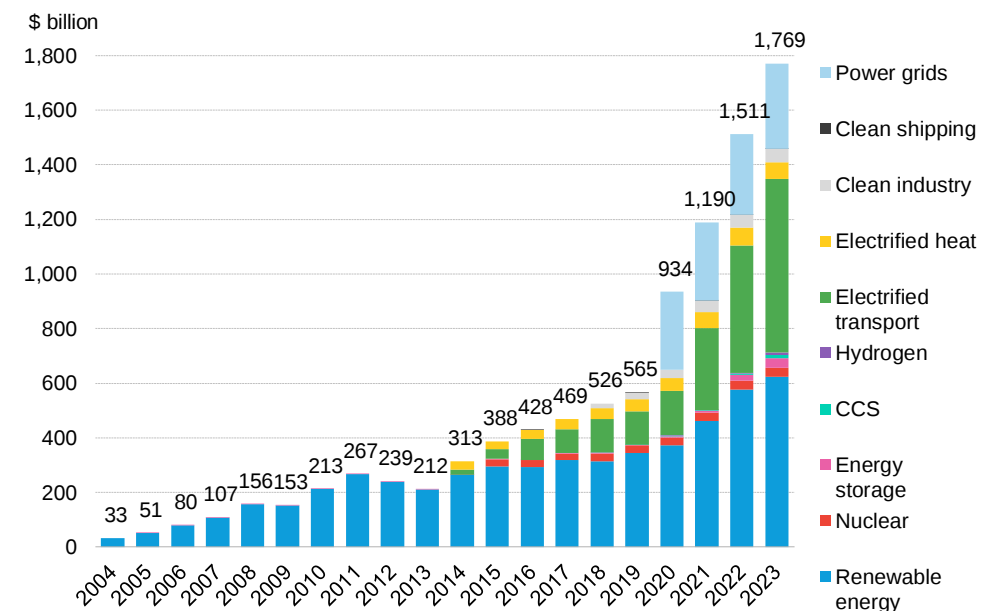
\$135 billion

Global clean energy supply chain investment in 2023

\$84 billion

Global climate-tech equity finance raised in 2023

Global energy transition investment, by sector



Source: BloombergNEF. Note: Start years differ by sector but all sectors are present from 2020 onwards – see [Methodology](#) for more detail. Most notably, nuclear figures start in 2015 and power grids in 2020. CCS refers to carbon capture and storage.

Types of funding covered in this report

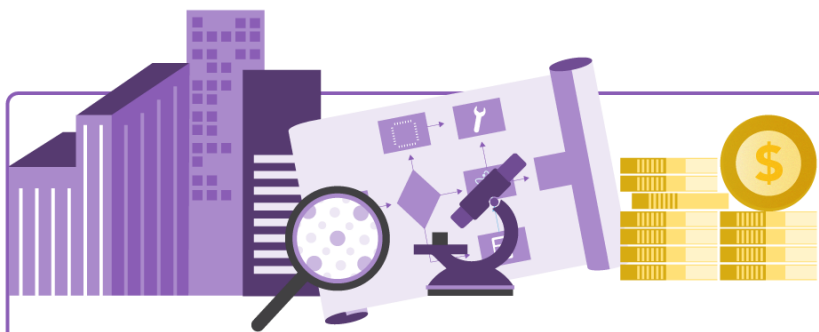


Energy transition investment

Deployment of net-zero-aligned technology and infrastructure

Clean energy supply chain investment

Construction of manufacturing facilities and materials production for clean energy technologies



Climate-tech equity raising

Equity raised by companies focused on climate and energy transition

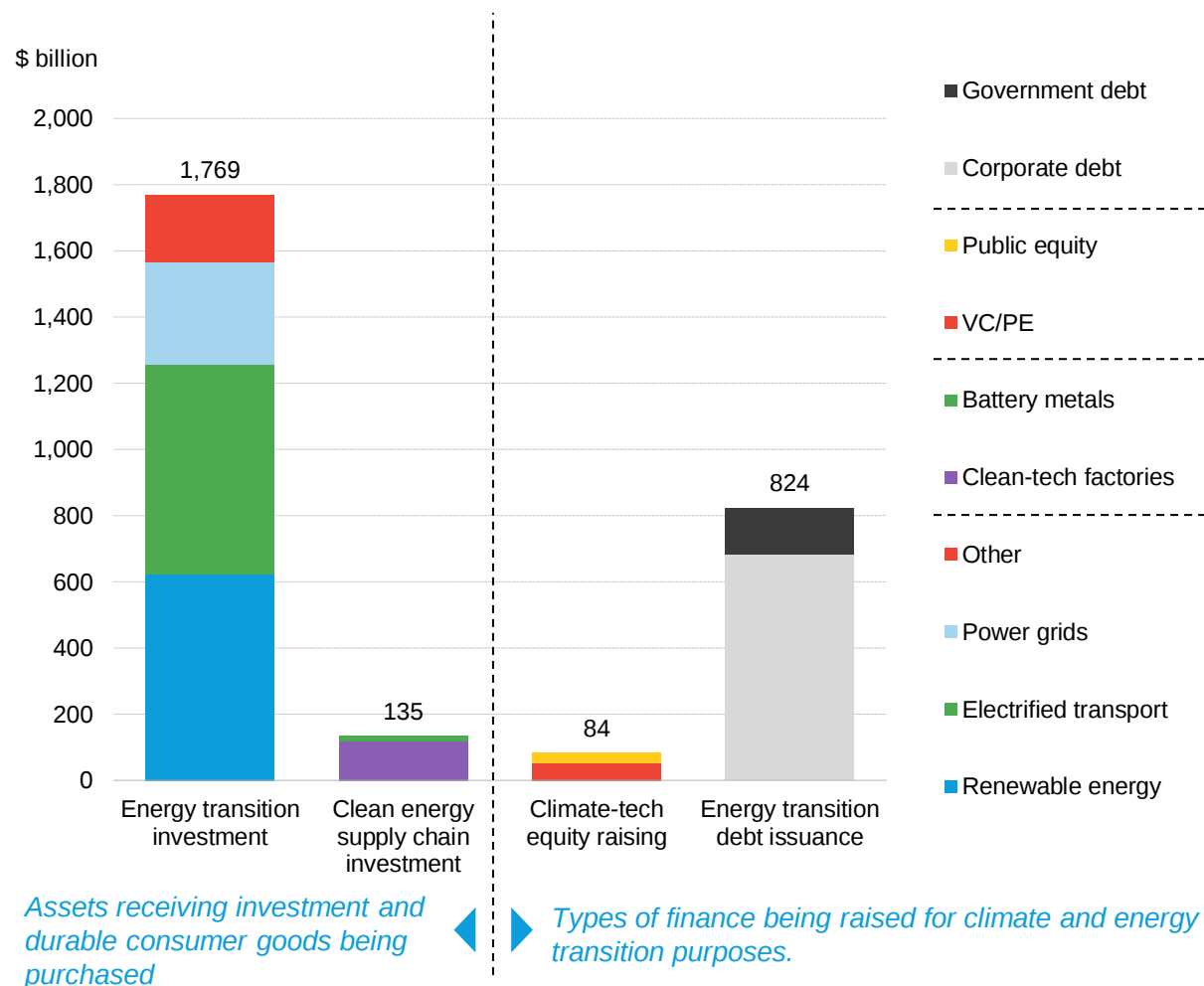


Energy transition debt issuance

Debt issued by companies and governments to fund the energy transition

We tracked \$2.8 trillion in funding flows across the four categories in 2023

2023 funding across categories covered in this report

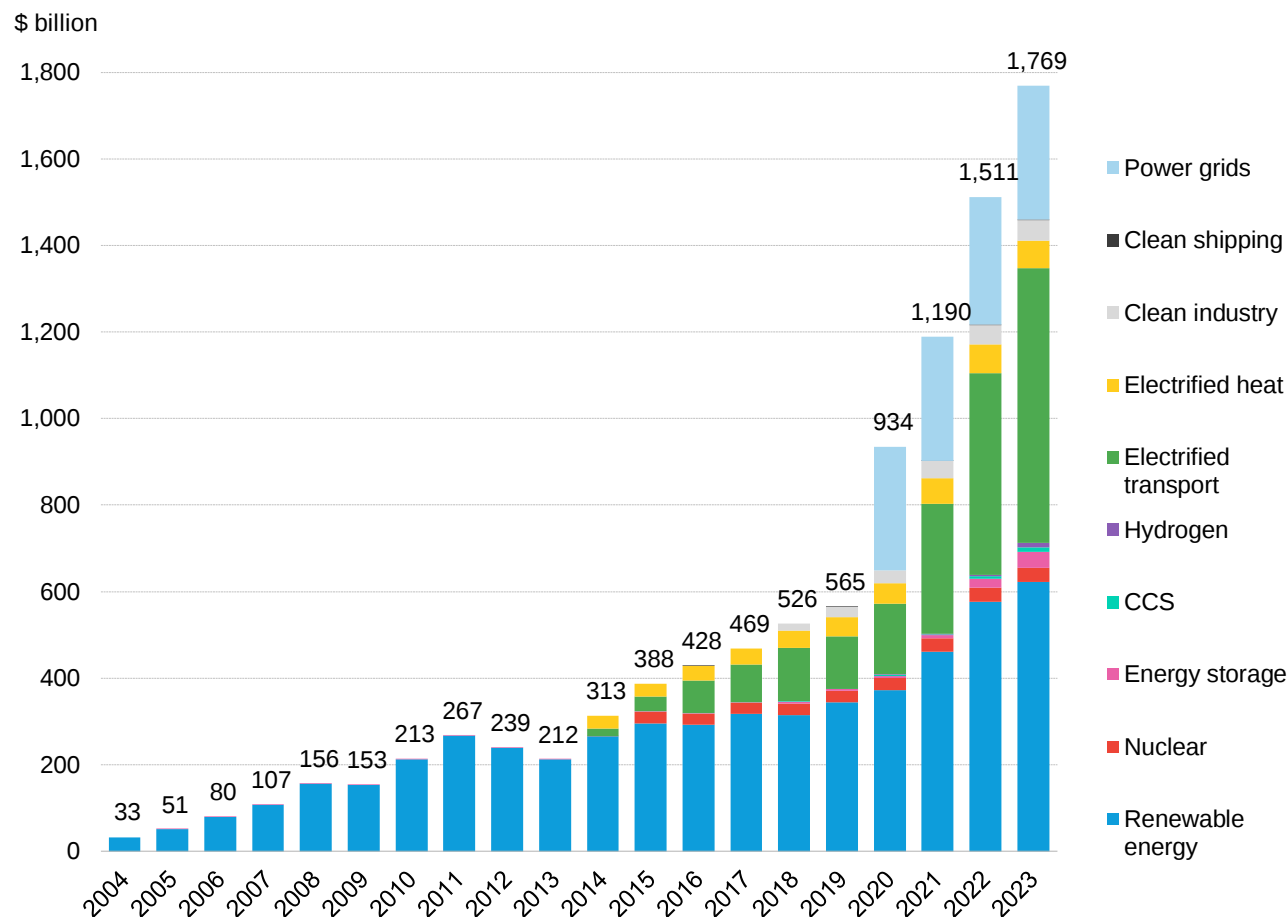


Source: BloombergNEF. Note: VC/PE refers to venture capital and private equity.

- Funding flows across all the categories tracked in this report totaled \$2.8 trillion in 2023.
- Some \$1.9 trillion of this capital was spent on either deploying clean tech (energy transition investment), or setting up the factories, mines and refineries to produce clean tech (clean energy supply chain investment).
- Energy transition investment far outweighs supply chain investment, as the capital expenditure to construct clean energy projects, and the sales value of key products such as EVs, is much higher than the cost of building factories and mines.
- The other roughly \$900 billion represents finance raised by companies or governments active in climate tech or the energy transition.
- Debt issuance for energy transition purposes, in particular by utilities, financial institutions and governments, far exceeds the amount of equity raised by climate-focused companies in private and public markets.
- In principle, equity and debt financing raised and counted on the right of the chart can then be deployed into assets on the left of the chart. However, due to differences in scope and methodology, the relationship is not one-to-one and the totals are not directly comparable.

Energy transition investment grew 17% in 2023

Global investment in energy transition, by sector

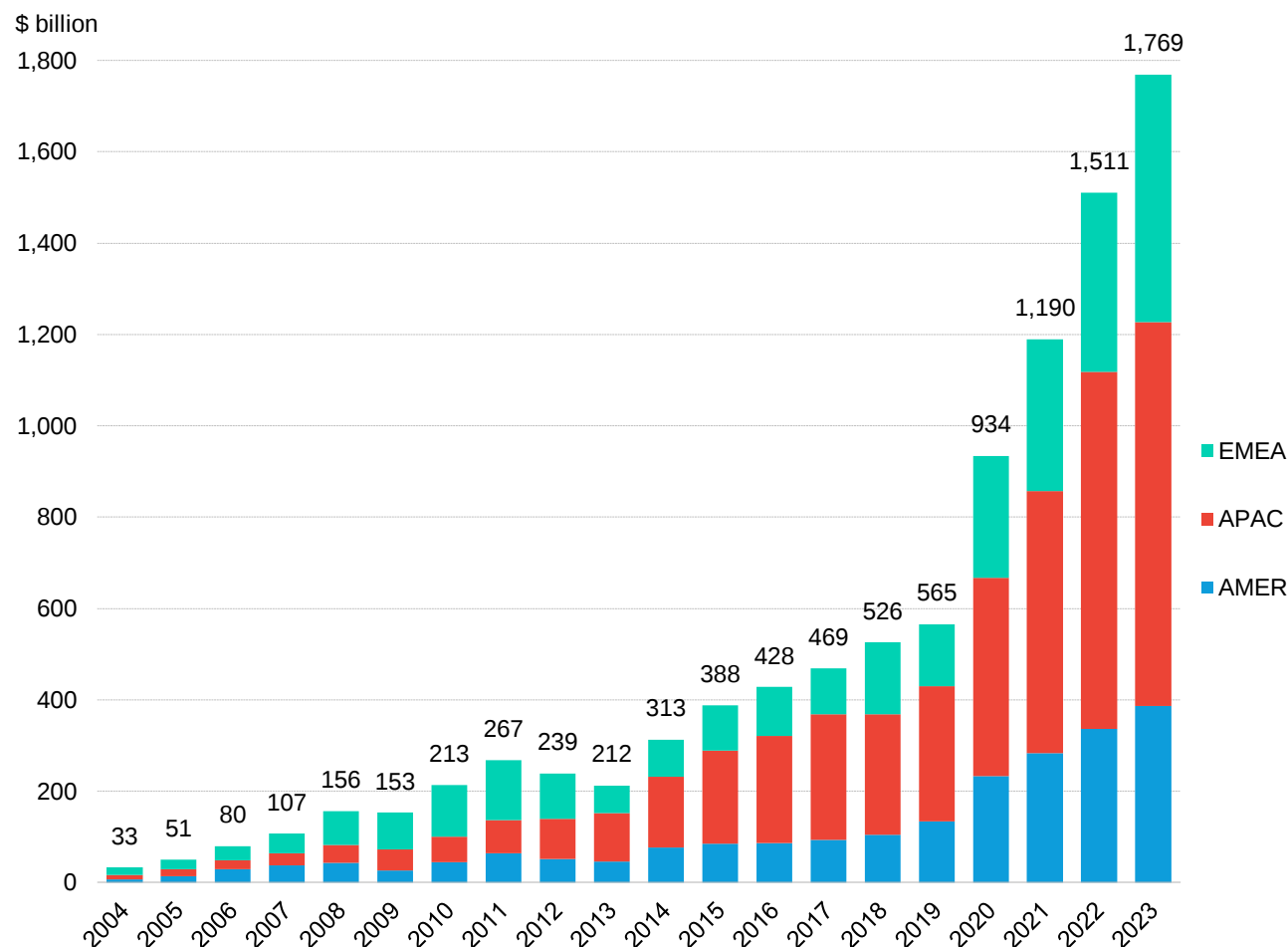


Source: BloombergNEF. Note: Start years differ by sector but all sectors are present from 2020 onwards; see [Methodology](#) for more detail. Most notably, nuclear figures start in 2015 and power grids in 2020. CCS refers to carbon capture and storage.

- Annual global investment in energy transition technologies rose to \$1.77 trillion in 2023 – a new all-time high and a 17% year-on-year gain.
- Electrified transport, which tracks spending on EVs and charging infrastructure, has overtaken renewable energy to become the largest sector for spending at \$634 billion in 2023, up 36% year-on-year. Electrified transport saw the largest absolute gain of any sector, reflecting a continued acceleration in global EV adoption.
- Investment in new renewable energy projects, which includes wind, solar, biofuels and other renewables, grew 8% to \$623 billion.
- Nuclear (\$33 billion), electrified heat (\$63 billion) and clean shipping (\$385 million) were slightly down from a year earlier, but all other sectors posted strong investment growth:
 - Hydrogen tripled to \$10.4 billion
 - CCS nearly doubled to \$11.1 billion
 - Energy storage grew 76% to \$36 billion
 - Clean industry grew 7% to \$49 billion
- The addition of power grids (which saw \$310 billion of investment in 2023) in our analysis from 2020 onwards substantially boosts the overall figures, but does not change the underlying upward trajectory in energy transition investment.

Once again, all regions achieved record levels of energy transition spending

Global investment in energy transition, by region

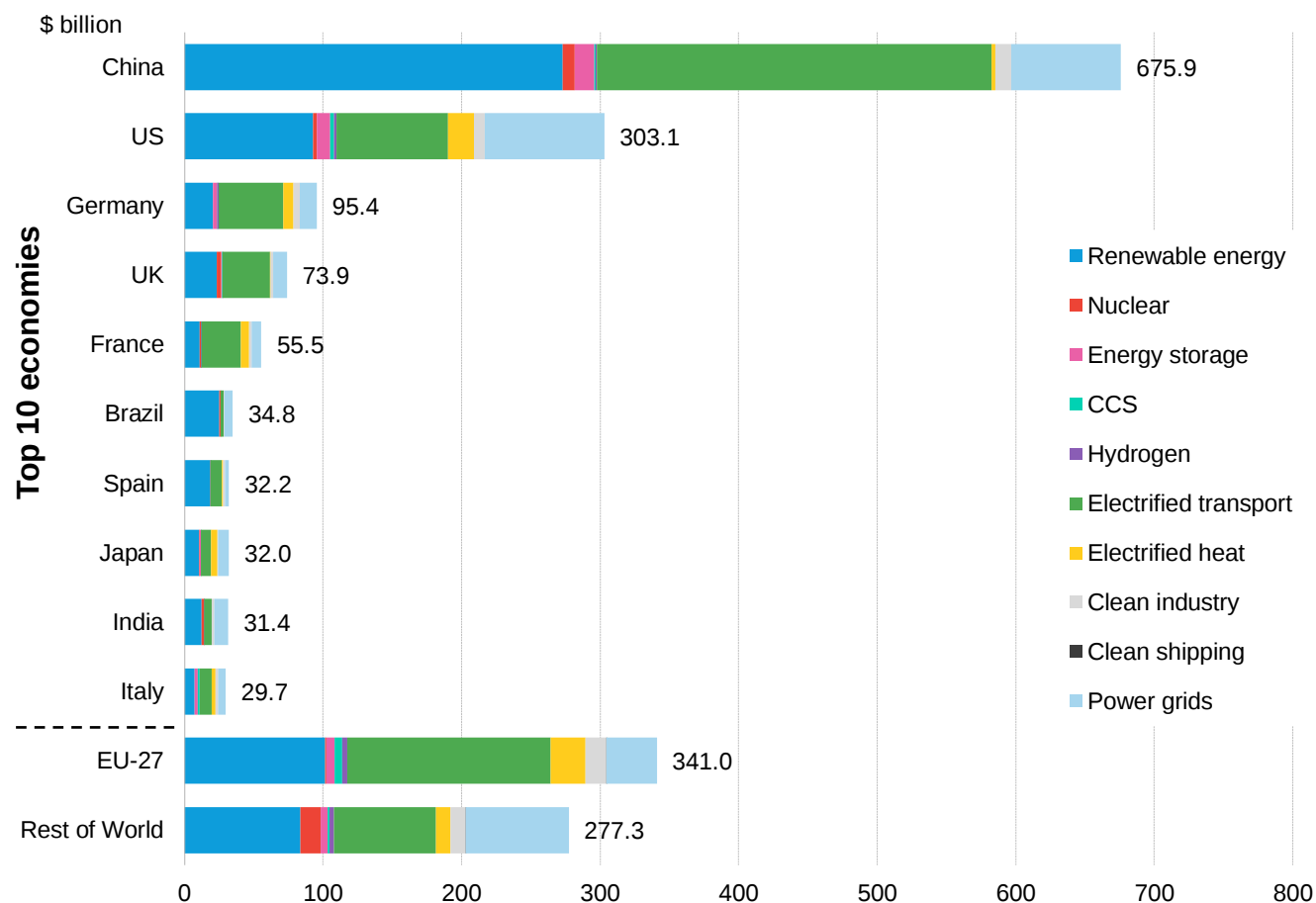


Source: BloombergNEF. Note: Start years differ by sector, but all sectors are present by 2020. The step-change in 2020 is caused in part by the addition of power grids into the scope from that year onward. EMEA refers to Europe, the Middle East and Africa; APAC is Asia Pacific; AMER is the Americas.

- For the fourth year in a row, all three regions in our analysis (the Americas, Asia Pacific, and Europe, the Middle East and Africa) set new all-time records for energy transition investment.
- In 2023, EMEA was the fastest-growing region, posting a 38% increase on the year before to \$542 billion. This came off the back of a strong year for solar in Europe and continued growth in the EV market there, as well as strong upticks in hydrogen, CCS and clean industry.
- APAC investment grew only 7% but the region once again had the biggest total, at \$840 billion, or 47% of the global sum. This share has fallen as renewable energy investment in the region receded in 2023. APAC previously accounted for more than half of global investment.
- The Americas remains the smallest of the three regions. Investment totaled \$387 billion in 2023, up 15% on the year before as the impacts of the Inflation Reduction Act started to be felt.

China remains the clear leader, though the gap is narrowing

Top 10 economies for 2023 energy transition investment, plus the EU-27 and rest of the world

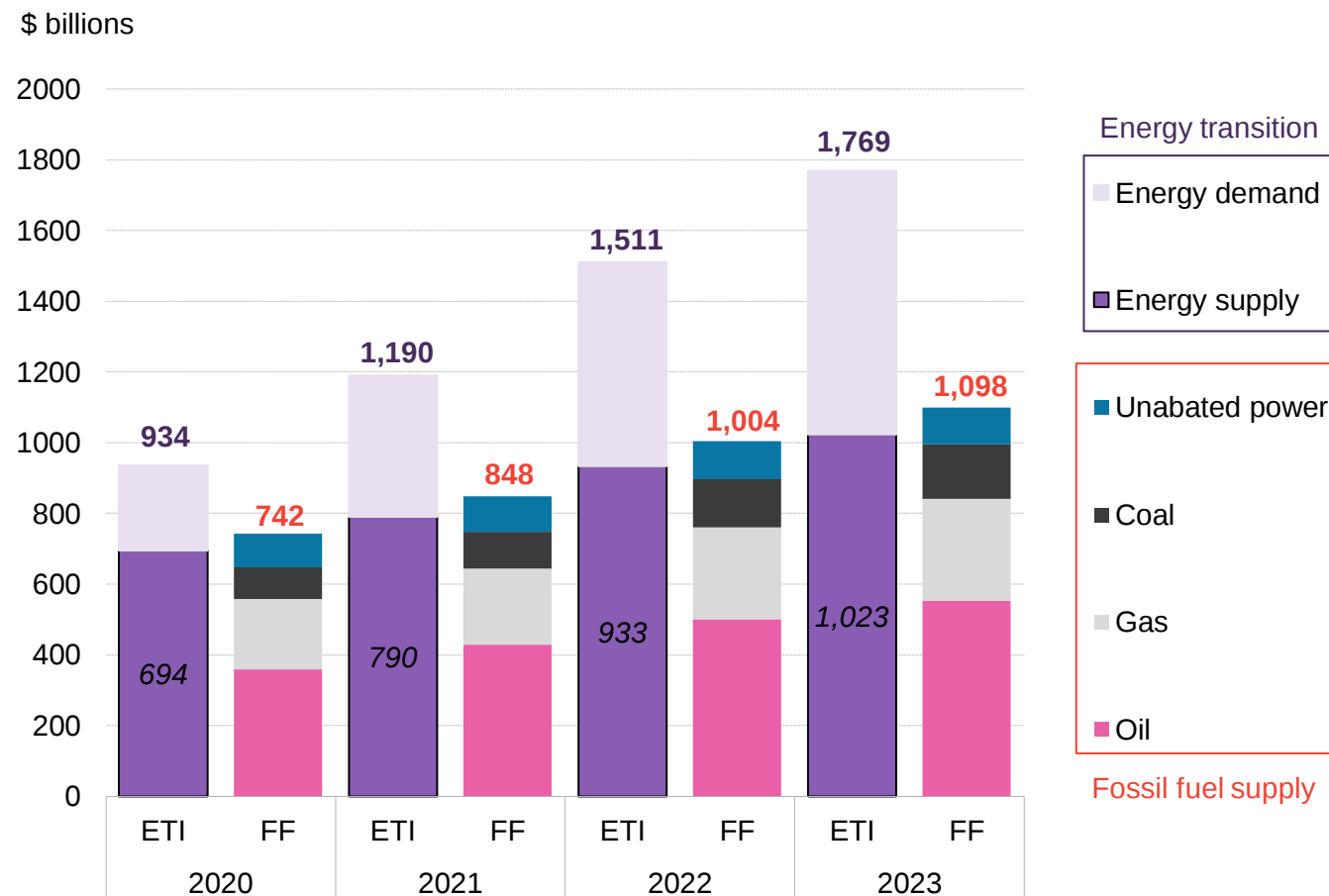


Source: BloombergNEF. Note: EU-27 bar also includes the EU member states shown. Rest of World is global investment excluding the EU and individual economies in the chart. A small amount of estimated spend for EU countries may be included in Rest of World. CCS refers to carbon capture and storage.

- Despite posting only modest growth in 2023, China remains by far the largest market for energy transition spending, reaching \$676 billion in 2023. This is 38% of the global total.
- The US is the second-largest funding destination for energy transition technologies, with a total of \$303 billion spent in 2023. The effects of the Inflation Reduction Act are starting to be felt, and the gap to China has narrowed.
- Germany retained third position among individual economies. Its investment mix is now heavily dominated by electrified transport.
- There are five European countries in the top 10, of which four are EU member states. The EU as a whole invested more than the US at \$341 billion in 2023, and the UK's \$74 billion puts the European total well above \$400 billion.
- This means that together, the US, EU and UK invested more than China in 2023, which was not the case in 2022.
- Brazil, Japan and India all feature in the top 10, with more than \$30 billion invested in each country.

Total energy transition investment far exceeds fossil fuel supply investment...

Investment comparison: energy transition versus fossil fuel supply



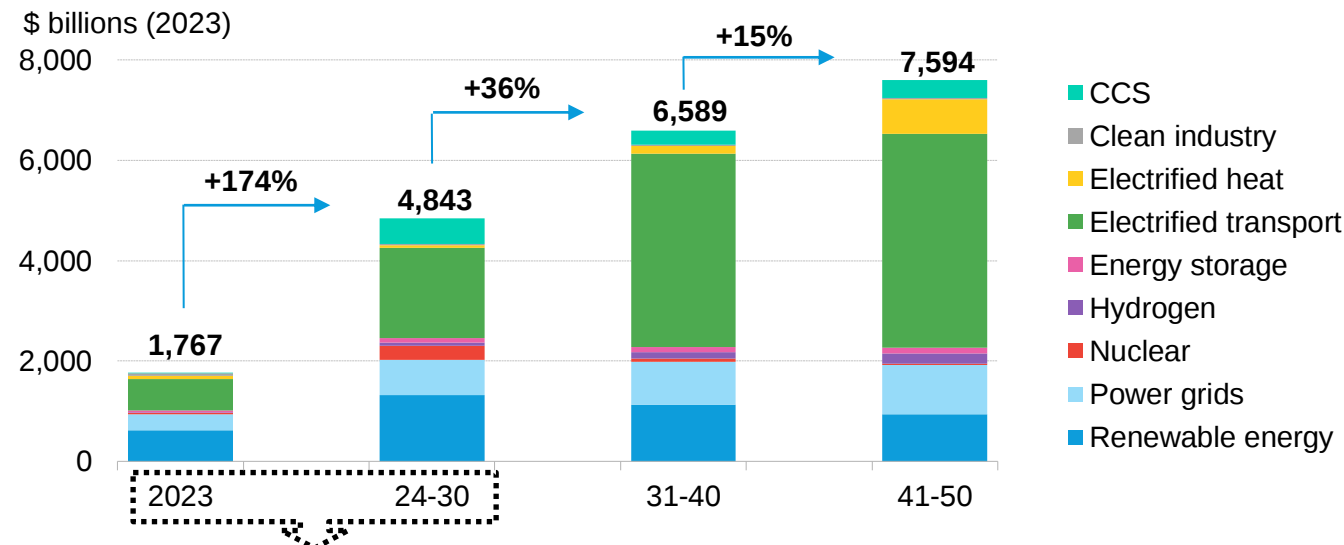
Source: BloombergNEF, IEA. Note: ETI stands for energy transition investment. FF stands for fossil fuels. Historical volumes for FF investment were aggregated from IEA World Energy Investment 2023 ([web](#)). Investment includes upstream, midstream, and downstream sectors and unabated fossil power generation. Dollar values have been adjusted to nominal terms. Investment in demand for fossil fuels - like gas boilers - is not included.

- Global investment and spending on energy transition technologies (both energy supply and demand) surpassed investment in fossil fuel supply by \$671 billion in 2023, an increase from the \$508 billion gap in 2022. This gap has consistently widened since 2020.
- The \$258 billion increase in energy transition investment in 2023 comfortably outpaced the \$95 billion rise in fossil fuel supply spending, over half of which was driven by oil projects in the Middle East and Asia Pacific.
- Investment in clean supply still trails behind fossil fuel supply investment, however, with a gap of \$75 billion in 2023. This puts fossil fuel supply investment 7% higher than clean supply spending – a relationship that has been broadly consistent since 2020.
- In last year's report, we concluded that total energy transition investment (supply and demand) had matched fossil fuel supply investment for the first time in 2022. This year's report newly includes investment in power grids and other new energy transition categories, which significantly lifts the energy transition side compared to last year.

The energy transition and fossil fuel investments were calculated separately. Future revisions to these estimates may impact the balance between the two.

Our Net Zero Scenario requires nearly three times today's investment levels

Comparison: 2023 energy transition investment versus required annualized levels in NEO 2022 Net Zero Scenario



Annual energy transition investment, 2023 actual vs 2024-30 required for NZS

\$ billion (2023)	2023 actual	2024-30 annualized	Multiplier
Clean industry	49	21	x0.4
Electrified heat	63	50	x0.8
Renewable energy	623	1,317	x2.1
Grids	310	700	x2.3
Energy storage	36	93	x2.6
Electrified transport	632	1,805	x2.9
Hydrogen	10	62	x6.0
Nuclear	33	284	x8.7
CCS	11	510	x45.9

- To align with BNEF's Paris-aligned Net Zero Scenario, global energy transition investment needs to average \$4.84 trillion per year between 2024 and 2030. This is almost triple the \$1.77¹ trillion spent in 2023.
- In our Net Zero Scenario, over the rest of this decade electrified transport is set to account for the largest share of energy transition spending, at \$1.81 trillion per year, or 37% of the total figure.
- This is followed by investment in renewable energy and power grids, at \$1.32 trillion and \$700 billion each year, respectively.
- To remain Paris-aligned, annual investment and spending in electrified transport, renewable energy, energy storage and power grids need to run at more than double their current rates across 2024 to 2030.
- In the 2030s, investment ticks up to \$6.59 trillion per year in the Net Zero Scenario, a fourfold increase from 2023 levels. The total further rises by 15% to \$7.59 trillion per year in the 2040s, with electrified transport spending accounting for the lion's share at 56% - or \$4.26 trillion per year.

¹ The 2023 figure used here excludes clean shipping and fuel cell vehicles.

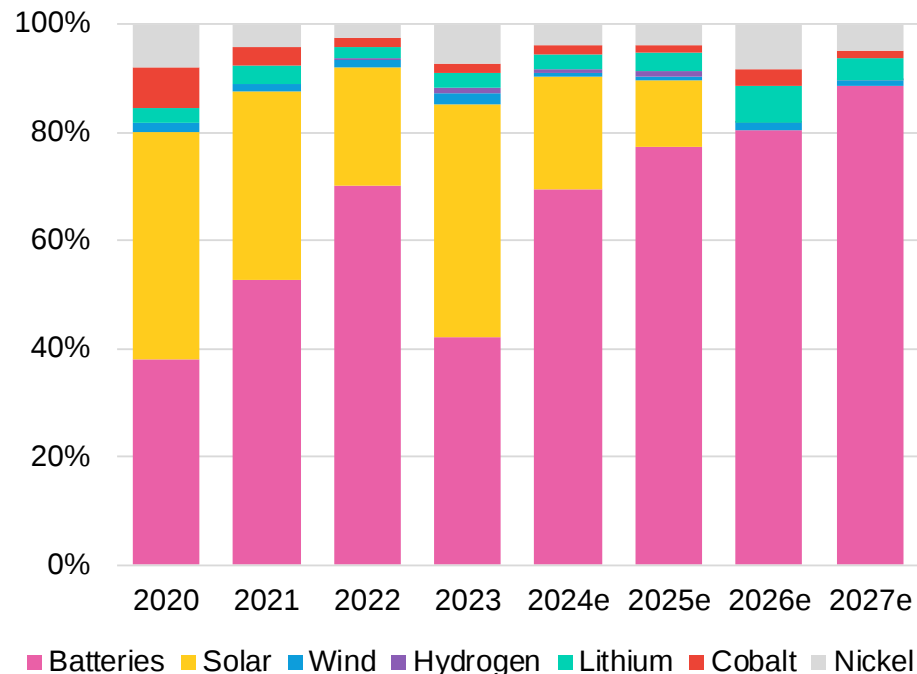
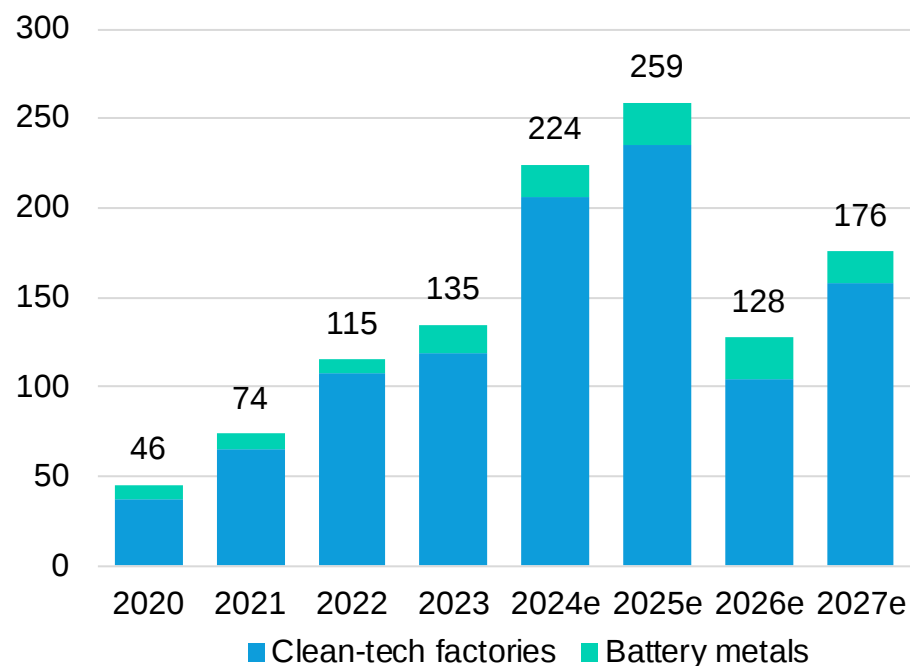
Source: BloombergNEF. Note: NZS = Net Zero Scenario. Future values are obtained from the New Energy Outlook 2022, except electrified transport, which is from the Electric Vehicle Outlook 2023 Net Zero Scenario.

Clean energy supply chain investment set to crank up 66% over 2023-24

- Clean energy supply chains can be split into clean-tech factories making equipment, and battery metal mines and refineries. Combined spending across these areas rose to \$135 billion in 2023 and is set to surge: investment plans show a 66% increase from 2023 to 2024, driven by a bulging pipeline of battery gigafactories.
- The share of battery metals investment is comparatively small at just 11% of the total in 2023. Based on announcements, this could increase to 18% in 2026. But mines have longer lead times and are outlined much earlier than, say, solar module factories, plans for which often go undisclosed until just a few months prior to starting up. Visibility on solar factory investments for 2026-27 is thus low.

New and planned clean energy supply chain investment, by sector – clean tech and battery metals

\$ billion (real 2023)

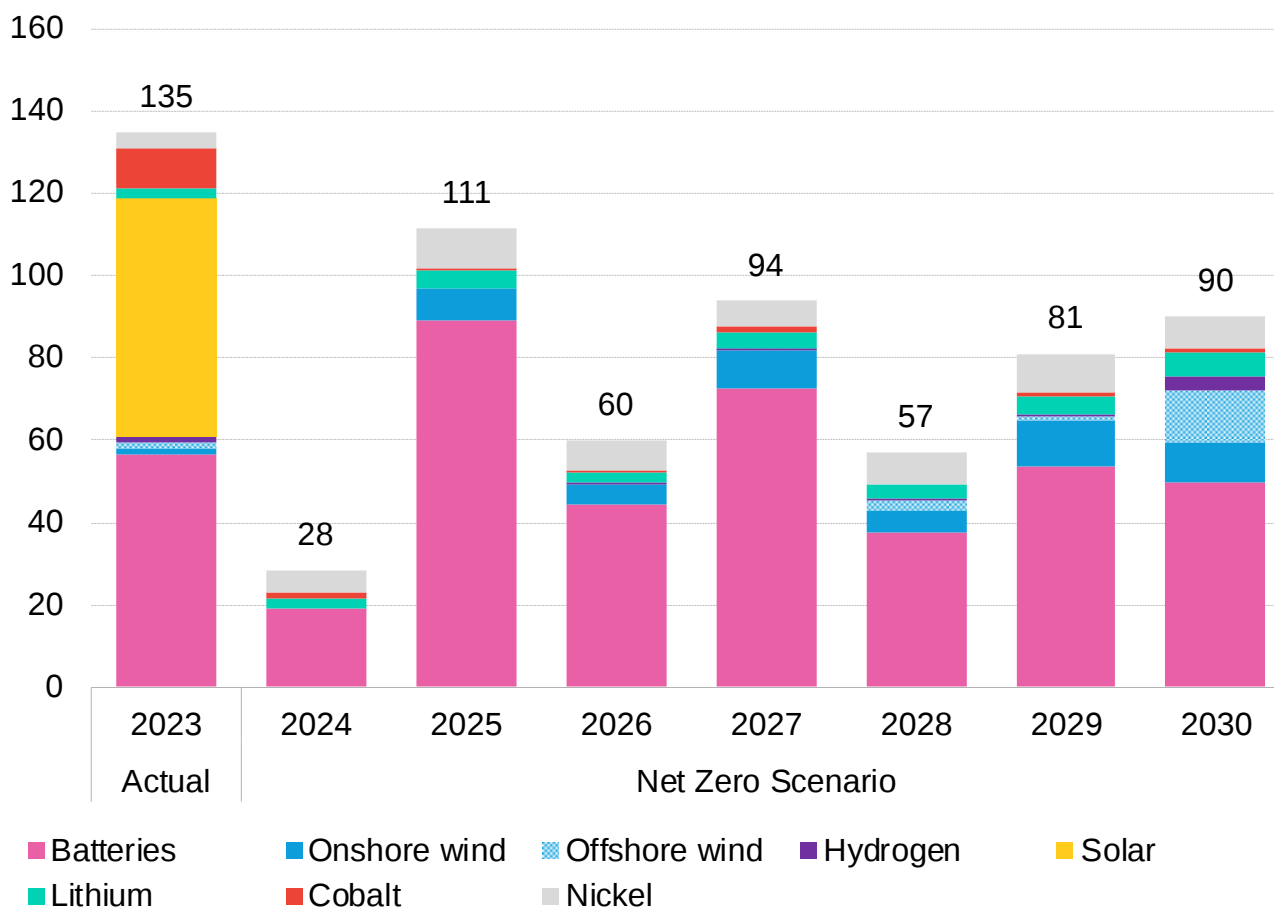


Source: BloombergNEF. Note: Clean tech includes upstream factories for solar and batteries, electrolyzer assembly for hydrogen and nacelles for wind. Battery metals includes mines and processing facilities for battery metals. Nickel is battery-grade. Coverage applies to both charts.

Clean energy supply chain spending is on track for a net-zero world

Clean-tech supply chain investment, actual 2023 and Net Zero Scenario to 2030

\$ billion (real 2023)



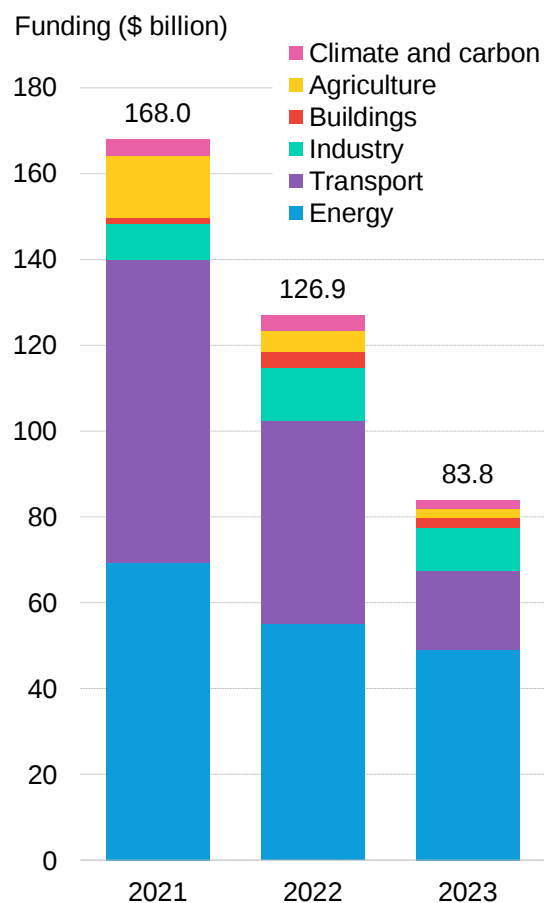
Source: BloombergNEF. Note: Battery metals include mines and refineries. Net Zero Scenario refers to BNEF's pathway to net-zero emissions by 2050 from New Energy Outlook 2022.

- Supply chain investment levels are running higher than what is immediately needed to be on track for net-zero emissions by 2050. Last year's factory addition figures are greater than annual investment required through 2030; that is largely the result of solar overcapacity. Our Net Zero Scenario requires yearly spending to average just 55% of what was achieved in 2023.
- It is a good thing that a large pipeline of lithium-ion factories has already been announced: achieving net zero will require a big expansion in battery manufacturing. Battery plants make up roughly 70% of the spending required over 2024-2030.
- Strikingly, the current solar oversupply is such that no new factories are required by 2030. The supply glut will put pressure on solar module prices for years to come, and weakens the case for localizing production in markets with little existing solar manufacturing.
- The world's need for new electrolyzer factories is similarly modest, even assuming they run at just 50% of their nameplate capacity. Utilization rates are hard to gauge given the technical problems currently facing electrolyzer makers.
- Required net-zero spending on battery metals – meaning mines and refineries – is significant. Taken together, the investment needed for cobalt, nickel and lithium capacity averages roughly 20% of the yearly totals over 2024-2030.

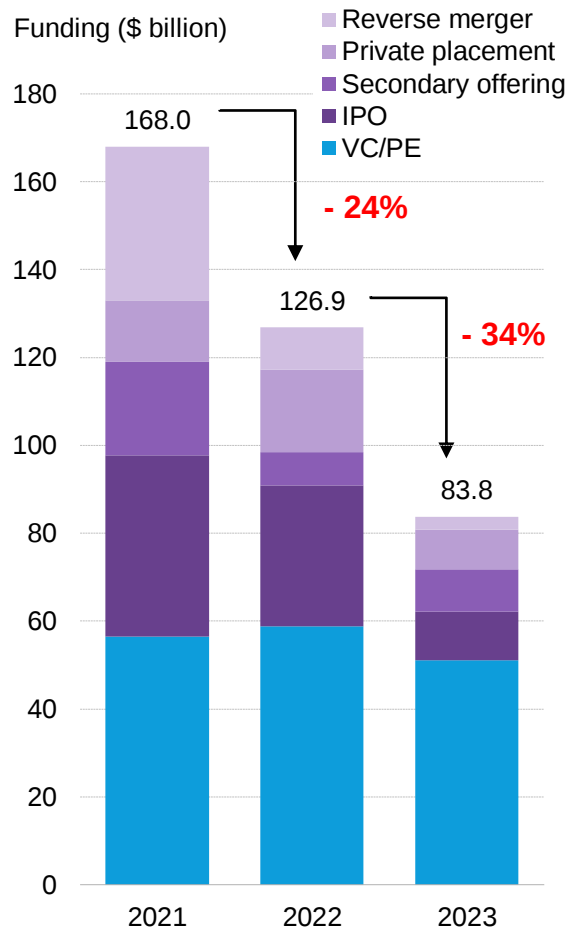
Climate-tech equity financing dropped by a third, declining for the second year running

Climate-tech equity financing, by financing type and sector

By sector



By financing type



Climate-tech companies raised \$83.8 billion in 2023, a 34% decline year-on-year as high interest rates continued to impact market activity. This drop was even more drastic than the 24% decrease seen in 2022.

While high interest rates are typically associated with having popped the Covid-era boom in early-stage investment, VC/PE funding in climate tech remained relatively stable last year, dropping only 13%.

There was little reason, however, for VC/PE investors to celebrate, as the big driver of the funding decrease in 2023 was a fall in capital raised via companies going public. Funding for reverse mergers and IPOs slumped by 69% and 65%, respectively. This suggests that investors could struggle to successfully exit on their portfolios if interest rates remain high for an extended period. Companies that were already public saw a boost in equity financing, with funding from secondary equity offerings up 27% in 2023.

The energy and transport sectors attracted more than 70% of total climate-tech funding for a third year running. But they also saw the biggest dollar value declines in funding, while transport and agriculture saw the largest percentage decreases. No sector saw an increase in funding this year.

Companies located in mainland China attracted the most funding of any market, mostly due to its strength in clean-energy equipment and EV manufacturing. The US continued to rank second overall, but first in VC/PE funding.

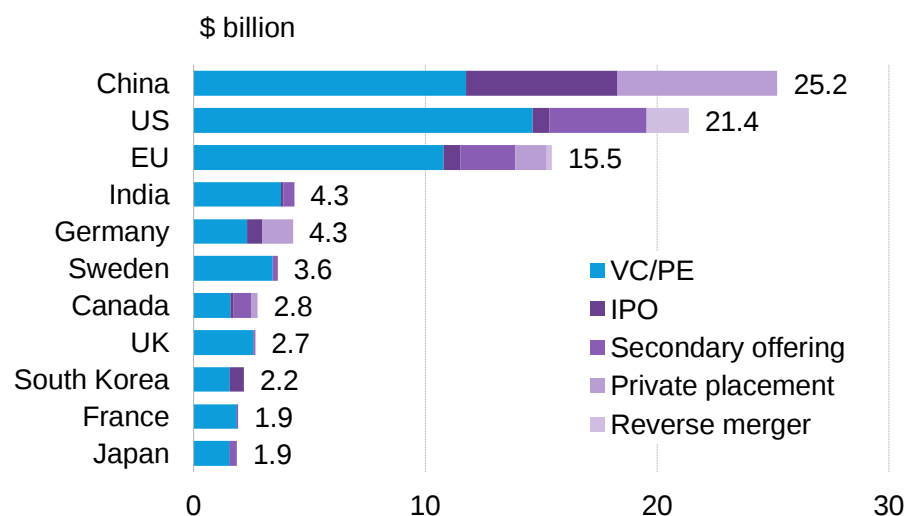
Source: BloombergNEF, PitchBook. Note: VC/PE refers to venture capital and private equity; IPO is initial public offering.

Mainland China remains the best funded market for climate tech

Even with the aforementioned struggles, mainland China continues to be the biggest market for climate-tech financing with \$25.2 billion raised in 2023, a 51% drop year-on-year. Much of this funding came from clean-energy equipment and EV manufacturers. The region is the only one where a majority of funding comes from the public market.

The US came in second overall with \$21.4 billion in funding, but remained the leader in the VC/PE market, outpacing mainland China by \$2.9 billion. Companies located in the EU raised upwards of \$15 billion, led by Germany and Sweden. Canada stands as the sole market to have all types of funding represented last year.

Climate-tech corporate finance by market in 2023

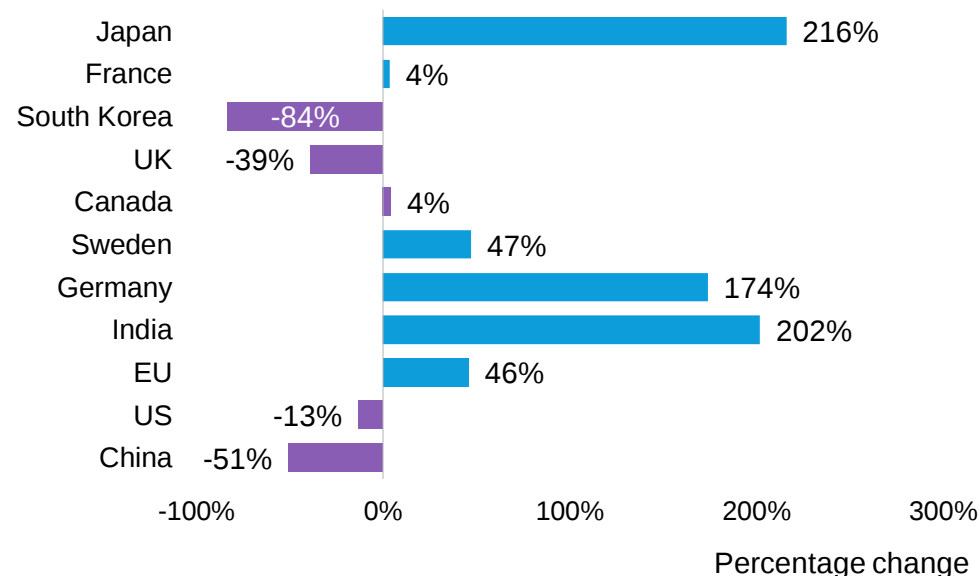


Source: BloombergNEF. Note: China here refers to Mainland China. EU total also includes the totals for EU member states listed in the chart. VC/PE refers to venture capital and private equity; IPO is initial public offering.

In 2023, Swedish climate-tech companies raised a total of \$3.6 billion. **H2 Green Steel** and **Northvolt** – two startups championing European green manufacturing – were responsible for 89% of that funding. In January of this year, the EU approved almost \$1 billion in German aid to Northvolt, highlighting the desire of European governments to grow a stronger clean-tech manufacturing base.

Several markets saw an increase in funding despite the overall downturn globally. Funding in India tripled from 2022 due to large raises from developers such as **Avaada Energy** (\$1 billion), **Tata Power Renewable Energy** (\$500 million), and **Juniper Green Energy** (\$350 million). The market jumped to third in overall funding.

Percentage change in funding, by market, 2022-23

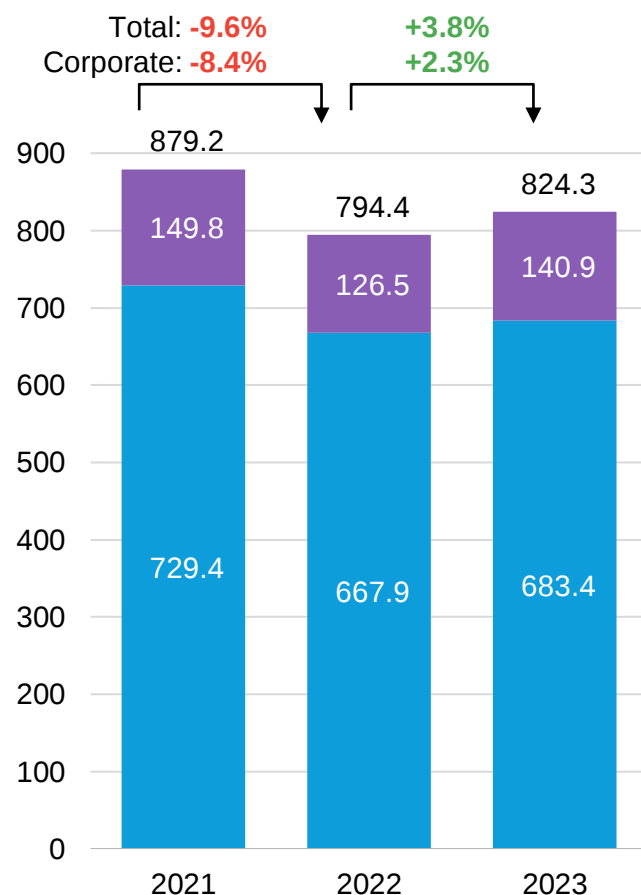


Source: BloombergNEF. Note: China here refers to Mainland China.

Energy transition debt benefited from interest rate drops in the wider economy

Energy transition debt issuance

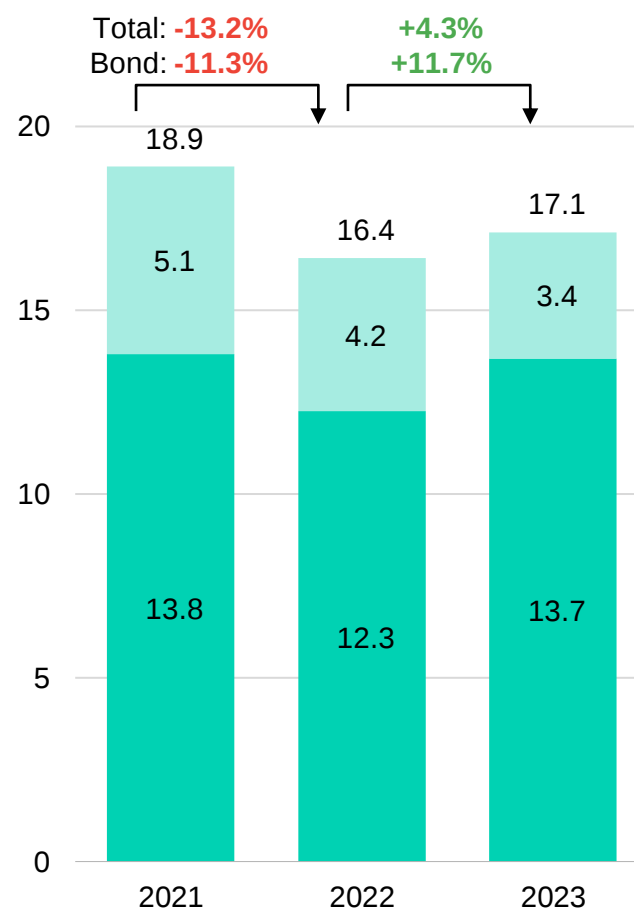
\$ billion ■ Government ■ Corporate



Source: Bloomberg, BloombergNEF.

Total corporate debt issuance

\$ trillion ■ Loan ■ Bond

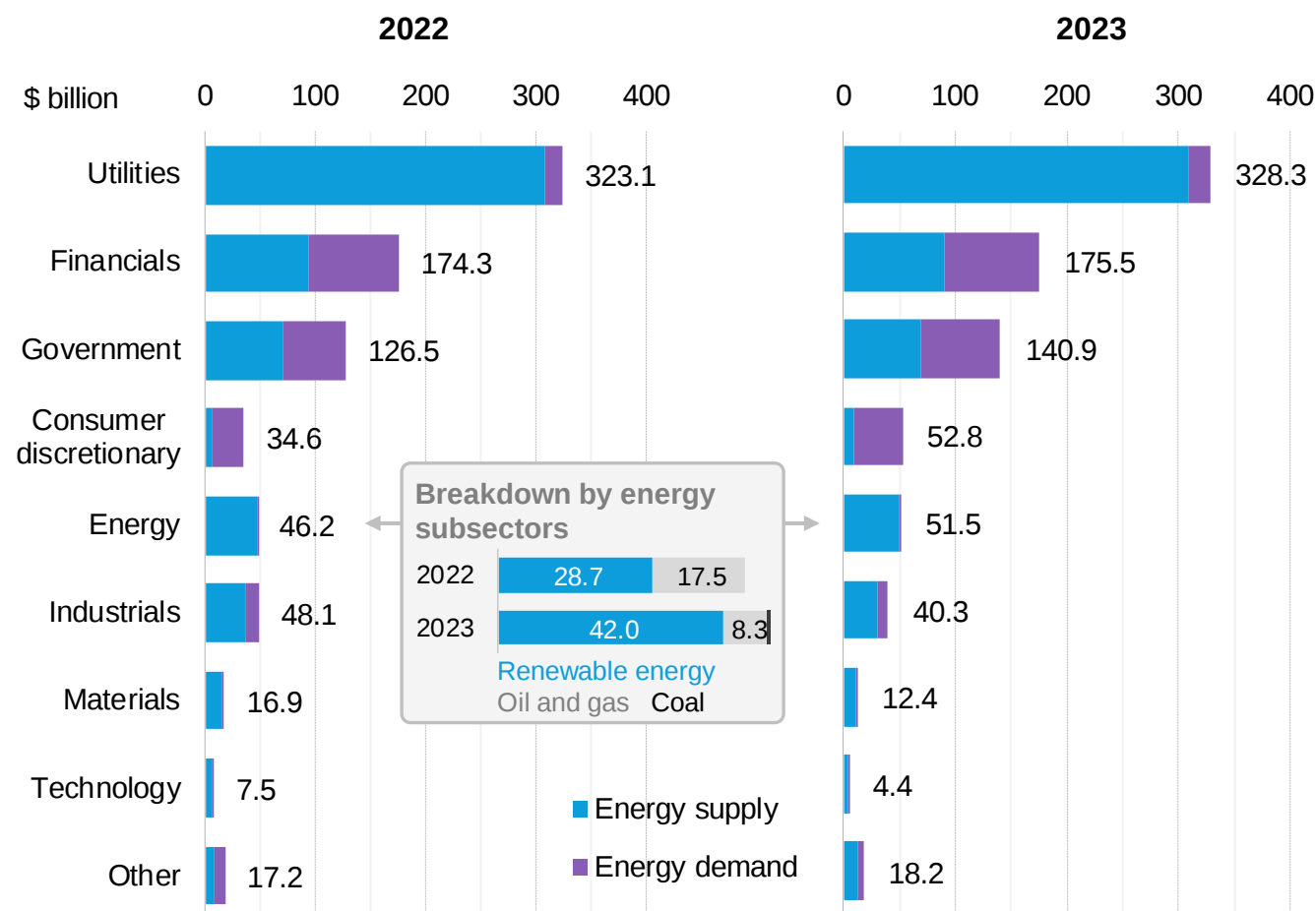


Source: Bloomberg, BloombergNEF.

- Debt issuance among energy transition-exposed companies mirrors changes seen in the wider market. About 4% more debt was sold for energy transition-linked purposes in 2023. The wider corporate debt market also grew by 4%, bouncing back from a steep contraction a year ago.
- The corporate bond market recovered last year as interest rate hikes slowed or even started to reverse, and expectations for future hikes calmed. Overall corporate bond issuance was 12% higher compared to the year prior. Loan issuance continued to shrink, however.
- Several key energy transition markets saw interest rates drop. China's average 10-year government yield declined by 28 basis points from the beginning of the year, even though the government maintained a low-rate environment through the pandemic. The 10-year yields for Germany, the UK, South Korea, France, Italy and the Netherlands also ended the year lower than they started.
- Average US 10-year Treasury yields ended 2023 where they started, at 3.88%. The uncertain pace of the Federal Reserve's decisions may have contributed to a 9% slide in US corporate debt sales.

Many sectors raised debt to fund energy transition

Energy transition debt issuance in 2022-23, by BICS sector



- Many sectors and company types contribute to the energy transition – not just pureplay clean energy firms. Utilities, banks, governments and other corporations raise funds to deploy clean energy assets, build manufacturing facilities and expand research and development, among other purposes.
- Utilities are by far the largest sector raising debt for the energy transition. Financials, especially banks, also play a strong role in raising funds, sometimes via labeled green debt, to then lend to energy transition clients.
- Renewable energy companies sold \$42 billion of debt in 2023. Many of them were more active in equity raising, illustrating that a lot are still growth companies willing to tap both equity and debt markets.
- While renewable energy players sold 46% more debt in 2023, the volume for oil and gas companies halved. Higher earnings reduced the need for new debt financing, and many oil majors, such as Shell and BP, also scaled back their energy transition ambitions last year.

Source: Bloomberg, BloombergNEF. Note: Sectors based on Bloomberg Industry Classification System (BICS) level 1. Energy subsector breakdown based on BICS level 2.

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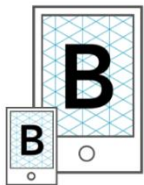
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